

Pre-Congress Courses (Abstracts 001–003)

001	Pre-Congress Course 1 – Avoiding and Managing Poor Implant Position
-----	---

Avoiding and managing poor implant position

Schneider D

Zürich University, Zürich, Switzerland

Dental implants are usually used for retention of fixed or removable prostheses in partially or completely edentulous patients. The position of the implants is mainly determined by prosthetic and biological parameters and has to be thoroughly planned before their installation. Since the prosthetic rehabilitation of the patient is the final treatment goal the prosthetically optimal position is one of the most important parameters to be evaluated during treatment planning. Biological parameters to be considered include the presence of bone for implant stability and osseointegration, topographic relation of vital anatomic structures and soft tissue condition. Implant malposition can have negative biological, functional and esthetic consequences. It can compromise the final treatment outcome and also lead to irreversible tissue destruction. Depending on its nature and severity, compensation of the malposition by prosthetic or surgical means may sometimes be possible. However, in some cases implant removal is the ultima ratio leading to significant iatrogenic tissue destruction and a complex consecutive therapy. If proper clinical, radiographic and prosthetic preoperative diagnostics are applied, the surgical and prosthetic treatment are well planned and performed thereafter, malposition can be avoided. In this regard, communication between the surgeon, the prosthodontist and the dental technician are of great importance. Moreover, recent developments in radiology and digital dentistry have led the development of new tools and procedures for implant treatment planning and implant placement.

002	Pre-Congress Course 2 – Avoiding and Managing Surgical and Biological Complications
-----	---

Avoiding and managing surgical and biological complications

Salvi GE

University of Bern, Bern, Switzerland

Medical interventions involving surgical procedures for the insertion of dental implants are associated with risks. Before undergoing such interventions, the risks of complications and failure as well as treatment alternatives need to be carefully evaluated between the

patient and the dentist. Surgical complications such as injury of the inferior alveolar nerve, perforation of the floor of the mouth and the sinus cavity and damage of adjacent teeth may occur at time of implant placement. On the other hand, biological complications represent late inflammatory processes in the soft and hard tissues surrounding osseointegrated dental implants. Findings from longitudinal clinical studies revealed that subjects treated for periodontitis may experience more implant failures and biological complications compared with nonperiodontitis subjects. Proper understanding of local anatomy, the correct use of diagnostic tools and careful surgical protocols are essential in reducing the rate of surgical complications. Moreover, the control of medical conditions and of bacterial infections, smoking cessation or reduction as well as the implementation of a strict maintenance care program are pivotal for the survival and success of dental implants and their reconstructions. The aim of this lecture is to present an overview of the most frequent surgical complications related to implant placement as well as of biological complications and to provide recommendations in order to avoid and manage such complications.

003	Pre-Congress Course 3 – Avoiding and Managing Prosthodontic Complications
-----	---

Avoiding and managing prosthodontic complications

Eitner S

University Hospital Erlangen, Erlangen, Germany

... stands for a successful therapy.

According to the actual data base in the scientific literature prosthodontic complications are known as the most frequent complications in the treatment with dental implants. Therefore, it is necessary to know possible complications, to handle occurring complications and to avoid pitfalls from the therapeutic as well as the forensic point of view:

- The risk analysis – The best way of risk-, complications- and failure-minimization!
- The fixed denture on implants – Always the best solution?
- The combination of implants and natural teeth – Does it work or not?
- The fracture of screws and the “chipping” of ceramics – An avoidable defeat?

The answers to these questions should lead to a patient-oriented individual treatment strategy, based on the scientific knowledge as well as the daily treatment experience.

Plenary Sessions (Abstracts 004–025)

004	Plenary Session 1 – Risk Indicators for Implant Therapy: Clinical Guidelines
-----	---

Genetic predictability for implant loss

Donos N

UCL Eastman Dental Institute, London, UK

Dental implants are now considered an effective and predictable treatment modality for the functional and aesthetic rehabilitation of either partially or completely edentulous patients. However, biological complications which are defined as the biological processes that affect the soft and hard tissues supporting the implant and include early and late implant loss, peri-implantitis and peri-implant bone loss can occur. It has been stated that several factors could contribute to the failure of the osseointegration and research evidence indicated that implant complications and failures might be clustered in a subset of individuals than being randomly distributed in the population implying that possibly patient's host response might play a determinant role for the long-term implant success. However, it has not yet been clarified whether or not host genetic susceptibility influences the biological complications of dental implant even though it has been raised as one of the potential risk indicators. This lecture will focus on a critical appraisal of the recent literature concerning the potential effect of different genetic polymorphisms of the host on dental implant biological complications and will evaluate the future steps required for further research.

005	Plenary Session 1 – Risk Indicators for Implant Therapy: Clinical Guidelines
-----	---

Hardware characteristics affecting peri-implant diseases

Gotfredsen K

University of Copenhagen, Copenhagen, Denmark

Peri-implantitis is an inflammatory disease that affects the tissues surrounding a functional implant and may lead to implant loss and impaired function. Peri-implantitis is characterized by peri-implant bone loss and bleeding on probing. During the last decade a number of publications have shown that the prevalence of peri-implantitis is much higher than earlier reported. Is this increase in prevalence based on new knowledge about progressive bone loss around implants, or is it caused by changes in implant design and especially implants surfaces? A number of experimental studies have elucidated the influence of implant surfaces on the severity of peri-implantitis. How can we interpret these studies, and do we have clinical studies supporting the experimental data? Furthermore, do the clinical studies reflect the experience from private practitioners working within implant dentistry, and what will be the future

developments in implant surfaces? The lecture will try to analyze these questions using evidence from the literature and also discuss the subject areas based on own studies and experiences.

006	Plenary Session 1 – Risk Indicators for Implant Therapy: Clinical Guidelines
-----	---

Long-term implant prognosis in periodontal patients

Karoussis IK

University of Athens, Athens, Greece

The outcome of implant treatment in periodontally compromised partially edentulous patients has been an issue of controversies. The aim of this presentation is to focus, applying a systematic approach, on the currently available knowledge, regarding the short-term (≤ 5 years) and especially the long-term (≥ 5 years) prognosis of osseointegrated implants placed in periodontally compromised partially edentulous patients. A systematic search in the English literature reveals no significant differences in both short-term and long-term implant survival between patients with a history of chronic periodontitis and periodontally healthy individuals. Patients with a history of chronic periodontitis may exhibit significantly greater long-term probing pocket depth, peri-implant marginal bone loss and incidence of peri-implantitis compared with periodontally healthy subjects. Even though the short-term implant prognosis for patients treated for aggressive periodontitis is acceptable, on a long-term basis the matter is open to question. Alterations in clinical parameters around implants and teeth in aggressive periodontitis patients may not follow the same pattern, in contrast to what has been reported for chronic periodontitis patients. However, since there are only few studies comprising patients treated for aggressive periodontitis, more studies, specially designed, are required to evaluate implant prognosis in this subtype of periodontitis. As the existing publications exhibit considerable discrepancies, more studies, uniformly designed, preferably longitudinal, prospective and controlled, would be important.

007	Plenary Session 1 – Risk Indicators for Implant Therapy: Clinical Guidelines
-----	---

Medically compromised patients

Nkenke E

Erlangen University Hospital, Erlangen, Germany

As the average age of people steadily increases in industrial countries, a higher rate of medically compromised patients requires treatment with dental implants. Today, a large variety of diseases and related therapies have to be taken into account that may negatively affect the outcome of implant treatment. Diabetes is a widespread disease among the elderly that has to be treated

adequately by the general practitioner in order not to reduce the long-term survival of dental implants. Another major problem can be anticoagulation of patients scheduled for implant placement. It has been shown that stopping anticoagulation in these patients will not reduce the rate of postoperative complications. However, transmucosal implant placement will help to minimize postoperative problems. Patients receiving bisphosphonates are another group that may be affected by major complication as a consequence of implant placement. If bisphosphonates have been administered intravenously these persons are at risk for developing bisphosphonate-related necrosis of the jaws. Therefore, the decision for placing implants in these patients has to be made carefully. All in all, implant therapy in the medically compromised patient is an interdisciplinary challenge that requires full attention to all the different aspects of the state of health in order to receive a success rate of dental implants that is comparable with that of patients without general diseases.

008	Plenary Session 1 – Risk Indicators for Implant Therapy: Clinical Guidelines
-----	--

Is Peri-implantitis a Risk for Systemic Diseases?

Papapanou PN

Columbia University College of Dental Medicine, New York, USA

There are several levels of evidence that need to be fulfilled in order to accept that a putative risk factor is causally associated with a particular disease: These include (i) a biologically plausible scenario by which the exposure contributes to the potential outcome; (ii) supporting data from epidemiologic studies (cross-sectional, case-control and prospective cohort studies); (iii) evidence from mechanistic, experimental studies; and (iv) ultimately, evidence from intervention studies, ideally randomized controlled trials. A substantial body of evidence has accumulated over the past decade supporting an association between periodontal infections, systemic inflammation and atherogenesis. Such an association appears to be biologically plausible, and is corroborated by data from mechanistic experimental studies and epidemiologic studies, while findings from intervention studies that have focused on surrogate markers of atherosclerosis largely suggest that periodontal therapy may contribute to a promotion of an antiatherogenic phenotype. There are no available studies in the literature that have investigated the role of peri-implant infections in a similar context. In the lack of hard evidence supporting or refuting an association between peri-implantitis and systemic disease, the talk will focus on exploring similarities and differences between peri-implant and periodontal infections that may allow extrapolation of available data when drawing conclusions about the role of peri-implant infections on systemic health outcomes.

009	Plenary Session 2 – Computers-Supported Fabrication of Implant Reconstructions
-----	--

Digital changes and their influence on the lab – European picture

Bergler M

University of Pennsylvania School of Dental Medicine, Pennsylvania, USA

The availability and sharply increasing use of numerous CAD/CAM-Systems seems to drastically alter traditional dental restoration fabrication processes. These changes are not limited to the significantly more reliable and precise fabrication process, but also offer a whole range of new materials that cannot be used with traditional fabrication protocols. The excellent esthetic features (i.e., translucency) paired with favorable physical and biological properties have made high-strength ceramic materials such as zirconium-oxide and aluminum-oxide ceramics true alternatives to conventional dental alloys in a variety of clinical indications. For long-term clinical success, however, and to take full advantage of the unique material properties, it is crucial for the laboratory technician and the dentist to understand clinical indications, advantages and limitations, and required clinical protocol changes for these technologies and materials. The knowledge of material and handling properties as well as combination and application of different ceramic materials is fundamental to the clinical success and longevity. Furthermore, the abilities and limitations of the available CAD/CAM systems must be known and applied. If these guidelines are followed, CAD/CAM technology and all-ceramic materials are not limited to single crowns and short-span FPDs, but can be applied to construct implant-supported restorations and even full-mouth rehabilitations in complex cases. This lecture will present and discuss the possibilities and limits of various CAD/CAM-Systems and will detail the capabilities of modern scanners and software and their influence on the daily lab business. Differences in scanning technology and the various possibilities for the design of tooth- and implant-supported restorations ranging from single-crowns to complex full-mouth-reconstruction frameworks will be outlined and explained. Furthermore, details about the properties and handling requirements of ceramic frame materials will be discussed and exemplified with a variety of clinical cases.

010	Plenary Session 2 – Computers-Supported Fabrication of Implant Reconstructions
-----	--

Digital impression taking

Kapos T

Harvard Faculty, Boston, USA

In modern dentistry, intraoral digital impression systems are becoming more prevalent. The use of such systems, presents a paradigm shift in the way dental impressions are made. Will this dental technology replace conventional impression techniques? And, if so, how fast will this happen? Oral scanners were originally implemented for use on the natural dentition. This technology is

capable of capturing three-dimensional (3D) virtual images of tooth preparations from which restorations can be fabricated directly (chair-side) or indirectly (laboratory). Recently, oral digital impression systems have been introduced, particularly, in the field of implant dentistry, primarily for patient comfort, and also, in order to simplify the impression process. This lecture will concentrate on the application of digital impression systems and techniques, on implant dentistry. The leading digital impression systems and their functions will be presented. Clinical cases will be examined, and advantages and disadvantages of this relatively young, innovative technology will be put forward. A comparison between conventional impression techniques and the digital technique will be emphasized throughout the entire lecture. Furthermore, current evidence for these techniques will be reviewed. Digital impressions in conjunction with CAD/CAM technology are introducing a new era in the field of Implant Dentistry. Are we ready?

011	Plenary Session 2 – Computers-Supported Fabrication of Implant Reconstructions
-----	--

Digital changes and their influence on the lab – European picture

Kern M

Christian-Albrechts University at Kiel, Kiel, Germany

This lecture gives an overview on the work flow and advantages when using computer-aided designing (CAD) and computer-aided manufacturing (CAM) for the fabrication of implant-supported restorations. While CAD-CAM fabrication in general presents many advantages regarding technical procedures and the use of specific materials the clinical benefits for the patients regarding survival und complication rates of these restorations need still to be shown. The lecture therefore summarizes the scientific evidence regarding survival and complication rates of implant-supported CAD-CAM-fabricated restorations and compares them with those of conventionally fabricated implant-supported restorations. However the number of clinical studies reporting on implant-supported CAD-CAM fabricated restorations is still limited. Yet long-term studies are needed to explore the full potential of CAD/CAM technology in implant dentistry.

012	Plenary Session 2 – Computers-Supported Fabrication of Implant Reconstructions
-----	--

Digital registration of functional patterns

Palla S

Zurich, Switzerland

Condylar and mandibular movements have been studied extensively in the past. These investigations provided a good understanding for the motion of the mandible in space during nonfunctional and functional jaw movements. Recording of non-functional borders movements have been used to understand the mandibular envelop of motion and how this relates to functional

jaw movements, but also to transfer these data into articulators in order to program them for designing dental reconstructions. Of course, this procedure allows adjusting the occlusion only to border movements, well knowing that these differ from the functional ones. Furthermore, these recordings provided initially only the representation of the trajectory of single points, i.e., without correlation to anatomical structures. It is only since the combination of 3-D reconstructions of the skull anatomy with jaw motion recordings that it is possible to visualize the movement of the whole mandible and in particular to study the relationship of the condyle within the fossa and/or of the lower teeth in relation to the upper ones during in function and parafunction. This approach already permitted the construction of articulators reproducing the movement of a real anatomical structure and controlling the occlusal surface during all jaw movements. Unfortunately, this development arrives when the number of complex reconstructions is decreasing in the developed countries because of caries reduction. It is therefore questionable if there is a need to pursue developing such recording systems, and whether they will ever gain access to clinical practice.

013	Plenary Session 3 – Treatment Planning with Experts
-----	---

Computer Technology Applications

Cooper LF

University of North Carolina at Chapel Hill, North Carolina, USA

Treatment planning for dental implant therapy involves the accumulation of information (data), analysis of the information to identify problems and opportunities and creation of unique solutions for patients. The human element of clinical therapy requires that conversations occur parallel with whatever algorithm is employed to solve the anticipated problem. The digital compilation of clinical information permits logical discussion of treatment for patients. Placement of the proposed prosthesis as the central aspect of the digital dataset offers three main advantages: (1) tissue limitations can be recognized in relationship to ideal prosthetic goals, (2) implants may be ideally located to meet esthetic and functional needs, and most importantly, (3) the concurrent visualization of the proposed prosthesis, the underlying tissues and planned implant locations permits rational and iterative discussions to occur between the prosthodontist, surgeon, technician and the patient. This presentation will illustrate a Prosthodontic perspective of comprehensive dental implant therapy in the digital environment.

014	Plenary Session 3 – Treatment Planning with Experts
-----	---

Microbiological testing

Mombelli A

University of Geneva, Geneva, Switzerland

Peri-implant disease maybe viewed as a mixed anaerobic infection. In most cases the composition of the flora is similar to the

subgingival flora of chronic periodontitis that is dominated by Gram-negative bacteria. Occasionally, however, peri-implant infections may be associated with a microbiota that is characterized by high numbers of peptostreptococci or staphylococci. The lack of consistent microbiological differences between mucositis and peri-implantitis, or moderate and severe peri-implantitis, may signify that in most cases the disease evolves gradually from mucositis to peri-implantitis. It has been recommended that antibiotics should be prescribed based on a microbiological diagnosis. However, it has not been proven that the selective suppression of specific members of the subgingival microbial complex is the key element for success of therapy of either periodontitis or peri-implantitis. Given the large diversity of the microbiota and multiple synergistic and antagonistic interactions among the members of the flora, the concept of specifically targeting particular pathogens may be illusionary. Data from recent trials illustrate beneficial effects of adjunctive amoxicillin plus metronidazole independent of microbiological status and clinical diagnosis for both conditions.

015 | Plenary Session 3 – Treatment Planning with Experts

Ideal fixed prosthodontic treatment from a biological point of view

Smeekens S

Radboud University Nijmegen, Nijmegen, The Netherlands

Although treatment focus is more and more based on esthetic demands of the patient and of dental society, prosthodontics should be more than just placing good looking (in)direct restorations on natural teeth or implants. Despite enormous efforts to fulfill these important esthetic requirements, biology and function should not be ignored. Dental restorations must be oriented as closely as possible to the natural pattern for function as well. Departure from this fundamental principle may lead to disturbances in the stomatognathic system. Great effort is made to prevent caries, periodontitis, peri-implantitis and iatrogenic problems. In order to achieve a predictable and durable fixed reconstruction, intraoral tissues should be healthy and maintain this status over time. Furthermore they should also be located in the right three-dimensional position within an optimal envelop of function. Therefore, a prosthodontist should implement a thorough analysis of the entire dentition before starting treatment. To help the clinician efficiently analyze the intraoral status, basic parameters for biologic and functional evaluation are outlined. Furthermore, planning tools and treatment steps for a predictable outcome are discussed. Based on the prosthetic rehabilitation of patients, contemporary treatment planning aspects are presented, including: handling of periodontal and perimplant tissues, handling of problems in clinical crown length, evaluation of overeruption, determination of causal therapy, communication with the orthodontist and the dental technician, conventional vs. implant-supported restorations, tissue stability over time, occlusal concept, impact on the quality of life. The different clinical options will be critically evaluated including current references from the dental literature.

016 | Plenary Session 3 – Treatment Planning with Experts

Ideal fixed prosthodontic treatment from a biological point of view

Tepper G

Vienna Dental School, Vienna, Austria

Little is known about the level of information on implant dentistry in the public. A representative opinion poll on dental implants in the Austrian population was published in 2003 (*Clinical Oral Implants Research* 14:621–642). Seven years later in 2010 the poll was rerun to assess the up-to-date information level and evaluate recent progress and trends in patients' mindset on dental implants. One thousand representatively selected adults were presented with a total of 35 questionnaire items regarding the level and the sources of information about dental implants, the subjective and objective need for patient information, acceptance and subjectively perceived costs of dental implant treatment as well as patient satisfaction with implant-supported rehabilitation. This representative survey reveals that dentists are still the main source of patient information, but throws doubt on the quality of their public relations work. Dentists must improve communication strategies to provide their patients with comprehensible, legally tenable information on dental implants to bridge information gaps in the future and to increase patient acceptance of dental implants as a treatment modality.

017 | Plenary Session 3 – Treatment Planning with Experts

Updated Guidelines on Imaging in Implantology

Tsiklakis K

University of Athens, Athens, Greece

Cone beam CT (CBCT) is the most recent development in the field of DentoMaxillofacial Radiology and it has been introduced as an alternative imaging technology for acquiring three-dimensional information. The rapid expansions of CBCT technology lead the European Union to approve a collaborative project under the acronym SEDENTEXCT (2008–2011). One of the objectives of the SEDENTEXCT project was to develop evidence-based guidelines dealing with justification, optimization and referral criteria for users of CBCT. In investigating an implant site the surgeon requires information of bone volume and quality, topography and the relationship to important anatomical structures. The consensus guidelines on imaging for implant dentistry developed in 2002 by EAO, did not include any comment on CBCT, but they described criteria for use of cross sectional imaging with the use of conventional CT. Since then there is a substantial literature related to the use of CBCT in dental implantology. Several studies suggest that CBCT has sufficient geometric accuracy for linear measurements in implant dentistry and other studies focused on the ability of CBCT to image neurovascular structures on the jaws. Finally there is evidenced that CBCT is an effective means of providing data for the manufacture of surgical guides in implant dentistry. The Guideline Panel of the SEDENTEXCT project made the following recommendations: (a) CBCT is indicated for cross-sectional imaging before implant placement as

an alternative to existing techniques where the radiation dose is shown to be lower, (b) For cross-sectional imaging the advantage of CBCT with adjustable fields of view, compared with conventional CT, becomes greater where the region of interest is localized part of the jaws, as a similar field of view can be used.

018 | Plenary Session 4 – Predictability of Esthetic Outcomes

Papilla preservation techniques: mastering periodontal regeneration of intrabony defects

Cortellini P

A.T.R.O., Firenze, Italy

This lecture will focus on the “state-of-the-art” of periodontal regeneration of intrabony defects with papilla preservation techniques. It is a clinically oriented, scientifically sound presentation with the objective of perfecting clinical outcomes of periodontal regenerative therapy. Regeneration is aimed at reducing pockets and limiting gingival recession through the reconstruction of the lost periodontal support. Three key issues greatly impact the clinical success of regenerative therapies: formation of a blood clot in a given space, stability of the blood clot and protection of the blood clot. Application of papilla preservation techniques helps clinicians in reaching these goals. The speaker will present a step by step approach to optimize the application of various papilla preservation techniques in different clinical conditions. Special emphasis will be given to diagnosis, indications, and surgical technique. Specific areas, like selection of the regenerative strategy according to the given defect, application of specifically designed surgical approaches and suturing techniques, will be discussed in details. Esthetic implications will be carefully explored. The adjunctive benefit of using a surgical microscope, and microsurgical instruments will be discussed, along with the presentation of a novel “minimally invasive surgical technique”. Predictability and long-term outcomes of periodontal regeneration with papilla preservation techniques will be evaluated.

019 | Plenary Session 4 – Predictability of Esthetic Outcomes

Provisional prosthetic treatment: key factor of the aesthetic outcome

Holst S

University of Erlangen, Erlangen, Germany

Implant-retained restorations have become a routine treatment option with high reliability and excellent clinical success rates. Restoring anterior teeth with implant-supported crowns is still considered a technique sensitive task for the surgical-restorative team. When restoring anterior implants, clinical success is not only defined by osseointegration of the implant and rehabilitation of proper function, but by a harmonious and natural blending of the restoration with the surrounding tissues and dentition. The maintenance of an existing or recreated gingival architecture around dental implants can be demanding. Provisional restorations may help to shape, prepare, and stabilize the peri-implant soft tissues

during the healing phase in immediate or delayed loading cases or after second-stage surgery. In addition, provisionals allow evaluation of esthetic parameters before finalizing treatment. The key objective of the presentation is to discuss advantages and disadvantages of various treatment protocols when provisional restorations are applied. While the majority of scientific evidence is limited to technique articles and case series, currently applied and future assessment methodologies for long-term quantitative follow-up studies are discussed with a special emphasis on measurement of 3-dimensional tissue alterations.

020 | Plenary Session 4 – Predictability of Esthetic Outcomes

Impact of Buccal Bone on Immediate Implant Esthetics

Kan J

Loma Linda University School of Dentistry, Loma Linda, CA, USA

Achieving anterior implant esthetics is a challenging and demanding procedure. To create implant restorations with harmonious gingival contour that emulate nature is a fusion of science and art. Understanding the biologic and physiologic limitations of the soft and hard tissue will facilitate predictability in simple to complex esthetic situations. This lecture will focus on current implant treatment philosophies and methodologies for immediate tooth replacement in the esthetic zone. Emphasis will be placed on the impact of buccal bone for optimal anterior implant esthetics.

021 | Plenary Session 4 – Predictability of Esthetic Outcomes

Does biology influence the aesthetic outcome?

Meijer HJA

University Medical Center Groningen, Groningen, The Netherlands

Dental implants are more and more applied in the aesthetic zone, therefore, it is essential to be able to establish a predictable aesthetic result. According to the professionals’ opinion, dental implant crowns in the aesthetic zone are successful if a harmonious anatomical outcome has been established with the right dimensions of white and pink structures. On the other hand, regeneration of a soft tissue contour with intact interproximal papillae and a gingival outline that is harmonious with the gingival silhouette of the adjacent teeth appears to be one of the major challenges. A number of biological factors is said to be of importance to reach a satisfactory result. Enough original bone in the implant region, noncompromised bone height at neighbouring teeth and a thick biotype are considered as favourable. Extra bone augmentations in the aesthetic region, reduced bone height at neighbouring teeth and a thin biotype are considered as negative in trying to create a satisfactory result. Large prospective studies on implant outcome in the aesthetic region have become available recently at the University Medical Center in Groningen, the Netherlands. By combining results from these studies one could get a better insight in the impact of each of the mentioned biologic factors on aesthetic outcome. Perhaps one of

them dominates, but possibly other factors, not that obvious, are more important.

022 | Plenary Session 5 – Maintaining Long-Term Implant Outcomes

Application of periodontal soft tissue surgery techniques to peri-implant defects – peri-implant recession defect management

Becker J

University of Düsseldorf, Düsseldorf, Germany

Peri-implant mucosal recessions can be associated with peri-implant intraosseous (class I) and supraalveolar (class II) bone defects. Numerous etiological factors have been identified, i.e. insufficient interimplant space, malpositioning of implants, insufficient augmentations with residual defects or peri-implant infections. Some of these complications can only be treated by implant removal. Treatment of peri-implant defects and mucosal recessions requires the removal of biological contaminations from machined and structured implant surfaces to improve the biocompatibility of the titanium surface that it might serve again as a sufficient base to reestablish bone-to-implant contact. Defect configurations might have an impact on the clinical outcome following surgical regenerative therapy of peri-implantitis lesions. While class Ie circumferential defects seem to be promising in conjunction with natural bone minerals and a collagen membrane, other defects (especially vertical class II defects) may be considered as unfavorable. Most of the intraosseous peri-implant augmentation procedures are often associated with further mucosal recessions which must be treated in a second approach while class II defects usually can only be controlled by implantoplasty. After successful biofilm removal and augmentation of intraosseous defects mucosal recessions can be reduced in a second approach using coronally advanced flaps (CAF) alone, CAF and free or vascularized connective tissue graft, CAF and a collagen matrix and the envelope technique with a free subepithelial connective tissue graft. After removal of the prosthetic suprastructure, a modified roll technique can be adapted around submerged and nonsubmerged implants in the maxilla. A submerged procedure improves bone regeneration in peri-implant bone defects more compared with a nonsubmerged procedure.

023 | Plenary Session 5 – Maintaining Long-Term Implant Outcomes

Management of peri-implantitis

Fourmousis I

University of Athens, Athens, Greece

Peri-implantitis may be defined as inflammatory process affecting both soft and hard peri-implant tissues, resulting in loss of supporting bone around a functioning implant. The aim of this presentation is to review the literature on the diagnosis and therapy of peri-implantitis and present the newest views on this subject. Diagnosis of peri-implantitis in clinical practice is mainly based on clinical and radiographical examination. Therapy of peri-implantitis in

cases of shallow (<4 mm) peri-implant pockets comprises oral hygiene instructions and patient motivation in oral hygiene and the exclusive use of mechanical cleansing means (plastic curettes or instruments manufactured of soft carbon fibers, rubber cups and polishing paste) for the removal of microbial accumulations from implant surfaces and their polishing, whereas in cases of peri-implants pockets of a moderate (4–5 mm) or advanced (>5 mm) probing depth, mechanical therapy should always be combined with adjunctive therapeutic modalities. Such modalities could be the use of chlorhexidine digluconate as an antiseptic agent (as a mouthrinse or topically applied gel) or the use of antibiotics (systemically administered or topically applied). The use of laser devices is a modern therapeutic modality, yielding some positive early results, but its efficacy certainly has to be documented by additional studies. Surgical procedures, similar to those employed for surgical treatment of periodontitis, can be used for the therapy of peri-implantitis, as a rule in cases of an advanced (>5 mm) peri-implant probing pocket depth with concomitant bleeding and/or suppuration on probing and radiographical peri-implant bone loss. The principal objective of the clinician should be focused on maintenance since treatment of peri-implantitis is a difficult process that needs special training and experience.

024 | Plenary Session 5 – Maintaining Long-Term Implant Outcomes

Prevalence, extent and severity of peri-implantitis

Koldslund OC

University of Oslo, Oslo, Norway

Epidemiological studies of periodontal diseases are complicated by the diversity of methodologies and definitions used. The same seems to be true regarding peri-implant diseases. Several measurements are combined to diagnose peri-implant disease and different thresholds are used in describing disease. To arrive at meaningful conclusions regarding prevalence and severity of biological complications, consensus regarding definitions and criteria are required. The diversity of brands and designs of dental implants furthermore hampers the process of reaching consensus. Peri-implantitis has been defined as presence of inflammation of the mucosa and loss of supporting bone surrounding the implant. Detection of initial signs of disease is essential in order to prevent further progression, as we do not have any evidence-based treatment to offer today. This presentation focuses on and discusses limitations and possibilities in diagnosis of peri-implant disease.

025 | Plenary Session 5 – Maintaining Long-Term Implant Outcomes

Risk factors of peri-implantitis

Madianos PN

University of Athens, Athens, Greece

The well-documented high success rates of osseointegrated dental implants has lead to their use as a common clinical protocol to reestablish function and aesthetics in edentulous and partially edentulous subjects. Nevertheless, the long-term maintenance of

osseointegration, after incorporation of supra-structures, depends on the healthy preservation of marginal soft and hard peri-implant tissues. Peri-implantitis is an inflammatory condition that affects alveolar bone and soft tissues around implants that result in the loss of supporting bone; a similar condition to periodontitis around natural teeth. As the number of patients treated with dental implants increases, it is inevitable that the incidence of peri-implant infections will increase, posing a significant future health care problem. Peri-implant diseases are infectious in nature in which the dental plaque biofilm and many of the specific periodontopathogens have the lead role in their initiation and progression. The presence of different risk variables, however, may modify susceptibility to peri-implant disease.

Identifying risk factors for peri-implantitis and understanding their role in the aetiopathogenesis of the disease is essential for the long-term success of implant therapy. Data derived mainly from cross-sectional studies and few longitudinal studies provide strong evidence that major risk indicators for peri-implantitis are poor oral hygiene, history of periodontitis in the natural dentition and smoking. Lesser evidence exists for other patient-related factors including diabetes, genetic traits, alcohol consumption, as well as site-related factors, such as presence of keratinized mucosa, and finally implant-related factors such as specific implant surface or design. Large population prospective studies are needed in order to confirm which of these factors are true risk factors for peri-implantitis.

Parallel Sessions (Abstracts 026–041)

026 | Parallel Session 1 – Loading Protocols

Influence of implant surface characteristics and implant length on the immediate loading protocol

Junker R

UMC Nijmegen, Nijmegen, The Netherlands

Shortening treatment time and reducing patient discomfort and/or inconvenience is a trend in implant dentistry. Consequently, immediate loading protocols have gained some popularity among clinicians. In fact, immediate loading of dental implants has shown promising and predictable results. Nonetheless, it is important to note that beside meticulous case selection, implant-related factors have to be considered before initiation of treatment. Until now, the influence of implant surface characteristics and implant length on immediate loading protocols is not fully understood. A critical look at this subject matter will be taken by reviewing the relevant literature. As an interim result of the reviewing process, it might be concluded (1) that as machined (turned) implant surfaces should not be considered within immediate loading protocols, and (2) that only limited evidence exists that shorter implants (≤ 8 mm) with modified (“modern”) surfaces might perform less successful than longer implants.

027 | Parallel Session 1 – Loading Protocols

Influence of the immediate loading protocol on the outcome in the esthetic zone

Meyenberg K

Universitit of Zurich, Zurich, Switzerland

Immediate loading of an implant is today a clinically predictable procedure provided the case selection is properly performed. In terms of functional and biological outcome the success rates can be comparable with conventional surgical and loading protocols. In terms of the esthetical outcome, however, some limitations and risk factors must be considered. The greatest limitation certainly is that due to the immediate provisionalisation only restricted surgical hard and soft augmentation techniques can be used. Whereas for the interdental papillary region an immediate support of the soft tissue structures can even be an advantage, this can be a handicap in the buccocervical region. Therefore, beside the optimal 3D-placement of the fixture into the alveolar bone the proper shape and contour and the material both of the abutment and the provisional crown are important. Furthermore cement excesses may account for unfavourable tissue remodeling and chronic inflammation both of the soft tissue and bone and account for the development of peri-implantitis.

Therefore, a concept should be preferred which allows to avoid cemented provisionals in favour of screw retained reconstructions. By means of a number of clinical cases some useful concepts are discussed which help to control the esthetic risks.

028 | Parallel Session 1 – Loading Protocols

Influence of hard and soft tissue augmentation procedures

Rocchietta I

University of Milan, Milan, Italy

One of the major endeavours in implant dentistry is the aesthetic result of the final prosthetic restoration. Implant positioning is now driven by the prosthetic demands and requirements rather than the quality, quantity and morphology of the available bone. A correct diagnosis based on a multidisciplinary approach, including periodontal, prosthetic and surgical parameters is crucial. The patients' periodontal evaluation must be based upon the following parameters; width of keratinized gingiva, clinical attachment level, probing depth and height and width of the existing bone. It is crucial that sufficient bone is maintained buccal, mesial and distal to the implant. In the past decade, many predictable techniques have been proposed in the literature to augment deficient alveolar ridges both horizontally and vertically and/or to enhance bone deformities in conjunction to implant placement. Bone regeneration has been further improved through the introduction of more effective barrier membranes and osteoconductive biomaterials (such as demineralized bovine bone) and the development of new surgical procedures. Advances in tissue engineering may offer solutions that resolve bone volume deficits and soft tissue defects while at the same time eliminating some of the concerns posed by current techniques. The recombinant platelet derived growth factor (rh-PDGF-BB) has been extensively used as a potent regenerating factor in orthopedics and periodontics with success. The principal aim in hard tissue regeneration would be to eliminate the need for autogenous bone harvesting and possibly eliminate the nonresorbable membrane. Regarding soft tissues, the ideal technique would comprise of an “off the shelf” product, eliminating the need of autogenous soft tissue harvesting. Numerous different alternative materials have been investigated to overcome the use of autogenous soft tissue. A porcine collagen matrix has been recently investigated in patients with fixed prosthetic restorations. In conclusion, the future is moving towards an era where less invasive treatment regimes are now available to minimize complications and side effects of a surgical procedure, decrease patients' morbidity, increase functional and aesthetic success rates and decrease technical difficulties. The maturation of tissue engineering and its application to clinical surgical procedures has helped create a new paradigm.

Influence of the immediate loading protocol in partially edentulous and edentulous patients

Testori T

Lake Como Institute, Como, Italy

The widespread therapeutic use of implants over the last 20 years has led to the revision of several aspects of the original two-stage Brånemark protocol. After using the single-stage approach as a valid treatment procedure for many years, one of the most dramatic changes in implant dentistry has been the increased acceptance of immediate loading protocols as a viable therapeutic procedure under certain circumstances. The ultimate goal of an immediate loading protocol is to reduce the number of surgical interventions and shorten the time frame between surgery and prosthetic delivery, all without sacrificing implant success rates. These new protocols will ultimately lessen patient's reservations and result in increased acceptance of implant therapy. Before embracing the procedure as a routine treatment, the immediate loading needs to be validated with a significant number of clinical studies, extended follow-ups and clear definition of limitations. Immediate loading procedures although predictable in many clinical scenarios are technique-sensitive and should be applied cautiously. A gradual and progressive approach to immediate loading is therefore recommended. The lecture will address a variety of topics related to immediate loading in different clinical situations: edentulous mandible and maxilla, partially edentulous patients from single tooth to multiple units. A review of the available literature along with the biologic rationale for immediate loading will be presented.

Can we prevent biomechanical complications on implant dentistry?

Blanes Servera RJ

Clínica Pronova, Palma de Mallorca, Spain

Treatment planning with implant-supported prostheses is probably one of the most challenging disciplines in dentistry. Decisions on the design, type and number of implant-supported prosthetic restorations may affect the long-term outcome of the prosthetic complex. Despite high success and survival rates on implant therapy, technical and mechanical complications occur. Since the advent on implant rehabilitation, several biomechanical risk factors have been associated with implant complications. Nevertheless, large part of the current knowledge about biomechanical risk factors on implant treatment is still based on clinical experience, treatment protocols extrapolated from conventional fixed dental prosthesis, mathematical models, *in vitro* investigations and low-scale clinical studies. More recently, controlled clinical prospective studies are giving a more reliable guidance. The aim of this presentation is to review the scientific evidence associated to these risk factors, trying to guide the clinician on the best clinical decision, in order to avoid or reduce biomechanical complications on implant-supported prostheses in the fully and partially edentulous patient.

Implant treatment of the growing – malpractice or challenge?

Heuberer S

Vienna University Clinic of Dentistry, Vienna, Austria

A number of additional factors have to be considered for the implant treatment in adolescents vs. that in adult patients. Ongoing craniofacial growth, number of missing teeth and underdeveloped alveolar process are critical factors for establishing the treatment plan. Implant treatment of the growing patients at the Vienna Clinic of Dentistry is based on the experience of up to 25 years. Several aspects should be considered in selecting the appropriate therapy ensuring satisfying outcome. When is the cessation of growth? Does the general standard remain the state-of-the-art? What are the consequences of a nontreated "hypodontal" jaw, adverting the stomathognathic system and the postponed oral rehabilitation with dental implants? What are the pros and cons of early implant placement? Which alternative therapies are available? Is the treatment of single tooth gaps (e.g. caused by trauma) different to the treatment of hypodontia? Which parameters affect and limit treatment? This lecture will concentrate on these questions accompanied by examples of treatment failure and success.

Compromised Patients – limitations and goals

Madrid C

Medical School, University of Lausanne, Lausanne, Switzerland

Proper patient selection and careful technique will always be the marks of quality implant dentistry providers. All health care delivery provided by dental practitioners must take into account, always and foremost, the patient health. Careful patient evaluation is critical. Patients' physicians may not fully appreciate the physiologic ramifications of the complex and sometimes lengthy appointments required in performing implant procedures. The final decisions regarding the prescription of therapy rest with the dentist. Through increased knowledge of the pathophysiology of diabetes mellitus, disorders of bone metabolism, radiotherapy, and chemotherapy, improved patient selection and perioperative management can benefit the dental implant team. The literature contains numerous observations on the significance of systemic disorders as contraindications to dental endosseous implant treatment, but the justification for these statements is often apparently allegorical. Although implants are increasingly used in healthy patients, their appropriateness in medically compromised patients is less equivocal. Perhaps surprisingly, the evidence of their efficacy in these groups of patients is quite sparse. Indeed, there are few if any randomized controlled trials (RCTs) in this field. Furthermore, any health risks from the placement of implants are unclear. We review the current evidence for the risks associated with endosseous implants in a range of systemic disorders. The degree of disease-control may be far more important than the nature of the disorder itself, and individualized assessment, including the medical

condition, quality of life and life expectancy is indicated. The benefits of implants to many of these patients may outweigh any risks. However, proper informed consent is mandatory.

033 | Parallel Session 2 – Prevention of Problems

Compromised patients – limitations and goals

Van Assche N

Department of Periodontology, Faculty of Medicine, Catholic University Leuven, Leuven, Belgium

The unavoidable resorption of the alveolar crest after tooth extraction implies the augmentation of the crest before implant installation (two stage) or the use of a bone substitute to cover bone dehiscences after implant insertion (one stage). Previous studies demonstrated that bovine bone derived filling material is able to cover dehiscences along implants. A new fully synthetic bone substitute has been developed composed of hydroxyapatite and beta-tricalcium phosphate. The results of a split-mouth randomized prospective study, comparing the capacity of both bone substitutes to treat dehiscences, will be presented. Fourteen patients received four to six implants to support an overdenture. Two comparable dehiscences of at least 4 mm, within the same patient, were first covered with a layer of autogenous bone, followed by a layer of either Bio-Oss® (GBO, Geistlich Biomaterials) or Straumann® BoneCeramic (SBC, Institut Straumann AG) and sealed by a resorbable membrane. The change in vertical dimension of the defect was measured at implant placement and at abutment connection (6.5 months). Clinical and radiological parameters were evaluated up to 1 year of loading. Both bone substitutes showed a comparable capacity to cover the dehiscence, with no significant differences. The clinical parameters after 1 year of loading showed a healthy peri-implant condition at both augmented sites and no implant failure was observed. SBC can be used successfully to cover dehiscences along implants. Besides a comparison with previous results, some important clinical steps in guided tissue regeneration will be highlighted, and the rationale behind guided tissue regeneration will be summarized.

034 | Parallel Session 3 – Long-Term Predictability

Immediate implant placement vs. delayed

De Bruyn H

University of Ghent, Ghent, Belgium

Immediate placement is defined as implant placement in conjunction with tooth extraction and offers several benefits for the patient and the clinician. It reduces the treatment time with several months since implant osseointegration coincide with soft tissue healing after extraction. Today immediate implantation combined with immediate provisionalisation further enhances socket and soft tissue preservation, cost-benefits and patient comfort. The first-generation dental implants resulted in unacceptably high failure rates. The introduction of rougher surfaces, however, has improved survival in such a way that comparable results to

implants placed in a delayed manner have been obtained. A brief overview of evidence-based literature will be given pointing to the prerequisites needed for an optimal clinical implant survival. On the other hand, implant placement in the aesthetic zone is more critical and more demanding. It is imperative that after implant placement the hard and soft tissues are in perfect harmony with the neighbouring natural teeth. The process of healing and tissue preservation seems to benefit from immediate provisionalisation but is affected by the patient's biotype. The clinical results of a prospective clinical trial will be presented whereby single implants were placed in the anterior maxilla in either healed bone or in extraction sockets. The discussion will focus on bone and soft tissue healing and patient-centered aesthetic outcome. Clinical guidelines for this treatment option will be given regarding the surgical as well as prosthetic approach in order to obtain predictability.

035 | Parallel Session 3 – Long-Term Predictability

Long term outcomes of vertical augmentation procedures

Chiapasco M

University of Milano, Milano, Italy

Vertical defects of the partially or totally edentulous ridges may render implant placement impossible or inadequate from a functional and esthetic point of view, due to the lack of bone, the proximity of important anatomical structures not to be violated, and the unfavorable intermaxillary relationships. Several bone augmentation procedures, aimed to recreate adequate bone volume to harbour implants of adequate dimensions placed in the proper, prosthetically driven position, have been proposed over the years. Aim of this lecture is to present updated data on the outcome of different augmentation procedures including autogenous bone grafts, allografts, GBR, and distraction osteogenesis based on the personal experience of the author and on the international literature. Advantages and disadvantages of the different procedures, including postoperative morbidity, as well as survival and success rates of implants placed in the reconstructed areas will be presented.

036 | Parallel Session 3 – Long-Term Predictability

Fixed vs. removable implant rehabilitation

Feine JS

McGill University, Montreal, Quebec, Canada

The choice of a particular prosthesis for an edentulous patient is dependent on many factors. When the clinical condition is deemed acceptable for a broad choice, which type of implant prosthesis will most satisfy the patient? In this presentation, Dr. Feine will discuss the results of studies in which edentulous patients rated their satisfaction and preference for fixed and removable mandibular prostheses. This information will clarify what aspects of intraoral prostheses patients consider to be important and the reasons that they may choose or reject implant therapy.

Sinus augmentations vs. short implants

Thoma DS

University of Zurich, Zurich, Switzerland

Dental implants represent a predictable treatment option for replacing missing teeth at single and multiple tooth gaps. However, in daily practice, the clinician is often confronted with bony situations that do not allow placing implants in a prosthetically ideal position without the need for a concomitant bone augmentation procedure. This may be due to a lack of horizontal or vertical bone height. For the latter, in the case of the maxilla, a sinus elevation procedure is the treatment of choice. Even though, this kind of treatment shows a high predictability and high implant survival rates, sinus elevation procedures are still associated with an increased risk for implant failures and an increased patient morbidity. In order to overcome these shortcomings, the use of short implants has been proposed. Historically, clinical studies reported on lower survival rates for short implants. However, based on recent scientific evidence, short implants with a rough surface appear to have similar survival rates as standard length implants. The use of short implants in the maxilla may therefore be a valid treatment option to avoid major surgeries. In addition, this treatment may save time, reduce costs and eliminate possible complications associated with grafting procedures.

The biological width – a myth revised

Abrahamsson I

University of Gothenburg, Gothenburg, Sweden

The dimension of the epithelial and connective tissue components of the peri-implant mucosa is established during the wound healing subsequent to implant surgery. Healing of peri-implant soft tissues has been examined in man and in animal experiments. It was observed that the barrier epithelium terminated about 2 mm apical of the soft tissue margin and that the subjacent connective compartment was about 1.5 mm high. It was suggested that a certain width of the peri-implant mucosa is required to enable a proper epithelial-connective tissue attachment, and, if this soft tissue dimension is not sufficient, bone resorption will occur to ensure the establishment of an attachment with an appropriate "biological width". Recent observations suggest that the implant design (e.g. "platform switching") or the surgical technique may influence initial marginal bone loss and soft tissue dimensions. In the presentation, scientific evidence will be presented supporting the biological width concept and factors that may modify the soft tissue dimensions will also be discussed.

The effectiveness of short implants vs. longer implants placed in augmented bone

Esposito M

Göteborg University, Göteborg, Sweden

After a brief methodological introduction on evidence-based practice and on the role of randomised controlled trials (RCTs) in order to properly evaluate effectiveness of medical interventions, the most updated evidence originating from several RCTs comparing the use of short implants (up to 8 mm long) with longer implants placed in augmented bone will be summarised. The main objective is to help clinicians to develop critical skills when interpreting the scientific literature on controversial topics so that it might be easier to take sound clinical decisions for the patient benefit. The preliminary available evidence-based data with a prosthetic follow-up of about 1 year after loading, suggest the following: (1) in atrophic mandibles (5–8 mm of residual bone height), short implants seems to have significantly better clinical outcomes than longer implants placed in vertically augmented bone. In atrophic maxillas (5–8 mm of residual bone height) there are similar clinical outcomes, though short implants achieved the same goal causing less patient morbidity and in shorter treatment periods. It should also be stressed that the medium- (5 years) and long-term prognosis (≥ 10 years) of short implants is largely anecdotal and that reliable information from long-term trials is extremely important in order to guide clinical decisions to rehabilitate patients with atrophic edentulous jaws.

Augmentation vs. angulation

Brägger U

University of Bern, Bern, Switzerland

Historically great concern has been expressed related to unfavorable so-called nonaxial loading forces exerted on implants i.e. in situations with anatomical conditions resulting in implant positions with divergent axes compared with adjacent teeth or within multiple implants. In edentulous maxillae, after traumatic tooth and bone loss in the upper front area, in case of lingual undercuts, in situations with structures interfering with a regular implant axis and when the implants are not placed in a somewhat planned and guided concept considerable discrepancies in implant axes can be created. In order to correct for discrepancies there exist several approaches to improve the situation. First of all, augmentative surgical procedures including GBR and grafting may change the anatomical basis at the recipient site that will allow to place the implant in a more regular axis. In addition, refined surgical methods may create an envelope of hard and soft tissue to end with the platform at a position for the achievement of optimal function and esthetics with the suprastructure. Still remaining discrepancies between implants can be corrected using implants with an angled neck design or more often by using prefabricated or individually shaped angled abutments/mesostructures. CAD/CAM-based individual abutments offer the best flexibility for an individual situation.

Additional augmentative/grafting procedures will result in an increased morbidity and costs and may also increase the risk for implant failure. Biomechanically unfavorable nonaxially loaded implants may suffer from increased failure rates and/or crestal bone resorption. Excessive forces may also lead to increased rates of mechanical and technical failure rates of the suprastructures and the components. This report will focus on the risks to be taken with treatment plans outweighing angulation/no angulation and augmentation/no augmentation. We will take available information from the literature and use clinical examples to try to solve the controversial aspects.

041	Parallel Session 4 – Controversial Issues
-----	---

Endodontic treatment vs. implant placement

Kvist T

University of Gothenburg, Gothenburg, Sweden

The endodontic lesion is evolving as a response to microbiological challenges and mainly as a sequel to dental caries. Endodontic

treatment is perceived as the removal of diseased or infected pulpal tissue, instrumentation and medication of the root canal system and, finally, the placement of a root filling and permanent restoration. The ultimate objective is to protect the individual from a potentially painful and harmful infection and, at the same time, preserve the affected tooth in the long term. It has convincingly been shown that endodontic treatment performed with controlled asepsis and of good technical standards, promotes the lesion to heal and the possibility to preserve the affected tooth in the long term. However, epidemiological surveys have demonstrated a high frequency of root fillings of poor technical quality. As a consequence 25–50% of endodontically treated teeth are associated with radiographic signs of persistent pathology. Although rarely associated with clinical symptoms such teeth have been classified as “failures” and researchers have pointed out the high number of potential retreatment cases. This presentation gives a briefly overview the outcome of modern endodontic retreatment strategies but also call attention to important knowledge gaps regarding endodontic lesions associated with root-filled teeth.

Greek Sessions (Abstracts 042–048)

042	Greek Session – Prosthetic Treatment Planning in Implant Dentistry: Clinical Guidelines
-----	---

Preprosthetic surgical planning

Kalyvas D

University of Athens, Athens, Greece

The role of the oral surgeon in the treatment planning is essential. It is his responsibility to get a detailed and well-documented medical history, to perform the clinical examination and to judge if the prosthetic treatment plan is realistic and if not, how it could become realistic.

The clinical examination must include:

- Extraoral Examination.
 - Nutritional and general health.
 - The facial symmetry.
 - The lip support.
- Intraoral Examination.
 - Mouth opening.
 - TMJ function.
 - Full mouth examination to exclude pathologic changes (leukoplakia, lichen planus, oral candidosis etc.).
 - The evaluation of the keratinized oral mucosa.
 - The profile of the alveolar crest.
 - The type of occlusion.

The treatment plan should include the following consecutive steps:

- Determination of relative or absolute, local or general contraindications.
- Determination of functional and aesthetic problems of the patient.
- Evaluation of the prosthetic feasibility.
- Evaluation of both quantitative and qualitative alveolar bone deficiencies which may affect the final treatment result.

The tools to realize these steps are:

- Laboratory tests (blood tests) if needed.
- Wax-up on study casts.
- Radiographic analysis of the case.
- Extra oral and intraoral photos.

In case a problem concerning an alveolar bone deficiency is diagnosed, the oral surgeon must use the appropriate method to solve it.

Augmentation techniques such as bone splitting, GBR, bone grafting, distraction osteogenesis and in some cases free vascularized bone grafting may be used to restore bone volume for an ideal implant placement.

043	Greek Session – Prosthetic Treatment Planning in Implant Dentistry: Clinical Guidelines
-----	---

Predicting and achieving the final result with implant restorations for partially and completely edentulous patients

Kourtis SG

University of Athens, Athens, Greece

The evolution of dental implants in the last decades has changed the treatment options for partially and completely edentulous patients. An individualized treatment plan for each specific clinical case, must aim for a functional and esthetic final result. The final restoration must also fulfill the patient's demands and expectations. The patients often feel insecure about the functional ability and the esthetics of the planned restoration. Although the same questions arise at conventional prosthetic procedures, implant restorations require surgical procedures, additional treatment time and increased cost compared with conventional restorations. The possibilities of the clinician to predict the final result before the insertion of implants, have been improved since the introduction of CAD/CAM technology. In many cases, however, the conventional techniques still offer precious guidance in simple and complicated cases. These techniques include the diagnostic wax-up before implant placement, a detailed radiographic examination by the use of a radiographic guide and implant placement to the selected and predetermined areas by means of a surgical guide. After the osseointegration period, a detailed wax-up based on the inserted implants should be the guide for the fabrication of the definite prosthetic restorations. Implant-supported interim prostheses allow both the clinician and the patient to evaluate the aimed result for a period of time. During these treatment steps, the functional ability and the esthetic performance can be checked repeatedly and any needed corrections should be accomplished before fabrication of the definite prosthetic restoration. The aim of this presentation is to present the possibilities for predicting and achieving the final result in partially and completely edentulous patients with clinical examples.

044	Greek Session – Prosthetic Treatment Planning in Implant Dentistry: Clinical Guidelines
-----	---

Stepped approach for restoring functionally and esthetically the lost prosthetic space

Chronopoulos V

National and Kapodistrian University of Athens, Athens, Greece

The prosthetic space is a 3D area is occupied by a restoration in order to achieve an esthetic and functional result. In implant restorations this space is usually increased and very often soft and hard tissue is missing. This deficiency can be localized or a generalized and result to an esthetic problem, a functional problem or a combination. The procedure to "reduce" this

increased prosthetic space may include soft and hard tissue augmentation, utilization of pink esthetic materials, alteration of the existing vertical dimension etc. A philosophy of stepped approach for restoring localized and generalized problems of prosthetic space will be presented. Key factors to this procedure are the presurgical diagnosis, the utilization of fixed interim prosthesis representing the final result both functionally and esthetically, the use of contemporary surgical procedures to restore missing soft and hard tissues, the prosthetically driven implant placement and the utilization of implant-supported interim restorations and finally the design of the final restoration according to the classic principals of esthetics, occlusion and function.

045	Greek Session – Prosthetic Treatment Planning in Implant Dentistry: Clinical Guidelines
-----	---

Advanced problem solving: going back to the basics

Papavasiliou G

University of Athens, Athens, Greece

When osseointegrated implants were first introduced they offered a solution to serious clinical problems such as edentulism with absorbed alveolar ridge. Since then implant treatment has become very popular and a solution that many clinicians can provide to their patients. Advanced surgical techniques, new biomaterials, improved implant surfaces as well as technologically advanced restoration production techniques, allow the rehabilitation of most dental patients. These include simple patients as well as more advanced ones. Overexposure to implant products, has led many clinicians to believe that all treatments can be accomplished with them and teeth with less than good prognosis should be extracted. It has also led many implant manufacturers to develop products marketed to allow the novice to accomplish extensive treatments by avoiding steps such as treatment planning or special impression making. This presentation gives the main role to the educated clinician. It provides an insight to simple as well as complicated cases. It shows how each one of them can be accomplished by following the basic principles of prosthodontics, well known to most clinicians but overlooked very often.

046	Greek Session – Prosthetic Treatment Planning in Implant Dentistry: Clinical Guidelines
-----	---

Solving the equation: esthetics vs. function

Kamposiora P

University of Athens, Athens, Greece

Esthetics plays a major role in many people’s lives. An esthetic appearance can help professional as well as personal interrelationships. A major asset for a beautiful face is an appealing smile. Many dental materials and techniques developed the last few years are

marketed as able to produce the ultimate esthetic restoration. The aim of this presentation is to address the question whether the hunt for ultimate esthetics in what regards osseointegrated implants can compromise the restoration’s function. Osseointegrated implants were initially introduced for the restoration of fully edentulous jaws, mainly the mandible, of the elderly population. This was done mainly with fixed “hybrid” restorations. The improvement in the patient’s function was usually impressive but esthetically the restoration was acceptable only behind a low smile line. Today the mean patient population is younger, is missing fewer teeth and has lost less of its function. A lot was done on surgical techniques, allowing implants to be placed in esthetically acceptable positions. New and improved materials and components (glass ceramics, zirconium, ceramic abutments, ceramic implants, CAD-CAM restorations) were developed in a quest to extend the restoration’s esthetic region deep into the tissues. These developments have the potential to improve patient’s function and restoration’s hygiene as well. Unfortunately they can also lead to restorations with more maintenance problems such as chipping of porcelain over zirconium frameworks, fracture of ceramic abutments as well as peri-implantitis. Education, experience and clinical thinking will help clinicians to solve the equation: function vs. esthetics.

047	Greek Session – Prosthetic Treatment Planning in Implant Dentistry: Clinical Guidelines
-----	---

Implant supported overdentures: combining function and esthetics

Sykaras N

University of Athens, Athens, Greece

Implant supported restorations present a wide spectrum of clinical applications in modern dentistry. Removable prostheses which are planned to be implant supported or retained offer many advantages to the patient stemming from their improved stability. The successful clinical outcome of an implant overdenture begins with proper diagnostic evaluation and precise execution of the treatment plan. This presentation will analyze the clinical parameters affecting the decision for removable prosthesis restoration. Once the treatment plan is confirmed, implant position and distribution must be evaluated. This evaluation takes into consideration the anatomy of bone, the functional load, the opposing dentition and patient’s needs regarding support, stability and retention. Splinted or free-standing implants is an important factor for their long-term success and prosthesis design. The retentive mechanism plays a crucial role in patient satisfaction and ease of maintenance and repair. The retentive force, its stability over time, the option of increasing it and the clinical consequences are of fundamental importance for patient acceptance during function. The aforementioned parameters will be covered in detail and supported by evidence-based clinical and experimental data. The presentation of the clinical procedures and laboratory techniques will help the clinician to apply this information in daily practice in a successful and predictable way.

Bruxism and implant rehabilitation

Roussou I

University of Athens, Athens, Greece

According to the Glossary of Prosthodontic Terms, bruxism is defined as a parafunctional grinding of teeth and an oral habit consisting of involuntary rhythmic or spasmodic nonfunctional gnashing, grinding, or clenching of teeth, in other than chewing movements of the mandible, which may lead to occlusal trauma called also tooth grinding, occlusal neurosis. The etiology of this bruxism is still difficult to be determined since the literature is very controversial. However, most of the articles agree on the multifactorial nature of the etiology of this disorder. Peripheral factors, central factors and factors like smoking, alcohol, drugs, diseases and trauma may be involved in the bruxism etiology. In addition in the available literature there is still insufficient

evidence to support or not a causal relationship between bruxism and implant failure. There is a vast need for well-designed studies to study both the etiology of bruxism and its possible relationship with implant failure and complications. On a clinical base the use of dental implants to aid in the support of restorations replacing missing teeth has been reported in the literature dating back to the early 1960s. To achieve and maintain osseointegration, indications and contraindications must be carefully balanced, and proper patient selection is a key issue in treatment planning. Several factors have been shown to have a potential influence on the incidence of dental implant success. Based on clinical experience, probably every dentist would group bruxers into a high-risk category for technical and mechanical complications and failures. Even implant fractures seem to occur more frequently in bruxers according to case reports. In clinical reports studies in which bruxers were compared with nonbruxers the bruxers showed statistically significantly higher rates of mechanical complications and failure. Even implant losses were observed in bruxer at a higher rate.

EAO Statement (Abstract 049)

049	EAO Statement
-----	---------------

EAO guidelines for diagnostic imaging in implant dentistry 2011: overview

Harris D

Blackrock Clinic, Dublin, Ireland

EAO Guidelines for the use of diagnostic imaging in implant dentistry were published in the *Journal of Clinical Implant Research* in 2002. These arose from the proceedings of a consensus workshop held at Trinity College Dublin under the auspices of EAO. In the recent publication of "Guidelines on Radiation Protection: Cone Beam CT

for Dental and Maxillofacial Radiology. Provisional Guidelines May 2009" produced by the Sedentex Project (2008–2011), and supported by the Seventh Framework Programme of the European Atomic Energy Community (Euratom) it was requested that the EAO might update these guidelines and expand them to include the use of Cone Beam C T. The Board of EAO approved this and an international group of expert clinicians, radiologists and scientists took part in a workshop at the Medical University of Warsaw on May 6/7 2011 under the chairmanship of Profs. David Harris (Ireland) and Marc Quiryne (Belgium). These guidelines will be presented, as well as the rationale behind them, before full publication in the *Journal of Clinical and Oral Implants*.

Basic Research Competitions (Abstracts 050–059)

050 | Basic Research Competition

Influence of peri-implant bone tissue composition on progression of peri-implantitis

Presenter: Stavropoulos A

Department of Periodontology, School of Dentistry, Aarhus University, Aarhus, Denmark

Co-authors: Stavropoulos A¹, Papadimitriou S², Nyengaard J³, Karring T¹

¹*Department of Periodontology, School of Dentistry, Aarhus University, Aarhus, Denmark,* ²*Center for Experimental and Preclinical Biomedical Research (CEPBR), Athens, Greece,* ³*Veterinary School, Aristotelian University of Thessaloniki, Thessaloniki, Greece,* ⁴*Stereology and Electron Microscopy, Aarhus University, Aarhus, Denmark*

Background: Nonresorbable bone substitute materials are frequently used in bone augmentation procedures in association with dental implants. Such materials persist in the peri-implant tissues for long periods of time.

Aim: To evaluate whether bone tissue formed in combination with Bio-Oss (DBB) or bone ceramic (BC) grafting is more susceptible to peri-implant inflammatory breakdown than pristine bone.

Methods: Cylindrical defects (5 mm × 5 mm; Ø × H) were surgically created in the previously edentulated and healed mandibles in six Beagles. A screw-type implant (3.25 mm Ø × 10 mm long) was then placed in the center of each defect, with the top of the implant level with the defect margin; thus, a circumferential gap about 0.88 mm wide and 5 mm deep remained around the coronal portion of the implants. Subsequently, the gaps were filled out with DBB or BC and then the defects were covered with a bioresorbable membrane. An additional implant (control) was placed within pristine bone (i.e., no marginal defect). After 4 months of submerged healing abutments were placed, and after an additional 2 weeks, peri-implantitis was induced by means of silk sutures placed submarginally around the neck of the implants and by feeding the animals with soft diet and concomitant absence of any oral hygiene measures. Histological and histomorphometrical evaluation was performed 4.5 months after peri-implantitis induction. Differences among groups were evaluated with the Kruskal–Wallis and Mann–Whitney tests and the level of significance was set to $P = 0.05$.

Results: Peri-implantitis characterized by inflammatory lesions in the peri-implant mucosa and angular bone loss was observed in all three groups. The distance of the implant shoulder to the first bone-to-implant contact averaged 3.02 ± 0.67 , 3.20 ± 0.71 and 2.06 ± 0.69 mm in the DBB, BC and control sites, respectively. Bone-to-implant contact (in terms of % of the implant surface) in the portion of the implant within the original defect was $11.21 \pm 5.63\%$, $9.5 \pm 7.29\%$, and $23.6 \pm 9.63\%$ in the DBB, BC and control sites, respectively. The differences between the control group and the DBB and BC groups were statistically significant regarding both evaluated parameters,

while the differences between the two bone substitute groups were not significant.

Conclusions and clinical implications: Peri-implantitis seems to progress faster in peri-implant tissues containing bone substitute materials comparing with pristine sites. The study was supported by a grant from the Osteology Foundation, Switzerland.

051 | Basic Research Competition

Bone healing dynamics and crestal bone level at buccal peri-implant sites: a multivariable analysis in the dog

Presenter: Susin C

Laboratory for Applied Periodontal & Craniofacial Regeneration, Georgia Health Sciences University College of Dental Medicine, Augusta, Georgia, USA

Co-authors: Susin C, Gamboreba I, Fiorini T, Wentzel B, Lee J, Schüpbach P, Wikesjö U

Laboratory for Applied Periodontal & Craniofacial Regeneration, Georgia Health Sciences University College of Dental Medicine, Augusta, Georgia, USA

Background: Stable crestal bone levels are critical for the long-term esthetic and functional success of oral implants. Several clinical strategies, surgical techniques, implant technologies and abutment designs have been proposed to preserve the crestal bone level at buccal sites after implant placement.

Aim: To assess the effect of surgical technique, platform shifting and local factors on crestal bone level at buccal peri-implant sites.

Methods: Fifteen mongrel dogs received 120 dental implants (Ø4 × 8 mm) in the edentulous mandible (four implants/jaw quadrant) according to the following experimental design: surgical procedure (flap vs. flapless), implant placement (crest level vs. 2 mm subcrestally), abutment type (regular platform vs. platform shift), gap defect (no gap vs. 1 mm crestal peri-implant gap defect), implant position (anterior vs. posterior mandible). Plaque control was maintained using daily chlorhexidine rinses. Animals were euthanized at 8 weeks and block biopsies were removed for histometric analysis. Only buccal sites were included in this multivariable multilevel analysis.

Results: In the multivariable analysis, crest level at buccal sites were statistically associated with subcrestal placement of the implant, platform shifting and presence of a gap at the crest level. After adjusting for other factors, the crest level at implants placed 2 mm subcrestally was estimated to be, in average, 0.41 mm above the implant platform, whereas in implants placed at the bone level the buccal plate was 1.46 mm below the implant platform yielding a 1.88 mm significant difference between groups ($P < 0.001$). Crest level was coronal to the platform in narrow abutments whereas it was apical in regular abutments (0.25 vs. -0.22 mm, $P < 0.01$) totaling a difference of 0.47 mm between abutments. Implants placed in sites with 1 mm gap defects had

bone level 0.23 mm below the implant platform, whereas implants placed in sites without gap defects had bone 0.26 mm above the implant platform ($P=0.04$). Thus, gap defects yielded an additional 0.49 mm loss of the buccal plate. No significant differences were observed between implants placed with or without raising a flap ($P=0.31$). Similarly, implant position in the arch did not reach statistical significance ($P=0.30$).

Conclusions and clinical implications: Different factors affect the bone healing dynamics of the peri-implant buccal sites. A combination of clinical strategies and implant technologies are necessary to achieve optimal outcomes at these sites.

052 | Basic Research Competition

Layer-by-layer assembled, BMP-2-incorporated biomimetic calcium-phosphate granules induce bone formation

Presenter: Wu G

Department of Oral Implantology and Prosthetic Dentistry, Academic Centre for Dentistry Amsterdam (ACTA), Research Institute MOVE, VU University and University of Amsterdam, Amsterdam, the Netherlands
Co-authors: Wu G¹, Zheng Y^{1,2}, Liu T¹, Wismeiner D¹, Liu Y¹

¹Department of Oral Implantology and Prosthetic Dentistry, Academic Centre for Dentistry Amsterdam (ACTA), Research Institute MOVE, VU University and University of Amsterdam, Amsterdam, the Netherlands, ²School of Stomatology/Hangzhou Dental Hospital, Zhejiang Chinese Medical University, Hangzhou, China

Background: Current clinical bone-defect-filling materials for repairing critical-sized bone defects have various limitations. Autologous bone graft, the "gold-standard" treatment, is associated not only with donor-site morbidity but also with limited availability. These limitations also hamper its combined administration with granular biomaterials which are accessible on a large scale but not osteoinductive. We have hereby developed a novel layer-by-layer assembled, biomimetic calcium-phosphate (BioCP) granules for substituting autologous bone. The BioCP can incorporate and slowly release BMP-2, and thus it significantly promotes bone formation when it is mixed directly with granular bone-defect-filling biomaterials such as deproteinized bovine bone (DBB) on the spot of a surgical operation.

Aim: *In vivo* evaluation of the degradability and osteoinductivity of the BioCP with or without incorporated BMP-2 in the presence or absence of DBB.

Methods: *In vitro*: BioCP granules were produced by layer-by-layer assembling crystalline CaP and amorphous CaP alternatively for three times using our well-established biomimetic methods. BMP-2 was incorporated into the outer crystalline layer to confer osteoinductivity. We characterized its morphology using scanning electron microscopy. BMP-2 loading was evaluated using enzyme-linked immunosorbent assay. *In vivo*: Samples (0.35 cc per sample) were implanted subcutaneously in rats and retrieved after 5 weeks for a histomorphometric analysis of bone and BMP-2-incorporated BioCP. Six experimental

groups ($n=6$ animals per group) were established: (i) BMP-2-incorporated BioCP ($97 \pm 8 \mu\text{g BMP-2}$); (ii) BioCP; (iii) 1:4 (V:V) mixture of BMP-2-incorporated BioCP and DBB ($19.4 \pm 2 \mu\text{g BMP-2}$); and (iv) 1:4 (V:V) mixture of BioCP and DBB; (v) DBB with adsorbed BMP-2 ($10 \mu\text{g BMP-2}$); (vi) DBB alone. Data were presented as mean \pm SD and compared using a one-way analysis of variance with the level of significance set at $P < 0.05$.

Results: The BioCP presented morphology of irregular clusters of microspheres with a crystalline outer layer. Its size varied from 0.1 to 1 mm. Five weeks after implantation, BMP-2-incorporated BioCP induced tremendous new bone regardless of DBB, while either of BioCP or DBB or their 1:4 combination failed to do so. The percentage of bone in intragranular space in group i ($32.8 \pm 6.9\%$) and iii ($11.0 \pm 3.5\%$) is significantly higher than in group v ($1.3 \pm 0.26\%$). The degradation rate of BMP-2-incorporated BioCP was significantly lower than BioCP regardless of DBB. Such a difference was also significant in the presence of DBB. DBB degraded insignificantly.

Conclusions and clinical implications: BMP-2-incorporated BioCP bears good osteoinductivity and proper biodegradability, and can thus significantly promote bone regeneration of granular bone-defect-filling materials.

053 | Basic Research Competition

An *in vitro* model of bacterial shifts associated with peri-implantitis

Presenter: Hazeim E

Eastman Dental Institute, London, UK
Co-authors: Hazeim E, Mordan N, Pratten J, Spratt D
Eastman Dental Institute, London, UK

Background: With the increasing demand for dental implants, dental implant failure is also being reported more frequently; peri-implant mucositis and peri-implantitis are major complications. Peri-implantitis is the irreversible destruction of soft and hard tissues around osseointegrated implant. The surfaces of implants are colonized by microbial biofilm in the same way as all other available surfaces in the mouth. In the vast majority of cases this microbial community lives in harmony with the host (and dental implant). In response to some environmental or genetic influence the community becomes more pathogenic and an infection develops. The microbiota associated with this infection is similar to that associated with periodontitis but a few important differences are evident; namely the common presence of staphylococci and some enterics.

Aim: To develop an *in vitro* model to characterize shifts in bacterial populations from those associated with health to peri-implant mucositis and peri-implantitis.

Methods: Microcosm biofilms were grown on titanium discs using a Constant depth film fermentor biofilm model. Environmental conditions were changed during the progression from health to peri-implantitis by altering the growth medium from an artificial saliva to an artificial tissue fluid and altering atmosphere (microaerophilic, anaerobic). Biofilms were removed at a different time points and visualised by confocal laser scanning microscopy (Live/Dead stain). Cloning and

sequencing of the 16S rRNA genes was also carried out to determine bacterial richness.

Results: Under health condition CLSM revealed a closed structure with few voids and the predominance of cocci. A dense biofilm was observed in peri-implant mucositis condition with increases in both biofilm matrix and morphotypes. The nature of the biofilm changed again under peri-implantitis condition with long rods and filaments present. Following comparative 16S rRNA gene sequencing of the three communities a wide range of taxa were identified. The majority represented taxa that would be expected to occur in the oral cavity. The healthy sample was dominated by oral streptococci. In peri-implant mucositis the community was more diverse with streptococci, *Neisseria* species and *Capnocytophaga* species predominating. *Fusobacterium nucleatum*, *Peptococcus* sp., TM7 and *Campylobacter* sp. were also detected. In peri-implantitis the community was dominated by *Capnocytophaga* species and *Veillonella parvula*. Gut-associated taxa e.g. *Klebsiella* species were also detected.

Conclusions and clinical implications: We have successfully monitored the bacterial shifts between health, mucositis and peri-implantitis. This will help to understand the mechanisms that these bacterial communities use to cause disease and test current and novel treatments.

054 | Basic Research Competition

Effect of neodymium magnet placed into SLA-surface implant in early stage of bone healing

Presenter: Leesungbok R

Dental Hospital at Gangdong, Kyung Hee University
School of Dentistry, Seoul, Republic of Korea

Co-authors: Leesungbok R, Chang S, Ahn S, Lee S, Park S

Dental Hospital at Gangdong, Kyung Hee University School of
Dentistry, Seoul, Republic of Korea

Background: There are researches that use electromagnetic field around implant as a speed booster for osseointegration. Hwang and et al. (2005) researched the interior part of a preinstalled pure titanium implant disc in the bone and looked at how magnetism of a magnet installation has impact on bone formation and found out from the histological viewpoint that such magnetism on the initial process of osseointegration by studying the bone contact ratio.

Aim: The purpose of this study was to evaluate the effect of static magnetic field (neodymium magnet) in early stage of bone healing by removal torque test and histologic examination on the SLA-treated implants.

Methods: Thirty-two New Zealand white rabbits that are average of < 3 kg and 6 weeks old were used as an experiment, and SLA-treated screw implants (Dentium Co., Suwon, Korea) and neodymium magnets (Ne₂Fe₁₄B, Qingdao Qiangsheng Magnets Co., Ltd., Province, Shandong, China) were used in this study. Stainless-steel was used as a protecting seal to prevent any exposure on biologic tissue of the neodymium magnet. 15.34 mT of permanent magnet magnetism was measured during the experiment around the implant's top area. After the

implant were placed in the tibia of the rabbit through the routine implant surgical procedure, the cover screw without magnet was placed on the fixture for the control group, and a neodymium magnet was placed into the cover screw for the experimental group. The animals were sacrificed at 3 and 6 weeks after the implant placement. The removal torque tests were performed in 10 rabbits and the decalcified specimens were prepared for histologic analysis in other two rabbits. The undecalcified specimens in 20 rabbits were prepared for histomorphometric analysis of implant–bone contact ratio and bone quantity. SPSS program (version 12.0) and Oneway ANOVA ($P < 0.05$) was used for statistical analysis.

Results: (1) The average removal torque value (34.07 N cm) on the experimental group were significantly higher than that (23.97 N cm) on the control group ($P < 0.05$). However, there was no significant difference statistically between the experimental group and the control group at 6 weeks. (2) In the marrow bone, the average bone–implant contact ratios of the experimental groups (3 weeks; 10.36%, 6 weeks; 10.41%) were higher compared with that of the control group (3 weeks; 6.41%, 6 weeks; 7.36%). After 3 weeks of implantation, there was a significant difference between the control and the experimental groups ($P < 0.05$).

Conclusions and clinical implications: The results suggested that the placement of neodymium magnet inside of the cover screw immediately after implant placement will be helpful to promote bone formation during initial period of bony healing, and shorten the timing of functional loading to the implants.

055 | Basic Research Competition

Osteogenic differentiation of primary human osteoblasts in 3D microcavity arrays

Presenter: Altmann B

Department of Prosthodontics, Freiburg, Germany

Co-authors: Altmann B¹, Giselsbrecht S², Steinberg T³, Gottwald E², Tomakidi P³, Bächle-haas M¹, Kohal R-J¹

¹Department of Prosthodontics, Freiburg, Germany, ²Institute for Biological Interfaces, Karlsruhe, Germany, ³Department of Oral Biotechnology, Freiburg, Germany

Background: Three-dimensional (3D) cell culture models provide a powerful tool for a tissue-specific cultivation of cells as they rather resemble the *in vivo* situation concerning cell shape and microenvironment than a conventional monolayer culture. Frequently used 3D cell culture configurations for osteogenic cells comprise simple micro-mass cultures and cell entrapment in porous sponges, as well as in hydrogels.

Aim: The objective of this study was to establish a new 3D culture configuration for primary human osteoblasts derived from alveolar bone as an *in vitro* model for applications in basic research and tissue engineering.

Methods: The culture system comprises a microstructured polymer chip (3D-KITChip) which serves as 3D scaffold for the generation of multicellular aggregates. Human alveolar bone osteoblasts were cultured for up to 2 weeks in the absence of differentiation factors either in the 3D chip-culture or as conventional monolayer. Cell viability, aggregate formation and

distribution of osteoblasts inside the scaffolds after 7 and 14 days of culture were examined by live/dead staining (Syto16/propidium iodide), scanning electron microscopy and immunohistochemistry of resin-embedded sections (Technovit 8100). Cell differentiation was examined by gene expression analysis of osteogenic markers (osteonectin, osteocalcin, alkaline phosphatase and collagen type I) after 7 and 14 days using real-time RT-PCR. Experiments for gene expression studies were performed in duplicate in three independent experiments and were compared for statistically significant differences using the Student's *t*-test ($P < 0.05$).

Results: Morphological analysis of osteoblasts in 3D culture revealed the formation of uniform cell aggregates inside the cavities of the microstructured chips and high cell viability after 14 days of culture. Histological and immunohistochemical staining of resin-embedded sections showed a complete coverage of the cells in the microstructured area of the chips proven by the deposition of extracellular matrix components like fibronectin and osteocalcin. In addition, gene expression analysis on mRNA level demonstrated an up-regulation of the osteogenic markers osteonectin, osteocalcin and alkaline phosphatase in 3D culture compared with monolayer after 7 days.

Conclusions and clinical implications: Based on our results we conclude that the presented new 3D culture configuration is suitable to induce osteogenic differentiation in primary human osteoblasts and may have the potential to generate alveolar bone constructs *in vitro*. As the microstructured chips can be combined with custom made microbioreactors for long-term cell culture, we think that this *in vitro* bone model might be a useful tool to study bone physiology and regeneration, as well as biocompatibility of bone substitutes.

056 | Basic Research Competition

Impact of vitamin D on osseointegration in the ovariectomized rat

Presenter: Dvorak G

Medical University, Vienna, Austria

Co-authors: Dvorak G¹, Fügl A¹, Meinel A², Watzek G¹, Tangl S^{1,2}, Gruber R^{1,2}

¹Medical University, Vienna, Austria, ²Austrian Cluster for Tissue Regeneration, Vienna, Austria

Background: Vitamin D, a systemic calcium-regulating hormone, has an anabolic effect on bone metabolism. Recent data suggests a positive impact on the fracture healing process and mechanical properties of callus. According to several epidemiologic studies a majority of the elderly population is vitamin D deficient. Whether inadequate vitamin D levels or supplemental administration of vitamin D has an impact on osseointegration remains unknown. Vitamin D may enhance osseointegration and thus healing time in elderly patients.

Aim: The overall objective was to demonstrate the immanent importance of vitamin D supplementation on enhanced bone regeneration in an estrogen-deficient population.

Methods: Fifty adult ovariectomized female rats were randomly divided into three groups: Vitamin D depletion group (De) with a vitamin D free diet, control group (Co) fed a standard diet and

vitamin D depletion-repletion group (DeRe), fed a vitamin D food after 6 weeks of vitamin D depletion. After a housing period of 8 weeks two titanium implants with a diameter of 1 mm and a length of 3 mm were placed in the tibia. At the time of implant placement and sacrifice blood samples were collected in order to evaluate serum levels of 25(OH)D and parathyroid hormone (PTH). A double fluorochrome labelling method was used to demonstrate the dynamics of healing and the influence of vitamin D. Mineral apposition rate was evaluated at a defined region of interest. In order to quantify the percentage of the implant surface in contact with mineralized bone, referred to as "bone-to-implant-contact" (BIC) and "bone-volume-per-tissue volume" (BV/TV), histomorphometrical analysis was performed. Furthermore to evaluate the presence of vitamin D receptors (VDR) in the jaw an immunohistochemical staining of the lower jaw was performed.

Results: The median of bone volume in the cortical area (BV/TV) in De group was 93.20% and 91.17% in DeRe compared with 94.85% in Co group ($P = 0.05$). BIC in the cortical area showed a median of 59.68% in De group, 64.85% in DeRe group and 76.30% in Co group ($P < 0.05$). Bone volume and BIC in the medullary and periosteal compartment showed no significant difference in between groups ($P > 0.05$). Double fluorochrome labelling did not show a significant difference in between groups. Immunohistochemical staining enabled to localize VDR not only in the alveolar bone, but also in periodontal tissue and the pulp.

Conclusions and clinical implications: The combined withdrawal of vitamin D/calcium in combination with catabolic effects on bone metabolism of aging and estrogen deficiency will lead to delayed osseointegration, reversed by vitamin D administration. Even further we expect a positive dose response effect of vitamin D supplementation on the site-specific bone volume.

057 | Basic Research Competition

Novel exploitation of polysaccharide nanogel cross-linking membrane for GBR

Presenter: Miyahara T

Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan

Global Center of Excellence (GCOE) Program, International Research Center for Molecular Science in

Tooth and Bone Diseases, Tokyo, Japan

Co-authors: Kobayashi H¹, Shimizu Y¹, Fujimori T¹, Shiota M¹, Pluemsakunthai W^{1,2}, Nyan M^{1,2}, Kasugai S^{1,2}, Miyahara T^{1,4}, Shimoda A^{2,3}, Akiyoshi K^{2,3,4}

¹Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan, ²Global Center of Excellence (GCOE) Program, International Research Center for Molecular Science in Tooth and Bone Diseases, Tokyo, Japan, ³Organic Biomaterials Institute of Biomaterials and Bioengineering, Tokyo, Japan, ⁴Department of Polymer Chemistry, Graduate School of Engineering, Kyoto University, Kyoto, Japan

Background: Cholesterol-bearing pullulan (CHP) nanogel is synthetic degradable biomaterial for drug delivery with high biocompatibility. We have reported that the application of CHP nanogel alone stimulates wound healing in rats. This material is

also used as DDS for cancer immunotherapy, which has already been started in Japan.

Aim: The purpose of the present study was to evaluate effects of the novel CHP nanogel membrane in GBR.

Methods: The animal experiments in the present study were approved by the Committee of Animal Experiments, Tokyo Medical and Dental University. Thirty-six adult Wistar rats, were used and bilateral symmetrical full thickness parietal bone defects of 5 mm diameter were created with a bone trephine bur. Each defect was covered with the collagen membrane or the CHP nanogel membrane or untreated without any membrane. The animals were sacrificed at 2, 4 and 8 weeks and analyzed radiologically and histologically. Furthermore, after incubating human serum with CHP nanogel or collagen, the amount of PDGF in the serum was measured with ELISA.

Results: New bone formation in terms of bone volume in the bone defect was the highest in nanogel group than control and collagen groups at 2 and 4 weeks ($P < 0.05$). At 8 weeks, both membrane groups showed higher bone volume than control group. Notably, the newly formed bone in the bone defect in nanogel group was uniform and histologically indistinguishable from the original bone whereas in collagen group the new bone showed irregular structure, which was completely different from the original bone. After incubating with CHP nanogel, PDGF amount in the serum decreased significantly.

Conclusions and clinical implications: CHP nanogel GBR membrane favorably stimulated bone regeneration, in which a unique character of CHP nanogel, storing endogenous growth factors, was likely implicated.

058 | Basic Research Competition

A novel purmorphamine/ β -TCP filled degradable polymer membrane for GBR

Presenter: Mardas N

Periodontology Unit, UCL, Eastman Dental Institute, London, UK

Co-authors: Mardas N¹, Schwarz F², Hakimi A-R², Petrie A³, Gellynck K⁴, Neel EA⁴, Young A⁴, Buxton P⁴, Donos N¹

¹Periodontology Unit, UCL, Eastman Dental Institute, London, UK,

²Oral Surgery Department, Heinrich Heine Universität, Düsseldorf,

Germany, ³Biostatistics Unit, UCL, Eastman Dental Institute,

London, UK, ⁴Biostatistics Unit, UCL, Eastman Dental Institute,

London, UK

Background: Exogenous hedgehog signalling stimulates the proliferation and differentiation of osteoblast precursors while local application of hedgehog agonists like purmorphamine (*pm*) promotes bone formation. Our team has provided evidence as to how a β -TCP filled degradable polymer biomaterial loaded with *pm* affects cell attachment/proliferation and hedgehog activation and has customized a GBR barrier for controlled *pm* delivery.

Aim: To evaluate the effect of a novel degradable polymer membrane (PPLM) containing β -TCP and *pm* on the healing of critical sized calvarial defects (CSD) in rats.

Methods: In 48 rats, a 5.0 mm CSD was created between the two parietal bones. The animals were randomly allocated in four

groups with 12 animals in each group: *T+*: the defect was treated with a double PPLM barrier loaded with *pm*. *T-*: treatment with the same barrier without *pm*. *R*: treatment with a commercially available polymer membrane (GORE RESOLUT ADAPT LT) *C*: the defect was left untreated. In each group six animals were sacrificed at 1 month and another 6 at 3 months post op. Undecalcified sections were produced were used for histological/histometric analysis.

Results: New bone formation was observed in all groups. In several specimens the PPLM barrier was fragmented. In few cases the fragments were positioned in between the borders of the defect resulting in reduced bone formation. After 30 days of healing, new bone occupied $86.1\% \pm 11.7$, $83.6\% \pm 7.1$, $88.0\% \pm 9.9$ and $74.5\% \pm 17.4$ of the defect space in the *T+*, *T-*, *R* and *C* group, respectively. After 3 months, new bone occupied $90.6\% \pm 18.7$, $94.4\% \pm 8.8$, $98.4\% \pm 1.6$ and $73.5\% \pm 24.8$ of the defect space in the *T+*, *T-*, *R* and *C* group, respectively. Hierarchical analysis of variance showed that the type of barrier used significantly influenced new bone formation ($P = 0.018$). Bonferroni tests for multiple comparisons between the groups showed statistically significant less new bone formation new bone formation in the *C* group in comparison with the *R* group ($P = 0.016$) while no statistical significant differences were observed between the *R* group and the other two test groups.

Conclusions and clinical implications: Treatment of CSD calvarial defects in rats with a RESOLUT membrane is predictable. The use of a *pm*/ β -TCP-filled degradable polymer membrane did not further enhance osseous healing. The mechanical properties of the tested barriers should be improved in order to avoid their fragmentation during healing.

059 | Basic Research Competition

Maxillary sinus floor elevation with injectable porous calcium phosphate cements in sheep

Presenter: Hoekstra JWM

Department of Biomaterials, Radboud University

Nijmegen Medical Center, Nijmegen, The Netherlands

Co-authors: Hoekstra JWM^{1,2}, Klijn RJ¹, Van Den Beucken JJ¹, Meijer GJ², Jansen JA¹

¹Department of Biomaterials, Radboud University Nijmegen Medical

Center, Nijmegen, The Netherlands, ²Department of Implantology and

Periodontology, Radboud University Nijmegen Medical Center,

Nijmegen, The Netherlands

Background: The use of injectable calcium phosphate cements (CPCs) in animal testing and clinical applications has been widely described in the field of dentistry. CPCs show favorable characteristics for (pre)clinical application, e.g. ease of handling, moldability and biocompatibility. Unfortunately, biodegradation of CPC on itself is poor. Increasing porosity of CPC by adding hollow poly (D,L-lactic-co-glycolic acid) (PLGA) microspheres leads to faster degradation and simultaneously allows bone ingrowth into the material. In this study, two different types of PLGA microspheres (high and low molecular weight; HMW and LMW) were added to CPC to compare their biological performance in maxillary sinus floor elevation in sheep.

Aim: The aim of this study was to evaluate the biological performance of CPC enriched with HMW or LMW PLGA microspheres in maxillary sinus floor elevation procedures in sheep.

Methods: The experimental materials were obtained by adding HMW (CPC-H group) or LMW (CPC-L group) PLGA microspheres to CaP powder in a 20/80 wt.% ratio. An aqueous solution of 2% Na_2HPO_4 was used as the liquid phase (liquid-to-powder ratio: 0.39). Bilateral sinus floor elevation procedures were performed in 8 Swifter sheep. Surgery was performed via an extra-oral approach, creating a bony window in the lateral sinus wall with piezo-surgery. The bony window was replaced at its original position after applying the material. All animals alternately received CPC-H and CPC-L in the left and right maxillary sinus with an implantation period of 12 weeks (split-mouth design; $n=8$). Analysis consisted of histological and histomorphometrical evaluation. All quantitative measurements were expressed as mean

standard deviation. Differences in total area of bone and CPC in the region of interest (ROI) were analyzed by Student's *t*-tests.

Results: The surgical procedure was uneventful and all animals remained in good health during the entire 12-week implantation period. Both CPC-H and CPC-L showed no adverse tissue responses (e.g. inflammation or fibrous tissue formation at the bone-cement interface), as demonstrated by light microscopy. The percentage of bone in the ROI differed significantly ($P<0.001$) between CPC-H and CPC-L (8.6 ± 3.9 vs. 26.4 ± 10.5 , respectively). Additionally, the percentage of cement in the ROI differed significantly ($P<0.05$) between CPC-H and CPC-L (81.9 ± 10.9 vs. 61.2 ± 17.7 , respectively).

Conclusions and clinical implications: CPC enriched with LMW PLGA microspheres showed to significantly accelerate CPC degradation as well as bone formation in a sinus floor elevation model in sheep compared with equivalents with HMW PLGA microspheres.

Clinical Research Competitions (Abstracts 060–067)

060 Clinical Research Competition

The noninfluence of platform-switching on peri-implant crestal bone level alterations

Presenter: Enkling N

Department of Prosthodontics, University of Bern, Bern, Switzerland

Department of Prosthodontics, Preclinical Education and Dental Materials Science, University of Bonn, Bonn, Germany

Co-authors: Enkling N^{1,2}, Albrecht D¹, Gallo N¹, Dürstler M¹, Bayer S^{2,1}, Stark H², Mericske-Stern R¹

¹*Department of Prosthodontics, University of Bern, Bern, Switzerland,*

²*Department of Prosthodontics, Preclinical Education and Dental Materials Science, University of Bonn, Bonn, Germany*

Background: The concept of platform switching has been introduced to implant dentistry based on clinical observations of reduced peri-implant crestal bone loss. However, published data are controversial and only very few trials used intraindividual controls.

Aim: This study aimed to test the hypothesis of no influence of platform switching on crestal bone level changes.

Methods: In a split-mouth design two implants (SICace, SICinvent AG, Basel, CH; diameter 4 mm/length 9.5 mm) were inserted epicrestally in the lower canine-area of 30 edentulous subjects (baseline). Every subject received an implant with (3.3 mm platform, test) and one without platform-switching (4 mm platform, control). The allocation of test and control and of the loading protocol, i.e. immediate loading ($n = 15$ patients) or delayed loading after an open healing period of 3 months ($n = 15$ patients), was randomized before operation by means of a computer-generated list. The implants were loaded with a prefabricated bar (SFI-Bar, C + M, Biel, CH). Patients were followed-up at short intervals for monitoring of healing and for oral hygiene control. Standardized digital radiographs (baseline, 3 months, 6 months, 1 year after implant insertion) were independently evaluated for bone level alterations by two calibrated examiners. For equivalence testing of bone level alterations at test and control implants at every time-point, Wilcoxon's signed rank tests with an equivalence range of (-0.4 mm; $+0.4$ mm) were used. Statistical analysis for the influence of time, implant type (test or control) and loading protocol on bone levels were performed with the Brunner-Langer model.

Results: One year after implant insertion, the mean radiographic peri-implant bone level alteration at the test implants was -0.51 ± 0.49 mm and at the control implants -0.56 ± 0.52 mm. The median difference between the two treatment modalities was 0.04 mm (IQR 0.47 mm, adjusted nonparametric 90% CI: -0.09 ; 0.20). The bone level alterations of test and control implants were equivalent at every time point (all $P < 0.001$). Crestal bone level alteration depended on time ($P < 0.001$), on loading protocol ($P = 0.022$) and on the interaction of time and loading protocol ($P = 0.015$), but not on implant type ($P = 0.609$). Immediate loaded implants showed less bone loss than delayed loaded.

Conclusions and clinical implications: The present randomized clinical trial confirmed the hypothesis of an equivalent bone level alteration of implants with platform-switching and implants with matching abutments. Therefore, the prosthetic concept of platform-switching does not necessarily prevent bone loss.

061 Clinical Research Competition

Reversibility of experimental peri-implant mucositis compared with experimental gingivitis in man

Presenter: Aglietta M

University of Bern, Bern, Switzerland

Co-authors: Aglietta M¹, Eick S¹, Sculean A¹, Ramseier CA¹, Lang NP², Salvi GE¹

¹*University of Bern, Bern, Switzerland,* ²*University of Hong Kong, Hong Kong, China*

Background: Experimental studies demonstrated that gingivitis and peri-implant mucositis are similarly dependent upon the presence of bacterial biofilm on tooth and implant surfaces. However, no study compared the healing sequence (i.e. resolution of inflammation) after experimental gingivitis and peri-implant mucositis at teeth and implants.

Aim: To elucidate factors involved in the pathogenesis of experimental gingivitis/peri-implant mucositis and to compare the resolution sequence of the inflammation after reinstatement of plaque control.

Methods: Fifteen patients in good general health, with excellent oral hygiene (FMPS $\leq 15\%$) and presenting an implant (test) and a controlateral tooth (control) in the posterior mandible were selected. After a pre-experimentally phase, the subjects were asked to abstain from oral hygiene practices in the posterior mandible for 21 days (T₀–T₂₁), following which these were resumed (T₂₁–T₄₂). At baseline and every 7 days for 6 weeks (T₀, T₇, T₁₄, T₂₁, T₂₈, T₃₅, T₄₂), Plaque Index (PI) and Gingival Index (GI) were assessed at each experimental unit. Probing pocket depth was assessed at T₀, T₂₁ and T₄₂. Subgingival plaque and crevicular fluid samples were collected during each appointment. The counts of 40 species were determined using checkerboard DNA–DNA hybridization; the concentrations of MMP-8 and IL-1 β were determined by enzyme-linked immunosorbent assay technique. For statistical analysis, Wilcoxon rank-sum test and Friedman test were used.

Results: PI and GI gradually increased from T₀ to T₂₁ at tests and controls. PI was consistently lower around implants than teeth ($P < 0.02$), whereas GI was higher ($P < 0.04$). After reinstatement of oral hygiene (T₂₁–42), PI and GI decreased. However, GI at implants and teeth did not reach at T₄₂ the pre-experimental levels ($P < 0.03$). Median PPDs were 3.00, 2.83 and 2.83 mm at implants and always 2.33 mm at teeth, at T₀, T₂₁ and T₄₂, respectively ($P < 0.001$). MMP-8 and IL-1 β concentrations increased from T₀ to T₂₁ at both implants and teeth. At T₄₂

pre-experimental levels were newly reached ($P > 0.05$). MMP-8 concentrations were significantly higher at implants at all observation times, whereas IL-1 β levels were comparable. Total DNA counts of the 40 species did not differ at any time between teeth and implants. Only minimal differences for few species were noted.

Conclusions and clinical implications: Reversibility of experimental gingivitis and peri-implant mucositis was demonstrated at biomarkers level and a cause-and-effect relationship was confirmed between biofilm formation and gingivitis/peri-implant mucositis. Peri-implant tissues seem to be more susceptible than gingival tissues to biofilm accumulation, displaying a more pronounced inflammatory response as well as a slower resolution of the inflammatory lesion.

062	Clinical Research Competition
-----	-------------------------------

Biological and technical complications with implant fixed dental prostheses for edentulous patients: a systematic review

Presenter: Chen C

Harvard School of Dental Medicine, Boston, USA

Chimei Medical Center, Tainan, Taiwan

Co-authors: Chen C^{1,2}, Papaspyridakos P¹, Gallucci G¹

¹*Harvard School of Dental Medicine, Boston, USA*, ²*Chimei Medical*

Center, Tainan, Taiwan, ³*Chimei Medical Center, Liouying, Tainan,*

Taiwan, ⁴*Chimei Medical Center, Tainan, Taiwan*

Background: The longitudinal effectiveness of osseointegrated implants with more than 20 years of stable success has been demonstrated and is well accepted for both partially and completely edentulous patients. It is now accepted that biologic and technical (mechanical) complications routinely occur with Implant Fixed Dental Prostheses (IFDPs). Additionally, it has been emphasized that longitudinal studies should report on complications and adverse clinical outcomes in order to provide clinicians with unbiased, thorough information for evidence-based treatment planning.

Aim: The purpose of this systematic review was to assess the incidence and type of biological and technical complications associated with IFDPs for edentulous patients.

Methods: An electronic MEDLINE/PubMED search was conducted to identify randomized controlled clinical trials and prospective cohort studies with IFDPs for edentulous patients. Reports on complications with 5-year follow-up after prosthesis insertion were selected. Pooled data was statistically analyzed and cumulative complication rates were calculated by Poisson-distributed number of complication events.

Results: From a total of 281 IFDPs (mean exposure time of 9.45 years) and 599 complication events, the complication rate was 21.4% estimated per 100 restoration years. Cumulative rate of "prosthesis free of complications" after 5- and 10-years was 34.3% and 11.8%, respectively. Most common implant-related biological complication was peri-implant bone loss (> 2 mm), with a complication rate of 20.1% (5 years) and 40.3% (10 years). Most frequent implant-related technical complication was screw fracture, yielding a complication rate of 10.4% (5 years)

and 20.8% (10 years). Most frequent prosthesis-related biological complication was hypertrophy or hyperplasia of tissue around the IFDPs, with complication rate of 13.0% and 26.0% after 5 and 10 years, respectively. Most common prosthesis-related technical complication reported with IFDPs was the veneering material chipping/fracture with an estimated complication rate of 33.3% at 5 years and 66.6% at 10 years.

Conclusions and clinical implications: Biological and technical complications after the insertion of IFDPs occur consistently. These events may not lead to implant/prosthetic failures but are significant in relation to the numbers of repair and maintenance sessions.

063	Clinical Research Competition
-----	-------------------------------

Implant surface decontamination using chlorhexidine during surgical treatment of peri-implantitis

Presenter: De Waal Y

University Medical Center Groningen, Groningen,

The Netherlands

Co-authors: De Waal Y, Van Winkelhoff A-J, Winkel E, Meijer H, Raghoobar G

University Medical Center Groningen, Groningen, The Netherlands

Background: Peri-implantitis is an infectious disease that resides in the mucosa surrounding dental implants and affects the supporting bone. Because the number of implants placed in everyday clinical practice is continuously increasing, it is reasonable to anticipate an increasing prevalence of peri-implantitis. This underlines the necessity for a predictable therapy.

Aim: The objective of this controlled clinical study was to evaluate the clinical effect of decontamination of the implant surface during the surgical treatment of peri-implantitis using chlorhexidine or placebo.

Methods: Adult patients ($n = 30$) with at least one dental implant with clinical and radiographical signs of peri-implantitis (BoP +, PPD ≥ 5 mm and peri-implant bone loss ≥ 2 mm) were consecutively included in this study. Patients were randomly allocated to either one of two treatment options and patients, surgeon and principal investigator were blind to group assignment. Implants with peri-implantitis lesions were surgically exposed, followed by mechanical cleansing using curettes and gauzes followed by 1 min of rinsing with a placebo solution (control group) or 1 min of chemical cleansing using 0.12% chlorhexidine + 0.05% cetylpyridinium chloride without alcohol (Perio-Aid[®]) (test group). The gingival flap was returned slightly apical to achieve pocket reduction. Bleeding index (BI), suppuration, probing pocket depth (PPD) and radiographic marginal bone level were assessed at baseline and 3, 6 and 12 months after surgery. Statistical analysis was performed using Mann-Whitney U -test and Wilcoxon-signed-rank-test.

Results: Both test and control group showed a significant reduction in mean BI and mean PPD between baseline and 12-months follow-up. Suppuration was significantly reduced in the test group. At 12-months follow-up no differences existed between test and control group for mean BI, mean PPD, suppuration and radiographic marginal bone loss. Nine implants in two patients

(both control) were removed between 6- and 12-months follow-up due to persisting peri-implant disease. One year following treatment 4% of the 78 implants (3% of subjects) with initial diagnosis of peri-implantitis showed no signs of peri-implant disease (no BoP, no suppuration, PPD < 5 mm, no progressive bone loss ≥ 1 mm between 3- and 12-months follow-up). An additional 35% of the implants (28% of subjects) showed peri-implant mucositis (BoP +, no suppuration, PPD < 5 mm, no progressive bone loss), but no persisting peri-implantitis.

Conclusions and clinical implications: Decontamination of the implant surface using 0.12% chlorhexidine + 0.05% cetylpyridinium chloride during the surgical treatment of peri-implantitis does not lead to better clinical results than using a placebo. Treatment was only successful for a minority of the implants and subjects.

064 | Clinical Research Competition

Use of short implants in single tooth replacement (follow-up 4 years)

Presenter: Rossi F

University of Bologna, Bologna, Italy

Co-authors: Rossi F¹, Ricci E¹, Marchetti C¹, Botticelli D², Lang N³

¹*University of Bologna, Bologna, Italy*, ²*Ardek, Rimini, Italy*,

³*University of Hong Kong, Hong Kong, China*

Background: In the posterior regions, however, the location of anatomical structures, i.e. the inferior alveolar nerve and the maxillary sinus, may limit the availability of a sufficient bone volume to install oral implants. An alternative therapy in situations with limited amounts of bone available is the installation of short implants, defined as implants with an intrabony length of 6 mm.

Aim: To evaluate prospectively the clinical and radiographic outcomes after 4 years of loading of 6 mm long moderately rough implants supporting single crowns in the posterior regions.

Methods: Forty SLActive Straumannshort (6 mm) implants were placed in 35 consecutively treated patients. Nineteen implants, 4.1 mm in diameter, and 21 implants, 4.8 mm in diameter, were installed. Implants were loaded after 6 weeks of healing. Implant survival rate, marginal bone loss and resonance frequency analysis (RFA) were evaluated at different intervals. The clinical crown/implant ratio was also calculated.

Results: Two out of 40 implants were lost before loading. Hence, the survival rate before loading was 95%. No further technical or biological complications were encountered during the 4-year follow-up. The mean marginal bone loss before loading was 0.34 ± 0.38 mm. After loading, the mean marginal bone loss was 0.23 ± 0.33 , 0.21 ± 0.39 , 0.18 ± 0.31 and 0.19 ± 0.32 mm at the 1-, 2-, 3- and 4-year follow-ups. The RFA values increased between insertion (70.2 ± 9) and the 6-week evaluation (74.8 ± 6.1). The clinical crown/implant ratio increased with time from 1.5 at the delivery of the prosthesis to 2.0 after 4 years of loading.

Conclusions and clinical implications: Short implants (6 mm) with a moderately rough surface loaded early (after 6 weeks) during healing yielded high implant survival rates and moderate

loss of bone after 4 years of loading. Longer observation periods are needed to draw more definite conclusions on the reliability of short implants supporting single crowns.

065 | Clinical Research Competition

Randomized-controlled clinical trial for prefabricated, anatomical shaped all-ceramic implant components in the posterior region

Presenter: Trimpou G

Department of Oral Surgery and Implantology,

Goethe-University Frankfurt Am Main, Faculty of Oral

and Dental Medicine, Frankfurt Am Main, Germany

Co-authors: Trimpou G¹, Grizas E¹, Hess P¹, Nentwig G-H¹, Weigl P²

¹*Department of Oral Surgery and Implantology, Goethe-University Frankfurt Am Main, Faculty of Oral and Dental Medicine, Frankfurt Am Main, Germany*, ²*Department of Prosthodontics, Faculty of Oral and Dental Medicine, Goethe-University Frankfurt Am Main, Frankfurt Am Main, Germany*

Background: There is less evidence on the clinical behavior of all-ceramic abutments in the posterior region. Additionally, a prefabricated anatomical-shaped healing abutment promises an early formed nature-like emergence profile.

Aim: The aim of the RCT was to evaluate the biological and technical performance of prefabricated, anatomical-shaped all-ceramic vs. conventional titanium abutments in the posterior region. Furthermore the effect of elliptic healing abutments on the early soft-tissue formation was of interest.

Methods: Forty-six patients needing implants at healed sites in the posterior region were included in this RCT. After four drop-outs, 42 patients were monitored. The 21 patients of the control group received round-shaped titanium healing abutments, replaced 2 weeks later by titanium abutments ($n_{\text{tit}} = 23$) retaining 19 single crowns and two bridges (PFM). The 21 patients of the test group were restored with 19 single crowns and two bridges borne on anatomical-shaped all-ceramic abutments ($n_{\text{zirc}} = 23$). The elliptical cross-sections of these abutments were identically at the all-ceramic healing abutments used for the test group. Sulcusfluid rate (SFFR) as well plaque index (PI) was recorded at baseline, 6 and 12 months. Radiographs were taken at baseline and at 12-months recalls to evaluate the crestal bone loss. The datas of both groups were analyzed by using the Student's unpaired *t*-test and the Mann-Whitney test ($P < 0.5$).

Results: The use of anatomical-shaped healing abutments accelerated and facilitated the assembling of the final all-ceramic abutments in the test group. A slightly nature-like scalloped peri-implant tissue was established compared with a flat soft-tissue at round-shaped healing abutments. Forty-two patients were examined at the 12-months recall (period of risk: 13.77 ± 3.93 months). No technical failure of implant components occurred. The test group showed a 4%, the control group an 8% rate of veneering porcelain chipping. The biological outcome between zirconia and titanium abutments showed no significant difference: SFFR ($\text{mSFFR}_{\text{ZrO}_2-12} = 8.0 \pm 6.2$; $\text{mSFFR}_{\text{Ti-12}} = 7.9 \pm 4.8$), PI ($\text{mPI}_{\text{ZrO}_2-12} = 0.4 \pm 0.7$ and

mPI_{Ti-12} 0.3 ± 0.5). The mean crestal bone loss was for the control group Ti_{mes} = 0.14 mm and Ti_{dist} = 0.26 mm. No changes of the crestal bone height were detected in the test group.

Conclusions and clinical implications: Under consideration of the short period of time posterior all-ceramic abutments lead to similar functional, mechanical and biological results as titanium abutments. Anatomical-shaped healing abutments enable an effective and minimal invasive prosthetic workflow to create a nature-like emergence profile.

066 | Clinical Research Competition

Periodontal disease and long-term dental implant survival

Presenter: Anner R

Private Practice, Kfar-saba, Israel

Co-authors: Levin L¹, Ofec R², Grossmann Y³, Anner R⁴

¹Rambam Health Care Campus, Haifa, Israel, ²Tel-Aviv University, Tel-Aviv, Israel, ³Sheba Medical Center, Ramat-gan, Israel, ⁴Private Practice, Kfar-saba, Israel

Background: Implant therapy is highly predictable and successful. However, certain risk factors might predispose individuals to lower success rates. There has been growing interest in identifying the factors associated with implant failure.

Aim: To evaluate the long-term survival rates of dental implants according to the patient's periodontal status as well as to estimate the effect of possible risk factors [i.e. smoking, diabetes mellitus, supportive periodontal therapy (SPT)] upon the survival rate of dental implants.

Methods: This was a prospective cohort study design of all consecutive patients operated from 1996 through 2006, at a periodontal clinic. The cohort consisted of 736 patients with a total of 2336 dental implants.

Results: Patients' mean (SD) age was 51.13 (12.35). Follow-up time was up to 144 months with a mean (SD) of 54.4 (35.6) months. Overall implant success was 95.9%. Severe periodontitis patients showed higher rates of late failures. The Kaplan-Meier estimates for the cumulative survival rate at 120 months was 0.96 for implants inserted to healthy periodontal patients or with moderate periodontitis. This rate dropped to 0.92 for the aggressive periodontitis group. For the severe periodontitis group the cumulative survival rate was only 0.87. According to Cox regression analysis with adjustment for diabetes and SPT status, the relative risk (RR) for a late failure among severe periodontal patients was 3.3 ($P = 0.005$). Implants of cigarette smokers are in a greater risk (RR = 1.98; $P = 0.036$) for late failures.

Conclusions and clinical implications: Periodontal status and smoking are significant risk factors for late implant failures. Highly frequent SPT programs might be warranted in order to decrease implant failure rates in high-risk populations.

067 | Clinical Research Competition

Osseointegration of zirconia oral implants: results from retrieved ceramic implants

Presenter: Bächle-Haas M

University Clinics Freiburg, Freiburg, Germany

Co-authors: Bächle-Haas M, Schwindling S, Kohal R

University Clinics Freiburg, Freiburg, Germany

Background: Zirconia oral implants are discussed as alternative to titanium implants. Regarding the osseointegrative capacity of these implants only few clinical investigations and animal studies are presented in the scientific literature.

Aim: The aim of the present examination was to evaluate the bone implant contact of retrieved zirconia oral implants due to peri-implantitis.

Methods: A prospective clinical investigation on surface modified zirconia oral implants (ZiUnite[®], NobelBiocare, Gothenburg, Sweden), approved by the ethics committee of the University of Freiburg, was initiated. The patients received either one implant for a single crown reconstruction or two implants for the reconstruction of a three unit bridge. During the course of the investigation, several implants showed severe peri-implant bone loss and soft tissue destruction (peri-implantitis) and had to be removed. The removal of the implants was performed using trephine burs with a slightly larger diameter than the implants, after the elevation of soft tissue flaps. The implants, removed with a thin layer of bone around the osseointegrated apical part, were then histologically processed according to Donath and Breuner (1982). The bone loss as well as the bone-to-implant contact of the remaining bone were analyzed.

Results: From 10 patients (age in years: 46–66), 16 implants (nine implants from lower molar areas, four from the lower premolar areas, two from upper molar areas, one from an upper premolar area) were removed after a mean function time of 48.8 months. The average bone loss (measured from the lower corner of the implant abutment area to the first bone-to-implant contact) amounted to 4.8 mm (min: 2 mm, max: 7.8 mm). The contact of the remaining bone to the implant surface amounted in average to 77% (SD: 9.2%; min: 65.2%, max: 90.3%). The bone-to-implant contact for the implants in the upper jaw amounted to 81.6% (SD: 3.5%) and for the implants in the lower jaw to 76% (SD: 9.9%) ($P = 0.9824$).

Conclusions and clinical implications: Sixteen zirconia implants out of 121 had to be removed after a mean function time of 48.8 months due to peri-implantitis. This is a high and unacceptable removal rate. The osseointegration rate of 77% of the remaining attached bone, however, was similar to that of surface-modified titanium implants (Degidi et al. 2010; Scarano et al. 2006). Within the limits of our investigation, there are indications that modified zirconia ceramic implants might be able to obtain a similar bone-to-implant contact as titanium implants.

Short Oral Communications (Abstracts 068–097)

068 Short Oral Communications

A randomized comparison of 6 mm long with 11 mm long implants: 1-year follow-up

Presenter: Guljé F

Praktijk de Mondhoek, Apeldoorn, The Netherlands

Co-authors: Guljé F¹, Abrahamsson I², Chen S³, Stanford C⁴, Zadeh H⁵, Palmer R⁶

¹*Praktijk de Mondhoek, Apeldoorn, The Netherlands*, ²*University of Gothenburg, Gothenburg, Sweden*, ³*University of Melbourne, Melbourne, Australia*, ⁴*University of Iowa, Iowa, USA*, ⁵*University of Southern California, California, USA*, ⁶*King's College London, London, UK*

Background: In cases with limited bone height in the premolar and molar regions, there is a clinical indication for using short implants.

Aim: The aim of this randomized controlled study was to compare the clinical performance of implants with a length of 6 with 11 mm, when using early loading in the premolar and molar region in both maxilla and mandible.

Methods: For this multicenter trial (study sites in Australia, The Netherlands, Sweden, UK and two study sites in USA), ninety-five patients (mean age 54 years, ranging from 26 to 70 years) with two or three teeth missing in the premolar and molar regions were included (63% mandibular cases and 37% maxillary cases). Each patient was randomly allocated to one of the two treatment groups to receive implants with a length of either 6 or 11 mm (OsseoSpeedTM 4.0 S, Astra Tech AB, Mölndal, Sweden). There was sufficient bone height to allow placement of an implant with a length of 11 mm. Implants were placed using a one-stage surgical procedure with a 42–48 days healing period before loading. The implants were restored with a screw retained fixed prosthesis. Clinical and radiographic examinations were performed preoperatively, postsurgery, loading, 6 and 12 months after restoration placement.

Results: In total 209 implants were inserted. From loading to the 12 months follow-up, a mean marginal bone resorption of 0.12 mm in the 6 mm group and 0.13 mm bone gain in the 11 mm group was found (*P*-value: 0.141). Presence of bleeding during probing was detected around 32% and 39% of the 6 mm implants and the 11 mm implants, respectively. Two 6 mm implants failed to integrate (early loss), and one 11 mm implant was lost 4 weeks after loading due to bone loss. Besides the loss of these three implants, no complications were recorded in the two treatment groups.

Conclusions and clinical implications: Initial data from this randomized multi-center study indicates that treatment with the OsseoSpeedTM 4.0 S 6 mm long implant is reliable as treatment with OsseoSpeedTM 4.0 S 11 mm long. This provides a good treatment option in situations with limited bone height in the premolar and molar regions.

069 Short Oral Communications

Peak insertion torque correlated to clinically and histologically evaluated bone density: a clinical study

Presenter: Makary C

Senior Lecturer, Oral Surgery Department, Faculty of Dental Medicine, St Joseph University, Beirut, Lebanon

Co-authors: Makary C¹, Rebaudi A², Naaman N³

¹*Oral Surgery Department, Faculty of Dental Medicine, St Joseph University, Beirut, Lebanon*, ²*University of Genoa, Genoa, Italy*, ³*Periodontology Department and Dean, Faculty of Dental Medicine, St Joseph University, Beirut, Lebanon*

Background: Bone quality is an important factor in successful implant treatment, since implant failures are more likely to occur in poor quality of bone. Implant peak insertion torque (IT) is influenced by bone density, surgical technique, and implant design.

Aim: The aim of this study was to establish a correlation between IT of tapered dental implants and histologically and clinically evaluated bone density.

Methods: Eighteen patients seeking implant placement were selected. Initial site preparation was done using a trephine drill to retrieve a bone biopsy for histological measurement of bone volume (BV). Osteotomy was completed using normal drilling protocols and bone type was assessed according to surgeon's tactile sense using Misch bone density classification (D1–D4). Forty mandibular and maxillary implants were placed. Peak IT values were recorded for each implant. Osseointegration was evaluated clinically at abutment connection. Data were analyzed for statistical significance using Pearson product-moment correlation coefficient.

Results: All implants but one achieved osseointegration. D1 and D4 bone types were significantly assessed using tactile sense. IT values ranged from 15 to 150 Ncm with a mean value of 78.30 Ncm. Mean IT was significantly higher in D1 bone (126.67 Ncm) and lower in D4 bone (40.22 Ncm) (*P*-value < 0.0001) while intermediate values were noted in D2 and D3 bone with no significant difference (*P*-value = 0.462). Statistically significant correlation was found between BV and IT values ($r = +0.771$, $P < 0.0001$). No statistically significant correlation was found between implant length and/or diameter and IT.

Conclusions and clinical implications: The results of this study suggest that clinical assessment of bone by the surgeon may be achieved in hard and soft bone but not in intermediate densities. Increasing peak IT values correlated with increasing BV. High IT does not seem to alter the osseointegration process.

Effect of wider implant/abutment mismatching: an histological study in dogs

Presenter: Canullo L

Private Practice, Rome, Italy

Co-authors: Canullo L¹, Baffone GM², Botticelli D^{2,3}, Pantani F², Beolchini M⁴, Lang NP⁵

¹Private Practice, Rome, Italy, ²UNESP – Faculty of Dentistry of Araçatuba, São Paulo State University, São Paulo, Brazil, ³ARDEC, Ariminum Odontologica, Rimini, Italy, ⁴Faculty of Dentistry, University of Medical Science, Habana, Cuba, ⁵Prince Philip Dental Hospital, The University of Hong Kong, Hong Kong, China

Background: Clinical studies extensively demonstrated positive effect of platform switching restorations, concluding that the degree of marginal bone resorption was inversely correlated with the degree of the implant/abutment mismatch. However, several histologic animal studies questioned the validity of platform switching in the maintenance of crestal bone levels.

Aim: The aim of the present study was to histologically evaluate the influence of wide implant/abutment mismatching on the peri-implant hard tissue remodeling and the soft tissue dimensions.

Methods: The research protocol was submitted and approved by the local Ethical Committee for Animal Research at the University of the State of São Paulo. Mandibular premolars and first molars of six Labrador dogs were extracted bilaterally. After 3 months of healing, one tapered implant was installed on each side of the mandibular molar region with the implant shoulder placed at the level of the alveolar buccal bony crest. On the right side of the mandible, a reduced in diameter abutment was used creating a mismatch of 0.85 mm (test), while a matching abutment was affixed in the left side of the mandible (control). The flaps were sutured to allow a nonsubmerged healing. After 4 months, the animals were sacrificed and ground sections were obtained for histometric assessment. The following landmarks were identified: implant shoulder (IS), most coronal bone-to-implant contact (B), top of the adjacent bony crest (C), top of the peri-implant mucosa (PM), apical portion of the junctional epithelium (JE). The following measurements were performed: vertical distance along the long axis of the implant between IS and B (IS-B), and IS and C (IS-C); vertical distance between PM and C (PM-C) and PM and JE (PM-JE). The distances PM-B, JE-B and PM-IS were extrapolated.

Results: At the end of the study, all implants resulted osseointegrated. Bone resorption was greater at the control than at the test sites. However, statistically significant differences were found only at the buccal and inter-implant aspects (Table 1). The soft tissue vertical dimension was higher at the control compared with

the test sites. However, no statistically significant differences were demonstrated for any of the variables evaluated

Conclusions and clinical implications: The present study demonstrated differences in peri-implant (buccal and inter-implant) hard tissue dimensions as a result of an implant/abutment mismatch of 0.85 mm, when the implant shoulder was placed at the level of the buccal bony crest.

An analysis of the decision-making process for single implant treatment in general practice

Presenter: Cosyn J

University of Ghent, Ghent, Belgium

Co-authors: Cosyn J^{1,2}, Raes S¹, De Meyer S¹, De Bruyn H¹

¹University of Ghent, Ghent, Belgium, ²Free University of Brussels (VUB), Brussels, Belgium

Background: There is little information on the decision-making process for single implant treatment in general practice.

Aim: To study the incidence of and the factors associated with the decision to perform single implant treatment after tooth extraction by general practitioners in a private, fee-for-service setting.

Methods: One hundred practitioners with a general dental practice in Ghent were randomly selected from an official list received by the Belgian Social Security Institute. Clinicians were asked to fill in a study form for every single extraction they performed during an 8-week period. The study form related to the treatment decision as discussed with the patient and a number of patient- and clinician-related factors. The association of these factors with single implant treatment was evaluated using univariate tests and logistic regression. A decision-tree was also constructed with the predictors from the regression analysis as independent variables.

Results: Ninety-four general dentists (52 males, 42 females; mean age 49; range 24–68) agreed to participate and extracted 1180 single teeth in an equal number of patients (50% males, 50% females; mean age 53; range 18–90). The main reasons for tooth loss were caries (48%) and periodontal disease (28%). At the time of extraction tooth replacement was deemed necessary in half of the patients and are movable partial denture was chosen in 55% of them. Similar frequencies were found for fixed partial denture (23%) and single implant treatment (21%). Although the vast majority of patient- and clinician-related factors showed a significant association with the latter on the basis of univariate tests, logistic regression only identified seven

Table 1

	IS-B			IS-C		
	B	L	I	B	L	I
Test (mismatching 0.85 mm)	0.67 (0.66)*	0.55 (0.58)	0.69 (0.54)*	0.62 (0.73)	0.21 (0.91)	0.19 (1.01)
Control	1.51 (0.51)	1.40 (0.93)	1.06 (0.50)	1.20 (0.72)	0.62 (0.90)	0.29 (0.86)

* $P < 0.05$ between different platform.

IS, implant shoulder; B, most coronal bone-to-implant contact; C, top of the adjacent bony crest. B, buccal, L, lingual, I, interproximal.

predictors. These included location of the extracted tooth, number of missing teeth, regular supportive care, bone loss at adjacent teeth, restoration level of adjacent teeth, gender of the clinician and dentists' experience in implant prosthetics. The decision tree identified bone loss at adjacent teeth and number of missing teeth as the most important predictors for single implant treatment.

Conclusions and clinical implications: If tooth replacement was deemed necessary at the time of extraction, a single implant was the treatment of choice in only one-fifth of the patients. Mainly oral factors had an impact on the decision-making process in contrast to patients' background and medical factors. Dentists' experience in implant prosthetics also showed a positive association with single implant treatment as opposed to dentists' experience in implant surgery.

072 | Short Oral Communications

Influence of cementation margin position on amount of undetected cement. A prospective clinical study

Presenter: Linkevicius T

Vilnius University, Vilnius, Lithuania

Co-authors: Linkevicius T^{1,2,3}, Vindasiute E^{2,3}, Puisys A^{2,3}, Maslova N^{2,3}, Linkeviciene L¹

¹Vilnius University, Vilnius, Lithuania, ²Vilnius Implantology Center, Vilnius, Lithuania, ³Vilnius Research Group, Vilnius, Lithuania

Background: Current recommendations allow clinicians to place cementation margins of implant-supported restorations up to 2 mm subgingivally. It is known that cement remnants might be associated with development of peri-implant disease, however clinical data on the influence of margin position on amount of undetected cement is lacking.

Aim: To perform clinical evaluation the amount of undetected cement after cementation and cleaning of implant-supported restorations.

Methods: Eighteen patients were treated with 26 single implant supported cement-retained metal ceramic restorations. The subgingival location of the standard abutment shoulder of each implant was measured with periodontal probe mesially, distally, buccally and lingually. Data was divided into five groups according to the position of the shoulder: 1 mm supragingivally (five cases), at the soft tissue level (30 cases), 1 mm (33), 2 mm (28) and 3 mm (8) subgingivally. Restorations were fabricated with occlusal openings (temporarily closed with composite during cementation) and cemented with resin reinforced glass ionomer. After cleaning, a radiograph was taken to evaluate if all cement had been removed. Then the composite was eliminated to gain the access to the abutment screw and cemented restoration-abutment unit was unscrewed. All quadrants of the specimens were photographed in a special device with standardized distance and analyzed with Adobe Photoshop. Total area of the restoration and the area of cement remnants were measured in each quadrant and proportion calculated. The level of significance was set to 0.05.

Results: Remnants of the cement were found in all restorations after cleaning: group 1 (0.0036 ± 0.0062); group 2 (0.0117 ± 0.0116); group 3 (0.0268 ± 0.0312); group 4 (0.0409 ± 0.0341)

and group 5 (0.0654 ± 0.0387). There was a significant increase of the relation between 1, 2, 3 and 4 groups ($P < 0.05$), except there was no difference between group 4 and 5 ($P > 0.05$). Dental radiographs did not show cement remnants in 96% of the cases mesially and in 80% of the cases distally.

Conclusions and clinical implications: The deeper position of the margin, the greater amount of undetected cement was discovered. The greatest amount of the residual cement was found when the crown margin was 2 or 3 mm below the gingival level. It is impossible to remove all luting agent, if margins are located subgingivally. Clinicians should select supragingival position of the margins for cementation of implant restorations. Dental radiographs should not be considered as a reliable method for evaluation of the residual cement after cementation.

073 | Short Oral Communications

Soft tissue response towards alumina-toughened zirconia oral implants: a 2-year follow-up

Presenter: Sperlich M

Department of Prosthodontics, University Clinics Freiburg, Freiburg, Germany

Co-authors: Sperlich M, Bernhart J, Kohal R-J

Department of Prosthodontics, University Clinics Freiburg, Freiburg, Germany

Background: Alumina-toughened zirconia (ATZ) possesses the potential for use as an oral implant material.

Aim: The objective of this prospective 5-year cohort investigation was to determine the soft tissue response of a one-piece ATZ oral implant system after 2 years.

Methods: The investigation was approved by the Ethics Committee of the University Clinics Freiburg. Twenty patients received one ATZ implant (Ziraldent, Metoxit, Thayngen, Switzerland) for single tooth reconstruction. Implants were immediately temporized after insertion. For the evaluation of the soft tissue response probing depth, gingival recession, clinical attachment level, bleeding index, and plaque index were recorded at prosthetic delivery (baseline), 1-year- and 2-year follow-up. A linear mixed model was fitted with random intercepts for each patient to evaluate effects on response variables. From these models least-square means with 95% confidence intervals were derived with adjustment of P -values for multiple testing. All calculations were performed with the statistical software SAS 9.1.2 using PROC MIXED.

Results: Of the 20 patients, 18 attended the 1-year follow-up and 17 attended the 2-year follow up. Two patients lost their implants due to non-integration after 3 and 4 weeks post implant insertion (implant survival rate: 90% after 2 years). Because of severe medical problems, one patient could not attend the 2-year follow-up. The average probing depth around the implants at the 2-year follow-up was 3.32 mm and increased significantly from baseline ($P < 0.0001$; baseline: 2.19 mm). The probing depth around adjacent teeth increased also, but on a lower level (from 2.1 to 2.5 mm). The gingival recession at implants decreased from baseline (0.36 mm) to the 2-year follow-up (0.11 mm) ($P = 0.0236$), whereas it remained stable around teeth. The plaque index at implant sites increased

from baseline (0.10; teeth: 0.5–0.65) to the 2-year follow-up (0.30; teeth: 0.32–0.83) ($P=0.0837$). The average marginal bone remodelling from implant placement to the 1-year follow-up was 0.88 mm (SD 0.89; $n=18$ implants).

Conclusions and clinical implications: The initial results regarding the soft tissue response showed clinically similar results between the implants and the adjacent teeth. A slight soft tissue creeping attachment around the ATZ oral implants could be observed. The average bone remodelling is comparable to the results obtained from studies of immediately loaded two-piece implants. Further research with a larger study population, however, is necessary in order to obtain robust information on the longevity of this implant system.

074 Short Oral Communications

Treatment of peri-implantitis lesions by means of chemical decontamination and bovine-derived xenograft, on different implant surfaces

Presenter: Rocuzzo M

Private Practice, Torino, Italy

Co-authors: Rocuzzo M¹, Bonino F¹, Bonino L¹, Dalmasso P²

¹Private Practice, Torino, Italy, ²University of Torino, Torino, Italy

Background: Recent animal studies have suggested that the outcome of the therapy of peri-implantitis lesions is influenced by implant surface characteristics. Limited information on the regenerative possibilities in peri-implantitis lesions is available on humans.

Aim: The aim of this prospective study was to compare the healing, following surface decontamination and regenerative surgery by means of bovine-derived xenograft (BDX), in peri-implantitis lesions around implants of two different surfaces: Titanium Plasma-sprayed Surface (TPS) and Sand blasted Large grit and Acid etched surface (SLA).

Methods: Twenty-six patients (10 males; mean age: 60 ± 7.9 years; four smokers), who presented a peri-implantitis crater-like lesion with a probing depth (PD) of ≥ 6 mm and no implant mobility, were consecutively enrolled. Full-thickness, mucoperiosteal flaps were raised, all granulation tissue was removed. The exposed implant was covered with EDTA 24% for 2 min and Chlorhexidine 1% gel for 2 min. Then the implant and bony surfaces were thoroughly rinsed with sterile physiologic saline. Bovine-derived xenograft (BDX) (BioOss[®] Collagen, Geistlich, Wolhusen, Switzerland) was applied in a way as to homogeneously fill the intrabony defect component.

Results: No patient dropout and no implant removal were registered during the first 12 months of observation. In Group 1 (TPS), PD decreased from 7.2 ± 1.5 to 5.1 ± 2.0 mm, corresponding to a statistically significant reduction of 2.1 ± 1.2 mm ($P=0.001$). In Group 2 (SLA), PD decreased from 6.8 ± 1.2 to 3.4 ± 1.0 mm, corresponding to a statistically significant reduction of 3.4 ± 1.7 mm ($P=0.003$). A statistically significant difference in PD reduction was found between the two groups ($P=0.04$). At baseline BOP was present around $91.1 \pm 12.4\%$ of the Group 1 and $75.0 \pm 30.2\%$ of Group 2 implant sites.

At 1-year examination, the values significantly decreased to $57.1 \pm 38.5\%$ ($P=0.004$) and to $14.6 \pm 16.7\%$ ($P=0.003$), respectively. The difference between the two groups was statistically significant ($P=0.007$).

Conclusions and clinical implications: In conclusion, within the limits of this study, the antimicrobial and surgical technique described resulted in a clinical healthier situation around most of the SLA-treated implants, so that their function could be fully maintained. These preliminary results seem to suggest that the clinical decision on whether implants should be removed or treated may also be based on the surface characteristics.

075 Short Oral Communications

Impact of dental implants on cranial mobility: an osteopathic point of view

Presenter: Goletti V

Collège Ostéopathique de Provence, Marseille, France

Co-authors: Goletti V¹, Orofino J^{2,3}, Palacci P⁴

¹Collège Ostéopathique de Provence, Marseille, France, ²Collège National d'Occlusodontologie, Marseille, France, ³Collège d'Implantologie Orale, Marseille, France, ⁴Centre Branemark d'Osseointegration, Marseille, France

Background: Osteopaths evidenced a relation between cranial structure (which is conditioned to evacuate mastication's forces) and cranial malleability and mobility. The amplitudes of cranial mobility changes in relation with under- or over-occlusion. Modifications will happen in different areas which depends on the teeth's over- or under-occlusion localization. Links were defined between: Occipital and Molars, Temporal and PreMolars, Frontal and Canines, Jaw and Incisors (Couly, 1980; Filippini, 1990; Coquillat, 2007).

Aim: Our purpose was to study the impact of dental implants on the amplitudes of cranial mobility from an osteopathic point of view.

Methods: A randomized single-blind test was conducted on 20 patients divided into two groups according to dental contacts: G1 = implant/implant (i/i) antagonist contacts, G2 = tooth/implant (t/i) antagonist contacts. Experienced osteopath evaluated the amplitudes of internal and/or external rotation of the cranium using manual palpation on four symmetrical bone points: maxillary, frontal, temporal, occipital. The measurement parameters were the variations in cranial amplitude with each patient and the number of "balanced" vs. "unbalanced" contacts in each group. The amplitude variations between the reference point (without occlusal contact) and the contact point were measured on a gradual scale from -3 to $+3$, with each patient (-3 = maximum decrease in amplitude, 0 = balance point, 3 = maximum increase in amplitude). "Balanced" contacts referred to occlusal contacts with 0 value or with identical values with and without contact; "unbalanced" referred to all other cases. McNemar's test was used to compare amplitude variations within a same group. Fisher's Exact test was used to compare G1 and G2 in "balanced" vs. "unbalanced" conditions, with or without contacts.

Results: i/i contacts (G1) resulted in significant changes in cranial amplitude ($P=0.027$). However, there was no obvious statistical

difference in G₂. The number of “balanced” vs. “unbalanced” contacts was statistically different between G₁ and G₂ ($P=0.03$): the “balanced” contacts were significantly more frequent in G₂.

Conclusions and clinical implications: Implants in occlusion with natural teeth (G₂) helped maintain good cranial mobility while antagonist dental implants (G₁) resulted in changes in cranial amplitude. Through manual palpation tests, osteopaths provide efficient informations on occlusal equilibration to dental surgeons, in order to balance occlusion for patient’s benefit.

Impact of implant-retained-overdentures on OHRQoL: immediate- vs. delayed-loading

Presenter: Albrecht D

Department of Prosthodontics, University of Bern, Bern, Switzerland

Co-authors: Albrecht D¹, Märki L¹, Fabian M¹, Bayer S², Stark H², Mericske-Stern R¹, Enkling N^{1,2}

¹*Department of Prosthodontics, University of Bern, Bern, Switzerland,*

²*Department of Prosthodontics, University of Bonn, Bonn, Germany*

Background: In edentulous patients, the retention of a lower complete denture with two interforaminal implants is a standard of care (Mc Gill Consensus Statement 2002). A new attachment system is available for this treatment indication: a prefabricated bar (SFI Bar[®] C + M, Switzerland).

Aim: The impact of the SFI Bar[®] mounted on two interforaminal implants on oral-health-related-quality-of-life (OHRQoL) was examined with an RCT: immediate vs. delayed loading with 6 months follow-up.

Methods: Twenty-eight edentulous subjects with complete dentures were treated with two interforaminal implants. The subjects were randomly assigned to either immediate (test, $n=14$) or delayed loading conditions after an open healing phase of 3 months (control, $n=14$). The OHRQoL was measured with the OHIP G 53 at the following time-points: at SFI Bar[®] integration, and 1, 3, 6 months after bar mounting. Additionally, in the control group, measurements were performed at implant insertion and 1 month later. Statistically, changes of OHIP G 53 total scores, subscores and single items over time were analysed with Brunner and Langer model and Wilcoxon signed-rank-test.

Results: OHIP G 53 total scores decreased over the time in both groups: statistically significant in the test group -21.9 ± 21.6 ($P=0.006$), but not in the control group -8.9 ± 25.7 ($P=0.511$). The change was mainly caused by alteration of the seven items towards “retention of the prostheses” and “food intake”. OHRQoL improved in the test group, but not in the control group, whereas in the control group OHRQoL deteriorated within the first 1 month after implant insertion by $+16.8 \pm 30.7$ ($P=0.058$).

Conclusions and clinical implications: The application of the SFI bars mounted on two interforaminal implants improved OHRQoL of edentulous patients. This improvement was significantly higher under immediate loading than under delayed loading conditions. Immediate loading may lead to a higher subjective patient-satisfaction as the benefit of the treatment is perceived directly after implant operation.

A radiographic evaluation of marginal bone levels of two different implant systems up to 7 years in function

Presenter: Burtscher D

¹Medical University Innsbruck, Innsbruck, Austria

Co-authors: Burtscher D¹, Schubert K¹, Beier U¹, Miklos A¹, Giesinger J¹, Norer B¹, Grunert I¹

Medical University Innsbruck, Innsbruck, Austria

Background: In the last decades in implant development many efforts have been made in order to improve the osseointegration and longevity of dental implants. Different types of implant surface conditionings were promoted which should supply the clinicians with products of predictable clinical outcomes.

Aim: The aim of this study was to evaluate the change of marginal bone level radiographically around two different implant systems up to 7 years in function.

Methods: In this study 20 fully edentulous patients were included and randomly assigned to two treatment groups of machined-surface implants (Branemark, $n=40$) and rough-surface implants (Xife, $n=40$). The implants were early loaded with individual bar retained overdentures. All patients were treated by the same surgeon and prosthodontist. Clinical and radiographic examinations were conducted at the time of implant loading (baseline) and annually up to 7 years in function. Measurements to the nearest 0.1 mm were taken at the mesial and distal site and average values were calculated for each implant. The two implant groups were compared by means of *t*-tests.

Results: The study population can be split up into five men (25%) and 15 women (75%) with an average age of 61.6 years at date of implant loading. A total 79 of 80 implants completed the study until the average time of 7 years and 2 months after implant loading. $N=1$ Branemark implant failed to integrate. There is a statistically significant difference ($P=0.003$) between the two implant systems at the baseline-measurements (0.36 mm Branemark vs. 0.71 mm Xife) as well as for the annual bone loss (0.041 mm (Branemark) and 0.095 mm (Xife), $P=0.014$).

Conclusions and clinical implications: Both of the implant systems are clinically satisfying. Thus, the Branemark-group shows a better radiological performance than the Xife-group.

Various evaluation methods for dental implant stability: how are they related to each other?

Presenter: Kwon T-K

The Catholic University of Korea, St. Vincent’s Hospital, Gyeonggi, Republic of Korea

Co-authors: Kwon T-K¹

¹The Catholic University of Korea, St. Vincent’s Hospital, Gyeonggi, Republic of Korea

Background: There are various evaluation methods for dental implant stability. These are resonance frequency analysis (RFA), Periotest, insertion torque measurements, etc.

Aim: The aim of this study is to determine the reaction and relation of implant stability assessment methods when the cortical bone thickness and condition change.

Methods: Bovine femoral cortical bones were trimmed to various thicknesses. CT scan was taken to verify similar Hounsfield units. Trimmed bones were fixed to aluminum jigs with screws. Simulated cortical bone thicknesses were 1.5, 3, 5, and 10 mm. Some unique bone situations were simulated that the total bone thicknesses were 3 and 5 mm but they had a central empty space of 1 and 2 mm thickness. It was simulated that implants were installed 5 mm above 5 mm-thick cortical bones. Implants were installed with 30, 45, and 60 N cm peak insertion torque at 1.5, 3, and 5 mm-thick cortical bones; with 45 N cm on other bone conditions. Basically 4 mm diameter implants were almost used but the 5 mm diameter implants were also used at 3 mm cortical bone thickness with 45 N cm insertion torque. Six fixtures were installed on each simulated bone condition. The resonance frequency analysis and Periotest were always taken at 0, 90, 180, and 270 degrees using a repositioning jig.

Results: It was found that the Implant Stability Quotient (ISQ) values increased and the Periotest values (PTVs) decreased when the cortical bone thickness increased from 1.5 to 5 mm ($P < 0.05$). There was no statistically significant difference between the 5 and 10 mm cortical bones ($P > 0.05$). When the cortical bone had a central empty space, the ISQ values decreased while the PTVs increased ($P < 0.001$) except the PTVs of 5 mm cortical bones ($P > 0.05$). The 5 mm diameter implants showed larger ISQ values and smaller PTVs than the 4 mm. Statistically significant strong correlation was found between ISQ values and PTVs ($r = -0.95$, $P < 0.001$). The insertion torque had weak correlation with ISQ values and PTVs ($r = 0.20$, $P < 0.001$; $r = -0.23$, $P < 0.001$).

Conclusions and clinical implications: The result of this study demonstrated that the implant stability was enhanced according to cortical bone thickening and implant diameter widening. Under standardized measuring condition, the accuracy of Periotest was similar to the one of RFA. The peak insertion torque was weakly related with ISQ and PTVs.

079 | Short Oral Communications

Four modalities of single implant treatment in the anterior maxilla: a clinical, radiographic and aesthetic evaluation

Presenter: Cosyn J

University of Ghent, Ghent, Belgium

Free University of Brussels (VUB), Brussels, Belgium

Co-authors: Cosyn J^{1,2}, De Bruyn H¹

¹*University of Ghent, Ghent, Belgium*, ²*Free University of Brussels (VUB), Brussels, Belgium*

Background: A number of single implant treatment modalities have been described, mainly depending on the bone support. However, it is difficult to compare the outcome of different treatment concepts based on the available literature. Indeed, heterogeneity in terms of care providers, implant system, biomaterials and follow-up may render any conclusion in this

respect highly biased. In addition, aesthetic aspects of treatment outcome have been underexposed to research.

Aim: To document the outcome of single implants in the anterior maxilla following four routine treatment modalities when performed by experienced clinicians in daily practice using the same implant system and biomaterials.

Methods: A retrospective study in patients who had been treated by two periodontists and two prosthodontists in 2006 and 2007 was conducted. The four treatment modalities practically covered every clinical situation and included standard implant treatment (SIT), immediate implant treatment (IIT), implant treatment in conjunction with guided bone regeneration (GBR) and implant treatment in grafted bone harvested from the chin (BGR). Patients were clinically and radiographically examined. Complications were registered and the aesthetic outcome (Pink and White Esthetic Score) was rated. A blinded clinician who had not been involved in the treatment performed all evaluations.

Results: One hundred and four out of 115 eligible patients (44 SIT, 28 IIT, 18 GBR, 14 BGR) received at least one single NobelReplace tapered TiUnite® (Nobel Biocare, Göteborg, Sweden) implant in the anterior maxilla and were available for evaluation. Clinical parameters (implant survival: 93%, plaque level: 24%, bleeding on probing: 33%, probing depth: 3.2 mm) and bone level (1.19 mm) did not differ significantly between treatment modalities. Postoperative complications were more common following GBR/BGR (>61%) when compared with SIT/IIT (<18%) ($P < 0.001$). BGR was in 4/14 patients associated with permanent sensory complications at the donor site. Technical complications occurred in 9/104 patients. SIT and IIT showed similar soft tissue aesthetics (PES: 10.07 and 10.88, respectively), however major alveolar process deficiency was common (>15%). PES was 9.65 for GBR. BGR showed inferior soft tissue aesthetics (PES: 9.00; $P = 0.045$) and shorter distal papillae were found following GBR/BGR ($P = 0.009$). Periodontal disease (OR: 13.0, $P < 0.001$), GBR/BGR (OR: 4.3, $P = 0.004$) and a thin-scalloped gingival biotype (OR: 3.7, $P = 0.011$) increased the risk for incomplete distal papillae. WES was 7.98, all patients considered.

Conclusions and clinical implications: All treatment modalities were predictable from a clinical and radiographic point of view. However, advanced reconstructive surgery, especially BGR, increased the risk for complications and compromised aesthetics. Research is required on the prevention and treatment of buccal bone defects at the time of tooth loss to avoid complex therapy.

080 | Short Oral Communications

Patient satisfaction with a single-tooth implant in the aesthetic zone

Presenter: Den Hartog L

University Medical Center Groningen, Groningen, The Netherlands

Co-authors: Den Hartog L¹, Raghoobar G¹, Vissink A¹, Meijer H¹

¹*University Medical Center Groningen, Groningen, The Netherlands*

Background: Studies investigating patient satisfaction with a single-tooth implant in the aesthetic zone are scarce. As the patient

is the final user of implant therapy, patient-reported outcomes provide valuable information to express treatment success.

Aim: This prospective study aimed to determine patient satisfaction with a single-tooth implant replacing a missing anterior tooth.

Methods: One hundred and twenty-four consecutive patients with a single missing tooth in the anterior maxilla (region 14–24) were included. At time of inclusion, subjects were wearing a removable partial denture. Patients received an implant that was immediately (31 patients) or conventionally (93 patients) restored with a provisional crown. After 6 months, a definitive all-ceramic crown was made. Before implant placement, patient satisfaction with the removable partial denture was assessed using a self-administered questionnaire. The questionnaire comprised of questions or statements related to function, comfort and aesthetics and could be answered on a 5-point Likert scale. Besides, overall satisfaction was explored with a 10 cm Visual Analogue Scale (VAS) ranging from very dissatisfied (0) to very satisfied (10). At 6 (T_{6m}) and 18 months (T_{18m}) post-implant placement, patient satisfaction with the implant was assessed using the same questionnaire. Two weeks post-implant placement, patients were asked about pain after surgery and use of painkillers. Friedman's test followed by post hoc Wilcoxon's signed-rank test was used to compare patient satisfaction before and after treatment.

Results: Two implants were lost and 122 patients were available to complete the questionnaire at T_{6m} and T_{18m} . Patient satisfaction with the implant was high and increased significantly on all items compared with the preoperative situation (removable partial denture). There were no differences in patient satisfaction between T_{6m} and T_{18m} . Mean overall satisfaction increased significantly from 5.2 ± 2.8 before treatment to 8.9 ± 1.0 and 9.0 ± 1.0 at T_{6m} and T_{18m} , respectively. In total, 77.2% of the patients used painkillers for a mean period of 3.2 days. 47.9% of the patients had no pain after surgery, 48.9% little pain and 3.2% lots of pain. All patients except one would recommend the treatment to other patients.

Conclusions and clinical implications: This study shows that patient satisfaction with a single-tooth implant in the aesthetic zone is high. Compared with a removable partial denture, patient satisfaction regarding function, comfort and aesthetics improves significantly after implant treatment.

081 | Short Oral Communications

Staged guided bone regeneration and osseointegration. Part 1: augmentation using bone graft substitutes and autogenous bone

Presenter: Mihatovic I

Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Co-authors: Mihatovic I¹, Golubovic V¹, Becker J¹, Schwarz F¹

¹Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Background: Even though the survival rates of implants placed in augmented bone have been reported to be comparable to the rates of implants placed in pristine bone, it still remains

unknown to what extent a staged GBR procedure may influence the initial process of osseointegration.

Aim: To assess the influence of two barrier membranes and two bone graft substitutes mixed with autogenous bone (AB) on staged guided bone regeneration and osseointegration of titanium implants in dogs.

Methods: Four saddle-type defects each were prepared in the upper jaw of six fox hounds and randomly filled with a natural bone mineral (NBM) + AB and a biphasic calcium phosphate (SBC) + AB and allocated to either an *in situ* gelling polyethylene glycol- (PEG), or a collagen membrane (CM). At 8 weeks, modSLA titanium implants were inserted and left to heal in a submerged position. At 8 + 2 weeks, dissected blocks were processed for histomorphometrical analysis [e.g., treated area (TA), bone-to-implant contact (BIC)].

Results: Mean TA values (mm^2) and BIC values (%) tended to be higher in the PEG groups [TA: NBM + AB (10.4 ± 2.5); SBC + AB (10.4 ± 5.8)/BIC: NBM + AB (86.4 ± 20.1); SBC + AB (80.1 ± 21.5)] when compared with the corresponding CM groups [TA: NBM + AB (9.7 ± 4.8); SBC + AB (7.8 ± 4.3)/BIC: NBM + AB (71.3 ± 20.8); SBC + AB (72.4 ± 20.3)]. A significant difference was observed for mean TA values in the SBC + AB groups.

Conclusions and clinical implications: It was concluded that all augmentation procedures investigated supported bone regeneration and staged osseointegration of modSLA titanium implants. However, the application of PEG may be associated with increased TA values.

082 | Short Oral Communications

Dental implant loss and peri-implant diseases in diabetic patients

Presenter: Kotsovilis S

Department of Periodontology, School of Dentistry, University of Athens, Athens, Greece

Biomedical Research Foundation of the Academy of Athens, Athens, Greece

Co-authors: Kotsovilis S^{1,2}, Fourmoussis I¹, Karoussis I¹, Vrotsos JA¹

¹Department of Periodontology, School of Dentistry, University of Athens, Athens, Greece, ²Biomedical Research Foundation of the Academy of Athens, Athens, Greece

Background: Previous systematic reviews have indicated that diabetes is no absolute contraindication for dental implant therapy, on condition that it remains under metabolic control. Therefore, controlled diabetic patients could be regarded as candidates for implant therapy. However, the impact of diabetes type and the level of diabetic control (HbA1c blood levels) on early or late implant loss and on the incidence of peri-implant diseases still remain unknown.

Aim: The aim of this systematic review was to address the focused question: "Is there a significant difference in early or late implant loss and in the incidence of peri-implant mucositis or peri-implantitis between diabetic patients (type 1 or 2; controlled or uncontrolled) and nondiabetic patients, receiving

dental endosseous implants?" by examining studies published in the dental literature in English, up to and including February 2011.

Methods: *PubMed* and *Cochrane* (CENTRAL) databases were searched electronically and 16 journals were examined manually. At the first phase of selection, the titles and abstracts and at the second phase, full-text papers were examined autonomously and in duplicate by two reviewers (S.K., I.F.). On the basis of the inclusion/exclusion criteria, case series/reports, animal studies, reviews, consensus reports, expert opinion articles practice guidelines, letters and editorials were excluded. Contact with 16 study authors was performed to retrieve unpublished data.

Results: The search provided 706 potentially relevant titles and abstracts. After the first phase of selection, 34 articles reporting on 27 patient cohorts were selected for full-text assessment. After the second phase, eight articles reporting on seven patient cohorts: (1) Three patient cohorts studied prospectively, (2) Two patient cohorts studied retrospectively and (3) Two patient cohorts studied cross-sectionally were selected.

Conclusions and clinical implications: Early implant loss is not significantly higher in type 2 diabetic patients (controlled or uncontrolled) than in nondiabetic patients, but might be higher in type 1 diabetic patients. Late implant loss is significantly higher in uncontrolled, but not in controlled type 2 diabetic than in non-diabetic patients. No data are available for peri-implant diseases in type 1 or controlled type 2 diabetes. The incidence of peri-implant mucositis, but not peri-implantitis, is significantly higher in uncontrolled type 2 diabetic than in nondiabetic patients. However, on a long-term basis, cases of peri-implant mucositis conceptually have the potential to be transformed to cases of peri-implantitis.

083 | Short Oral Communications

Low implant success in fibula-free flaps: a long-term retrospective study

Presenter: Pellegrino G

Oral and Maxillofacial Surgery Division, Department of Dental Sciences, University of Bologna, Bologna, Italy

Co-authors: Pellegrino G¹, Macchia MT¹, Lizio G¹, Corinaldesi G¹, Bianchi A¹, Marchetti C¹

¹*Oral and Maxillofacial Surgery Division, Department of Dental Sciences, University of Bologna, Bologna, Italy*

Background: An implant-supported prosthetic rehabilitation after a fibula free flap reconstruction should be considered a valid solution in resected patients but the soft tissue complications, that often occur, could compromise the long-term success.

Aim: The objectives of this study are: to evaluate the survival and success rates of implants placed in fibula-free flaps used to reconstruct maxillary and mandibular defects following surgical resection; to evaluate the differences between the clinical outcome of the native fibula-free flap and vertically distracted fibula-free flaps and the differences between the different kind of perimplants mucous.

Methods: In a 11-years period (1999–2010), nine patients, aged from 17 years to 65 years, presenting with maxillary and mandibular defects due to resection for cancers and reconstructed with

fibula free flap were rehabilitated with an implant-supported prostheses. Fibula-free flap distraction osteogenesis (DO) was performed on five patients (four males, one female). At a mean of 31.5(range 11–52) months after jaw (seven mandibles and two maxillae) reconstruction, 44 implants were inserted and loaded with implant-supported fixed-prostheses in eight patients and with an implant-supported overdenture in one case. Two procedures to increase keratinized mucosa around implants were performed: a skin graft in three patients and an oral mucosa graft harvested from the palate in four. The follow-up period averaged 50.5(23–88) months after loading. The clinical and radiographic outcomes of the implants were assessed. Success and survival rate were evaluated through the Albrektsson criteria.

Results: Four of 44 (9.1%) implants failed during the follow-up period, all implants placed in distracted fibula free flaps without skin or palatal grafts. The mean peri-implant bone resorption was 1.93 mm. The cumulative implants survival and success rates were 90.9% and 65.85%, respectively. In distracted and not distracted fibula the success rate was 60.71% and 76.92% respectively. The implant success rate after a skin graft placement was 88.8%, after a palatal graft placement 84.21%.

Conclusions and clinical implications: Implants placed in fibula free flaps were demonstrated to integrate normally, with an regular survival but lower success rate. We have marked bone resorption around the implants probably due to the formation of granulomatous tissue. We have a high number of complications of perimplant mucosa. Corrective soft tissues surgeries are required, careful peri-implant follow-up and the maintenance of oral hygiene is mandatory.

084 | Short Oral Communications

Block vs. particulate bone grafting for ridge augmentation: an RCT

Presenter: Marchetti C

University of Bologna, Bologna, Italy

Co-authors: Pieri F¹, Lizio G¹, Marchetti C¹, Corinaldesi G¹

¹*University of Bologna, Bologna, Italy*

Background: The placement of dental implants in partially edentulous areas is frequently limited by inadequate bone volume of the residual ridge. Mandibular bone grafts in either a block or particulate form have been widely used for alveolar reconstruction before implant placement although the superiority of one grafting technique vs. the other is still unclear.

Aim: To compare the efficacy of block and particulate bone grafting techniques associated with a resorbable collagen membrane in terms of horizontal and vertical bone formation and implant outcomes for correcting localized alveolar ridge defects.

Methods: Twenty-four surgical sites were randomly allocated to two treatment groups, block and particulate, with mandibular ramus as donor site. After 5 to 6 months, 21 implants in the block group and 26 in the particulate group were placed and loaded 3 to 4 months later with fixed prostheses. Outcome measures were: bone augmentation measured on computed tomography scans, complication rate, implant and prosthetic success, and marginal bone resorption (MBR). All patients were

followed up to 2 year after loading. Paired and independent *t*-tests and Fisher exact tests were conducted to compare means and proportions at the 0.05 level of significance.

Results: For the block vs. particulate group, the mean vertical augmentation was 3.13 ± 0.83 vs. 2.95 ± 0.9 mm ($P=0.61$), and the mean horizontal augmentation was 4.1 ± 0.8 vs. 3.21 ± 0.73 mm ($P=0.01$). There were no differences in complications between groups (33.3% vs. 8.3%, respectively) ($P=0.26$). However, two major complications (dehiscences with bone graft exposure) occurred in the block group during healing, which determined the partial failure of the augmentative procedure. The implant survival rate was 100% in both groups, while the implant success rate was 85.8% vs. 100% ($P=0.164$). Mean MBR after 2 years was significantly higher in block group (1.12 ± 0.37 mm) compared with particulate group (0.85 ± 0.18 mm) ($P=0.002$).

Conclusions and clinical implications: Block bone grafts resulted in more horizontal bone augmentation than particulate grafts, but were more prone to resorption during functional loading.

085 | Short Oral Communications

Short-term teriparatide delivery and osseointegration: a clinical feasibility study

Presenter: Kuchler U

Medical University of Vienna, Vienna, Austria

Co-authors: Kuchler U¹, Luvizuto ER², Watzek G¹, Gruber R¹

¹*Medical University of Vienna, Vienna, Austria*, ²*University Estadual Paulista, Araçatuba, São Paulo, Brazil*

Background: Teriparatide is an anabolic osteoporosis therapeutic agent that can improve healing after fractures and periodontal surgeries. Clinical studies investigating the effects of teriparatide on the osseointegration of titanium implants have not been performed.

Aim: The aim of our study was to investigate the effect of teriparatide on osseointegration.

Methods: We conducted an open-label randomized controlled feasibility study and included 24 patients with edentulous lower jaws. The participants received two study implants in the mandible during interforaminal dental implant surgery. The patients were randomly assigned to receive 20 µg of teriparatide once daily for 28 days or no treatment. Study implants were retrieved from 23 patients after 9 weeks and were subjected to histomorphometric analyses. End points were new bone-volume-per-tissue-volume (NBV/TV) and new bone-to-implant-contact (NBIC).

Results: We report that median values of NBV/TV in the control and the teriparatide group were 15.4% vs. 17.6% in the periosteal compartment, 11.3% vs. 16.5% in the cortical compartment, and 7.3% vs. 12.0% in the medullary compartment, respectively. NBIC median values in the control and the teriparatide group were 3.3% vs. 4.1% in the periosteal compartment, 0.3% vs. 1.4% in the cortical compartment, and 5.0% vs. 4.4% in the medullary compartment, respectively.

Conclusions and clinical implications: The results provide first histological data on the osseointegration of titanium study

implants in patients treated with teriparatide. These preliminary findings should be considered as a primer for the design of placebo controlled and randomized longitudinal trials with sufficient power and clinical endpoints. This research was supported by the Osteology Foundation (project # 08-012) and Eli Lilly; ClinicalTrials.gov#NCT00089674.

086 | Short Oral Communications

Flapless and graftless transcrestal sinus floor elevation-intrasinus bone formation

Presenter: Atamni F

Private Practice, Tel-Aviv, Republic of Moldova

Co-authors: Atamni F¹, Topalo V²

¹*Private Practice, Tel-Aviv, Republic of Moldova*, ²*State Medical and Pharmaceutical University, Chisinau, Republic of Moldova*

Background: Transcrestal sinus floor elevation is more frequently used in oral implantology but bone formation in this case is incompletely studied.

Aim: Evaluation of new bone formation around inserted implant using flapless and graftless transcrestal sinus floor elevation.

Methods: Sixty-three screw-type implants were installed in 41 patients (10 men, 31 women), with an mean age of 48.6 ± 3.4 , in the posterior maxilla using flapless and graftless transcrestal sinus floor elevation. The subantral residual bone height was 5.2 ± 2.8 mm. The implant site was prepared to the sinus floor, which was fractured using hammer and osteotome. Integrity of schneiderian membrane was verified with Valsalva test. After the spontaneous filling of the prepared implant site with blood an implant was inserted till the appreciated depth. Twenty-one implants with 11.5 mm, 29 with 10 mm and 13 with 8 mm in length were inserted. The diameter of the implants varied between 3.75 and 5 mm. The second surgical step was performed after 5.8 ± 1.8 months. The length of the penetrating part in the sinus and new formed bone height were determined on the posterior and anterior sides of the implants measured on panoramic radiographs after the first and at the second surgical step using Adobe Photoshop CS3 program. Statistical analysis was made by calculating mean values, standard deviation, standard errors, indices of Student's paired *t*-test and Pearson $-r_{xy}$ correlation coefficient.

Results: Six ($9.52 \pm 3.70\%$) from 63 inserted implants showed positive Valsalva test. During the healing period no pathologic changes were registered on the alveolar ridge or the maxillary sinus. The height of new formed bone around the non membrane perforating implants was from 0.60 up to 6.87 mm with an average value of 3.33 ± 0.14 mm. In cases where implants perforated the membrane the height of new bone varied from 1.43 up to 3.99 mm, average value was 2.29 ± 0.23 mm, with a significant statistical difference between the two groups ($P<0.001$). The results showed direct strong correlation ($r_{xy}=0.90$ and 0.78 for implants with perforation) between the height of new formed bone and penetration degree of an implant in the maxillary sinus. The average periosteal values were -4.7 ± 0.22 .

Conclusions and clinical implications: The insertion of implants using flapless and graftless transcrestal sinus floor elevation ensures the new bone formation around the penetrated part of the implants in the sinus, contributing to its integration. Bone formation depends on the height of penetrating part of an implant in the maxillary sinus and the integrity of the Schneiderian membrane.

087 | Short Oral Communications

The effect of experimental diabetes and metabolic control on *de novo* bone formation under SLA or SLActive domes following the GBR principle

Presenter: Lee RS

Eastman Dental Institute, London, UK

Co-authors: Lee RS¹, Retzepi M, Donos N¹

¹*Eastman Dental Institute, London, UK*

Background: It has been demonstrated in multiple studies that *de novo* bone formation beyond the skeletal envelope of the organism can be predictably achieved via application of the guided bone regeneration (GBR) principle (Kostopoulos et al. 1994; Lundgren et al. 1995; Donos et al. 2005; Retzepi et al. 2010). Diabetes mellitus has been associated with impaired osseous wound healing capacity. Recently, a preclinical study demonstrated adverse effects of experimental diabetes in the osseous healing following GBR application (Retzepi et al. 2010). However, it is unknown to what extent the diabetic bone pathophysiology may influence the potential for new bone formation and osseointegration following the GBR application with the use of the osteoconductive materials like hydrophobic and hydrophilic titanium domes.

Aim: The aim of the study was to evaluate the effect of experimental diabetes and metabolic control on *de novo* bone formation under rough surface hydrophobic titanium (SLA) dome or modified hydrophilic titanium (SLActive) domes following the GBR principle.

Methods: Sixty Wistar rats were randomly allocated in three experimental groups of 20 animals per group: (a) uncontrolled, streptozotocin-induced diabetes (D); (b) insulin-controlled diabetes (CD); (c) healthy (H). Each group was further divided into two treatment groups of 10 animals each; SLA (A) and SLActive (B). The titanium domes were stabilised with four titanium mini-screws on the calvarium. Following 7 and 42 days of healing period, histologic analysis and histomorphometric measurements were performed in the most central of the undecalcified sections produced. Differences between means for the groups (D, CD, and H), the type of domes (SLA and SLActive) and the time periods (7 and 42 days) were assessed by performing the univariate analysis of variance (ANOVA) for each variable.

Results: In all experimental groups, significant *de novo* bone formation under the dome was observed. However the total bone (TB) area and percent bone-to-implant contact (BIC) under the both dome treatment (SLA and SLActive) were not statistically significantly different among the H, CD, and D groups at both 7 and 42 days.

Conclusions and clinical implications: Despite of the presence of uncontrolled diabetes, significant *de novo* bone formation can be achieved in titanium domes with a hydrophobic and a hydrophilic surface. The use of modified hydrophilic titanium surface (SLActive) may have a tendency to promote new bone formation in healthy and diabetic conditions but the substantial variability of the obtained data does not allow to make any robust conclusions.

088 | Short Oral Communications

Surgical techniques for alveolar socket preservation: a systematic review

Presenter: Clementini M

Department Odontostomatological Science, University Tor Vergata, Rome, Italy

Co-authors: Clementini M¹, Orgeas GV², De Risi V², Mannocci A³, Deli G²

¹*Department Odontostomatological Science, University Tor Vergata, Rome, Italy,* ²*Istitute of Dentistry, Catholic University Sacred Heart, Rome, Italy,* ³*Clinical Medicine and Public Health Unit, University La Sapienza, Rome, Italy*

Background: Tooth loss creates relevant anatomical modifications in width and height, resulting in deformed alveolar ridges. Clearly this defective ridges formation does not allow both appropriate pontic fabrication or correct placement of endosseous implants. In order to prevent this clinical situation, different authors described several surgical techniques ranging from regenerative techniques for socket preservation to immediate implant placement. The formers have been largely tested in many studies with various materials and different clinical approaches: bone graft, membrane, membrane plus grafts. To date it is still completely unclear which socket preservation technique is the most predictable and reliable.

Aim: The aim of the present paper is to set a systematic review to clarify the real efficacy and effectiveness of various alveolar socket preservation techniques, and to identify which technique could prevent the most relevant dimensional changes in the extraction sites.

Methods: MEDLINE-PubMed was searched up to January 2010, and the search was supplemented by cross-checking the reference list of selected studies and review articles, looking for additional papers which reported data concerning the dimensional changes in alveolar height and width after tooth extraction with additional treatment like graft, membrane or membrane plus grafts. Heterogeneity and methodological study quality was assessed. Means weighted change of crestal width and height and meta-analysis of the difference means with graft and/or barrier techniques were performed.

Results: The search resulted in 424 papers, but only 13 papers fulfilled the inclusion criteria. The mean weighted change of all socket preservation technique shows a loss of 0.36 mm for crestal width and a loss of 0.58 mm for crestal height. Results from meta-analysis of studies in which only a membrane was used seems to be statistically significant.

Conclusions and clinical implications: Data from weighted means analysis show a slight advantage in favour of socket

preservation techniques vs. no post-extraction treatment because of reduced bone loss both horizontally and vertically; the higher level of significance was obtained by the meta-analysis of the membrane-testing studies. This results suggests that an additional benefit may be obtained from socket preservation procedures being able at least to limit bone changes of the alveolar process. However, future researches are needed, aiming to develop a clearer understanding of the reported variability of clinical outcomes; it is advisable that they should adhere to statement guidelines, follow a split-mouth design and standardize both surgical procedures and outcome measures.

089 | Short Oral Communications

Two unsplinted immediately loaded nanotite implants supporting mandibular overdentures; a four-year follow-up

Presenter: Doff M

University Medical Center Groningen, Groningen, The Netherlands

Co-authors: Doff M¹, Goené R², Lingbeek S³

¹University Medical Center Groningen, Groningen, The Netherlands, ²VU Medical Center, Amsterdam, The Netherlands, ³Center of Oral Implantology, Haaksbergen, The Netherlands

Background: Dental rehabilitation with mandibular overdentures supported by two implants splinted with a rigid bar is well documented.

Aim: The aim of this prospective, observational study was to assess the effect of immediately loading of two nanometer-scale textured, unsplinted implants to support a mandibular overdenture.

Methods: Patients to be enrolled in the study had to have worn a full mandibular denture for at least 1 year, which could be transformed into the overdenture; If not a new denture was fabricated before implant placement procedures. Two 4-mm diameter implants (NanoTite™ Prevail®, Biomet 3i) were placed in the canine regions and an Osstell Type 15 SmartPeg® was attached to each to obtain a baseline Implant Stability Quotient (ISQ) reading. Locator abutments were connected to implants and following a chairside technique the denture was converted into an overdenture. ISQ values were recorded at baseline, after 3, 6, 12 weeks and after 4 years. Furthermore, patients were evaluated for prosthesis function and implant survival.

Results: Fifteen patients were enrolled, of which three had existing conventional dentures that could be converted to overdenture; 12 patients received a new denture before implant placement. The mean (±SD) ISQ values were 80.1 (±4.8) at baseline, 80.6 (±3.4) at 3 weeks, 80.0 (±4.2) at 6 weeks, 78.3 (±5.1) at 12 weeks and 81.5 (±4.1) after 4 years. No significant differences were found between the baseline- and all follow-up ISQ values ($P > 0.05$). One implant with an ISQ of 73 at placement failed after 2 weeks of function. Two months thereafter the implant was replaced in support of the same overdenture. The 4-year cumulative implant survival rate is 96.7% and the 4-year prosthesis success is 100%.

Conclusions and clinical implications: Our results suggest that immediate loading of two unsplinted, nanometer-scale textured implants supporting a mandibular overdenture does not compromise implant stability. We also conclude that the Locator system can facilitate the revision of a conventional denture into an overdenture in one appointment. With this technique patients have the pleasure of stability and comfort within a few hours.

090 | Short Oral Communications

Implant primary stability (RFA): correlation with insertion torque, bone volume and osseointegration at 6 weeks

Presenter: Makary C

Oral Surgery Department, Faculty of Dental Medicine, St Joseph University, Beirut, Lebanon

Co-authors: Makary C¹, Rebaudi A², Naaman N³

¹Oral Surgery Department, Faculty of Dental Medicine, St Joseph University, Beirut, Lebanon, ²University of Genoa, Genoa, Italy, ³Periodontology Department and Dean, Faculty of Dental Medicine, St Joseph University, Beirut, Lebanon

Background: Implant primary stability during healing phase is a prerequisite for successful osseointegration. Many factors play a major role in achieving a stable bone to implant interface, mainly bone density and insertion torque.

Aim: The aim of this study is to determine if Resonance Frequency Analysis (RFA) is correlated to Insertion Torque (IT), Bone Volume (BV) and clinical osseointegration at 6 weeks.

Methods: For 18 patients BV was evaluated histologically by retrieving bone core biopsies before placement of 40 dental implants. Peak IT was recorded at implant placement and RFA values (ISQ) were noted at baseline, 3 and 6 weeks. Osseointegration was evaluated clinically when tightening the final abutment to 30 Ncm at 6 weeks. ISQ values were correlated with IT, BV and abutment torquing results. Data were analyzed using Spearman and Pearson product-moment correlation coefficient.

Results: ISQ values significantly decreased at 3 weeks and increased at 6 weeks (P -value = 0.001). There was a positive correlation between BV and ISQ at baseline ($r = 0.366$, P -value = 0.02), at 3 weeks ($r = 0.465$, P -value = 0.003), but not at 6 weeks, and between ISQ and jaw location, implant diameter and IT at baseline ($r = 0.313$, P -value = 0.049), 3 weeks ($r = 0.472$, P -value = 0.002) and 6 weeks ($r = 0.419$, P -value = 0.007). There was a significant correlation between spinning/painful implants during abutment torquing and low ISQ (P -value < 0.031), low BV ($r = -0.454$, P -value = 0.003) and low IT values ($r = -0.528$, P -value < 0.001).

Conclusions and clinical implications: Correlations between BV and IT values, and ISQ suggest that RFA may indicate primary implant stability. BV, IT and ISQ values can predict the degree of osseointegration at 6 weeks and may determine future loading protocols.

The implant-supported maxillary overdenture; a prospective study on 4 vs. 6 implants

Presenter: Slot W

Department of Fixed and Removable Prosthodontics, Groningen, The Netherlands

Co-authors: Slot W¹, Raghoobar G², Meijer H¹

¹*Department of Fixed and Removable Prosthodontics, Groningen, The Netherlands,* ²*Department of Oral and Maxillofacial Surgery, Groningen, The Netherlands*

Background: An overdenture supported by endosseous implants gives the opportunity to improve retention and stability. In case of insufficient bone a maxillary sinus floor elevation procedure is carried out. After a 3-months healing period the implants are inserted in the posterior areas of the maxilla. However, in case of sufficient bone in the anterior area of the maxilla it is possible to insert the implants without a bone augmentation procedure. There are a number of prospective studies on overdentures retained by implants in the anterior area of the maxilla. A clinical trial in which a different number of implants are compared, has not been published yet.

Aim: The aim of the study is to compare 4 or 6 implants in the anterior area of the maxilla to support an overdenture during a 1-year follow-up period.

Methods: Fifty fully edentulous patients, 25 in each group, with problems with retention and stability of the upper denture were selected for the study. All patients had sufficient bone to place the implants anterior region and bicuspid area without augmentation of the sinus floor. After randomization patients were assigned to: Group 1: Four implants (ASTRA-Tech) of at least 10 mm length inserted in the anterior area Group 2: Six implants (ASTRA-Tech) of at least 10 mm length inserted in the anterior area and bicuspid area. In each patient also four implants were placed in the interforaminal region of the mandible. After 3 months of osseointegration, a bar-supported overdenture was constructed. In this clinical trial the following items are evaluated: Implant survival, overdenture survival, peri-implant bone changes and patient satisfaction.

Results: After a functional period of 1 year implant survival was 100% in group 1 and 99.4% (one implant lost) in group 2. Overdenture survival was 100% in both groups. The mean marginal bone resorption was 0.23 mm (SD ± 0.58) in group 1 and 0.31 mm (SD ± 0.29) in group 2. Patient satisfaction was measured with a general satisfaction score (from 1 to 10). General satisfaction improved significant from score 5 (pre-treatment) to score 9 (after 1 year) in both groups.

Conclusions and clinical implications: In this study, no significant differences could be detected between the two groups in implant survival, overdenture survival and peri-implant bone height changes. There was a significant increase in patient satisfaction within the two groups, 1 year after treatment. For reason of cost-effectiveness, four bar-connected implants to support a maxillary overdenture is the method of choice.

Impact of the outcome of guided bone regeneration in dehiscence-type defects on the long-term stability of peri-implant health

Presenter: Schwarz F

Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Co-authors: Schwarz F, Sahm N, Becker J

Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Background: A complete defect fill following one-stage guided bone regeneration was only obtained in 68.5% of the cases (Jensen & Terheyden 2009). Limited evidence suggests that rough surface implants (Sa: > 2.0 μm) are more likely to develop peri-implantitis than minimally rough implants once exposed to the oral environment (Renvert et al. 2011). Accordingly, it might be suggested that residual defect areas may be at higher risk to accumulate bacterial plaque biofilms and subsequently develop peri-implant diseases than nondehiscenced or smooth surface implant parts.

Aim: To investigate the impact of residual defect height (RDH) following guided bone regeneration (GBR) in dehiscence-type defects on the long-term stability of peri-implant health after a period of 4 years.

Methods: RDH values in dehiscence-type defects at titanium implants were clinically assessed after 4 months of submerged healing following augmentation using a natural bone mineral (NBM) and randomized application of either a cross-linked (VN), or a native collagen membrane (BG) ($n=12$ patients each). RDH values were classified as absent (0 mm, control; $n=8$), minimal (1 mm, test 1; $n=8$), or advanced (> 1 mm, test 2; $n=8$). Clinical parameters (i.e. bleeding on probing – BOP, probing pocket depth – PD, mucosal recession – MR) were recorded (mesio-, mid-, and disto-buccal aspects) at 4 years after prosthesis installation.

Results: Mean PD (2.9 ± 0.7 , 2.8 ± 0.7 , 2.7 ± 0.8 mm) values at 4 years were comparable in all groups investigated. Mean MR values tended to be increased in both test groups (0.5 ± 0.7 , 0.4 ± 0.6 mm; respectively), when compared with the control group (0.2 ± 0.3 mm) ($P > 0.05$, respectively). Mean BOP values were also increased in both test groups ($45.8 \pm 30.5\%$, $54.1 \pm 24.8\%$; respectively), even reaching statistical significance when comparing test 2 and control ($29.1 \pm 21.3\%$) groups ($P < 0.05$). The diagnosis peri-implant mucositis and peri-implantitis was observed for six and one patients in the control group, five and two patients in test 1, and two and four patients in test group 2, respectively.

Conclusions and clinical implications: The present study indicated that (i) implants exhibiting RDH values > 1 mm are at higher risk to develop peri-implant disease, and (ii) positive RDH values may be associated with an increase in MR and therefore compromise the overall esthetic outcome of implant therapy.

Osteoblast behavior on β -TCP with calcium phosphate and magnesium coatings

Presenter: Park K-D

More Dental Clinic, Suncheon, Republic of Korea

Co-authors: Park K-D¹, Kim Y-J², Chung H-J², Kim O-S², Lee K-K³, Sohn K-S⁴, Jeon H-R⁵

¹*More Dental Clinic, Suncheon, Republic of Korea*, ²*School of Dentistry, Chonnam National University, Gwang Ju, Republic of Korea*, ³*School of Materials Science and Engineering, Chonnam National University, Gwang Ju, Republic of Korea*, ⁴*Materials Science and Metallurgical Engineering, Suncheon National University, Suncheon, Republic of Korea*, ⁵*JinSu Dental Clinic, Gwang Ju, Republic of Korea*

Background: The ideal properties of bone substitute materials are biocompatibility and bioactivity. Magnesium (Mg) is expected to be a new class of graft materials because of its ability to bone formation. However, there were few studies with regard to interaction of osteoblasts on the β -tricalcium phosphate (β -TCP) with Mg and Hydroxyapatite (HA)-Mg coatings.

Aim: In this study, β -TCP blocks were coated with Magnesium (Mg) to improve biocompatibility and bioactivity.

Methods: HA, Mg, and HA-Mg multicoatings were produced as thin films on β -TCP blocks by RF magnetron sputtering. The samples were then divided into three groups. Group I was HA coated surface (HA group). Group II was magnesium-coated surfaces (Mg group). Group III was HA-magnesium multi-coated surfaces (HA-Mg group). The control was noncoated β -TCP block (TCP group). The obtained coatings were identified by X-ray diffraction (XRD), Scanning electron microscopy (SEM) and EDX. The biological responses of MC3T3-E1 cells on the coated surfaces were evaluated by MTT assay, alkaline phosphatase (ALP) activity.

Results: XRD, SEM, and EDX results showed that HA, Mg, and HA-Mg deposition and calcination were successfully performed. In SEM images, cells adhered and grew well on the surface of all β -TCP specimens. In MTT assay, the cells on all samples proliferated actively within culture period, showing good cell viability. HA group, Mg group, and HA-Mg group showed 98%, 103%, and 110% cell viability, respectively, when normalized to control. However, there was no significant difference among groups. ALP activity of Mg group and HA-Mg group significantly increased to 140% and 150%, respectively, compared with control.

Conclusions and clinical implications: These results suggest that magnesium and/or HA-magnesium multicoatings on β -TCP could have excellent biocompatibility and osteoconductivity, and offer great potential as graft materials for future applications in hard tissue regeneration

Systematic review of the association between genetic predisposition and dental implant biological complications

Presenter: Dereka X

School of Dentistry, University of Athens, Athens, Greece

Co-authors: Dereka X¹, Mardas N², Chin S², Donos N²

¹*School of Dentistry, University of Athens, Athens, Greece*, ²*Eastman Dental Institute, UCL, London, UK*

Background: The clinical success of dental implants is based on the osseointegration which is a very complex process referring to the structural contact between the implant surface and the bone and the *de novo* bone formation. The success of osseointegration relies on biological (e.g. microbial infection, peri-implantitis, bone loss in absence of infection), and technical factors (e.g. overloading, fracture of the device). Dental implants are an effective and predictable treatment modality for the functional and aesthetic rehabilitation of partially and completely edentulous patients. Research evidence indicated that implant failures rather tend to be clustered in a small subset of individuals than randomly distributed in the population implying that patient's host response plays a determinant role for the implant success.

Aim: The purpose of this systematic review was therefore to perform a comprehensive and critical evaluation of the published data concerning the relationship between genetic polymorphism and implant survival and peri-implantitis and to address whether it is possible to predict which patients are predisposed to implant failure or peri-implantitis.

Methods: A search was conducted for all prospective, retrospective (i.e. randomized-controlled trials, controlled clinical trials, cohort studies, case-control studies and case series) and cross-sectional studies reporting on endosseous dental implant biological complications in systemically healthy patients tested for any gene polymorphism. Studies needed to report on implant failure, peri-implantitis and peri-implant bone loss after loading in order to observe implant complications possibly due, among other factors, to reduced healing ability of the host and biological complications during function as well.

Results: From 344 potentially relevant published papers, 22 full-texts were screened and 8 were found fulfilling the inclusion criteria. The association between (a) peri-implantitis and IL-1 (four studies), (b) bone loss after loading and IL-1 (one study), and (c) implant failure and IL-1 (one study), -2 and -6 (one study), TNF- α (one study) was investigated. The results of these studies revealed no data supporting any genetic association with implant biological complications. When smokers were included, a synergistic effect with IL-1 was found resulting to increased implant failure rate and bone loss.

Conclusions and clinical implications: The findings of this systematic review led to the conclusion that no adequate evidence exists to support or exclude genetic predisposition to implant failure. The diversity of definitions, the small number of patients involved, the heterogeneity in study design and the bias of these studies underline the necessity of well designed prospective cohort studies.

Are implants a risk factor for osteonecrosis in intravenous bisphosphonate?

Presenter: Matsuo A

Tokyo Medical University, Tokyo, Japan

Co-authors: Matsuo A, Hamada H, Tsuji E, Okamoto A, Chikazu D, Kaise H, Kono N

Tokyo Medical University, Tokyo, Japan

Background: Bisphosphonates (BP) are widely used to decrease skeletal-related events in patients with various diseases, especially osteoporosis and solid cancers with bone metastasis. BP-related osteonecrosis of the jaw (BRONJ) has recently been recognized as a severe adverse reaction to BP because of its unresponsiveness to treatment. However, outcomes of placing dental implants in patients taking BP have not yet been established. Furthermore, while several studies evaluated BRONJ incidence in cases of oral BP treatments with implants, none has described its incidence in intravenous BP treatment. In our institution, an oral monitoring program of all intravenous BP treatments of breast cancer patients is jointly instituted by breast cancer surgeons and oral and maxillofacial surgeons.

Aim: To elucidate the risk for BRONJ in patients with implant treatment and given intravenous BP.

Methods: We examined and followed up 44 patients (18.2%) from a total of 247 intravenous BP-treatment breast cancer patients in our institution between 2002 and 2009. The 3-year cumulative incidence rate of 247 patients was calculated using the Kaplan–Meier method, and the systemic and local risk factors including implant placement of the 44 patients were statistically evaluated using logistic regression analysis.

Results: The average age of the 247 breast cancer patients (246 women; 1 man) was 58.7 years (range, 31–92), the BP treatment period was 14.9 months (range 1–90), and the 3-year cumulative incidence rate was 0.074% (8/247, 95% CI: 0.0081–0.014). In the 44 orally examined patients, five placed implants (11.4%: 5/44), three of whom suffered BRONJ. However, there was only one case of BRONJ at the implant site (1/44: 2.3%). There was no statistically significant risk factor for BRONJ in age, total BP treatment duration, number of residual teeth, regular oral monitoring oral hygiene or implant placement. One patient with BRONJ at the implant site underwent marginal resection of the mandible, including the implants. However, the conditions of implants in the remaining patients did not change during follow up, and there was no evidence of BRONJ at the implant site.

Conclusions and clinical implications: Although BRONJ developed at the implant site in one intravenous BP-treated breast cancer patient, implants were not a risk factor for BRONJ in this study.

Histological and radiographic studies after intraoperative stem cell settlement in complex augmentation of the jaws

Presenter: Heine J

Department of Oral-, Craniomaxillofacial- and Facial Plastic Surgery, University Hospital Schleswig-Holstein Campus Kiel, Kiel, Germany

Co-authors: Heine J¹, Siewert T¹, Liu Q¹, Behrens E¹, Gierloff M¹, Acil Y¹, Bader A², Wiltfang J¹

¹*Department of Oral-, Craniomaxillofacial- and Facial Plastic Surgery, University Hospital Schleswig-Holstein Campus Kiel, Kiel, Germany,*

²*Center for Biotechnology and Biomedicine Cell Techniques and Applied Stem Cell Biology, University of Leipzig, Leipzig, Germany*

Background: Osteogenic induction is regarded as an indispensable step for complex augmentations. The harvesting of large corticocancellous bone grafts often meet clinical needs but is attended by painful load for the patient. Intraoperative stem cell settlement as an *in situ* regenerative approach leads to higher clinical bone quality.

Aim: For *in situ* regeneration, integration of intraoperative concentrated stem cells and bioactive growth factors in complex augmentations may promote tissue regeneration. Aim of this randomized study in humans was to determine histological and radiographic findings in regard of postoperative loss of bone and histological bone quality.

Methods: Thirty patients undergoing complex augmentations by harvesting large bone grafts from the iliac crest were treated by stem cell harvest and intraoperative concentration. Patients were randomized for an open sterile bench technique, a closed sterile chair-side system and a control group with conventional augmentation (each group: $n = 10$). Samples of cells identified by FACS-analysis were counted before/after concentration by an adherence expansion technique. Histological bone biopsies and radiographic augmentation high results were compared with controls. Considering homogeneity of variances by Levene statistics, one-way analyses of variance (AnoVa) and Scheffé test were performed in order to reveal significant influence of the applied stem cell concentration techniques.

Results: The clinical routine of harvesting bone grafts for complex augmentations may supplemented by intraoperative stem cell harvest, concentration and settlement of stem cells and growth factors without additional donor site morbidity. The harvested cells are detectable with typical surface characteristics of quiescent mesenchymal stem cells. Histological examination of bone biopsies, gained at that time while preparing of dental implant adits, and radiographics showed, that augmented bone have a higher histological quality of bone ($P = 0.012$) and a 15% less post-transplantational loss by bone resorption at the time of dental implant insertion after 6 months ($P = 0.011$) compared with controls.

Conclusions and clinical implications: The proof of less resorption in the post-transplantation-phase before dental implant insertion may allow harvesting minor sized bone grafts to reduce donor site morbidity by applying stem cell concentration and settlement techniques in complex augmentations. Further clinical studies

optimizing this in-situ regeneration aspect are performed to reduce the autologous bone part in complex augmentations.

097 | Short Oral Communications

Lithium chloride effects on osteoblast differentiation are enhanced by hydrophilic titanium surfaces

Presenter: Galli C

University of Parma, Parma, Italy

Co-authors: Galli C¹, Piemontese M¹, Passeri G¹, Macaluso G¹

¹*University of Parma, Parma, Italy*

Background: Rough surfaces induce cell commitment and differentiation along the osteoblastic lineage. We previously showed that rough topography enhances the activation of Wnt canonical signaling, a pathway required for osteoblast differentiation. Recently, an acid-etched/sand-blasted surface with increased wettability was created, and a report from the literature shows that it promotes the expression of Wnt-family growth factor Wnt5a. It is however unclear whether canonical Wnt activators such as Glycogen Synthase Kinase 3 beta inhibitor Lithium Chloride can help promote osteoblast differentiation on titanium surfaces.

Aim: The present study investigated the effects of Lithium Chloride (LiCl) on differentiation of mesenchymal cells growing on titanium surfaces with different topography and wettability.

Methods: The murine uncommitted cell line C₂C₁₂ was plated on smooth, acid-etched/sand-blasted (SLA) and modified hydrophilic SLA titanium discs (modSLA) and stimulated with 1 mM

LiCl. Activation of Wnt canonical signaling was measured by transfecting cells with a reporter vector system carrying the Firey Luciferase gene under the control of a promoter binding TCF/beta-catenin and a control plasmid constitutively expressing Renilla Luciferase and by stimulating cells with soluble Wnt3a protein. Gene expression was measured in the same cell system by Real Time PCR. Murine osteoblastic cells MC₃T₃ were plated on smooth, SLA and modSLA discs and the effects of LiCl on the expression of osteoblast specific genes were assessed by Real Time PCR.

Results: We showed that activation of Wnt canonical signaling was dramatically higher in C₂C₁₂ cells on modSLA surfaces as compared with smooth or SLA, but LiCl did not increase TCF/beta catenin-mediated transcription at the dose tested in C₂C₁₂ cells. However LiCl dramatically increased Osteoprotegerin (OPG) expression in C₂C₁₂ cells on modSLA surfaces. Basal mRNA levels for Osteocalcin were significantly lower in MC₃T₃ cells growing on smooth surfaces but no difference was observed between vehicle-treated cells on SLA and modSLA. However, addition of 1 mM LiCl increased Osteocalcin levels in the SLA group and more markedly so on modSLA. Consistently with this result, LiCl potently enhanced OPG levels but only on modSLA surfaces.

Conclusions and clinical implications: The present study shows that modSLA surfaces promote activation of Wnt canonical signaling and that Lithium Chloride enhances the expression of osteoblastic and osteogenic genes on modSLA surfaces. This opens up the possibility of a surface-specific pharmacological treatment to enhance implant osseointegration.

Posters: Implant Therapy Outcomes, Surgical Aspects (Abstracts 098–216)

098 | Implant Therapy Outcomes, Surgical Aspects

Clinical, radiological and photoelastic evaluation of conventional vs. mini dental implants

Presenter: Taiyeb-Ali T

University of Malaya, Kuala Lumpur, Malaysia

Co-authors: Taiyeb-Ali T, Ali A, Yunus N, Mahmood WA

University of Malaya, Kuala Lumpur, Malaysia

Background: The study comprised two aspects: a retrospective clinical study and photoelastic investigation.

Aim: To compare clinically and radiologically the peri-implant tissue status around Conventional (Ankylos[®]) and Mini Dental Implants (IMTEC[®]) supporting various prostheses and the stress around these implants supporting overdentures by an *in vitro* study.

Methods: (1) 22 patients with mean age 45.5 years (age range 22–65 years) were treated at the Faculty of Dentistry, University of Malaya for missing teeth with implant supported prostheses. Peri-implant tissue status of 28 Mini Dental Implants (MDI) and 48 Conventional Dental implants (CDI) were examined clinically and radiologically. Clinical parameters assessed included Plaque Index (PI), Bleeding on Probing (BOP), Gingival Index (GI), Probing Pocket Depth (PPD), & Keratinized Mucosa (KM). Radiological assessments of peri-implant bone were conducted using Leica QWin[®] image analysis software after more than 1 year (1–3 years) in relation to the baseline radiographs. Statistical analysis was performed using Mann–Whitney test. (2) Photoelastic stress analysis of 4 MDI (1.8 mm diameter, 15 mm length) with O-Ball Prosthetic Heads and nylon matrices supporting an overdenture were made. The stresses were compared with that on two conventional Ankylos[®] implants (3.5 mm diameter, 11 mm length) with Ball abutments and gold matrices supporting an overdenture. Unilateral forces of 70, 130 and 200 N were applied.

Results: All clinical parameters (PI, BOP, GI, PPD and KM) and radiological evaluation showed no statistically significant differences between all CDI and MDI. Mean distal bone loss was statistically significantly less around MDI, supporting removable prostheses ($P < 0.05$). Mean GI was significantly greater for MDI vs. CDI, supporting fixed appliances ($P < 0.01$). Photoelastic analysis showed mild stresses on distal MDI on both unloaded and loaded sides; with higher stress intensity on loaded side with the increase in force to 200 N. Stress concentration was at the apical part of MDI while in CDI it was around the mid length of the implants and in the body of the mandible.

Conclusions and clinical implications: Clinical parameters and bone level status around CDI and MDI were not significantly different. Loaded MDI exhibited different stress concentration patterns as compared with conventional regular diameter implants when used to support overdenture prosthesis.

099 | Implant Therapy Outcomes, Surgical Aspects

Survival of autogenous bone graft placed in immediate peri-implant defects

Presenter: Ahn J-J

School of Dentistry, Kyungpook National University, Daegu, Republic of Korea

Co-authors: Ahn J-J, Kim J-H, Cho S-A, Shin H-I

School of Dentistry, Kyungpook National University, Daegu, Republic of Korea

Background: Immediate implant defects can be treated by grafting of autogenous drill chip bone without use of any artificial grafts or membranes. However, the fate of the autogenous bone graft in the peri-implant defects has not been proven in humans up to this point.

Aim: To evaluate the clinical outcomes of grafted defects and non grafted defects by measuring bone morphologies under direct visual observation after over 1 year loading.

Methods: One hundred twenty-four subjects with a total of 139 teeth were scheduled for extraction and immediate implant placement. Following minimal flap elevation and extraction, implant installation was performed, and then intrasurgical measurements were taken to record the dimension of the surrounding bone walls and marginal defects. Non-submerged implants were used, and the rough and smooth border of the implant was placed subcrestally. Autogenous bone was collected during the drilling procedure and grafted in the peri-implant defect. Dehiscence defects were preferentially grafted; however high crestal intrabony defects were left without graft. A healing abutment was connected and flaps were sutured without membranes to allow transmucosal healing. After 4 months the implants were connected with definitive crowns, and loaded. Reentry measurement candidates were selected among those who had the implants functionally loaded over 1 year and fulfilled the following indication. In case additional new implant surgery was necessary in adjacent to the previously measured implant, and extended flap elevation was required. After performing reentry procedure to the indicated implant, the bone measurement was repeated.

Results: Twenty-nine implants of 22 patients were indicated for reentry measurement, and reopened. Mean post implant placement time and prosthetic loading time were 26, 22 months, respectively. Mean amount of autogenous drill chip bone obtained from each osteotomy site was 0.13 cc. At reentry most of peri-implant marginal defects were healed with bone completely either in grafted sites or in non grafted sites. On grafted sites, buccal width, buccal height, lingual width, lingual height increased +0.1 and +1.8, +0.2, +0.6 mm, respectively ($n = 12$). On nongrafted sites, buccal width, buccal height, lingual width, lingual height decreased -1.4, -1.4, -0.6, -0.5 mm, respectively ($n = 17$). Statistically significant differences ($P < 0.05$) were observed in the bone changes between grafted and nongrafted defects.

Conclusions and clinical implications: Autogenous drill chip bone grafted in the peri-implant defect had survived, and contributed to substantial bone regeneration. Although the amount of obtainable drill chip bone was small and limited, this autogenous bone was very useful for the treatment of peri-implant defects.

100 | Implant Therapy Outcomes, Surgical Aspects

Overerupted maxillary molar intrusion using subapical corticotomy combined with miniplates anchorage system

Presenter: Akay MC

Ege University, Izmir, Turkey

Co-authors: Akay MC, Tekin U, Sezer B, Gungor MA, Gunbay T

Ege University, Izmir, Turkey

Background: In the clinical practice in Dentistry, overeruption of teeth due to loss of antagonists occur generally. In severe cases, the lost antagonist cannot be restored because the overerupted molar interferes prosthodontic treatment. Desired intrusion can only be achieved when an adequate anchorage system supports light and continuous forces that are directed through the tooth's center of resistance. During the last decade, the performance of subapical corticotomy was again suggested as a means to enhance orthodontic treatment. Despite some initial resistance, some researchers saw potential in the clinical reports and began to investigate the effects of corticotomies with a more scientific perspective. Overerupted molars can be intruded quickly and without side effects by using a corticotomy and skeletal anchors. Subapical corticotomy is defined as a surgical intervention limited to the cortical portion of the alveolar bone.

Aim: The aim of this study was to determine the long-term clinical and radiological effects of overerupted maxillary molars and premolars after their intrusion was done using combined treatment with subapical corticotomy and L-miniplates.

Methods: In the presented clinical study, four patients (three females, one male) with ages ranging from 18 to 51 years (mean age 38.4 years) were involved. All of the individuals received combined subapical corticotomy and L-miniplates anchorage procedure. Intrusion forces of 200–300g were applied on the attachments of each premolar and both molars during 12 weeks. The mean follow-up period was 81 month (range 79–84 month).

Results: The immediate postoperative radiographs showed excellent positions for all L-miniplates, and postoperative healing was uneventful in all patients except mild postoperative facial swelling after flap operation for L-miniplate insertion. Radiologically, within 12 weeks significant intrusion (4–5 mm) of the overerupted teeth was detected. No movement of the miniplates occurred at any time during their use or before intentional clinical removal. No signs of root resorption and no effect on the vitality of the pulps of the teeth in the area of corticotomy were detected either upon the completion of intrusion or at the end of prosthodontics treatment.

Conclusions and clinical implications: Clinically, the combined treatment with subapical corticotomy and L-miniplates was well tolerated by the patients. The presented alternative technique was easy to use and it greatly simplified orthodontic intrusion in the

adult patients, however, must further be investigated with larger study groups in the long-term.

101 | Implant Therapy Outcomes, Surgical Aspects

Implant-supported oral rehabilitation of a patient with pemphigus vulgaris

Presenter: Altin N

Department of Oral Medicine and Surgery, Faculty of Dentistry, Istanbul University Istanbul, Turkey

Co-authors: Altin N, Ergun S, Koray M, Tanyeri H

Department of Oral Medicine and Surgery, Faculty of Dentistry, Istanbul University Istanbul, Turkey

Background: Pemphigus vulgaris (PV) is a rare mucocutaneous vesiculobullous disease of the skin and mucous membranes characterized by the development of autoantibodies against the desmosomal proteins. Patients with PV may be on the long term use of topical and systemic steroids or other immunosuppressive drugs, thereby suppressing the immune response. In the case of patients on systemic corticosteroid there may be immunosuppression together with reduced bone mineral density. Immune-suppressive drugs can increase the risk of infection and delay healing, which are of concern in oral surgical procedures. **Aim:** The purpose of this article is to report the clinical course of a patient with PV who was treated with an implant-supported overdenture for the mandible and review the effects of long-term use of corticosteroids in oral surgical procedures.

Methods: This clinical report presents a 70-year-old patient with PV who has a atrophic mandible with ill-fitting denture and required oral rehabilitation with dental implants

Results: Oral rehabilitation was achieved with implant-supported over dentures.

Conclusions and clinical implications: Oral problems such as blister formation with minimal trauma are usually encountered in patients with PV. Ill-fitting dentures can cause vesiculobullous and ulcerative lesions. Therefore prosthetic rehabilitation with implant supported prosthesis improves stabilization of the prosthesis resulting in higher level of patients comfort. However, dental implant treatment for a patient with PV can be complicated by the side effects of long-term use of systemic corticosteroids, in our case no complication like delay healing or infection were seen.

102 | Implant Therapy Outcomes, Surgical Aspects

Comparison of conventional and cone-beam tomography in computer-assisted implant surgery

Presenter: Arısan V

Department of Oral Implantology, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Arısan V¹, Piskin B², Avsever H³, Karabuda C¹

¹Department of Oral Implantology, Faculty of Dentistry, Istanbul University, Istanbul, Turkey, ²Department of Prosthodontics, Dental Science Center, GATA, Ankara, Turkey, ³Department of Oral Radiology and Diagnosis, Dental Science Center, GATA, Ankara, Turkey

Background: Conventional (CT) and cone-beam computed tomography (CBCT) has become widely used for presurgical evaluation

and planning of implants. However, the use of these images for stereolithography (SLA)-assisted implant surgery is to be elucidated. **Aim:** The aim of this study was to analyze the radiographic bone density of the implant recipient bone areas by CT and CBCT images with relation to implant stability parameters in the surgical stage. The deviation between the planned and placed implants was also investigated.

Methods: Following the determination of the required sample size, a total of 108 implants were placed to 22 patients using stereolithographic surgical guides (Simplant, Materialise Dental, Leuven, Belgium) derived from CT (Siemens, Somatom, Erlanger, Germany); (CT) CBCT (Kodak-Iluma, 3M, Ardmore, USA); (CBCT) images. Radiographic bone density values (Hounsfield unit (HU) in CT and voxel value (VV) in CBCT) recorded for the planned implants were analyzed with relation to the insertion torque (ITV) and resonance frequency analysis (RFA). The deviation between the planned and placed implants was also measured with the help of a new tomographic image. Results were analyzed using nonparametric tests and multiple regression models ($P < 0.05$).

Results: All implants were placed as planned in the planning software. Significant relations were found between the stability parameters and HU ($P = 0.021$ and $P = 0.22$) and VV ($P = 0.036$ and $P = 0.30$, $P = 0.0038$ for ITV and RFA, respectively) measured from the 1-mm outer shell of the implants. Mean deviation in the implant apex and tip were 0.82 ± 0.42 and 0.94 ± 0.46 mm in CT group and 0.79 ± 0.39 and 0.95 ± 0.4 mm in the CBCT group. Neither in the implant shoulder ($P = 0.22$) nor in the implant tip ($P = 0.092$) a statistically significant difference was present between the groups. Mean angular deviation was 3.35 ± 1.01 and $3.47 \pm 1.09^\circ$ in CT and CBCT groups, respectively with no statistically significant differences ($P = 0.36$).

Conclusions and clinical implications: Both CT and CBCT are effective in the prediction of primary implant stability. The deviations of planned and placed implants are also found similar. Reduced radiation dose and costs may render CBCT preferential.

103 | Implant Therapy Outcomes, Surgical Aspects

Implants following lateral ridge augmentation in the posterior lower jaw 8–12 years after surgery

Presenter: Arnhart C

Bernhard Gottlieb Dental School, Medical University of Vienna, Vienna, Austria

Co-authors: Arnhart C, Lettner M, Dvorak G, Watzek G, Watzak G

Bernhard Gottlieb Dental School, Medical University of Vienna, Vienna, Austria

Background: The posterior lower jaw is highly affected by atrophic bone resorption after tooth loss. Therefore implant rehabilitation is often limited by compromised residual ridge height and width. In case of knife edged bony situations, lateral ridge augmentation procedures before implant surgery enables therapy. In posterior lower jaw situations, block graft consolidation and resorption is intensely disputed in literature.

Aim: The retrospective study design aimed at evaluating peri-implant conditions e.g. bone level and soft tissue integration of

implants following lateral ridge augmentation procedures in the posterior mandible 8–12 years after implant surgery.

Methods: Institutional review board approval was obtained for this study (EK 088/2009, Medical University of Vienna, Austria) and informed consent was secured from all participants. Overall 100 patients were included and invited to participate the follow-up examination. Patients who underwent autologous block graft augmentation procedures in the posterior lower jaw before implant surgery were considered as test group. Implant patients with adequate residual ridge height and width at the time of implant surgery were allocated to control group. Actual radiographs (follow-up) were obtained and matched to the baseline X-rays after implant surgery. During clinical examination bleeding on probing (BoP), pocket probing depth (PPD) and oral hygiene (HI) were evaluated. **Results:** Data analysis is not completely finished yet, but preliminary data show significantly higher peri-implant bone loss in patients who underwent lateral ridge augmentation procedures. Results of the clinical examination correlate to radiographic data. Implant survival rate was significantly decreased in augmented implant sites.

Conclusions and clinical implications: Peri-implant bone loss was significantly higher in patients who underwent ridge augmentation procedures in posterior lower jaw before implant placement. In case of autologous block graft augmentation procedures in the posterior lower jaw, short implants should be considered as an alternative treatment concept particularly with regard to donor site morbidity and block graft resorption.

104 | Implant Therapy Outcomes, Surgical Aspects

Morphologic evaluation of the incisive canal in the anterior mandible: a CBCT study

Presenter: Babiuc I

UMF Carol Davila, Bucharest, Romania

Co-author: Babiuc I

UMF Carol Davila, Bucharest, Romania

Background: The interforaminal region of the mandible is considered a relatively safe place to insert implants and it is also a common donor site in bone grafting techniques. However, harvesting bone from the chin can lead to neurosensory disturbances and there are reports of neurologic complications following implant placement, caused by the compression of the incisive nerve.

Aim: This study aims to describe the presence and the anatomy of the incisive canal as depicted from CBCT investigations.

Methods: Thirty-eight subjects underwent CBCT examination of the mandible for implant therapy. CBCT data was acquired using a Picasso Trio from Vatech with a standardized exposure protocol. The tomographic volumes were analyzed with EzImplant-Plus software. The anatomy of the interforaminal region of the mandible was carefully examined in order to detect the incisive canals. The presence and the position in relation to the buccal border of the mandible, to the teeth and to the lingual foramina were established.

Results: The incisive canals were detected in all CBCT examination. The mean distance from buccal border of the mandible

to the incisive canal was 5.91 mm (SD 3.09). The mean distance from the apex of the lateral incisor to the incisive canal was 7.68 mm (SD 3.06) in dentate subjects; in edentulous patients, the mean distance from the canal to the top of the alveolar ridge was 11.89 mm (SD 2.15). In 28.94% of the cases, the incisive canal was depicted in the midline. The incisive canal was found underneath the main lingual foramen in 72.73% of the cases and above it in 27.27% of the cases.

Conclusions and clinical implications: Cone beam computed tomography can offer accurate and reliable morphologic evaluation on the anatomy of the anterior mandible. The incisive canal is a constant finding in the interforaminal region and should be evaluated when planning surgical procedures.

105 Implant Therapy Outcomes, Surgical Aspects

Healing abutment influence on peri-implant soft tissue healing. A randomized control trial (RCT)

Presenter: Beretta M

University of Milan Fondazione IRCCS Cà Granda Ospedale Maggiore Policlinico Dental Clinic, Milan, Italy

Co-authors: Beretta M, Barbaglio M, Panigalli A, Pivetti L, Maiorana C

University of Milan Fondazione IRCCS Cà Granda Ospedale Maggiore Policlinico Dental Clinic, Milan, Italy

Background: Health, function and esthetics strictly depend on a healthy soft tissue surrounding dental implants. The success of dental implants depends on the establishment of a soft-tissue barrier that is able to protect the underlying osseous structures and the osseointegration surrounding the implant body.

Aim: The aim of this study is to evaluate the possible correlation between the shape of the healing abutment and the volume of peri-implant soft tissues, immediately after the second surgical stage.

Methods: A sample of 14 adults was selected. In each of these patients, previously treated with the insertion of at least two adjacent implants, a second surgical stage was performed, and for each of them two or four different types of healing abutment (cylindrical and bottleneck shape by Camlog, Altatech Biotechnologies) were placed. In particular, the test group (T) used the bottleneck healing abutment, while the control group (C) used the cylindrical healing abutment. A spot test was performed to determine the test site and the control site. The sites subjected to the study were required to have a good amount of keratinized gingiva, identified as at least 3 mm between middlecrest and mucogingival line. The measurements were taken immediately after the second surgical stage, after 15 days and after 30 days. The thickness of the vestibular and palatal/lingual was measured 3 mm from the implant neck. The mesial, vestibular, distal and palatal/lingual probing of every implant site was measured calculating the distance between the free gingival margin and the implant neck.

Results: After 2 weeks the results showed a significant difference in the variation of vestibular probing (Sig. 0.020) and a very significant difference in the variation of the distal probing of the implant site (Sig. 0.002). After 30 days the results showed a very significant difference in the variation of the vestibular thickness

(Sig. = 0.0001) and in the variation of the mesial probing (Sig. = 0.0001), vestibular probing (Sig. = 0.001) and distal probing (Sig. = 0.000) of the healing abutment. The results do not show any statistical difference in the palatal/lingual thickness (Sig. = 0.060), and in the palatal/lingual probing (Sig. = 0.234). This is probably because in some cases, where patients had insufficient depth of the vestibular fornix, an apical positioning of the flap was performed.

Conclusions and clinical implications: The bottleneck healing abutment, compared with the cylindrical healing abutment, seems to influence the volume of peri-implant soft tissue, increasing both the thickness and the vertical aspect in the early stages of healing, after the second surgical stage. These results are considered preliminary because the sample examined cannot guarantee significant statistical reliability.

106 Implant Therapy Outcomes, Surgical Aspects

Dimensions of the Schneiderian membrane as visualized using cone beam computed tomography: when is sinus floor elevation possible?

Presenter: Bornstein M

Department of Oral Surgery and Stomatology, University of Bern, Bern, Switzerland

Co-authors: Bornstein M¹, Janner S¹, Caversaccio M², Dubach P², Buser D¹

¹Department of Oral Surgery and Stomatology, University of Bern, Bern, Switzerland, ²Clinic for Ear, Nose and Throat Diseases, Head and Neck Surgery, Bern University Hospital and University of Bern, Bern, Switzerland

Background: Data on the dimensions and changes of the Schneiderian membrane based on radiographic imaging are rare in the literature. To date, there are no guidelines for classification and treatment of mucosal findings in the maxillary sinus before sinus floor elevation (SFE).

Aim: To determine the dimensions of the Schneiderian membrane using limited cone beam computed tomography (CBCT) in individuals referred for dental implant surgery, and to determine factors influencing the mucosal thickness.

Methods: The study included 143 patients referred for dental implant placement in the posterior maxilla. A total of 168 CBCT images were taken using a limited field of view (FOV) of 4 × 4, 6 × 6 or 8 × 8 cm. Reformatted coronal CBCT slices were analyzed with regard to the thickness and characteristics of the Schneiderian membrane in nine standardized points of reference. The pathologic findings were classified by an experienced oral surgeon and an ENT specialist. Factors such as age, gender or status of the remaining dentition that could influence the dimensions of the Schneiderian membrane were evaluated using univariate and multivariate linear regression models.

Results: The thickness of the Schneiderian membrane exhibited a wide range, with a minimum value of 0.16 mm and a maximum value of 34.61 mm. In the descriptive analysis of the CBCT images, 76 maxillary sinuses (45% out of a total of 168) were classified as healthy. The most frequent pathologies diagnosed were flat thickenings of the Schneiderian membrane (62 positive findings in 168 maxillary sinuses/37%), and the prevalence of

cyst-shaped lesions was 7%. Only one case of a mucocele-like radioopacity in the respective sinus was found.

Conclusions and clinical implications: There is great interindividual variability in the thickness of the Schneiderian membrane. Gender seems to be the most important parameter influencing mucosal thickness in asymptomatic patients. Mucocele-like radioopacities need further diagnostics and treatment before SFE. Patency of the ostium was not always visible on CBCT images, making it necessary to discuss the optimal FOV for analysis of the maxillary sinus before SFE. Future studies are needed to assess the therapeutic and prognostic consequences of mucosal alterations in the maxillary sinus.

107 | Implant Therapy Outcomes, Surgical Aspects

Zygomatic implants – analysis of clinical outcomes over 10 years

Presenter: Brook I

Oral and Maxillofacial Medicine and Surgery, University of Sheffield, Sheffield, UK

Co-authors: Yates J, Patel R, Wragg P, Brook I

Oral and Maxillofacial Medicine and Surgery, University of Sheffield, Sheffield, UK

Background: Initially developed to enable dental prosthesis placement in patients with significant maxillary bone loss due to trauma, surgical resection or atrophy, zygomatic implants are now used in clinically challenging patients with resorbed edentulous maxillae to circumvent the need for grafting procedures. Few studies report the long-term outcome of zygomatic implants and those available vary in terms of numbers performed, surgical technique, duration of review and prosthesis design.

Aim: The aim of this study was to analyse and report the survival rates of endosseous zygomatic implants (Nobel Biocare UK) used in maxillary rehabilitation to determine the predictability of prosthesis delivery.

Methods: Fifty consecutive machined surface zygomatic implants were placed in 28 patients were evaluated for up to 10 years. Placement was undertaken using the modified sinus slot technique¹. The outcome measures and determinants for success were survival of the restored implants and the proportion of originally planned prostheses delivered to patients.

Results: Of 28 patients (15 male, 13 female, 23 nonsmokers, mean age at time of surgery 56 years), 24 patients were fully edentulous and four patients were semi-dentate. All patients were treatment planned for either implant retained bridgework, removable upper prostheses retained by fixed cast gold or milled titanium beams or magnet retained removable prostheses. A combination of zygomatic and conventional implants was used in all but one patient. The overall success rate for zygomatic implants was 88% with six of the implants either failing to integrate or requiring removal due to persistent infection associated with the maxillary sinus. All patients received their planned prosthesis, although in five cases the method of retention required modification.

Conclusions and clinical implications: Zygomatic implants are a successful and important treatment option when trying to restore

the atrophic maxilla, avoid additional augmentation/grafting procedures and obtain a high long-term success rate.

1. Stella J. P., Warner M. R. (2000) Sinus slot technique for simplification and improved orientation of zygomatic dental implants: a technical note. *International Journal of Oral Maxillofacial Implants* 15: 889–893.

108 | Implant Therapy Outcomes, Surgical Aspects

For ideal implantation ridge alterations following tooth extraction with and without flap elevation: an animal study

Presenter: Byung-Ho C

Yonsei University Wonju College of Medicine, Wonju, Republic of Korea

Co-authors: Seung-Mi J, Byung-Ho C

Yonsei University Wonju College of Medicine, Wonju, Republic of Korea

Background: Alveolar bone resorption is a common finding after tooth extraction. As such, the height and width of the alveolar bone will decrease over time following the procedure. In a recent dog experiment, contradictory results were reported on the effect of the type of procedure used on ridge alterations following tooth extraction.

Aim: The purpose of this study was to assess alveolar ridge alterations occurring six months following tooth extractions with or without flap elevation.

Methods: In five dogs, the bilateral fourth mandibular premolars were extracted using either a flap or flapless extraction procedure. After a healing period of 6 months, micro-computed tomography scans at the extraction sites were performed.

Results: The flap group demonstrated significantly more bucco-crestal bone loss in the coronal third of the edentulous ridge than did the flapless group.

Conclusions and clinical implications: The findings demonstrated that a flapless extraction procedure decreases the resorption rate of the extraction socket.

109 | Implant Therapy Outcomes, Surgical Aspects

One stage operation for the treatment of a complicated maxillary sinusitis due to complication of sinus lifting procedure

Presenter: Cansiz E

Dentistry Faculty Oral and Maxillofacial Surgery Department, Istanbul University, Istanbul, Turkey

Co-authors: Isler SC¹, Cansiz E¹, Atalay B¹, Ulusan M²

¹Dentistry Faculty Oral and Maxillofacial Surgery Department, Istanbul University, Istanbul, Turkey, ²Medical Faculty Otorhinolaryngology Department, Istanbul University, Istanbul, Turkey

Background: Sinus lifting procedure is one of the most popular techniques for the dental implant placement in deficient maxillary alveolar ridges. Generally, autogenous, alloplastic or allogenic bone materials are used for the augmentation of the maxillary sinus. When the residual bone height of alveolar ridge

is suitable, the bone augmentation and the implantation can be performed at the same time to reduce total rehabilitation period. Although, sinus lifting procedure is not considered as a difficult procedure, it is technically delicate. Poor operation technique or inappropriate indications can cause complications like perforation of sinus membrane, disturbed wound healing and maxillary sinusitis.

Aim: The main objective of this case report is to describe the treatment approach for an acute maxillary sinusitis also affected the ethmoidal and frontal sinuses occurred due to complication of sinus lifting operation.

Methods: This is a case report. In this case report we present a patient who have unilateral pansinusitis as a result of sinus lifting operation with immediate implantation. Functional endoscopic sinus surgery and endoscopy assisted intraoral approach is used to remove the infected graft material and drain infected sinuses. Rotational palatal island flap and otogen bone grafting is used for the closure of the oroantral fistula.

Results: The treatment was performed by the combination of functional endoscopic surgery and intraoral approach. Also rotational palatal island flap and otogenous bone grafting was performed. Six months later, there were no clinical symptoms and radiologic signs of sinusitis.

Conclusions and clinical implications: Our experience with the maxillary sinusitis due to infected graft material is showed us that, ideal healing can be maintained only by the complete removal of the graft from the sinus. Although, complete removal of the infected graft is very important, only the clearance of the maxillary sinus is not enough for the ideal healing. The correction of the physiological air circulation and drainage of the maxillary sinus must be done at the same time with the complete removal of the infected graft material. For this purpose, intraoral or nasal approaches can be performed.

110 | Implant Therapy Outcomes, Surgical Aspects

Healing of implants with different morphology placed in fresh extraction socket. An experimental study in the dogs

Presenter: Cardaropoli G

Clinical Research Center, UMDNJ New Jersey Dental School, Newark, USA

Co-authors: Cardaropoli G

Clinical Research Center, UMDNJ New Jersey Dental School, Newark, USA

Background: Following tooth extraction, intra-alveolar and extra-alveolar bone remodeling occurs and, consequently, marked bone alterations have been reported (Cardaropoli et al. 2003; Araújo et al. 2005). In a preclinical study, Cardaropoli et al. (2003) assessed the sequence of healing that occurred in the socket following tooth extraction. Several studies have been performed both in animals and in humans investigating whether the insertion of an implant immediately after tooth extraction might prevent or decrease the buccal bone loss (Araújo et al. 2005, Araújo et al. 2006). The conclusions of these research were very similar, demonstrating that marked bone alteration

occurred following immediate implant placement. On the other hand several new studies suggested that implants with microthreads and platform switching have better healing regarding bone loss and ridge preservation when placed in healed bone (Cardaropoli et al., 2006, Chang et al., 2010).

Aim: To study the healing following immediated placement of implants with different morphology (microthreads, platform switching).

Methods: Eight beagle dogs approximately 12 months old and weighing approximately 10kg each were used for the experiment. The mandibular premolars were carefully separated and extracted. Immediate implant installation was performed with a split mouth design in all animals with a total of sixteen 3.3×10 mm Osseospeed (Astra-Tech, Moldal, Sweden) A group and 16 (3.25×10 mm NanoTite, Biomet 3i, Palm Beach, FL, USA) B group. After 3 months of healing the dogs were euthanized and buccal-lingual histology sections were obtained. Histometric measurements of bone loss the bone implant contact were performed. The mean values and standard deviation among animals were calculated for each experimental site. Student's *t*-test for paired observations was used to compare the variables of the two groups. *P*-values < 0.05 were considered to be statistically significant.

Results: All experimental sites healed uneventfully. During the experimental period. A buccal bone loss of 1.7 mm (0.55) was recorded in the A group compared with 1.6 mm (0.63) in the B group. The bone implant contact was 74% in the test group and 71% in the control group.

Conclusions and clinical implications: The results of the present study revealed a buccal bone remodelling in the A and in the B group. However, we find no difference between the implants with or without microthreads and with and without platform switching. Moreover the two surfaces characteristic did not show any superiority regarding the BIC. Therefore, dental implant behave differently when inserted immediate following tooth extraction compared with implant inserted in healed ridge. New implant morphology and surface have to be investigate for the usage in fresh extraction socket to preserve the buccal bone plate.

111 | Implant Therapy Outcomes, Surgical Aspects

Maxillary sinus augmentation with Osteon; a clinical and radiographic study

Presenter: Cha J-K

Department of Periodontology, Research institute for periodontal regeneration, College of dentistry, Yonsei University, Seoul, Republic of Korea

Co-authors: Cha J-K¹, Park J-C¹, Jung U-W¹, Kim C-S¹, Chung S-M², Cho K-S¹, Choi S-H¹

¹Department of Periodontology, Research institute for periodontal regeneration, College of dentistry, Yonsei University, Seoul, Republic of Korea, ²Dentium Co., Seoul, Republic of Korea

Background: As in the development of new synthetic materials for maxillary sinus augmentation, it is critical that the healing process occurring at the augmented site be evaluated. However,

there are very little data on the suitability of the grafting materials for sinus augmentation. The Osteon[®] (Dentium, Seoul, Korea) is alloplastic material containing 70% hydroxyapatite and 30% beta-tricalcium phosphate.

Aim: The aim of this study was to evaluate 3.5 years-cumulative survival rate of implants placed on augmented sinus using Osteon[®] and to assess the change of height of the grafted material through radiographic evaluation.

Methods: Twenty patients were treated with maxillary sinus augmentation and 45 implant fixtures were installed simultaneously ($n=34$) or after 6 months healing period ($n=11$). The height of the augmented sinus and the loss of marginal bone were measured by panoramic and intraoral radiographs immediately after augmentation and up to 42 months subsequently. Changes in the height of the Osteon[®] were calculated radiographically. Differences in the residual height of Osteon[®] according to the timing of implantation and the type of Osteon[®] were analyzed using the independent t -test. Correlation between the residual height of Osteon[®] and follow-up period were determined by Spearman's test.

Results: The cumulative survival rate was 95.56% in all 45 implants. Additionally, normal healing process without any complication was observed in all patients. The original sinus height was mean 4.3 mm and the augmented sinus height was mean 13.4 mm after the surgery. The mean marginal bone loss till 42 months was 0.52 ± 0.56 mm. The reduced height of Osteon[®] was 0.83 ± 0.38 mm and it did not show significant correlation with the follow up periods ($P=0.102$). There were no statistically significant differences in reduced height of Osteon[®] according to the simultaneous/delayed implantation ($P=0.299$) and particle size of Osteon[®] ($P=0.644$).

Conclusions and clinical implications: In the limitations of present study, the grafted Osteon[®] was well maintained in sinus and the height of the grafted material decreased slightly over 3.5 years of time period demonstrating that it is a clinically suitable material for sinus augmentation.

112 | Implant Therapy Outcomes, Surgical Aspects

Clinical evaluation of two kinds alveolar ridge distractor with dental implants in defect of alveolar bone

Presenter: Chang Y-M

Chang-Gung Hospital, Taipei, Taiwan

Co-authors: Chang Y-M

Chang-Gung Hospital, Taipei, Taiwan

Background: Comparison of intraosseous and extraosseous alveolar distraction osteogenesis and dental implants functional loading long-term result.

Aim: To evaluate the clinical effects of osteogenesis in alveolar bone defect area by two kinds different vertical distractor, after that dental implantations were used for oral functional reconstruction.

Methods: From 2002 to 2007, 23 patients were performed vertical ridge distraction method by two type distractor: Group (A) eight cases with intra-osseous distractor and Group(B) 15

cases with extra-periosteum distractor in alveolar ridge defect area. Routine distraction principle were applied: 7–14 days latency period, distraction rate is 0.8 mm/day, until the bone height was enough for dental implant placement, after 3 month consolidation, distractor was removed followed by implant placement.

Results: Increased bone height-group (A) 7–11 mm, average 8.5 mm, group (B) 5–14 mm, average 10.6 mm. In group (A) the distracted vector inclination to lingual or palatal side, additional bone graft at bone gap and buccal layer is necessary. In group (A) 27 implants, group (B) 48 implants under functional load for 2–7 years, the marginal bone lose in group(A) 0.32 ± 0.17 mm, group(B) 0.21 ± 0.16 mm.

Conclusions and clinical implications: The technique of vertical distraction osteogenesis is an effective technique for treatment on severe alveolar bone deficient area, carefully selective patient is necessary.

113 | Implant Therapy Outcomes, Surgical Aspects

Survival rate of apical tapered implants vs. parallel implants

Presenter: Chen A

Instituto de Implantologia, Lisbon, Portugal

Co-authors: Chen A, Real-Dias M, Ascenso J, Crispim P, Francisco H, Carames J, Cervino E

Instituto de Implantologia, Lisbon, Portugal

Background: Astra Tech[™] change the apical third macrogeometry of their parallel wall implant to ease implant insertion and primary stability.

Aim: Report retrospectively, the survival rate of the new osseospeed &trade TX implants compared with the old straight parallel wall one (astra tech osseospeed[™]).

Methods: A retrospective study of 100 consecutive implants

Fifty osseospeed[™] TX implants included in the study-group, and 50 Straight osseospeed[™] implants in the control-group.

Both had the same grit blasted with titanium dioxide particles titanium surface with additional chemical (fluoride) treatment (osseospeed[™] The Study-Group included 21 implants in the maxilla. Ten (dimensions in mm were 3.5*8-(1), 4*8-(3), 4*11-(2), 4*13-(4)) in the posterior area (directly under the maxillary sinus) and 11 (3.5*11-(3), 3.5*13-(4), 4*13-(4), in the anterior area. Twenty-nine were in the mandible from which 18 (4*8-(3), 4*9-(8), 4*11-(7)) were in the posterior area (distal from the mental foramen), and 11 (4*11-(3), 4*13-(8)) in the interforaminal area. The Control-Group included 26 implants in the maxilla, 16 (4*13-(5), 3.5*13-(11)) in the anterior area and 10 (4*8-(3), 4*11-(2), 4*13-(5)) posterior. 24 in the mandible, from these 10 (4*11-(2), 3.5*13-(8)) in the anterior area, and 14 (4*8-(2), 4*9-(5), 4*11-(7)) posterior. For the entire sample, insertion torque was between 35 and 50-n/cm². Primary stability achieved from native bone, all left submerged and Stage-Two made 3–5 month after implant insertion. Final restoration placed 4–7 month after implant installation and 1-year follow-up was made.

Results: The overall survival rate of the Study-Group was 100% and the Control-Group was 100% The average

dimensions of the implants for the Study-Group in the maxilla were 3.68*12.45 posterior and 3.95*10.6 anterior, while in the mandible was 4*9.6 posterior and 4*12.45 anterior. For the Control-Group the average in the maxilla was 3.65*13 anterior and 4*11.1 posterior. In the mandible was 4*9.8 posterior and 3.6*12.6 anterior.

Conclusions and clinical implications: When sufficient native bone is present for primary stability, a two-stage implant approach is made with at least 3 month interval from installation and with 1 year follow-up after final restoration, the survival rate of new osseospeed™ TX implant with fluoride modification has a tendency to be similar to the straight ones with the same surface treatment, despite implant dimensions or site specifications.

114 | Implant Therapy Outcomes, Surgical Aspects

Using decoronation technique in a case with external root resorption

Presenter: Chen W

E-Da Hospital, Kaohsiung, Taiwan

Co-authors: Chen W, Cheng H

E-Da Hospital, Kaohsiung, Taiwan

Background: Replacement resorption and ankylosis are frequently diagnosed following severe dental trauma. The most accepted treatment option of ankylosed teeth has been their surgical removal which is frequently accompanied by traumatic alveolar bone loss. Unlike the traditional treatment, decoronation can preserve the alveolar bone without removal of ankylosed teeth by surgery.

Aim: Present a case with using decoronation method to decrease the bone loss and improve the esthetic outcome.

Methods: Here, we present a case who is a victim of dental trauma. He presented in our department 4 months after the original trauma with #12, 11 and #22 missing as well as #21 crown fracture. Besides crowding dentition was also diagnosed. In order to gain optimum esthetic result, orthodontic treatment is initiated in 3 weeks after initial appointment. After finishing orthodontic treatment, implant is then placed at tooth #11 and #22 approximately 2 years later. By the time to restore #21, the external root resorption was noted. Decision was made to remove to removal the coronal portion and submerge the root underneath the alveolus using the concept of decoronation technique. Then final restoration is finished.

Results: During the follow-up, patient is satisfied with the final result. No root exposure or infection happened. Although the follow-up radiograph film showed mild progression of resorption, no obvious buccal depression at tooth #21 area.

Conclusions and clinical implications: There is no specific protocol for this kind of case when to initiate orthodontic treatment after traumatic injury. But the resorption may be originally from the late endodontic treatment instead of orthodontic treatment. Owing to continue intracanal inflammation, the risk of external resorption may increase. Decoronation provides certain advantages over other treatment options: (1) It is reliable in terms of alveolar process width and height

preservation. (2) It is a simpler and more economical surgical procedure than ridge or soft tissue augmentation. In the present case, although this patient had alveolus development completed, but conservative treatment using decoronation did save him from another traumatic surgery by removing the ankylosed root surgically. Numerous case reports describing decoronation can be found in dental literature. However, further research and observation are still necessary in order to predict the long-term outcome.

115 | Implant Therapy Outcomes, Surgical Aspects

A retrospective radiographic evaluation of graft height changes after maxillary sinus floor augmentation: 3 years follow-up

Presenter: Chung JE

Kangbuk Samsung Medical School, Seoul, Republic of Korea

Co-authors: Chung JE

Kangbuk Samsung Medical School, Seoul, Republic of Korea

Background: Maxillary sinus augmentation procedures involving various graft materials with or without simultaneous implant placement have become a common treatment modality as numerous studies report successful clinical outcomes. However, only few reports have focused on maxillary sinus pneumatization after maxillary sinus floor augmentation procedures.

Aim: The aim of this study was to evaluate the vertical dimensional changes in graft height and analyze contributing factors affecting graft height changes in maxillary sinus floor augmentation with anorganic bovine bone.

Methods: Total 49 maxillary sinuses in 43 patients were augmented with anorganic bovine bone and panoramic radiographs were taken before, immediately, 6, 12, 24, and 36 months after the sinus graft. Radiographic measurements consisted of the (1) distance from the platform of the implant fixture to the augmented sinus floor at the distal side of the second most posterior implant (L1), (2) distance from halfway between the platform of the second most and most posterior implant to the augmented sinus floor (L2), and (3) remaining alveolar bone height at the second most posterior implant site (L3). The installed implant length, perforation during procedure, and timing of implant placement were also recorded.

Results: A total of 134 implants were installed, and the overall survival rate was 98.51%. The Schneiderian membrane was perforated in eight cases (16.32%). The mean dimensional decrease in the grafted sinus was 1.90 ± 1.13 mm over 36 months. The graft height decreased significantly during the first 12 months. The dimensional changes that occurred in grafted sinuses with and without Schneiderian membrane perforation were 2.11 ± 1.39 mm and 1.34 ± 0.49 mm ($P < 0.05$), respectively.

Conclusions and clinical implications: The overall graft height shrinkage during the 36 months was approximately 9% of the newly created sinus height. Only perforation of the sinus membrane appeared to have an effect on the change in graft height.

Changes in soft tissues around immediate full arch rehabilitations: a prospective study

Presenter: Covani U

Istituto stomatologico Tirreno, Camaiore, Italy

Co-authors: Covani U, Ricci M, Barone A

Istituto stomatologico Tirreno, Camaiore, Italy

Background: Nowadays, aesthetic appearance is receiving more and more attention by clinicians and patients. Therefore, it is of paramount importance for the surgeon to maintain or to improve the quality and the stability of the soft tissue-implant interface for the long-term prognosis of oral implants. Scientific literature supports the idea that the immediate placement and provisionalization of endosseous implants and abutments could offer additional clinical control over the peri-implant tissue architecture.

Aim: On this basis, this prospective study aims to evaluate the changes in soft tissues around immediate loaded dental implants in full arch rehabilitations over a period of 3 months.

Methods: Fifteen subjects were treated for an immediate full arch rehabilitations. A total of six to eight implants for each patient were placed in prepared osteotomies for full arch maxillary rehabilitation. Following implant placement, definitive abutments were selected and placed using finger tight pressure. Provisional rehabilitations made of bisphenol-A-glycidyl dimethacrylate (BIS-GMA) and resin were placed. All records were made using a periodontal probe to the nearest 0.5 mm. Facial soft tissue level was measured evaluating the distance between the soft tissue margin and the incisal edge of the crown. Moreover, papilla levels were measured at the mesial and distal sites from a reference line connecting the occlusal edge of the crowns.

Results: The average value at the mesial site was -0.035 mm (± 1 , median 0 mm), while at the midfacial site was 0 mm (± 0.76 , median 0 mm) and at the distal site was -0.05 mm (± 0.92 , median 0 mm). Plaque score index showed a reduction during the follow-up period.

Conclusions and clinical implications: Our data indicate that no differences at the midfacial point were detectable over the observational period. This is in agreement with several studies. It is plausible that this results are linked to a correct position of the implant in the alveolar socket. Moreover, comparing our results with what has been reported by other authors, it is surprising that, while other studies highlight that papilla loss at the mesial and distal aspect is an expected consequence of immediate implant restorations, our data do not show any changes. What are the explanations of these results is still unclear. One interpretation could be that a deeper implant placement with the implant abutment interface beyond the facial osseous crest may result in alveolar bone loss and, subsequently, papilla. However, the role of the immediate provisionalization, which offers support to alveolar walls preventing their collapse has to be carefully evaluated. Further studies are needing to support our data and to clarify what mechanisms are involved in the soft-tissue maintenance.

Implant and prosthetics rehabilitation with regenerative procedures in the aesthetic area: a case report

Presenter: Cremonesi S

Department of Surgical Speciality, U.O. Dental Clinic, Fondazione IRCCS Cà Granda, University of Milan, Milan, Italy

Co-authors: Cremonesi S, Bett F, Benigni M, Stoffella E, Maiorana C

Department of Surgical Speciality, U.O. Dental Clinic, Fondazione IRCCS Cà Granda, University of Milan, Milan, Italy

Background: As widely documented in the literature, the use of regenerative procedure has become a predictable and reliable technique. The use of bone augmentation procedures is often fundamental when an implant has to be inserted in the aesthetic area.

Aim: The purpose of this case report is to illustrate how an implant-prosthetic rehabilitation in the frontal area can be performed even in case of absence of adequate bone support, by using regenerative surgical procedures, in order to obtain a good final aesthetic outcome.

Methods: A 40 years-old male patient presented absence of tooth 21, as a result of a sport injury. The clinical and X-ray examination showed loss of bone support both horizontally and vertically. A need of bone graft was necessary in order to perform an implant-prosthetic rehabilitation with a satisfactory final aesthetic result. A vertical bone regeneration procedure using a ePTFE-reinforced titanium membrane with the contextual insertion of an implant of proper size (3i Biomet 4.00 mm \times 13 mm) was performed. A temporary screwed crown was positioned 6 months postoperatively in order to condition the periimplant soft tissues. Six months later an allumina-ceramic crown was cemented on a zirconia abutment.

Results: Two years post operatively, the peri-implant soft tissues did not show signs of inflammation, resulting in a very good aesthetic outcome.

Conclusions and clinical implications: As widely accepted in the literature, bone grafting procedures are predictable and reliable techniques available in cases of need of bone augmentation for a correct prosthetically guided implant insertion, especially in the aesthetic area.

Preventing peri-implant bone loss using particulated autograft infused with rhPDGF-BB

Presenter: Damianaki S

Aristotle University of Thessaloniki, Thessaloniki, Greece

Co-authors: Damianaki S, Kalpidis C, Menexes G, Koumpias S, Konstantinidis A

Aristotle University of Thessaloniki, Thessaloniki, Greece

Background: Surgical trauma during implant placement has been related to peri-implant bone loss after implant installation. Thus, efforts of minimizing crestal bone loss during healing are of great importance.

Aim: The present prospective controlled clinical study aimed to: (a) record dimensional alterations of peri-implant bone from

implant placement to uncovering, (b) evaluate the effect of a particulated autogenous bone graft alone or in combination with rhPDGF-BB in reducing buccal bone loss during healing and (c) establish factors that contribute to greater bone loss.

Methods: Forty-five implants were placed following a two-stage protocol in 18 patients, aged 41–60 years. Patients were randomly assigned to three groups:

- Group 1: control.
- Group 2: placement of 0.1 cm³ autograft at the buccal bone plate after implant installation.
- Group 3: placement of 0.1 cm³ autograft infused with 100 µl of rhPDGF-BB at the buccal bone plate after implant installation.

Clinical assessments were performed at implant placement and at the second stage, 3 months later. It was recorded: (a) facial and labial bone thickness, (b) crestal bone height mesio-distally, buccally and palatally, (c) mucosal thickness and (d) duration of implant surgery. Statistical analysis was performed with the Mann–Whitney test for continuous variables and with the χ^2 test for categorical variables. The relationships between variables were investigated with the Pearson's correlation test.

Results: Mean horizontal bone changes on the buccal and lingual sides were, respectively:

- Group 1: –0.83 and –0.48 mm.
- Group 2: –0.17 and –0.47 mm.
- Group 3: +0.30 and –0.03 mm.

Statistically significant differences were found between groups 1–2, 1–3 and 2–3 buccally and between groups 1–3 and 2–3 lingually. Mean crestal bone height changes on the buccal, lingual and mesio-distal sides were respectively:

- Group 1: –0.85, –0.76 and –0.64 mm.
- Group 2: +0.08, –0.53 and –0.11 mm.
- Group 3: +0.35, –0.01 and –0.25 mm.

Statistically significant differences were found between groups 1 and 3 for all sides and between groups 1 and 2 buccally and mesio-distally.

Conclusions and clinical implications: Surgical trauma resulted in cervical peri-implant bone loss. Increased bone resorption was recorded buccally. The use of the autograft resulted in significant reduction of horizontal buccal bone loss and vertical bone gain, while addition of rhPDGF-BB to the autograft resulted in more significant bone gain. Extended duration of implant surgery and thin mucosa were correlated with greater bone resorption.

of missing teeth. Immediate loading exposes immediately the implants to occlusal and muscular forces. In order to avoid complications the achievement of high primary stability was often suggested, in particular inserting implants with a high insertion torque. Nevertheless it is still quite common to insert implants with low insertion torque values; in these cases different authors advice to splint several implants together: the intra-oral welded bar is one of the techniques suggested.

Aim: The aim of the present study is to evaluate the osteointegration and crestal bone remodelling after 1 year around implants for intra-oral welded immediate full arch prosthesis inserted with low insertion torque values.

Methods: The study was conducted from June 2008 to September 2010. Patients were eligible for the study if they needed an immediate intra-oral welded implant-supported full arch fixed prosthesis and received three or more implants with an insertion torque < 20 N cm and two or more implants with insertion torque > 25 and < 50. For each implant peak insertion torque was recorded during insertion surgery; periapical X-rays were taken at the time of surgery and again after 12 months. Finally, it was recorded whether an implant was lost or removed (within 12 months from insertion surgery). Mann–Whitney test was used to compare mean values. Spearman tests and Eta squared index were used to explore possible association between the studied variables.

Results: Thirteen patients were included in the study; the prosthesis presented the following number of implants: nine with six implants and four with seven implants. A total of 82 implants were inserted: 51 implants presented an insertion torque < 20 N cm (test group), 31 implants an insertion torque > 25 and < 50 N cm (control group). Each prosthesis presented at least three test implants and two control implants. The survival rate after 1 year was 98% for the test and 100% for the control group. The mean distance between the fixture-abutment junction and the bone crest was 0.1 + 0.8 mm for test and 0.2 + 0.5 mm for control group at implant insertion. After 12 months it was 0.7 + 0.9 mm for test group and 0.8 + 0.6 mm for control group. The differences were not statistically significant.

Conclusions and clinical implications: Within the limitations of this study, the results suggested that rigid framework splinting can be a viable technique to improve success rate of implants with low primary stability using immediate loading protocols for full arch prosthesis.

Implants inserted with low insertion torque values for intra-oral welded full arch prosthesis

Presenter: Daprile G

Private Practice, Bologna, Italy

Co-authors: Degidi M¹, Daprile G¹, Piattelli A²

¹Private Practice, Bologna, Italy, ²Dental School, University of Chieti, Chieti, Italy

Background: The evolution of implant dentistry brought an increasing interest in immediate loading and esthetic replacement

RFA for early loading of implants in grafted areas

Presenter: Diamantis I

Private Practice, Athens, Greece

Co-authors: Diamantis I¹, Alexandridis C², Tosios K³

¹Private Practice, Athens, Greece, ²Department of Oral and Maxillofacial Surgery, Dental School, University of Athens, Athens, Greece, ³Department of Oral Pathology, Dental School, University of Athens, Athens, Greece

Background: Among several methods for the clinical determination of implant stability, Resonance Frequency Analysis is considered to be the most accurate, giving an implant stability

quotient. A lot of cases are treated with implantation and simultaneous bone grafting, increasing the healing period. In these complex cases, implant and graft success also, may be determined by measuring discrepancy of implant stability quotients.

Aim: The objective is to reduce the time interval between implant placement and loading, in grafted areas, measuring the changes of implant stability quotient values, using Resonance Frequency Analysis.

Methods: Bone augmentation procedures were carried out in sixteen patients. In eight patients, bone grafts were obtained as blocks from mandibular angle region, exclusively. Bone chips from the adjacent to implant area were obtained in two patients and a combination of block and bone chips was used in three patients. Other three patients were treated using bovine derivative bone substitute (BioOss). Implantation was performed using five implants with SLA (Straumann), seven with high-temperature etched (Xive) and 19 with Ca-modified (Ospol), surface. All of them were placed with bone grafts, simultaneously. Using Resonance Frequency Analysis, implant stability quotient of the implants was recorded. Bone grafts and submerged implants were allowed to heal for 2 months in mandible and for 4 months, in maxilla. The second stage procedure was performed and core biopsies were taken, from adjacent to implants sites, for histomorphometric evaluation of the bone formation at grafted areas. Implant stability quotient of the implants was recorded again and the changes were evaluated. The definitive metal ceramic restorations were fabricated and positioned after this short healing period.

Results: All implants were well integrated at this early time and the Resonance Frequency Analysis showed stable or increased values. All of the implants are considered successful after 2 years of follow-up. In some implants, especially those at bone block bed with or without bone chips, a very high increase of implant stability quotient was observed. No complications arose in the donor or recipient sites.

Conclusions and clinical implications: Resonance Frequency Analysis can be a valuable tool in clinical practice, for the estimation of success of both implants and grafts. Simultaneous implantation and grafting are time and cost efficient procedures and the use of Resonance Frequency Analysis can lead to an early loading protocol even for these complex cases.

Aim: The primary objective of this study was to evaluate the microbiota around single turned Brånemark™ implants after 16–22 years of follow-up. Secondary objectives were to compare the microbiota around teeth and implants and to correlate microbiological findings and clinical parameters.

Methods: Fifty patients with 59 single implants were invited after a mean follow-up of 18.4 years (range 16–22). Paper point samples were retrieved from the deepest implant pocket (I, $n = 59$), the deepest pocket of the contralateral tooth (C, $n = 48$), and of the deepest pocket on natural teeth in each quadrant (P, $n = 50$). Checkerboard DNA-DNA hybridization was performed evaluating 40 species as well as the total DNA count. Bacterial counts were standardized according to the number of paper points used. Overall differences between implants, contralaterals and the pooled samples were analyzed using the Friedman test. Comparison between implants and contralateral teeth was made by means of the Wilcoxon Signed Ranks test. Correlations between microbiological and clinical parameters were performed using the Spearman correlation coefficient.

Results: The species with the highest mean bacterial counts around implants were *C. showae* (1.07 ± 2.32). Significant differences in bacterial counts between an implant and the contralateral tooth were found for *P. micra* ($P = 0.049$), *P. gingivalis* ($P = 0.025$), *P. intermedia* ($P = 0.006$), *T. forsythia* ($P = 0.014$) and *T. denticola* ($P = 0.003$). The mean counts of these species were higher around implants than around teeth. Spearman correlations of the total bacterial counts were weak but significant for mean interproximal probing depth around the implant ($r = 0.352$; $P = 0.006$) and mean interproximal bleeding index ($r = 0.381$; $P = 0.003$). The species with the highest correlation coefficients for mean interproximal probing depth were *S. haemolyticus* ($r = 0.405$), *S. anginosus* ($r = 0.421$) and *S. mitis* ($r = 0.401$).

Conclusions and clinical implications: Periodontal pathogens are present in higher numbers around implants after 16–22 years of function than around contralateral teeth. This, however, is not correlated to the clinical measurements of probing depth, bleeding index, plaque index or marginal bone level. The overall count of bacteria seems to be weakly correlated to mean interproximal probing depth and bleeding indices.

121 | Implant Therapy Outcomes, Surgical Aspects

Long-term follow-up of single turned Brånemark™ implants after 16–22 years: Microbiological findings

Presenter: Dierens M

University of Ghent, Ghent, Belgium

Co-authors: Dierens M¹, Vandeweghe S^{1,2}, Cosyn J¹, Kisch J³, Persson R⁴, De Bruyn H^{1,2}

¹University of Ghent, Ghent, Belgium, ²Malmö University, Malmö,

Sweden, ³Centre of Dental Specialist Care, Malmö, Sweden,

⁴University of Berne, Bern, Switzerland

Background: Research on long-term outcome of single dental implants is scarce. Microbiological data around single implants have been described after short-term follow-up only.

122 | Implant Therapy Outcomes, Surgical Aspects

Osseointegration of dental implants in a patient with Hajdu–Cheney syndrome

Presenter: Dokou P

Department of Periodontics, Dental School, University of Athens, Athens, Greece

Co-authors: Dokou P¹, Armaou M², Karoussis IK¹, Papavasiliou G², Kamposiora P², Vrotsos IA¹

¹Department of Periodontics, Dental School, University of Athens,

Athens, Greece²Department of Prosthodontics, Dental School,

University of Athens, Athens, Greece

Background: Hajdu–Cheney Syndrome is a rare hereditary bone metabolism disorder characterized by acro-osteolysis of the distal phalanges, short stature, craniofacial and skull changes, periodontitis and premature tooth loss. Search of the current

literature revealed no reports of implant placement in patients with Hajdu–Cheney Syndrome.

Aim: To report a case of an already prosthetic restored patient with Hajdu–Cheney Syndrome, who was treated with dental implants, in an attempt to examine the possibility of osseointegration in such patients.

Methods: A case of Hajdu–Cheney Syndrome in a 29-year-old woman with osteoporosis, generalized advanced chronic periodontitis, increased tooth mobility and premature tooth loss was studied. Patient was diagnosed 8 years ago with Hajdu–Cheney Syndrome after clinical, radiographic and histological examination. Patient was referred to the Postgraduate Clinic of Periodontics for oral rehabilitation of the edentulous posterior upper right region. Five years after placement and successful osseointegration of an implant (Replace Select Tapered, RP 4.3 × 13 mm) in the upper right first premolar region, a second implant was placed (Replace Select Tapered, RP 4.3 × 8 mm) in the upper right first molar region. Bone mineral density appeared physiological (Bone Type III).

Results: Clinical and radiographic examination of the patient during the periodontal maintenance program in 3 months interval after implant placement revealed no abnormalities in the implant region.

Conclusions and clinical implications: Patients with Hajdu–Cheney syndrome suffer of periodontitis with rapid bone destruction, increased tooth mobility and premature tooth loss. This case implies the osseointegration of dental implants in patients with Hajdu–Cheney Syndrome. However, further research is required to examine the predictability of oral rehabilitation of those patients with placement of dental implants, although a larger patient population is difficult to obtain.

123 | Implant Therapy Outcomes, Surgical Aspects

Sinus floor augmentation with one-stage, nonsubmerged, simultaneous implant placement in the severely atrophic maxilla: case series

Presenter: Dung S

Buddhist Tzuchi General Hospital, Taipei, Taiwan

Co-authors: Dung S^{1,2,3}

¹*Buddhist Tzuchi General Hospital, Taipei, Taiwan*, ²*National Yang-Ming University, Taipei, Taiwan*, ³*Taipei Medical University, Taipei, Taiwan*

Background: The presence of pneumatized sinus is often an obstacle in the posterior maxilla to make implant placement difficult. A remaining bone height of a minimum 5 mm is indicated for simultaneous sinus grafting and implant placement. A one-stage, nonsubmerged, open window surgical technique has rarely been adopted that allows simultaneous implant placement in as little as 1–2 mm of residual bone.

Aim: The retrospective study was to evaluate the clinical performance of single-stage, nonsubmerged implant placement in severely atrophic edentulous maxillae in patients with 1–5 mm residual bone height by open window sinus augmentation technique.

Methods: Clinical data were obtained from dental clinics at Buddhist Tzuchi General Hospital, Taipei. Data were obtained for all

consecutively placed implants in the maxillary sinus with open window technique. Thirty-two patients and 38 sinuses received 66 two-piece implants to support both multiple and single tooth reconstruction. Two Nobel Direct one-piece, 25 Branemark and 39 Replace two-piece implants were used. For two-piece implants, healing abutments were simultaneously inserted at the time of fixture placement. Remaining bone height at implant sites was classified as A (> 5 mm), B (3–5 mm), and C (< 3 mm).

Results: Maxillary sinuses of all patients were grafted with either Bio-Oss or MBCP (bTCP + HA). Seventy-six percent (50) of the implant site had class C (< 3 mm) remaining bone and 24% had class B bone condition. Sinus perforation occurred in 21% (14) implant sites. No implant had marginal bone loss > 2 mm. No sinus infection was observed. Implants were loaded 2–4 months after placement for Class B and 6–12 months after placement for Class C bone condition. One one-piece and two two-piece implants were lost and were replaced successfully. The overall implant survival rate was 95.4% up to 5 years.

Conclusions and clinical implications: Data from the present clinical case studies showed that under careful case selection and proper implant protocol, single-stage implant placement in maxillary sinus with open window technique is feasible and deserve further evaluation.

124 | Implant Therapy Outcomes, Surgical Aspects

Prosthodontic rehabilitation of resorbed ridges; using platelet rich fibrin and bone allograft

Presenter: Durrani F

Banaras Hindu University, Varanasi, India

Co-authors: Durrani F^{1,2}, Singh R¹

¹*Banaras Hindu University, Varanasi, India*, ²*Durrani Speciality Clinic, Varanasi, India*

Background: Extensive bone grafting remains a delicate procedure, because of the slow and difficult integration of the grafted material into the physiological architecture. PRF is a healing biomaterial that concentrates in a single autologous fibrin membrane, containing a large quantity of platelet and leukocyte cytokines. It is collected from 10 mL of blood harvest, without artificial biochemical modification. PRF as a membrane or fragments, allows a significant postoperative protection of the surgical site and seems to accelerate the integration and remodeling of the grafted biomaterial. These properties are particularly helpful for vestibular bone grafting on the alveolar ridges as well as to protect the surgical site and foster soft tissue healing.

Aim: The purpose was to elicit whether Platelet-Rich Fibrin (PRF) offer better postoperative control of the surgical site and accelerate the integration and remodeling of the grafted biomaterial.

Methods: The resorbed ridges were initially grafted with Puros particulate allograft (zimmer dental) and PRF membranes and then evaluated for implant placement after 4 months. Twenty implants were placed in the maxilla and 16 in the mandible in five patients. The implanted ridges were entirely covered with PRF membranes, to further accelerate healing of

the soft tissue. The criterion for treatment evaluation was a simple qualitative variable related to three possible treatment outcomes. Success was reached if no clinical implant mobility, no radiographic peri-implant translucency, no neuropathic sign, or pain or infection symptoms were observed.

Results: After 4 months, the CT scan confirmed that the placement of implants could be undertaken. Gingival tissue exhibited thickening and more keratinization. PRF used to cover the head of the implants, acts as a fibrin bandage between the allograft and the gingival tissue. After 9 months, implant supported prosthesis was connected and adjusted to obtain satisfactory esthetic result. Four months seemed very efficient time considering the gingival tissue thickness and long-term stability. If PRF presents clear effects on gingival healing and maturation.

Conclusions and clinical implications: PRF seems to play a significant role on the stability of the grafted bone surface. It represents a new opportunity to improve grafting procedures.

125	Implant Therapy Outcomes, Surgical Aspects
-----	--

Experience of OsseoSpeed™ implants used in a private practice setting

Presenter: Eberhardt M

Zahnarztzentrum.Ch AG, Winterthur, Switzerland

Co-authors: Hürlimann S, Eberhardt M, Ferjencik R, Hoeb J, Momkvist M, Seefeld F

Zahnarztzentrum.Ch AG, Winterthur, Switzerland

Background: As a complement to the implant studies performed to evaluate a specific aim in a well defined study population, larger and broader effectiveness studies evaluating the typical implant patient and the outcome of routine implant therapy in clinical practice are needed.

Aim: The aim of the current study was to evaluate the Astra Tech OsseoSpeed™ implant when routinely used in a private practice setting.

Methods: Six dental clinics in Switzerland have retrospectively compiled data according to an established case record form from all patients who had been treated with OsseoSpeed™ implants between November 2007 and August 2010.

Results: Altogether, the six clinics had treated 345 patients with 603 OsseoSpeed™ implants during the specified time period. The mean age of the patients was 52 years, ranging from 20 to 85 years. Fifty-five percent of the patients were men and 21% of all patients were smokers. More than half of the patients (56%) only received one implant, but up to eight implants were placed in the same patient. Almost all implants (99%) were placed in healed ridges and 60% of the implant sites were bone-grafted before, or in connection with, implant installation. A flap was raised in connection to implant placement for 95% of the implants, and a two-stage surgical protocol was applied for 53% of the implants. One hundred and eighty-three OsseoSpeed™ implants placed in 112 patients had been in function for a minimum of 12 months. The most commonly used OsseoSpeed™ implants were the two straight implants with diameters of 3.5 and 4.0 mm, respectively, and the most commonly used lengths were the 11 and 13 mm. Implants were evenly distributed between the maxilla and the

mandible but were more often placed in the posterior regions than in the anterior regions of the mouth. As many as 80% of the implants were placed posterior, replacing premolars or molars.

Conclusions and clinical implications: This study contributes to the knowledge of the typical implant treated patient as routinely treated by clinicians in private clinical practices in Switzerland.

126	Implant Therapy Outcomes, Surgical Aspects
-----	--

Short, wide diameter implants, as an alternative choice to bone augmentation procedures.

Results after 4 years of loading

Presenter: Efremidis I

Private Dental Clinic, Larissa, Greece

Co-authors: Siormpas K¹, Kontsiotou-Siormpa E¹, Mitsias M², Efremidis I¹

¹Private Dental Clinic, Larissa, Greece, ²Private Dental Clinic, Athens, Greece,

Background: The implant placement specifically in the region of molars, in the mandible and the maxilla, many times requires the application of augmentative techniques of the bone, due to the absorption of the alveolar bone and the anatomic particularities of the region. The application of these techniques, as sinus lift elevation, increase of the alveolar bone height with graft of bone, or moving of the inferior alveolar nerve, for various reasons cannot be applied in all cases. Moreover, it should be taken under notice the additional cost, the elongation of treatment time and the by any chance complications from these techniques. In the past few year, however, with the development in the design and implants surface structure, as well as with the improvements of surgical techniques the use of shorter and wider diameter's implants, appears as an alternative solution toward the augmentative techniques. This development appears also in the results of recent relative clinical studies that present similar survival rates of short implants, with regular use. In this study, we present interesting clinical cases, using short implants of the "Rescue Mega-Gen" system, in the region of molars in the upper and lower jaw and results after a period of 4 years of loading.

Aim: The aim of this study is to come up with useful conclusions, on the use of short implants, as alternative therapeutic choice toward the augmentative techniques. The implants were restored using single crowns or partial bridges.

Methods: Ninety-two short implants of length between 5.0–8.0 mm and diameter 6.0–8.0 mm were placed in 77 men and women over the last 4 years (2007–2011). Nineteen of them were placed in the rear region of mandible and the rest in the rear region of maxilla. Their initial loading took place after 3 months in the mandible and after 6 months in the maxilla.

Results: Only one implant was lost in the maxilla in the phase of osseointegration, and was replaced by another in a different position.

Conclusions and clinical implications: The short implants are a valid treatment, particularly in the cases where for various reasons we cannot use an augmentative technique for the placement of longer implants. However, more long-lasting studies are necessary, in order for their use to be consolidated.

Bone healing in animal surgically created circumferential defects around submerged implants

Presenter: Fabio R

university, Bologna, Italy

Co-authors: Fabio R¹, Daniele B², Luiz S³

¹*University, Bologna, Italy*, ²*Ardek, Rimini, Italy*, ³*University, Riberao Preto, Brazil*

Background: Various possible patterns of bone-to-implant healing such as distance and contact osteogenesis were proposed as two different types of bone formation on implant surfaces. (Davies 1998). So we investigate this topics.

Aim: The aim of the study is to describe the healing of marginal defects below or above one millimeter of dimension around submerged implants in a dog model.

Methods: In 12 Labrador dogs, all mandibular premolars and first molars were extracted bilaterally. After 3 months of healing, full-thickness flaps were elevated in the edentulous region of the right side of the mandible. Two recipient sites were prepared and the marginal 5 mm were widened to such an extent to obtain, after implant installation, a marginal gap of 0.5 mm at the mesial site (small defect) and of 1.25 mm at the distal site (large defect).

Results: The defect filling with newly formed bone was incomplete after 1 month of healing. Bone formation occurred from the base and the lateral walls of the defects.

Conclusions and clinical implications: Marginal defects around titanium implants appeared to regenerate in 20–30 days by means of a distance osteogenesis. The bone fill of the defects was incomplete after 1 month.

Full mouth oral rehabilitation of a patient with hereditary ectodermal dysplasia

Presenter: Fanaras N

Luton @ Dunstable Hospital, Luton, UK

Co-authors: Fanaras N, Bunyan R, Majumdar A

Luton @ Dunstable Hospital, Luton, UK

Background: This well illustrated poster is a case presentation of a young man with clinical manifestation of hereditary ectodermal dysplasia and a failing limited dentition.

Aim: The importance of a comprehensive multidisciplinary assessment to achieve complete oral rehabilitation.

Methods: The upper and lower jaw was imaged and a surgical stent was made based on the patient's existing removable full dentures. The surgical treatment plan involved removal of the remaining deciduous canines, inferior alveolar nerve lateralisation, bone grafting using intraoral donor sites and fixture insertion $\times 6$ for each arch. This was carried out at the same episode. After 6 months the fixation was removed from the bone grafts and the fixtures were exposed to construct an implant-retained prosthesis.

Results: The complete treatment plan is presented, including presurgical assessment, surgical techniques and prosthetic rehabilitation.

Conclusions and clinical implications: The presentation illustrates the importance of multidisciplinary treatment planning in this patient to achieve a predictable long-term result.

Top-cited articles in surgical dental implantology.

A literature review

Presenter: Fardi A

Department of Dentoalveolar Surgery, Surgical

Implantology and Radiology, School of Dentistry,

Aristotle University of Thessaloniki, Thessaloniki, Greece

Co-authors: Fardi A, Lillis T, Veis A

Department of Dentoalveolar Surgery, Surgical Implantology and

Radiology, School of Dentistry, Aristotle University of Thessaloniki,

Thessaloniki, Greece

Background: Citation analysis is the field of bibliometrics that utilizes citation data to quantify the impact of research as illustrated by the number of references that an article receives over time. The number of citations that a published article receives reflects its recognition in the scientific community.

Aim: The aim of this study was to identify the 50 top-cited articles published in journals dedicated to surgical dental implantology and to analyze their specific characteristics in order to demonstrate the most interesting topics and trends negotiated by the researchers.

Methods: The 50 top-cited articles published in dental implantology journals were identified using Science Citation Index Database, up to February 2011. The Classic articles, i.e. articles that had been cited at least 100 times, were analyzed regarding the number of citations, publication name & year, authors, institution, country of origin, article type, study design, level of evidence and field of study.

Results: The 50 top-cited papers were published in two journals pertaining to implantology, 35 in *Clinical Oral Implant Research* and 15 in the *International Journal of Oral and Maxillofacial Implants*. The individual citation counts for these articles ranged from 105 to 467 per article (mean 162). The year of publication ranged from 1990 to 2004, with 80% published between 1990 and 1999. Publications from Sweden (26%) and USA (26%) were the most heavily cited in the above articles, followed by those from the Switzerland (22%). University of Bern in Switzerland produced the highest number of publications ($n = 10$), followed by the University of Gothenburg in Sweden ($n = 9$). The majority of papers were clinical ($n = 28$), followed by basic science research ($n = 16$), reviews ($n = 5$) and one meta-analysis. Among the clinical papers, there were 20 case series studies and one randomised controlled trial, providing level of evidence four and one, respectively. Guided bone regeneration (28%), implant survival rates (24%), and implant loading (16%) were the most common fields of research.

Conclusions and clinical implications: Analysis of the top-cited papers in the field of dental implantology reveals useful and interesting information about the evolutionary trends in surgical implant research and provides a unique insight into the qualities, characteristics and innovations that are required for a paper to attain a "classic" status. Clinical research and observational studies published in high-impact English journals pertaining to implantology had the highest citations.

Non-treated periodontal disease: a risk factor for full arch immediate loading

Presenter: Francisco H

Implantology Institute, Lisbon, Portugal

Co-authors: Francisco H^{1,2}, Mata AD^{1,2}, Marques DS^{1,2}, Chen A^{1,2}, Moreira A¹, Real-Dias MC^{1,2}, Caramês J^{1,2}

¹*Implantology Institute, Lisbon, Portugal*, ²*College of Dentistry, University of Lisbon, Lisbon, Portugal*

Background: Oral rehabilitation with osseointegrated implants can be successful in partially edentulous patients treated for generalized chronic periodontitis. However, little is known regarding full arch extractions, immediate implant placement and full arch immediate loading in patients with previous nontreated severe generalized chronic periodontal disease (GCSPD).

Aim: To evaluate implant survival rates of immediate implant placement and immediate loading protocol, in patients with nontreated generalized chronic severe periodontal disease (GCSPD) in full arch rehabilitation.

Methods: *Design:* Retrospective cohort. *Subjects:* Seven hundred and sixty-two implants placed in 152 patients using an immediate loading protocol. Participants were assigned to either one of two groups based on: full edentulous patients and presence of non-treated GCSPD (group A and B, respectively). Evaluation of dental records and X-rays was performed to assess implant survival. Smoking status, maxillary vs. mandible rehabilitation and diabetes were recorded and considered as covariates. Follow-up periods ranged from 1 to 6 years with appointments at 6 months intervals. Survival analysis with Cox Regression Model, Chi-square, relative risk, absolute risk increase and number needed to harm were used as appropriated, confidence level was set at 95%. Alpha was set at 0.05.

Results: No significant differences ($P > 0.05$) were found for Cumulative implant survival comparing both groups up to 6 years of follow-up. All implant loss occurred during the first 24 months of the study. Relative risk for implant loss at 2 year follow-up was 1.22 [0.445–3.316] 95% CI, for group B compared with group A, Absolute increase risk for implant loss at 2 year 95% CI was 0.5% [0–2.9%], the Number needed to harm was 200. Cox Logistic regression suggested that only the covariate gender was significantly different with increased loss for implants placed in female patients.

Conclusions and clinical implications: The results suggest no differences in implant survival rates for full arch immediate implant placement and immediate loading protocol in the presence of nontreated generalized chronic severe periodontal disease when compared with immediate loading in full edentulous patients. Diabetes, smoking status or location of the immediate loading (mandible vs. maxilla) were not retained in the model.

Clinical implications: Within the limitation of this study, immediate implant placement and loading in full arch rehabilitations in periodontally compromised patients seems to be an alternative treatment option offering a viable oral rehabilitation.

Staged guided bone regeneration and osseointegration. Part 2: augmentation using bone graft substitutes

Presenter: Golubovic V

Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Co-authors: Golubovic V, Mihatovic I, Schwarz F, Becker J

Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Background: Even though the survival rates of implants placed in augmented bone have been reported to be comparable to the rates of implants placed in pristine bone, only a very few data aimed at investigating the impact of two-stage GBR on the process of osseointegration at grafted implant site.

Aim: To assess the influence of two barrier membranes and two bone graft substitutes on staged guided bone regeneration and osseointegration of titanium implants in dogs.

Methods: Saddle-type defects were prepared in the lower jaws of twelve fox hounds and randomly filled with a natural bone mineral (NBM) and a biphasic calcium phosphate (SBC) and allocated to either an *in situ* gelling polyethylene glycol- (PEG), or a collagen membrane (CM). At 8 weeks, modSLA titanium implants were inserted and left to heal in a submerged position. At 8 + 2 weeks, respectively, dissected blocks were processed for histomorphometrical analysis [e.g., mineralized tissue (MT), bone-to-implant contact (BIC)].

Results: Mean MT values (mm^2) and BIC values (%) tended to be higher in the PEG groups [MT: NBM (3.4 ± 1.7); SBC (4.2 ± 2.0)/BIC: NBM (67.7 ± 16.9); SBC (66.9 ± 17.8)] when compared with the corresponding CM groups [MT: NBM (2.5 ± 0.8); SBC (2.3 ± 1.6)/BIC: NBM (54.1 ± 22.6); SBC (61.0 ± 8.7)]. These differences, however, did not reach statistical significance.

Conclusions and clinical implications: It was concluded that all augmentation procedures investigated supported bone regeneration and staged osseointegration of modSLA titanium implants. However, PEG application may be associated with a more homogeneous bony filling than CM.

Implant therapy in the aesthetic zone: a study case

Presenter: Pinto MG

FMD.UP, Porto, Portugal

Co-authors: Pinto MG, Fernandes P, Fontes J, Fernandes JC, Almeida RF

FMD.UP, Porto, Portugal

Background: Aesthetic treatment outcome became a fundamental criterion of success in modern implant therapy and no deficit of hard or soft tissue should be accepted in the maxillary anterior area. However, following tooth loss the edentulous ridge may become concave or flat with the presence of Class I s, m deficiencies (Wang 2002) and frequently it is necessary to increase tissue thickness in order to achieve a good emergence prosthetic profile.

Aim: This study case represents a multidisciplinary approach, through the years, to treat the traumatic loss of an upper central incisor in a 10-year-old child, aiming to demonstrate the different surgical and prosthetic procedures that can be taken along the years in order to achieve a good aesthetic result with implant therapy.

Methods: At the time of the root fragment extraction a socket preservation technique was executed. Eleven years after, in order to increase tissue thickness, a connective tissue and bone grafts were made. Implant and ceramic crown placement were done at patient's age of 21.

Results: Six months after crown placement a good aesthetic and emergence prosthetic profile was achieved.

Conclusions and clinical implications: Dental implants are rarely, if ever, a good option to replace a missing tooth in a child. However, with the proper multidisciplinary approach, implant therapy of a traumatic incisor loss in a young patient may be considered successful.

133 | Implant Therapy Outcomes, Surgical Aspects

Treatment concepts of fresh extraction socket with defect buccal plate

Presenter: Grizas E

Goethe University, Frankfurt Am Main, Germany

Co-authors: Grizas E, Broseta C, Thiele P, Nentwig G-H

Goethe University, Frankfurt Am Main, Germany

Background: The alveolar ridge alteration after tooth extraction is a good described phenomenon. Furthermore it is known that resorption will especially target the buccal plate. When the buccal wall shows a deficiency, the early or delayed implantation has to be combined with complex bone and soft tissue augmentation procedures. Preservation techniques as well as immediate implantation with grafting procedures at time of tooth extraction may be an alternative.

Aim: The aim of this study was to present two treatment concepts of fresh extraction sockets with a defect buccal wall, as alternative to augmentation procedure after healing of the ridge.

Methods: Two patients (patient A, patient B) presented with maxillary central incisors that should be extracted due to root fracture (patient A) and persisting periapical infection (patient B). After the tooth extraction a vertical deficiency of the buccal plate was diagnosed at both patients.

Patient A: An immediate implantation was accomplished with an Ankylos implant. An envelope was prepared 3 mm circular of the defect at buccal plate and a resorbable collagen membrane was inserted. The void between the implant and the regenerated site was filled with de-proteinized bovine bone material (DBBM). The implant was then immediately restored with the natural crown prepared as a provisional. After 3 months of healing the definitive restoration was inserted. **Patient B:** After the tooth extraction, the defect at the buccal plate was respectively with the case of patient A restored by means of a resorbable membrane. The extraction socket was then filled with DBBM. Subsequently the sealing of the socket was accomplished with a free palatal gingival graft. After 4 months an Ankylos implant was inserted without additional augmentation. Eight weeks later, the uncoverly was performed, followed by the

corresponding peri-implant formation and the definitive restoration. On the follow-up recall 1 year after the implantation the pink esthetic score (PES) was used to evaluate the treatment result of the two cases.

Results: The PES was 13 out of 14 for Patient A and 12 for Patient B respectively. In comparison with Patient A, the treatment concept performed in patient B requires less experience and practical skills.

Conclusions and clinical implications: Within the limitation of this case-report, the regenerative procedures at fresh sockets or immediate implantation combined with grafting procedure may be a minimal invasive surgery with a predictable esthetical and functional result.

134 | Implant Therapy Outcomes, Surgical Aspects

Biomechanical testing in computer guided flapless implant surgery

Presenter: Grošelj D

Megfid d.o.o., Ljubljana, Slovenia

Co-authors: Grošelj D¹, Grošelj H¹, Grabec I²

¹Megfid d.o.o., Ljubljana, Slovenia, ²Amanova d.o.o., Ljubljana, Slovenia

Background: Obtaining a solid biomedical device restoring masticatory function and esthetics is a meaningful prerequisite for long-term success of dental implantology. Not only a structure of bone analysed by computed tomography (CT) but also assessment of torque measurement and resonance frequency analysis (RFA) are of interest for clinical practice and for prognostic evaluation giving suggestions about primary implant stability.

Aim: The aim of this study was to evaluate the implant stability based upon observation of a test group of patients. For this purpose the mean values of insertion torque (M), regional bone density (in Hounsfield Unites), and implant stability quotient (ISQ) obtained by the RFA, as well as the correlation coefficient between measured values, have been determined. However, the final goal is to provide in advance the prediction of implant mechanical stability based upon noninvasive measurements of ISQ and HU.

Methods: Forty-one implants (Hexcel) were inserted into the upper and lower jaws of eight males and eight females of mean age 60 ± 10 years from 2009 to 2010. The bone density was determined using CBCT. 3D surgical planning software with surgical templates permitted flapless osteotomies with minimal trauma and discomfort for patients. Insertion torque (in Ncm, Table 1), ISQ and HU were determined at implant placement.

After conventional protocol of osseointegration secondary implant stability parameters have been measured. The correlation coefficient between bone density, maximum torque or ISQ was assessed during implant or abutment placement. The correlation

Table 1. Scores of insertion torque

Score	N cm
1	< 15
2	16–34
3	> 35

coefficient between primary torque and primary ISQ values were also determined.

Results: The mean values of measured variables were: primary torque and secondary torque = 2.6 ± 0.8 and 3.0 ± 0.2 N cm, respectively. The correlation coefficients between local bone density and insertion torque or bone density and ISQ values during implant placing were 0.42 and 0.32, respectively. The highest correlation coefficient (0.72) was found between insertion torque and primary ISQ values. *T*-test demonstrated that there was the significant difference between insertion torque for implants placement and screwing torque at abutment fixation ($P < 0.01$). At abutment fixation RFA yielded no ISQ under 60; secondary torques for 41 implants were ≥ 35 N cm except in two implants with $M = 16-34$ N cm.

Conclusions and clinical implications: It is characteristic that the mean value = 3.0 ± 0.2 N cm at the final test is very high. The insertion torque and ISQ correlate very well at implant placement. Both tests present remarkable clinical aid for assessments of primary stability using computer guided surgical approach especially in poor alveolar bone quality.

135	Implant Therapy Outcomes, Surgical Aspects
-----	--

Osteotome sinus floor elevation with simultaneous implantation: 1-year retrospective study

Presenter: Gu S

Sahmyook Adventist Dental Hospital, Seoul, Republic of Korea

Co-authors: Gu S, Kim B, Seok H

Sahmyook Adventist Dental Hospital, Seoul, Republic of Korea

Background: To increase bone height in posterior maxilla area, sinus elevation is often performed using lateral window access or crestal approach. In comparison with the lateral window access, the osteotome sinus floor elevation (OSFE) procedure is less invasive and less time consuming. Since the transalveolar osteotome technique for sinus floor elevation was introduced, many studies have reported high survival rates of implants and stability of crestal bone level. However, lateral window access and staged implantation has been recommended in patients with minimal residual bone height (<4 mm), because of less predictability of survival rate with crestal approach in these areas.

Aim: The objectives of this retrospective evaluation were to (1) clinically and radiographically evaluate the 1-year stability of periimplant bone formation following implant placement into the maxillary sinus performed using osteotome sinus floor elevation procedure, and (2) compare the success rate of implants and stability of periimplant bone in two patient groups with different residual bone heights (≤ 4 and > 4 mm).

Methods: During 2004 to 2009, 50 implants of 13 mm were placed in 26 patients to rehabilitate atrophic maxilla by means of an osteotome sinus floor elevation (OSFE) procedure. The surgical technique was a modification of the original osteotome technique presented by Summers. The surgical sites were augmented with anorganic bovine bone. The mean residual bone height was 6.10 ± 2.30 mm. Bone heights were evaluated at preoperation, baseline and 1 years using panoramic radiographs

to assess whether there was loss of height during the studying periods.

Results: All simultaneous installed implants fulfilled survival criteria even the residual bone height was <4 mm area. The mean vertical height gain was 11.08 ± 1.03 mm.

Conclusions and clinical implications: Implant rehabilitation of atrophic maxillae may be greatly simplified using OSFE technique even <4 mm residual bone height area.

136	Implant Therapy Outcomes, Surgical Aspects
-----	--

Long term – up to 10 years – clinical and radiological performance of TiUnite and machined implants placed in the same mouth

Presenter: Gualini F

Private Practice, Bergamo, Italy

Co-authors: Polizzi G¹, Gualini F²

¹*Branemark Study Center, Verona, Italy,* ²*Private Practice, Bergamo, Italy*

Background: Machined implants have been successfully used in implant dentistry from the beginning of implant dentistry age. More recently rough or moderately rough surface implants have been introduced: in particular implants with an oxidized surface, first introduced in 2000, thanks to their osteoconductive properties allow faster bone healing and make them more suitable for critical bone conditions and immediate function applications.

Aim: The aim of the study was to retrospectively evaluate the long-term cumulative survival rate and bone level changes of both TiUnite and machined implants when placed in the same mouth.

Methods: Between April 2000 and May 2005, one hundred patients of both sexes and a mean age of 64 years (range 33–90) were treated with 269 TiUnite and 295 machined implants. One hundred and seventy-three TiUnite implants (64%) were inserted in the maxilla and 96(36%) in the mandible. For the machined implants there was an opposite distribution ratio with 97 (33%) in the maxilla and 198(67%) in the mandible. All included patients had to be treated with both types of implants in the same, or more often, in different restorations. Most of the implants (521) were placed using a two-stage surgery (237 for TiUnite and 284 for machined), while one-stage surgery was used for 12 TiUnite implants and three machined implants. Immediate loading was applied for 20 TiUnite and eight machined implants. Fifty-nine percentages of the patients were smokers. Descriptive statistics including life table analyses were performed. Radiological assessment of intraoral X-rays was performed by an independent radiologist.

Results: During the study period overall five TiUnite implants and 19 machined implants failed. Cumulative survival rate (CSR) after 9 years follow-up was 96.9% for TiUnite implants (86) and 93.9% for machined implants (133). Beyond this time point only one TiUnite and one machine dimplant failed. When examining the radiographic results concerning marginal bone remodeling, only implants with radiographs both from implant insertion and a follow-up of more than 7 years were included. The mean bone remodeling from loading to >7 years was -1.63 mm (SD 1.73, $n = 29$) for TiUnite and -1.84 (SD 0.98, $n = 54$) for machined implants. Besides the implant failures, bone level at or beyond third thread

with implant still “*in situ*” was reported for four patients (three in the TiUnite and one in the machined group).

Conclusions and clinical implications: The results from this retrospective intra-patient study show that both implants with a moderately rough surface (TiUnite) and machined implants are long-term reliable options when it comes to survival rate; both implants maintained stable marginal bone levels over time with no difference between the two groups.

137 Implant Therapy Outcomes, Surgical Aspects

Prospective study in patients treated with implants and oral bisphosphonates

Presenter: Guerra M

Gubbio Hospital, Gubbio, Italy

Co-authors: Guerra M, Belcastro S, Palazzo L, Floridi F, Russomanno M

Gubbio Hospital, Gubbio, Italy

Background: Bisphosphonates inhibit bone resorption and bone renewal by suppressing the recruitment and activity of osteoclasts shortening their life span. Bisphosphonates have been linked to bone exposures in the jaws. About 80 million people in the United States alone take bisphosphonates for cancer, osteoporosis, etc. It is clear that patients who have received IV bisphosphonates are at high risk for osteonecrosis in the mandible and maxilla. What is not clear is the situation for patients who have taken oral bisphosphonates. Not as much data has been collected on oral bisphosphonates, osteonecrosis and dental implant failure. What does this imply for dental implant placement and what might be the pathogenesis of osteonecrosis linked to implant therapy is still unknown. As the condition can occur spontaneously in the absence of known risk factors, it is important to avoid soft and hard tissues inflammation. Histological analyses, focused on connective tissue composition and number of inflammatory cells around the implant-to-abutment connection, confirmed the presence of healthier tissues surrounding a cone morse connection than around a classical butt joint one. A firm implant-to-abutment connection leads to tight bacterial seal, preserving tissues from inflammatory reactions.

Aim: A prospective study was started to verify if there is a relationship between oral bisphosphonates and implant therapy using Morse taper connection implants. The incidence of osteonecrosis of the jaws occurring in these patients was evaluated. We also assessed the implant survival rate and the bone peri-implant maintenance.

Methods: Fourteen patients (all females, mean age 71 years), treated with oral bisphosphonates (mean treatment time 3.8 years) prior and during implant therapy, were selected for the study. Fifty-two self-locking Morse taper connection implants (Exacone, Leone S.p.A., Italy) were placed with different clinical bony conditions. The X-rays were taken with a positioner immediately after surgery, at impression time, at the loading time, 12 months after surgery and then yearly. Soft tissues examination was performed to identify inflammatory areas. The mean follow-up time was 33 months.

Results: Clinical and radiological observations showed a mean bone loss of 0.5 mm after 33 months. No implants failed and no

evidence of osteonecrosis in the jaw was found in the treated patients.

Conclusions and clinical implications: Long-term clinical and radiological findings in terms of bone maintenance and absence of tissue inflammation around Morse taper connection implants suggest the capability of such a connection to prevent the potential osteonecrosis linked to oral bisphosphonates in patients treated with implant therapy.

138 Implant Therapy Outcomes, Surgical Aspects

Compare versatility of guided implant vs conventional surgery in full mouth rehabilitation

Presenter: Gupta GK

ICOI, Delhi, India

Co-authors: Gupta GK

ICOI, Delhi, India

Background: Immediate loading in full arch implant supported restoration is a reliable option with the same success rate as seen in delayed loaded implants. In this study, we have compared success rate of implants by open technique vs flap less guided implant surgery. A retrospective analysis of 40 patients in which 266 implants were placed.

Aim: To establish that immediate loading in full arch implant supported restorations is a reliable option and provide the same success rate as provided by delayed loaded implants. We would like to compare the success of the treatment whether done by open technique or done by flap less technique with guided surgery. We would like to see if there is any difference in success with different implant systems.

Methods: This is a 3 year study from 2007 to 2010 involving 40 patients who were restored with implant supported immediate restorations. In the present study 266 implants were placed either through guided surgery or open surgery. All the patients were primarily loaded with cement retained temporary restoration within 24 hours of implant placement. The temporary restoration was changed to the definitive restoration after 4–9 months and all cases were followed up for a period of 6 months to 2 years.

Results: In the present study 266 implants placed out of which 110 in 16 patients with guided surgery and 156 in 24 patients with nonguided surgery. Two implants failed due to lack of primary stability in the guided case due to faulty guide construction which did not get primary stability in a guided case and were taken out at the time of surgery, and there were two implants lost due to lack of osseointegration after 3 months in the case of guided surgery while there were three implants lost in the nonguided section of patients. Overall there was a success of 97% in both guided as well as non-guided surgery. The patient as well as the operator was much more comfortable with guided surgery and the time required for guided surgery was almost half as compared with nonguided surgery. Requirement of good volume of bone is a must, so the guided surgery could only be done in type 1 cases which have adequate bone and do not require any bone augmentation.

Conclusions and clinical implications:

- Immediate loading in full arch is as predictable as delayed loading.
- Cross arch rigid splinting is necessary.
- Initial primary stability of 35 μ c is essential for immediate loading.
- It is possible with any brand of implants.
- It can be done with both guided as well as open surgery.
- It improves patient comfort.
- It greatly enhances patients appreciation towards the procedure.

139	Implant Therapy Outcomes, Surgical Aspects
-----	--

Long-term results of immediate loading with interforaminal inserted implants

Presenter: Hess P

Department of Oral Surgery and Implantology, Dental School, Goethe-University, Frankfurt A.m., Germany

Co-authors: Hess P^{1,2}, Büttner D², Müller CK¹, Nentwig G-H¹

¹Department of Oral Surgery and Implantology, Dental School, Goethe-University, Frankfurt A.m., Germany, ²Center of oral Competence Dres. Kempf & Dr. Hess, Frankfurt A.m., Germany

Background: Owing to alveolar ridge atrophy in the edentulous lower jaw several patients suffer of an insufficient retention by a lower denture. Therefore, this retrospective study examines the implantological concept of the Ankylos SynCone System.

Aim: The purpose was to investigate the long-term stability of peri-implant bone and soft tissue condition after immediate loading of four interforaminal inserted Ankylos implants (Dentsply-Friadent, Germany), such as the objective and subjective retention force of the overdenture.

Methods: In this study all patients received four interforaminal implants, immediately loaded, with the Ankylos SynCone concept. The observation period started 2005 and ended 2011. One hundred thirty-two implants were placed. The clinical and radiographic examination was performed on the day of the final prosthetic treatment and annually after, ending in March 2011. The stability of the peri-implant bone and the soft tissue condition were evaluated. Besides, a questionnaire concerning patient's contentment and further clinical parameters, such as periotest values, periodontal sounding, and radiological bone loss were basis of examination.

Results: In this study 33 patients, 19 woman and 14 men, with an average age of 72.28 years were treated with 132 implants. Nine patients had the original SynCone denture, 14 had a framework included and 10 a ceramic electroplated denture. The collection of data was described descriptively. Among 132 implants merely four losses were recorded. Therefore the survival rate was 96.97%. The average time of the implants *in situ* was 45.1 months (range 12–72 months). At the final recall 98.48% of the implants revealed no vertical and horizontal bone-loss. Exclusively two implants showed a maximum marginal resorption of 1.5 mm. Furthermore no gingival recession could be recorded. Regarding patients' contentment concerning retention, a rate of 90.91% could be determined. Considering

periotest values and periodontal sounding no relevant deviation was noted.

Conclusions and clinical implications: Owing to contentment value of 90.91% SynCone can be recommended as a long-term provisional concept. Secondly included frameworks can enhance the retention but nonetheless the ceramic electroplated dentures provide prime results concerning retention and comfort in wearing. The Type of denture covering the implants has no influence on the beneath located implants.

140	Implant Therapy Outcomes, Surgical Aspects
-----	--

Flapless implant surgery and its effect on periimplant soft tissue. A prospective clinical longitudinal study

Presenter: Hoeckl K

Praxis Prof. Dr. Dr. Stoll & Partner, Freiburg, Germany

Co-authors: Hoeckl K¹, Stoll P¹, Bähr W², Stoll V³, Bach G²

¹Praxis Prof. Dr. Dr. Stoll & Partner, Freiburg, Germany, ²Private Practice, Freiburg, Germany, ³Albert-Ludwig-University, Freiburg, Germany

Background: Minimally invasive implant insertion may offer the reduction of peri-implant inflammation, pocket depth and crestal bone loss, as well as minimization of postsurgical complications.

Aim: The goal of the presented study was to clinically investigate the soft tissue response and to compare the outcome obtained with flapless placed implants of three different manufacturers.

Methods: For the purpose of this study 346 implants inserted in 115 patients between January 2001 and February 2009 were examined during the follow-up period. Three hundred and thirty-seven two-piece titanium (235 Straumann and 102 Thommen) and nine one piece zirconium-dioxide implants (Z-Systems) were used. The patient sample included seven smokers, two patients with diabetes mellitus, seven patients with bleeding disorders and one patient with i.v. bisphosphonate therapy. All implants have been loaded for at least 12 months with either fixed or removable prosthetic restorations. Attachment level, bleeding on probing, secretion, plaque and keratinized gingiva were documented.

Results: One of 347 implants was lost after loading. The survival rate of Straumann titanium implants ($n=235$) was 99.6%, of Thommen titanium implants ($n=102$) 100% and of Z-Systems zirconium-dioxide implants ($n=9$) 100% leading to a general survival rate of 99.6% after an mean follow-up period of 3 years and 8 months. A positive bleeding score (BOP) could be documented at 106 of the 346 implant sites (30.63%). A significant difference could be documented between Straumann implants where a bleeding occurred only in 14.9% and Thommen implants where a positive bleeding score could be documented in 38.2%. No differences between the three implant types were found in probing depths. The mean probing depth (PD) was 2.4 mm irrespectively of the implant design. Bleeding score was significantly higher for those implants without keratinized mucosa. One hundred and forty-four Straumann implants and 72 Thommen implants were surrounded by a band of

keratinized tissue. Only 38 Straumann (26.4%) and 22 Thommen (30.6%) implants showed positive bleeding on probing. Eight from nine Z-System implants were placed in keratinized mucosa and none showed any signs of inflammation.

Conclusions and clinical implications: Presented results demonstrated that healthy peri-implant soft tissue was obtained following minimally invasive surgery and transgingivally placed implants. Flapless implant insertion showed a success rate comparable to conventional implant surgery. The results of this study demonstrated that flapless implant surgery is a predictable procedure. In addition they lead to the conclusion that a band of keratinized gingival tissue around implants can minimize soft tissue inflammation.

141 | Implant Therapy Outcomes, Surgical Aspects

A retrospective analysis of bony window repositioning without using a barrier membrane in a lateral approach for sinus bone grafts

Presenter: Im T-Y

Division of Oral and Maxillofacial Surgery, Department of Dentistry, College of Medicine, Hanyang University, Seoul, Republic of Korea

Co-authors: Park C-J¹, Im T-Y¹, Hwang K-G¹, Jung G-U²

¹*Division of Oral and Maxillofacial Surgery, Department of Dentistry, College of Medicine, Hanyang University, Seoul, Republic of Korea,*

²*Division of Periodontology, Department of Dentistry, College of Medicine, Hanyang University, Seoul, Republic of Korea*

Background: In lateral window approaches for maxillary sinus bone grafts, there has been considerable controversy about the placement of barrier membranes over the osteotomy and graft sites. In particular, when there is no damage to the Schneiderian membrane, clinicians should decide whether to use a barrier membrane by considering both the benefits and costs.

Aim: The aim of this study is to demonstrate clinically and radiologically that repositioning of a detached bony window may lead to satisfactory bone healing without use of a barrier membrane or a rigid fixation in lateral approaches for maxillary sinus bone grafts.

Methods: Twenty-three consecutive patients were treated using the same surgical procedure. After a complete 360-degree osteotomy on the lateral maxillary wall, a bony window was outfractured and separated from the Schneiderian membrane by gentle elevating action. Confirming no perforation of the Schneiderian membrane, the grafting procedure was carried out and the bony window was repositioned over the grafted material without using any rigid fixation or barrier membrane. Clinical and radiologic examination was performed at post-operative 6 months re-entry. The relationships between the pattern of gap bone healing, number of implants, time of implant placement, and thickness of lateral sinus wall were analyzed. Fisher exact test and Spearman nonparametric correlation coefficient were employed for statistical evaluation.

Results: All 23 patients went on to uneventful healing with no complications associated with the bone graft. Overall external cortical healing and bone regeneration on the gap between the

repositioned window and the lateral wall of the maxillary sinus were satisfactory without evidences of epithelial invagination. With respect to number of implants or time of implant placement, no significant differences in the pattern of gap bone healing were found. As lateral sinus wall was thinner, pattern of gap bone healing was better ($P < 0.05$). To date, no implant failure was found.

Conclusions and clinical implications: This study indicated that a detached bony window that is just repositioned on grafted material might function as a barrier membrane in the lateral approach for maxillary sinus bone grafts. Further radiologic and histomorphometric investigations, including an assessment of implant survival rates, are necessary to apply this technique to routine practice.

142 | Implant Therapy Outcomes, Surgical Aspects

Evaluation of corticocancellous heterologous equine bone putty in augmenting the exposed implant threads; prospective clinical study

Presenter: Ismail A

Private Practice, Cairo, Egypt

Co-authors: Ismail A

Private Practice, Cairo, Egypt

Background: In implant placement post extraction we are faced with coronal gap between the implant and surrounding bone with exposed implant threads, different augmentation material and techniques can be utilized to solve this challenge. A mix of cancellous and cortical heterologous equine bone in the form of Putty[®] can provide good malleability and adaptability to the exposed implants threads, with osteoconduction properties.

Aim: Purpose of this prospective study was to evaluate the possibility of augmenting the exposed implant threads with mix of corticocancellous heterologous equine bone in form of Putty[®].

Methods:

- Sixteen patients indicated for single rooted tooth extraction
- All patients indicated for immediate implant placement
- Both marginal and fenestration defects were registered clinically and photographically
- The number of exposed implants threads were measured before augmentation and at second stage surgery 6 months after augmentation
- All patients received same implant type
- All sites were augmented with mix of corticocancellous heterologous equine bone in form of Putty[®]
- All cases covered after augmentation with collagen membrane "Evolution Membrane[®]"
- All cases carried a radiographic follow-up for 1 year
- All patients received definite restoration 6 months later from second surgery date

Results:

- in this prospective study both marginal (11 sites) and fenestration defect (five sites) with four to 12 exposed implant threads were registered clinically and photographically
- Complete bone coverage of the exposed implant threads was seen in 14 of the 16 implant sites.

- One site showed one to two remaining exposed threads, other site showed flattening of the defect but with five of six exposed.

Conclusions and clinical implications: This prospective clinical study shows it is possible to gain bone over exposed implant threads by augmentation with mix of cancellous and cortical heterologous equine bone putty®.

143 | Implant Therapy Outcomes, Surgical Aspects

Retrospective multicenter study of survival rate of Korean 8,263 implants

Presenter: Jang Y-H

Department of Periodontics, Asan Medical Center, Seoul, Republic of Korea

Co-authors: Jang Y-H¹, Kim Y-S^{1,2}, Kim W-K¹, Lee Y-K¹, Kim S-H^{1,2}

¹Department of Periodontics, Asan Medical Center, Seoul, Republic of Korea, ²Department of Dentistry, College of Medicine, University of Ulsan, Seoul, Republic of Korea

Background: Various dental implant systems have been developed and used worldwide. Limited data exist regarding the long-term result of implant therapy using domestic implant systems (Korean). A multicenter study of the large sample size is needed to reflect the actual clinical situation.

Aim: The aim of this study was to evaluate the long-term result of implant therapy using various Korean implant systems. In addition, possible associations between implant loss and various factors were analyzed.

Methods: A retrospective review of clinical records of treated patients with domestic implant systems was conducted. In a total of 3,604 patients, 8,263 implants placed between November 2003 and February 2010 at five implant centers of dental hospital in Korea were included. The data were kept on subgroups of medical history, smoking habits, surgery information, implant systems, prosthetic information, implant loss and complication. Kaplan–Meier Analysis and Cox regression multivariate analysis were performed with the implant as the unit of analysis.

Results: One hundred and ninety-six out of the 8,263 implants were lost between insertion and the follow-up examinations. The early implant loss was 52.6% of failures. The overall 6-year cumulative survival rate (CSR) was 92.1%. There were statistically significant differences in CSRs of subgroups between implants placed in male and female patients (89.8% and 94.5%, respectively; $P < 0.01$), smoker and non-smoker (85.0% and 92.8%, respectively; $P \ll 0.01$), diabetic and nondiabetic patients (91.9% and 92.5%, respectively; $P = 0.033$), single and multiple implants (80.3% and 95.0%, respectively; $P \ll 0.01$), and sinus grafting and nongrafting (80.4% and 93.3%, respectively; $P \ll 0.01$). The complication rates were 2.32% biologically and 4.82% technically of total implants.

Conclusions and clinical implications: A high cumulative survival rate of Korean implant systems, similar to foreign implant

systems, was showed in this retrospective multicenter study. Also, associated factor such as smoking habits, diabetes, single implant and sinus grafting may have an impact on the long-term survival of implants.

144 | Implant Therapy Outcomes, Surgical Aspects

Predictability and complications of dental implants in bisphosphonate-treated patients

Presenter: Kaplavi L

Private Clinic, Ramat-gan, Israel

Co-authors: Kaplavi L

Private Clinic, Ramat-gan, Israel

Background: Dental implants have constantly demonstrated high cumulative success rate, so that the prosthetic approach for the edentulous patients has been enormously changed during the years. Furthermore, because of the very high rate of predictability of dental implants, bone grafting procedures have been developed in order to enable implant therapy later on. The quality of the patient bone, beside the quantity, and the patient healing pattern are major factors that can influence on the predictability, and on of dental implants. BPs are commonly used in the treatment of various osteometabolic diseases including osteoporosis, During the last decade there were multiple reports on occurrence of ONJ in patients using BPs.

Aim: To evaluate whether patients who take BPs are at greater risk of implant therapy failure and complications in comparing with patients who are not treated with BPs.

Methods: The study includes 15 patients who received totally 100 dental implants, and who were treated between the years 2003 and 2010. The age range of the patients, was 56–75 years. In five patients the implant therapy included bone grafting before or during the implant placement. All patients were nonsmokers nor diabetic. The follow-up period, was 6–85 months with the mean follow-up of 31 months.

Results: Forty-three implants were placed in the mandible without prior augmentation, and 31 implants were placed in the maxilla without prior augmentation. All 74 implants were osseointegrated without any failure (CSR = 100%) From the 26 implants placed after major bone augmentation surgery, 10 implants failed (CSR = 61.54%).

Conclusions and clinical implications: Dental implants placed in osteoporotic patients taking BPs, can osseointegrated and remain functionally stable, even in patients under oral BPs therapy > 10 years before the implant placement. Development of ONJ in this group of patient is very rare. New approaches and protocols, in dental implant therapy as immediate loading and immediate implantation even with immediate loading, are viable and with the same predictability in comparing with the non osteoporotic patients who are without BPs therapy. Sinus lift procedure in BPs patients can yield less success rate in comparing with patients without BPs therapy. Fixed prostheses supported by dental implants is viable treatment in this population.

The predictability of dental implant therapy in diabetes type-II patients

Presenter: Kaplavi R

Private Clinic, Ramat-gan, Israel

Co-authors: Kaplavi R

Private Clinic, Ramat-gan, Israel

Background: The use of dental implants in patients with type II diabetes is a questionable issue, due to the adverse effect of hyperglycemia on osseointegration. There is lack of evidence about the long-term outcome of implant therapy in patients with diabetes, in comparing with patients without diabetes.

Aim: To evaluate whether diabetic type II patients, are at greater risk of implant therapy and bone grafting failure and complications in comparing with nondiabetic patients.

To evaluate whether the glycemic control, has influence on the success rate in this group diabetic type II patients.

Methods: The study includes 23 patients, who received totally 171 dental implants, which supported totally two removable full arch and 35 fixed partial and full arch prostheses. The age range of the patients was 46–82 years. All patients did not take BPs therapy. None of them was heavy smoker. The follow-up period, is 11–76 months with the mean follow up of 35 months after the implant surgery. In two patients the implant therapy included sinus lift grafting. All patients were monitored for HgA1c values.

Results: Sixty-one implants were placed in the mandible, and 102 implants were placed in the maxilla without prior augmentation. Three implants failed in the mandible and six implants failed to osseointegrate in the maxilla. The CSR in the mandible was 95.08%, and in the maxilla was 94.12%. From the eight implants placed after sinus lift surgery, none of them failed. The 163 implants which placed in native (non-augmented bone) were divided also to two groups: In patients with HgA1c < 7, one implant from the 73 implants placed failed to osseointegrate, resulting in CSR = 98.63%. In the second group with HgA1c > 7, eight implants from the 90 placed failed to osseointegrate, resulting in CSR = 91.11%.

Conclusions and clinical implications: Dental implants placed in diabetes type 2 patients, can successfully osseointegrated and remain functionally stable, New approaches and protocols, in dental implant therapy as immediate loading and immediate implantation, are viable and are with the same predictability in comparing with the non diabetic patients. There is difference in the predictability of dental implants therapy between well controlled diabetic patients (HgA1c < 7.0%), to uncontrolled diabetic patients (HgA1c > 7.0%). Sinus augmentation and GBR can be performed successfully in the well controlled diabetic type II patients.

Sinus lift should be avoided in the majority of cases

Presenter: Kaplavi Y

Private Clinic, Ramat-gan, Israel

Co-authors: Kaplavi Y

Private Clinic, Ramat-gan, Israel

Background: The rehabilitation of the edentulous maxilla usually, is very complicated procedure in those patients who desire for nonremovable prosthesis. Very often the placement of implants in the posterior maxilla is impossible without prior bone grafting, in the maxillary sinus. The procedure is contraindicated almost in 20% of cases due to pathology in the sinus, or to problematic anatomy of the sinus. Furthermore the morbidity, complications, and failure rates must be considered, and alternative treatment options should be developed.

Aim: The objective of this study is to evaluate the surgical outcome of Tilted Implants as alternative to Sinus Lift.

Methods: Two hundred forty-one patients were participated in this clinical study. All the patients were restored without prior sinus lift, by the use of 372 Tilted implants. The Tilted implants were placed in extreme angularity up to 45 degree located mesially to the maxillary sinuses. The patients were followed periodically for 6–72 months after the surgery, with clinical and radiographic evaluation.

Results: The cumulative survival rate (CSR) of the tilted implants was 97.98%, which is significantly higher than the CSR of implants after Sinus Lift procedure. No morbidity nor severe complications were occurred with this protocol of treatment.

Conclusions and clinical implications: Graftless rehabilitation of the atrophied maxilla, with the use of tilted implants to support fix prostheses, can be considered as a predictable technique, with an excellent prognosis and with considerable benefits.

Sinus grafting should be considered as an overtreatment in the majority of cases, and should be therefore avoided.

Clinical outcome of sinus bone augmentation without graft material

Presenter: Kasugai S

Tokyo Medical and Dental University, Tokyo, Japan

Co-authors: Kasugai S, Munakata M, Tachikawa N, Shimizu Y, Nakata H

Tokyo Medical and Dental University, Tokyo, Japan

Background: Implant treatment for posterior maxilla frequently requires sinus bone augmentation. Applying graft material to the sinus after elevating the sinus membrane is an established modality for sinus bone augmentation. Prof. Lundgren and his collaborators have reported that elevating the sinus membrane with implants without graft material induces new bone formation in sinus.

Aim: The purpose of the present study was to evaluate clinical outcome of this technique in severely atrophied posterior maxilla.

Methods: We modified the original method and applied to 10 patients: five females and five males from 44 years

old to 76 years old, average 60 years old. The residual bone height was from 1 to 5 mm and the average height was 2.2 mm. After raising muco-periosteal flap of the edentulous region the lateral bony window was opened and sinus membrane was elevated. The collagen membrane for GTR and GBR was cut to special shape and this membrane was used to support the sinus membrane and to close the lateral window. Utilizing a trimmed collagen membrane is the main modified point because in the original method the separated bony window is returned back to close the window. The part of the collagen membrane was inserted under the sinus membrane. Then, the implants were carefully installed and stabilized in the thin bone. At 5 months panoramic X-ray photo was taken to examine new bone formation in the sinus and the secondary surgery was performed. Provisional and final prostheses were delivered at 6–7 months and 8–9 months, respectively.

Results: We installed 21 implants to 11 posterior maxillas of 10 patients. The observation period varied from 6 to 15 months after the loading. In all cases new bone formation around the implant was clearly observed and all the implants were well functioning without any complication.

Conclusions and clinical implications: The present clinical results indicate that this technique is effective in implant treatment for severely atrophied posterior maxilla.

148 | Implant Therapy Outcomes, Surgical Aspects

Low bone density in the edentulous posterior maxilla is gender- and age-related

Presenter: Katsoulis J

Department of Prosthodontics, School of Dental Medicine, University of Bern, Bern, Switzerland

Co-authors: Katsoulis J, Ramseyer S, Avrampou M, Mericske-Stern R

Department of Prosthodontics, School of Dental Medicine, University of Bern, Bern, Switzerland

Background: Edentulous patients often exhibit a decrease of bone density in older age, which is a local risk factor for implant stability. Currently, modern computer-software allows for a detailed assessment of maxillary bone morphology and quality when doing virtual implant planning.

Aim: To assess bone density (Hounsfield Units HU) in the posterior maxilla of edentulous patients. The null hypothesis was that HU values of subjects < 60 years are not different from those of older ones.

Methods: Multi-slice computed tomography (CT) scans of 19 females and 14 males (mean age 58.4 ± 11.2 years) were available and analyzed by a calibrated examiner using an implant planning software. The patients had been completely edentulous for ≥ 1 year. Hounsfield Unit (HU) measurements were performed in three areas of the posterior maxilla (premolars and first molars). Data analysis included gender and age (< 60 vs. ≥ 60 years) using descriptive methods and ANOVA (Bonferroni correction) to test for group differences.

Results: Mean bone density assessed was 512HU (474–550HU 95% Confidence Interval CI). Older females exhibited statistically

lower values (mean 393HU, 334–452HU 95% CI) than younger females (mean 567HU, 503–631HU 95% CI, $P=0.003$) and younger males (578HU, 504–653HU 95% CI, $P=0.005$). Male patients > 60 years showed mean values of 514HU (406–622HU 95% CI), which was not significantly different compared with younger males ($P=1.000$) and younger females ($P=0.167$). The null hypothesis was thus rejected only for female patients.

Conclusions and clinical implications: Elderly female subjects (> 60 years) exhibited statistically significantly lower mean bone density of the posterior maxilla than younger patients. Identification of areas of low bone density improves final decision-making, comprising patient selection, appropriate surgical techniques and prosthetic design. This results in higher quality of implant therapy.

149 | Implant Therapy Outcomes, Surgical Aspects

Clinical study of tapered implant with SLA surface loading protocol

Presenter: Kim J-H *Seoul National University Bundang Hospital, Seongnam-si, Republic of Korea*

Co-authors: Kim J-H, Kim Y-K, Yi Y-J, Yun P-Y, Choi Y-H *Seoul National University Bundang Hospital, Seongnam-si, Republic of Korea*

Background: Many studies of which modify implant design and surface have conducted for improving primary stability. Rough surface prompted early osseointegration, so variable methods were attempted to make bioactive rough surface. According to recent research, sand-blasted, large-grit, acid-etched (SLA) surface implant provided favorable osseointegration with the result that early loading was enabled.

Aim: The aim of this study was to evaluate prospective clinical results of tapered implants with SLA surface which was installed at maxillary posterior area and loaded 12 weeks after implant placement.

Methods: From November 2009 through September 2010, 28 patients (male: 18, female: 10) from Seoul National University Bundang Hospital were identified who treated with implants (TSIII SA, Osstem Co., Seoul, Korea). Sixty-one implants were placed at maxillary posterior area, and patients' mean age was 59 years.

Results: Marginal bone loss 3-months after final restoration was 0.04 ± 0.11 mm, and implant survival rate was 98.4%. Between 12-weeks loading and 24-weeks loading group, survival rate was 97.0% and 100%, respectively ($P>0.05$). Marginal bone loss 3-months after final restoration was 0.05 ± 0.13 mm in 12-weeks loading group, 0.03 ± 0.07 mm in 24-weeks loading group, and there was no significant difference.

Conclusions and clinical implications: Within this limitation of short-term 3 months evaluation, we achieved favorable clinical results as follows that tapered implants with SLA surface can be used as which is placed at maxillary posterior area and followed 12-weeks loading protocol.

The influence of surface topography on implant stability in dog model

Presenter: Kim W, *Korea University, Ansan, Republic of Korea*

Co-authors: Jang H¹, Kim W¹, Jeong K², Kim J², Shin H², Kwon Y²

¹*Korea University, Ansan, Republic of Korea*, ²*New Millennium Implant Institute, Seoul, Republic of Korea*

Background: The formation of a direct contact between implant and surrounding bone is the primary parameter of dental implant success. This success is thought to be influenced by the topography of implant surface. The primary stability is important for evaluation of therapeutic success.

Aim: The aim of this study was to evaluate the influence of surface topography on implant primary stability by resonance-frequency analysis and histomorphometric analysis.

Methods: Four male mongrel dogs and a total of 32 screw-type implants were used. These implants were divided into the following four groups: (a) Machined surface implants, (b) SLA surface implants, (c) RBM surface implants, (d) Dual acid-etching surface implants. Implant Stability Quotient (ISQ) was recorded using an Osstell mentor™ at baseline (the day of surgery), and 4, 8 weeks after implant installation. Animals were sacrificed four, 8 weeks after implant placement, and histomorphometric analysis was performed in order to evaluate the degree of osseointegration. The bone-to-implant direct contact ratio (BIC) and mineralized bone ratio were measured. The statistical analysis of the differences were analyzed by two-way ANOVA and for post hoc comparison Duncan's test was performed.

Results: After 4 weeks, ISQ value increased from a mean baseline value of implant placement. But, at 8 weeks, there was no significant increase from the value of 4 weeks. But no significant difference was found between various implant surfaces. After 4 weeks, the mean bone-implant contact (BIC) and mean volume density of periimplant bone (BVD) increased significantly.

Conclusions and clinical implications: In this study, no significant difference was found from implant stability and histomorphometric results between various implant surfaces. But, the measured stability increased together with the healing process in all implants. The measured ISQ values did not change significantly after 4 weeks.

The Palatine Ruga transplant for papillae regeneration between implants

Presenter: Klonis S

Salamis Health Center, Salamis, Greece

Co-authors: Klonis S

Salamis Health Center, Salamis, Greece

Background: The papillary morphology between adjacent implants is an important parameter to obtain natural aesthetic results. It is a common problem in final implant prosthesis of more than one continuing missing teeth to have blank

triangular spaces in the region of papillae. Many authors have described a lot of technics to obtain adequate aesthetics in such cases, as Pallaci, Sklar, etc., but in almost all the cases the regeneration of papillae is poor and not permanent.

Aim: Our presentation concerns a case of successful aesthetic papillae regeneration. It was performed 16 years ago through a transplantation of Palatine Ruga.

Methods: Our case was a 16 years old girl who lost both upper central incisors in December 1993. Two adjacent immediate one stage ITI screw implants were placed. Six months after, a transplant of the patient's Palatine Ruga was taken and positioned in the flat interdental space between the two implants. The area of the most excessive Palatine Ruga was selected as an ideal transplant for papillary regeneration because of its anatomy and morphology. The transplant was taken through a double V incision on both sides of the Ruga (donor site) and it was about 1 cm long (as long as the width of the crowns of final prosthesis). It was then sutured in the V excised buccopalatal interdental space of the recipient site. This was done after the permanent cementation of both crowns. The ideal morphology and aesthetics were obtained through micro-incisions of the crest of the transplant imitating. On both buccal and palatal sides periodontal dressing was used for a week in order to protect the immobilized transplant.

Results: After the transplantation there was healthy interdental papillae that resembled the lost natural interdental papillae.

Conclusions and clinical implications: No clinical, functional or aesthetical complication were observed from both the donor and recipient sites. Our case results are stable for almost 16 years. More cases are required for statistical evaluation of the transplantation technique.

Prosthetic rehabilitation after complicated mandibular fractures: case report

Presenter: Koca H

Ege University, İzmir, Turkey

Co-authors: Koca H, Efeoglu C, Parlar MK, Seçkin T, Özgür L, Gökçe B, Özpınar B

Ege University, İzmir, Turkey

Background: Mandibular fractures are common injuries in the maxillofacial region. Open reduction and rigid internal fixation (ORIF) is the method of choice for treatment. Undetected fractures or late presentations often result in infection, partial loss of dentition and/or bone resorption. Consecutively this leads to a shortened dental arch and unfavourable maxillo-mandibular relationship. Prosthetic rehabilitation with dental implants is a convenient option that could offer higher patient satisfaction in these cases.

Aim: The aim of this poster presentation is to present two cases that were treated with dental implants following complicated mandibular fractures.

Methods: A 57 years old man referred to the Department of Oral Surgery in the School of Dentistry, Ege University. The laterally luxated and grade IV mobile lower left first molar tooth

in the fracture line were repositioned and the fractured left body of the mandible was treated with ORIF under GA. The tooth was removed at the end of the procedure. After completion of functional healing two endosseous implants were placed. The patient subsequently received a fixed partial denture for prosthodontic rehabilitation. The second patient was a 75 years old man with a fractured left mandibular body who was treated with rigid internal fixation several months earlier in another clinic. At the time of presentation the fractured segments were mobile and appeared not to be anatomically reduced, although there was no sign of infection. A panoramic film showed bone resorption along the fracture line. The patient was treated with ORIF under GA and healing was uneventful. Prosthodontic rehabilitation was achieved with a lower hybrid denture and a removable upper denture.

Results: Both patients were satisfied with regards to the function and aesthetics of their prosthesis. In the first case the timing of the extraction avoided the shortening of the dental arch that enabled rehabilitation of the previously existing occlusion. In the edentulous second case, the shortening of the mandibular arch and loss of vestibular depth due to bone resorption made provision of a conventional removable denture impossible. This case was successfully rehabilitated with a hybrid lower and removable upper denture.

Conclusions and clinical implications: Osseointegrated implants have a profound effect in the decision-making process for prosthodontic treatment planning. Restoration of the teeth with dental implants after complicated mandibular fractures is by no doubt the golden treatment option for satisfying functional and aesthetic results.

153 | Implant Therapy Outcomes, Surgical Aspects

Is bone scintigraphy required before implant placement in cured cancer patients?

Presenter: Berberoğlu HK

Oral Surgery Department, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Berberoğlu HK¹, Özcan İ², Barut O², Köseoğlu BG¹, Erdem TL²

¹*Oral Surgery Department, Faculty of Dentistry, Istanbul University, Istanbul, Turkey*, ²*Oral And Maxillofacial Radiology Department, Faculty Of Dentistry, Istanbul University, Istanbul, Turkey*

Background: Metastases to the oral cavity and jaw bones are relatively rare. The primary tumor has already been diagnosed and treated in the most of the patients who present with an oral manifestation.

Aim: In this case report, a metastasis to the mandible diagnosed after dental implant placement and the role of the radiologic examination, advanced diagnostic investigations in dental patients with cancer were discussed.

Methods: A 52-year-old female with breast cancer diagnosed 5 years earlier appealed to our clinic with missing of all her teeth and desiring to have fixed prosthesis supported with dental implants.

Results: Metastasis to the mandible and generalized bone metastases were detected 3 months after dental treatments completed.

Conclusions and clinical implications: Advanced imaging methods in conjunction with traditional radiographic examination like panoramic and tomographic images may be considered as a necessity in order to discover metastases before dental implant surgery.

154 | Implant Therapy Outcomes, Surgical Aspects

Sinus floor elevation and penetration depth in relation to prosthetic indications

Presenter: Kremer U

Department of Prosthodontics, Bern, Switzerland

Co-authors: Kremer U, Van Enckevort S, Enkling N, Katsoulis J, Mericske-Stern R

Department of Prosthodontics, Bern, Switzerland

Background: Limited bone height for implant placement in the posterior maxilla is a frequent anatomical feature and enhanced by tooth loss. A predictable treatment option nowadays is the Sinus Floor Elevation (SFE). This technique allows to displace the sinus floor and to fill the new space with graft material. Three different methods are applied: a one stage procedure with an internal, transcresal SFE and simultaneous implant placement (A), a one stage procedure with a lateral fenestration for SFE and simultaneous implant placement (B) and the two stage procedure with a lateral SFE and staged implant placement (C). **Aim:** The aim of this retrospective study was to identify the prosthetic indications for SFE and to measure the gain of height in relation to the chosen technique.

Methods: From 51 well-maintained service patients who had received implant prosthetic treatment in the maxilla radiographs were available for clinical evaluation. The implants had been placed during a time-period of 3 years. The graft material was particulated xenogen material (Bio OSS), sometimes mixed with harvested bone chips from the surgical site. All implant sites were radiographically examined before and after sinus floor elevation. The radiographs were digitized, the sinus floor was detected and the penetration depth of the implant into the sinus was measured. Two examiners were calibrated and the computer software Image-J was applied for measurements. Statistical analysis: ANOVA testing (Bonferoni correction) was used for comparison of the three methods.

Results: Altogether 83 implants could be analyzed. The number of implants and accordingly the technique was: A=31 (37%), B=21 (26%), C=31 (37%). The implant length was thoroughly 10 (55%) or 13 (45%)mm. The overall penetration depth of the implants was: A=4 mm (range 3.1–4.7 mm), B=6.5 mm (range 5.0–7.8 mm) and C=6.8 mm (range 5.7–7.8 mm) into the sinus. The difference between methods A and B/C was statistically significant, whereas the difference between B and C was not measurable. All three SFE methods were used for single tooth replacement or fixed partial prostheses in partially edentulous patients and fixed full arch prostheses or overdentures in completely edentulous arches.

Conclusions and clinical implications: The transcresal approach for the SFE is a good method to gain 4 mm of bone. The option of a one- or two-stage approach was first dependent on remaining

bone height and expected primary stability. There was no prevalent prosthetic indication related to the chosen technique.

155 | Implant Therapy Outcomes, Surgical Aspects

Early perforation of cover screws; is it a predictor of early time marginal bone loss?

Presenter: Kutan-Misirlioglu E

Istanbul University, Istanbul, Turkey

Co-authors: Kutan-Misirlioglu E, Bolukbasi N, Ozdemir T

Istanbul University, Istanbul, Turkey

Background: Early cover screw perforations may be a reason of early marginal bone loss of dental implants.

Aim: The aim of this study is to determine the relation between early cover screw exposure and marginal bone loss.

Methods: Seventy-one patients, 126 Astra Tech microthreaded implants (Astra Tech Dental, Sweden, Mölndal) were included in the study. All of the implants were left submerged healing. Early cover screw perforations were examined between the implant placement and the second stage surgery, retrospectively. Second stage surgery was performed 2 months later. Standardized periapical radiographs were taken at implant placement and second surgery stage to determine the marginal bone loss.

Results: Early perforation of cover screws were seen in 14 implants (% 11.1) and eight patients. Mean bone loss was found 1.96 mm (range 0.2–3.2) around early exposed implants and 0.14 mm (range 0.0–1.2 mm) around unexposed submerged implants.

Conclusions and clinical implications: Within the limitations of this study, it can be said that unintentional early perforation of cover screws may be a reason of early marginal bone resorption.

156 | Implant Therapy Outcomes, Surgical Aspects

Success of early loading of implants with minimal bone support, following maxillary sinus-lifts

Presenter: Kwok J

Queen Marys Hospital, Sidcup, Kent, UK

Co-authors: Kwok J^{1,2}, Ali S¹, Girgis S¹, Papineni A¹

¹*Queen Marys Hospital, Sidcup, Kent, UK*, ²*Guys Hospital, London, UK*

Background: Two main challenges presenting to the clinician when restoring the posterior maxilla with implant retained prosthesis are: (1) the highly cancellous bone of the maxilla (Type IV) (2) encroachment of the maxillary sinus There is limited research available on the success of early loading of implants placed in an area of minimal bone level, following maxillary sinus lift.

Aim: To investigate the success of early loading of implants placed in an area of minimal bone support in the posterior maxillary region, following maxillary sinus lift. Success was measured based on the parameters defined by the International Congress of Oral Implantologists ICOI (2009). Early loading was defined as loading of implant up to 3 months after placement, as per the Third ITI Consensus Conference (2003).

Methods: Retrospective data was collected from 13 implant cases (nine female, four male, mean age 54), in an area of minimal bone

support (average preoperative bone level 3.33 mm) in the posterior maxillary region, following sinus lifts. All patients were nonsmokers. 10 × 5 mm Branemark implant system was used for all cases. At postoperative review, the parameters of success, as defined by the ICOI 2009, were measured: history of exudate discharge; mobility; pain on function; and patient satisfaction. Radiographic bone loss was not included as a parameter as postoperative and preoperative bone levels were not comparable due to the significant increase in bone levels provided by the sinus lift. **Results:** Implants were loaded, on average, 2.6 months after placement. Three implants were placed after immediate extraction. Eleven implants were restored with a one unit crown, and two implants (placed in a single patient) served as abutments for a 4 unit fixed-bridge. The antral lining remained intact in all cases. Eleven cases required Bio-Oss socket grafts. Patient satisfaction was 100%, and there was no presence of exudate discharge, mobility or pain on function in any of the cases.

Conclusions and clinical implications: The data reflects a high success rate of early loading of implants placed in an area of minimal bone in the posterior maxillary region, following sinus lifts. Operator skill was a contributing factor; however other variables such as patient's medical history were not standardized. There is minimal research published on early loading of implants following sinus lifts, and there is much scope for further evidence in this area.

157 | Implant Therapy Outcomes, Surgical Aspects

Initial implant stability and gap size on the immediately placed implants: a Korean human cadaver study

Presenter: Lee CW

Department of Prosthodontics & Implantology, The Graduate school of Clinical Dental Science, The Catholic Univ. of Korea, St. Mary's Hospital, Seoul, Republic of Korea

Co-authors: Lee CW, Lee IA, Kim KT, Kim TY

Department of Prosthodontics & Implantology, The Graduate school of Clinical Dental Science, The Catholic Univ. of Korea, St. Mary's Hospital, Seoul, Republic of Korea

Background: Initial stability is important for the long-term implant success in immediate implant cases also. However, there were not so many studies on the gap size and implant stability in immediate implant cases.

Aim: The purpose of this study is to evaluate the initial stability of implants placed into fresh extraction sockets, and to explore the size and the pattern of the gap between the implant and extraction socket in Korean human cadavers.

Methods: Six fresh frozen human cadaver maxillas and mandibles including the majority of natural teeth were selected for this study. All natural teeth were gently extracted with sharp periosteal elevator, and 144 XiVE[®]S Plus implants (Friadent GmbH, DE/Mannheim, Germany) were immediately placed into fresh extraction sockets without tapping for stability as usual clinical guidelines. The primary stability of implants were measured by means of the Osstell Instrument (Integration

Diagnostics AB, Gothenburg, Sweden). The size of the gap between the implant and the extraction sockets (buccal, lingual, mesial, distal sites) were measured using a UNC-15 periodontal probe (Hu-Friedy, Chicago, IL, USA). Block biopsies including implants were obtained and prepared for histological examination. Randomized block ANOVA and Tukey's ASD was used for the maxillary and mandibular area stability analysis, Spearman correlation analysis was used for relation of stability and gap size.

Results: (1) It was found that the mean ISQ values were 63.55 ± 1.74 . The mean ISQ values of mandibular implants (66.34 ± 2.21) was significantly higher than that of maxillary implants (60.83 ± 1.50) ($P < 0.05$). (2) The areas of which critical horizontal gap width was more than 1.5 mm were buccal and lingual sites of canine, premolar, maxillary molar region, and mesial and distal sites of mandibular molar region. (3) The size of vertical gaps was larger than that of horizontal gaps at every measured sites. (4). It was found that there was negative correlation between ISQ values and bucco-lingual vertical depths of the gap ($P < 0.05$).

Conclusions and clinical implications: Through this experiment, when an immediate implantation is planned, a great attention should be necessary to get osseointegration on the crestal part of implant in the immediate implant cases.

158 | Implant Therapy Outcomes, Surgical Aspects

The clinical outcome of dental implants placed through the skin flap

Presenter: Lee J-H

Seoul National University, Seoul, Republic of Korea

Co-authors: Lee J-H

Seoul National University, Seoul, Republic of Korea

Background: Maxillo-mandibular tumor ablation frequently results in a mucosal lining defect including loss of bone and teeth. In such instances, vascularized tissue flaps (forearm free flap, fibular free flap) that include parts of the extraoral skin are microtransferred, and dental implants are placed through the skin paddle to restore the function and cosmetic appearance. The nature of the final peri-implant tissues may differ considerably from the peri-implant mucosa.

Aim: The purpose of this study was to evaluate the incidence of peri-implantitis, marginal bone loss, and the survival and success rate of implants placed through skin flaps that had been previously lined with oro-mandibular defects.

Methods: Seventeen patients, who received implants on the reconstructed oral mucosal defect (52 implants through skin flaps and 23 implants through neighboring gingiva), were included. The incidence of peri-implantitis was assessed by probing depth and bleeding on probing. Marginal bone loss was measured with panoramic and periapical X-rays. Implant success and survival rates were also investigated.

Results: The incidence of peri-implantitis at the implant through the skin flap was higher (32.7%) than that of implants placed through the mucosa (8.7%). With regards to marginal bone loss, no significant difference was found between the implant through the skin or mucosa groups (implant through

the skin: 0.39 ± 0.14 mm at 1 year, 0.50 ± 0.23 mm at 5 years, and implant through the mucosa: 0.32 ± 0.12 mm, 0.52 ± 0.21 mm, respectively). The 1 year and 2–5 years cumulative survival rate of the implants placed through skin were 100% and 98%, respectively, and the implants through mucosa was 95.65% in both. The 1 year and 2–5 years cumulative success rate of the implants placed through skin were 92.30% and 79.38%, and implants through the mucosa was 91.30% and 82.59%, respectively.

Conclusions and clinical implications: Implants can be successfully placed and maintained in lining defects covered with a skin flap. Considerations for minimizing peri-implantitis are highly recommended.

159 | Implant Therapy Outcomes, Surgical Aspects

The effect of platform switched external hex type narrow implant for peri-implant bone resorption

Presenter: Lee I

Department of Prosthodontics & Implantology, The Graduate School of Clinical Dental Science, The Catholic University of Korea, St. Mary's Hospital, Seoul, Republic of Korea

Co-authors: Lee I, Kim TY, Kim D-W, Lee CW

Department of Prosthodontics & Implantology, The Graduate School of Clinical Dental Science, The Catholic University of Korea, St. Mary's Hospital, Seoul, Republic of Korea

Background: In the Brånemark-type implants, peri-implant bone resorption to the first thread is regarded as normal. Meanwhile, Lazzara et al. reported that peri-implant bone resorption was decreased on the platform switching implants.

Aim: The purpose of this study is to compare the platform switching implants with the nonplatform switching implants to the peri-implant bone resorption when using Brånemark-type narrow implants, and to compare the effect of narrow inter-implant distances with the effect of wide distances to the peri-implant bone resorption when using platform switching implants only.

Methods: At first, all mandibular premolars (P1–P4) and first molar (M1) were extracted from three beagle dogs (average 12 months old, 15 kg). Three months after extraction, total 27 Brånemark-type 3.3 mm body width and 3.5 mm platform width Dio implants (DIOSeoulKorea) were inserted. Three months after implant insertion, second surgery was done and peri-implant bone states were evaluated as equicrest, subcrest and supracrest with UNC periodontal probe (Hu-Friedy, Chicago, IL, USA). Among 24 osseointegrated implants, six implants were randomly selected as nonplatform switched abutments and the remained 18 implants were engaged with 0.5 mm smaller milled platform switched abutments. Three months after abutment connection, histological and histomorphometrical evaluations were performed to assess the vertical bone distance (VBD), horizontal bone distance (HBD) and peri-implant bone slope (SLO). Differences of peri-implant bone resorption between the platform switching and the nonplatform switching implants were evaluated only on the subcrestal and equicrestal groups, and narrow distance (less than 3 mm) or wide distance (3 mm or more) groups

were evaluated only among the platform switching implants. Unpaired *T*-test and Wilcoxon rank sum test were used for statistical analysis.

Results: The results were as follows: (1) The average values were VBD -0.84 ± 0.19 mm, HBD -1.42 ± 0.66 mm, SLO $57.3 \pm 5.8^\circ$ in the nonplatform switching implants and VBD -0.53 ± 0.44 mm, HBD -0.33 ± 0.52 mm, SLO $28.1 \pm 33.5^\circ$ in the platform switching implants. There was statistical significance only in HBD ($P < 0.05$). (2) Among the platform switching implants, the average values were VBD -0.87 ± 0.09 mm, HBD -0.53 ± 0.26 mm, SLO $29.8 \pm 10.7^\circ$ at wide inter-implant sites and VBD -0.38 ± 0.51 mm, HBD -0.04 ± 0.57 mm, SLO $27.4 \pm 32.4^\circ$ at narrow inter-implant sites. There were not statistical differences in VBD, HBD and SLO ($P > 0.05$).

Conclusions and clinical implications: From this limited study, it is concluded that peri-implant bone resorption of platform switching implants is less than that of non-platform switching implants, and among platform switching implants, peri-implant bone resorption of narrow interimplant sites is not different significantly from that of wide interimplant sites.

160	Implant Therapy Outcomes, Surgical Aspects
-----	--

Oral surgery and dental implants in the oral bisphosphonates patients: a prospective study

Presenter: Leghissa GC

University of Milan, Milano, Italy

Co-authors: Demarosi F, Leghissa GC

University of Milan, Milano, Italy

Background: Since 2003, literature has been reporting a great number of cases of patients presenting a necrotic bone exposure named osteonecrosis of the jaw caused by the use of bisphosphonates. Oral bisphosphonate-induced osteonecrosis appears to be less frequent, less severe, more responsive to discontinuation of the drug, then osteonecrosis induced by intravenous bisphosphonates.

Aim: The aim of this prospective study is to determine the extent to which oral bisphosphonate-associated osteonecrosis occurs after oral and dental implant surgery using a drug holiday protocol. We also wanted to determine whether there was any indication that bisphosphonates affected the overall success of the implants.

Methods: We described patients undergoing oral or implants surgery who had took oral bisphosphonates. All patients received the followed protocol to prevent osteonecrosis.

Pre-operative phase:

- Professional oral hygiene performed at least 2 weeks before the intervention.
- Oral rinses with chlorhexidine mouthwashes for 2 weeks before the intervention.
- Antibiotic therapy with amoxicillin, 1 week before the intervention.

Intra-operative phase:

- The intervention has been done minimizing the soft tissues and bone trauma.

Post-operative phase:

- Oral rinses with chlorhexidine mouthwashes for 2 weeks after the intervention.
- Antibiotic therapy with amoxicillin, at least for 2 weeks after the intervention.
- Clinical monitoring was carried out 1, 3, 6, 9 and 12 months after surgery and then annually. Panoramic radiographs were obtained before, immediately after, and 6 months following the surgery.

Results: A total of 61 interventions (13 oral surgery (extractions), seven sinus elevation, 11 implant surgery, 30 post-extraction implant surgery) were performed in 46 patients who reported having received oral bisphosphonates. All patients stopped oral bisphosphonates therapy 3–120 months before the intervention. The mean duration of bisphosphonates therapy before the surgery was 62.5 months. No infection was noted during the post-operative period and healing was uneventful in all patients. There is no evidence of osteonecrosis in any of the patients evaluated. Of the 101 implants placed, all but five integrated fully and meet criteria for establishing implant success. Follow-up ranged from 6 to 48 months.

Conclusions and clinical implications: In this study of 46 patients, implant placement and oral surgery appear to be safe and successful procedures in patients who have took oral bisphosphonates. Considering the number of patients taking oral bisphosphonates, further retrospective studies as well as prospective studies of this nature will be helpful in clarifying this issue.

162	Implant Therapy Outcomes, Surgical Aspects
-----	--

Immediate implant placement in the aesthetic area vs. delayed loading: surgical approach and long term evaluation

Presenter: Lenzi CC

Private Practice, Bologna, Italy

Co-authors: Lenzi CC

Private Practice, Bologna, Italy

Background: The immediate implant placement in a fresh socket after tooth extraction is considered a reliable therapeutic procedure and it presents the advantage of having a considerable amount of native bone. This technique also reduces the number of surgical procedures and the overall treatment time, obtaining the patient's approval and satisfaction. The anterior aesthetic area is considered critical to treat: in fact it is fundamental to obtain hard and soft tissue stability in order to obtain long-term biological and aesthetic success. Clinical studies showed that in several situations the technique reported here is also applicable in the aesthetic area and if exclusion criteria are respected, the results obtained can be predictable. However, this concept is still controversial and some authors suggest delaying the placement and loading of the implant in the aesthetic area.

Aim: The aim of this study is to evaluate and compare two study groups (immediate and delayed) of five single implants each placed into the aesthetic area.

Methods: After a minimally traumatic extraction of the tooth, a different surgical approach was used. In the first study group (five individual cases), depending on the presence of thin or thick gingiva and on the residual volume of buccal plate, the implant was placed with conventional protocol and delayed loading. In the second study group (five individual cases), after the tooth extraction the implant was immediately placed and loaded without functional loading. In both study groups, if bone loss occurred in the buccal plate, an integration with GBR techniques and the use of biomaterials were necessary to fill the buccal gap. Good primary stability of the implant and a nonfunctional load were achieved in all loading cases.

Results: The follow-up after 24 months, performed by clinical and radiographic evaluation and also supported by TC scan, shows that the results are comparable and that postextractive implants with immediate nonfunctional loading can be used in selected cases.

Conclusions and clinical implications: The results obtained are good in both thin and thick biotype cases and it seems evident that it is possible to obtain predictable long-term functional and aesthetic success.

Immediate dental implants resonance frequency analysis and removal-torque in canines

Presenter: Levin L

Rambam Health Care Campus, Haifa, Israel

Co-authors: Levin L, Frankenthal S, Machtei EE

Rambam Health Care Campus, Haifa, Israel

Background: Initial implant stability is one of the major keys for implant success.

Aim: This canine study was aimed to evaluate resonance frequency analysis (RFA) and removal torque of newly designed dental implant.

Methods: Two mongrel dogs were used for this pilot study. The four mandibular premolars were bi-laterally extracted followed by immediate dental implants with a new design were inserted. All implants were evaluated for RFA and two implants in each dog were also evaluated for removal torque. After 4 and 8 weeks, all remaining implants were re-evaluated for RFA and three implants in each dog were also re-evaluated for removal torque.

Results: Healing was uneventful; all implants showed clinical osseointegration. The mean immediate RFA following implant placement was 64.38 (5.03 SD) and increased to 72.94 (3.89 SD) and 74.5 (3.08 SD) following 4 and 8 weeks, respectively. Average removal torque immediately following implant placement was 49.65 (20.3 SD), 49.4 (3.32 SD) following 4 weeks and 98.33 (12.34 SD) following 8 weeks.

Conclusions and clinical implications: The newly designed dental implant showed good results of RFA as well as removal torque during the initial healing phase and might be used for immediate implantation. Further research is warranted.

Transcrestal sinus floor elevation with bio-oss collagen: A clinical research

Presenter: Li S,

Department of Oral Implantology, Peking University School and Hospital of Stomatology, Beijing, China

Co-authors: Li S, Lin Y, Qiu L, Chen B, Hu X

Department of Oral Implantology, Peking University School and Hospital of Stomatology, Beijing, China

Background: Maxillary sinus floor elevation using the (transalveolar) osteotome technique has achieved rather good clinical result. Complications such as membrane perforation during the elevation procedure and placing bone grafts blindly into the space below the sinus membrane still bother clinicians. Several modified surgical techniques and bone graft materials have been used to improve the outcome. Deproteinized bovine bone mineral integrated in a 10% collagen matrix (bio-oss collagen) is a rather new material used in implant dentistry but hardly used in sinus lift.

Aim: To evaluate clinical outcome and technical aspects of osteotome maxillary sinus floor elevation using Bio-Oss Collagen as cushion of percussion and graft material.

Methods: Following bone-added osteotome sinus floor elevation (BAOSFE) protocol, Bio-Oss Collagen was placed between osteotome and sinus floor as cushion of percussion. When elevated, sinus floor was carefully checked with probe and nose blowing test for any perforation, more Bio-oss Collagen was added during the subsequent osteotome till the desired diameter and height. Implant was inserted and connected with healing abutment. Definite prosthesis was delivered 6 months after implant placement. X-ray examinations including OPG and CBCT were done before, immediately after surgery and 1 year after surgery to evaluate the gain of vertical bone height and its stability over time. Resonance frequency analysis (RFA) was recorded at implant placement and before restoration.

Results: During September 2007 to February 2009, 12 implants were inserted in 12 patients and restored. Five patients were male, seven were female, with average age of 43.4 years (27–58 years). Seven patients were followed for 3 years and five patients were followed for 2 years. None of the 12 cases had membrane perforation by clinical investigation and CBCT. All 12 implants were osseointegrated and restored. The mean height of sinus floor before surgery was 6.6 mm (5.8–8.0 mm). Sinus floor was elevated by 7.3 mm on average (from 4.5 to 10.3 mm). One year after surgery, the mean gain of height was 5.8 mm (from 2.8 to 7.6 mm). RFA was 68 at implant placement and 78 at restoration. All patients were satisfied.

Conclusions and clinical implications: Using Bio-Oss Collagen could reduce the risk of perforation during percussion of the sinus floor and placement of bone graft material. Sufficient new bone formation was confirmed by X-ray and remains stable over the period of observation.

Zygomatic fixture insertion under local anesthesia

Presenter: Lourenco S*Leslie Memorial Dental Clinic, Margao-Goa, India***Co-authors: Lourenco S, Lourenco C***Leslie Memorial Dental Clinic, Margao-Goa, India*

Background: Insertion of zygomatic implants to rehabilitate atrophic maxillae is considered an advanced surgical technique and is usually carried out under general anesthesia. The possibility of using local anesthesia to insert these implants can lead to shortened recovery times and decreased morbidity especially if carried out with guided templates.

Aim: To check possibility of placement of zygomatic fixtures under local anesthesia.

Methods: Three female patients were selected to receive zygomatic implants in their maxillae under local anesthesia. Software-driven surgical planning was carried out for the patients in order to ascertain the anatomy and the lengths of the fixtures before surgery. Apart from anesthetizing the surgical site, bilateral inferior alveolar mandibular blocks were also administered, to facilitate mouth opening and decrease pain. Sufficient time was permitted to allow relaxation of the jaws between the drills. One patient received bilateral zygomatic fixtures with conventional surgery, while another received bilateral fixtures through a guided template. The third patient received four fixtures (two on either side) through a guided template. A total of eight zygomatic fixtures and 20 conventional implants were placed under local anesthesia.

Results: The patients allowed placement of zygomatic implants under local anesthesia. Maximum mouth opening was achieved to allow the insertion of the relatively long drills. Within the small selection, patients who received zygomatic fixtures via guided templates had less facial edema and pain than the patient who underwent conventional surgery. However, the postoperative pain and edema was well controlled by nonsteroidal anti-inflammatory analgesics. The patients who were subjected to guided surgery did not exhibit facial edema or postoperative pain.

Conclusions and clinical implications: It is possible to place zygomatic implants with minimal postoperative discomfort, entirely under local anesthesia either by conventional means or by using guided surgical templates, without resorting to general anesthesia or intravenous sedation. The complications that are attendant with general anesthesia are thereby precluded and recovery time is shortened to that of an out-patient procedure. However, this sample size is small and techniques need to be developed to allow these implants to be placed safely and predictably in a manner similar to conventional implants.

Evaluation of a Protocol for the Surgical Treatment of Peri-implant Bone Loss

Presenter: Luchetti C*Department of Implant Dentistry, National University of La Plata, La Plata, Argentina***Co-authors: Luchetti C, Kitrilakis A, Ostrowicz D***Department of Implant Dentistry, National University of La Plata, La Plata, Argentina*

Background: Peri-implant bone loss treatment remains to be a challenging procedure in implant dentistry. There is an increasing number of studies about this, although definitive conclusions regarding the best approach are lacking.

Aim: To evaluate a protocol for decontamination of peri-implant bone lesions and a subsequent grafting procedure in order to attempt for regeneration.

Methods: Twenty-two cases with peri-implant bone loss bigger than 3 mm (range: 3.01–4.8) were selected. The baseline bone loss was measured in standardized X-rays. Cases were treated surgically according to the following protocol.

(1) Flap and exposure of the lesion.

(2) Manual curettage of the bone lesion and the implant surface.

(3) Application of citric acid 2% and hydrogen peroxide 3% over the lesion and the implant for 1 min each.

(4) Piezoelectric treatment of the bone lesion and the implant surface. Microorganisms were evaluated at each stage of the decontamination protocol through microbiological samples, resulting in four sequential samples of each site. The decontamination procedure was followed by a xenograft placement, covered with a collagen membrane, and a tension free closure of the soft tissues. The effectiveness of the protocol used in the decontamination of the lesions was evaluated by means of counting of microbiological colonies in cultures in each step. Microorganism typification and antibiogram were also performed. The degree of bone regeneration at 1 year postoperative was measured in X-rays.

Results: The microorganisms most frequently identified in these lesions were Gram negative bacilli and Spirochetes.

According to the findings in the cultures, each step in the evaluated protocol contributed to the reduction of microorganisms.

The most effective antibiotics according to antibiogram were ciprofloxacin, amoxicillin plus clavulanic acid and metronidazole. Baseline peri-implant bone loss was 4.12 (0.437) mm. Peri-implant bone loss at 1 year was 1.01 (0.244) mm. Bone gain after treatment at 1 year was 3.10 (0.441) mm. (75.24%) ($P = < 0.001$, Paired *t*-test).

Conclusions and clinical implications: Within the limits of this preliminary study, the evaluated protocol has proved to be useful in the decontamination of the bone lesion and the implant surface gradually in each step of it. The use of a piezoelectric device showed interesting results. Besides its mechanical action for the debridement of the bone defect, the piezoelectric effect could help in destroying the bacteria's cellular wall, although this possibility needs to be investigated. The percentage of bone regeneration was important, however, was not complete in any of the sites evaluated. Further research is needed.

Naso-sinusal pathology and implant survival rates in sinus augmentation

Presenter: Barbosa JM

Implantology Institute, Lisbon, Portugal

Co-authors: Barbosa JM¹, Mata A^{1,2}, Francisco H^{1,2}, Freitas F^{1,2}, Marques H^{1,2}, Moreira A^{1,2}, Caramês J^{1,2}

¹*Implantology Institute, Lisbon, Portugal*, ²*College of Dentistry, University of Lisbon, Lisbon, Portugal*

Background: Implant placement in association with maxillary sinus augmentation is a predictable therapeutic option of rehabilitation of the posterior maxilla. However, there are several risk factors described in the literature, as well as relative and absolute contraindications for this surgical procedure, among which some authors describe the naso-sinusal pathological phenomena. Current literature available does not provide consensual information about the influence of this pathology on the survival rates of implants placed in maxillary grafted sinuses.

Aim: To compare survival rates of implants placed in augmented maxillary sinuses without naso-sinusal pathology, with survival rates of implants placed in augmented maxillary sinuses with naso-sinusal pathology.

Methods: Participants were assigned to either one of two groups based on absence and presence of of naso-sinusal mucosa pathology (groups A and B, respectively) present on the Computerized Tomography Scan. Evaluation of dental records and X-rays was performed to assess implant survival rates. Follow-up periods ranged from 3 to 96 months, corresponding to an average follow-up period of 23 months. Kaplan–Meier survival analysis and Fischer's exact test were used as appropriated, confidence level was set at 95%. Alpha was set at 0.05.

Results: No significant differences ($P > 0.1$) were found for cumulative implant survival rates when comparing both groups up to 96 months of follow-up. All implant loss occurred during the first 8 months after placement. A survival rate of 100% was recorded for implants placed in Group B group, while for Group A was 96.3%. There was no statistically significant difference between groups ($P > 0.1$) log rank test.

Conclusions and clinical implications: For the analyzed sample, it was concluded that preoperative naso-sinusal mucosal pathology showed no influence on implant survival rates of implants placed in grafted maxillary sinus. *Clinical implications:* The survival rate of implants placed in augmented maxillary sinuses does not seem to be affected by the presence of naso-sinusal mucosal pathology.

Periimplant cervical bone resorption affected by implant-abutment connection types

Presenter: Markou E

Aristotle University Of Thessaloniki, Thessaloniki, Greece

Co-authors: Markou E, Menti S, Mikrogiorgis G, Sakellari D, Menexes G, Konstantinidis A

Aristotle University of Thessaloniki, Thessaloniki, Greece

Background: The implant-abutment connection surface represents a critical area, where cervical bone, soft tissues and oral environment converge, and has been the focal point of many observations and *in vitro* studies.

Aim: The effect of the implant–abutment connection type on the maintenance of the cervical peri-implant bone, according to clinical, microbiological, immunological and radiographic parameters.

Methods: In this Randomized, Prospective, Parallel Clinical study, 32 two-stage implants were placed to partially edentulous patients diagnosed with chronic, generalized periodontitis, during the maintenance phase. The implants were divided into three groups, depending on the type of the implant-healing abutment connection. Group A consisted of OSSEOTITE, *External Connection*, Parallel Walled 3i Implants, Group B of OSSEOTITE, *Internal Connection*, Parallel Walled 3i Implants and Group C of OSSEOSPEED, *Conical Seal*, Astra Tech Implants. Clinical parameters, regarding the depth of the periimplant crevice, bleeding on probing and plaque indices, were recorded. Samples of subgingival plaque were obtained and analyzed for several species, while samples of periimplant crevicular fluid were analyzed for the detection of MMP-8. The radiographic imaging of the periimplant cervical bone was performed by digital subtraction radiography. The reference time points of the study were: the day of the implant placement, the day of the implant exposure, two and six weeks later. Statistical analysis was performed considering cervical bone loss as the primary outcome, by SPSS v.18.0, while differences between groups were revealed through Mann–Whitney test and correlations by calculating Pearson's coefficient.

Results: Periimplant bone loss, from implant placement until 6 weeks after implant exposure, was statistically significant between groups, between Group A presenting a mean of 1.44 mm and Group B of 0.46 mm (Mann–Whitney test, $P = 0.003$) and between Group A and Group C of 0.43 mm (Mann–Whitney test, $P = 0.001$).

Conclusions and clinical implications: The conical seal internal implant–abutment connection type results in minimal periimplant marginal bone loss in comparison with external connection, based on radiographic and clinical findings.

Root retaining for maintaining soft and bone tissue height adjacent to implants

Presenter: Markou N

401 Athens Military Hospital, Athens, Greece

Co-authors: Markou N^{1,2}, Tsoutis K², Eudoxie P³, Chronopoulos V³

¹401 Athens Military Hospital, Athens, Greece, ²Department of Periodontology, Athens, Greece, ³Department of Prosthodontics, Athens, Greece

Background: Optimizing the esthetic result between two implants is often a challenging task for the clinician. When it comes to implant therapy, one must take into consideration several factors, such as reduced blood supply to the peri-implant tissues, bone resorption due to re-establishment of the biological width, interimplant distance and postsurgical recession of labial tissue affecting the interimplant papilla and therefore compromising the esthetic outcome. Hard and soft tissue augmentation techniques have been widely used in implant sites. Scalloped implants and platform switching have been developed in an attempt to preserve crestal bone height around adjacent implants. Root submergence adjacent to implants has been introduced as an alternative technique to maintain interproximal soft and bone tissue height. The root is sectioned at the bone crest level and covered by the flap allowing for a future ovate pontic site development.

Aim: The aim of this presentation was to analyze, through a detailed video movie, the root submergence technique for tissue height preservation that was applied to a 71-year male.

Methods: A patient with a severely compromised dentition presented seeking treatment demanding fixed restorations. The suggested treatment included fabrication of cement retained Fixed Dental Prostheses supported by six implants in the maxilla and a screw retained hybrid bridge supported by five implants in the mandible. The maxillary canines and central incisors, were temporarily maintained in order to support a fixed provisional restoration during the time of osseointegration. All implants osseointegrated successfully and a screw-retained implant-supported transitional restoration was fabricated in the maxilla. The crowns of the canines were sectioned at the bone level and the roots were submerged. Buccolingual flaps were mobilized to cover the roots. Selective pressure was applied on the soft tissues of the pontic sites with the provisional restoration. A natural scallop of the soft tissues was formed and the fabrication of the final Fixed Dental Prostheses with ovate pontics was followed.

Results: After 3 years in function, the esthetic appearance of the restorations at the pontic sites was excellent.

Conclusions and clinical implications: Root submergence in the pontic sites of fixed implant restorations is an effective and predictable technique for the maintenance of the soft and bone tissue height and enhancement the final esthetic result.

Postextraction sockets augmentation with acellular dermal matrix and allogenic bone substitute in the aesthetic area. A case series

Presenter: Maslova N

Vilnius Implantology Center, Vilnius, Lithuania

Co-authors: Maslova N^{1,3}, Puisys A^{1,3}, Linkevicius T^{1,2,3}, Vindasiute E^{1,3}, Daugela P⁴

¹Vilnius Implantology Center, Vilnius, Lithuania, ²Vilnius University, Vilnius, Lithuania, ³Vilnius Research Group, Vilnius, Lithuania, ⁴Lithuanian University of Health Sciences, Kaunas, Lithuania

Background: It is very important to keep favorable anatomical situation in the aesthetic zone after tooth extraction. Many studies confirm loss of both hard and soft tissues after tooth being extracted, especially in the clinical cases with thin soft tissue biotype. Therefore, the need of two surgical procedures occurs: implantation with bone and soft tissue augmentation and subsequent healing abutment placement 6 months after.

Aim: To evaluate the effectiveness of extraction socket grafting with acellular dermal matrix and allogenic bone substitute in order to eliminate the need of additional grafting procedures during implant placement in the aesthetic area.

Methods: Fourteen teeth were extracted in the anterior maxilla. After tooth extraction partial thickness flap in the buccal and palatal sites was splitted without vertical incisions. Thus, the envelope from both parts was generated. Alveolar postextraction socket was augmented with allogenic bone substitute and 2 mm thickness acellular dermal matrix membrane was positioned on the internal part of an envelope. Edges of buccal and a palatal flaps were sutured without a tension. After 4 months of healing a minimally invasive one-stage implantation without vertical incisions was carried out. All implants were restored with cement-retained metal ceramic restorations 5–6 months after implantation. Modified Pink Esthetic Score (MPES) was used to evaluate the esthetic outcome of the implant prosthesis.

Results: At the time of implant placement in all 14 socket grafting cases irrespective of genetic soft tissue biotype anatomical situation was found to be favorable for minimal invasive implantation without additional bone augmentation. Following implant placement and delivery of final restoration, 9–10 MPES in all patients was achieved. Therefore, the procedure was letting to obtain satisfactory esthetic results, time saving and cost effective.

Conclusions and clinical implications: Reduction of time (from tooth extraction to the final implant-supported restoration) and extent of surgery conduct to less traumatic and cost effective procedure for a patient. Because of a good initial anatomic situation implant surgery occurs without vertical incisions, allowing better esthetics in the mucosal tissues. This technique could be especially important in the cases with a very thin buccal bone or buccal bone defects.

A prospective 3-year multicenter study of the nobeldirect implant

Presenter: Medley M

Private Practice, Olympia, WA, USA

Co-authors: Medley M¹, Baer R², Clark P³, Shanaman R⁴

¹*Private Practice, Olympia, WA, USA*, ²*University of Chicago, Chicago, IL, USA*, ³*Whitecap Institute, Heber City, UT, USA*,

⁴*Private Practice, Reading, PA, USA*

Private Practice, Reading, PA, USA

Background: The one-piece implant (NobelDirect[®]; Nobel Biocare) is made of a single piece of titanium and presents a design with the absence of a submucosal gap. The implant has an oxidized surface (TiUnite[®]); additionally grooves have been added to the implant threads.

Aim: The aim of the study was to evaluate this 1-piece implant in daily clinical situations. The endpoints reported implant cumulative survival rate, marginal bone levels, bone remodeling, and soft tissue changes.

Methods: One hundred and fifteen implants restoring both single teeth and partially edentulous sites in 84 treated patients were included. Implants were inserted in healed and fresh extraction sites. A single stage procedure was used with immediate provisionalization within 24 hours after surgery. The definitive prosthesis was delivered within 6 months of implant insertion. Marginal bone level was evaluated on radiographs made at implant insertion, 6-month follow-up, and annually. An independent radiologist performed radiographic evaluation by relating the bone level to a reference point, which was the lower corner of the cylindrical collar. The bone level, coronal or apical to this point was recorded with positive or negative values, respectively. Presence of plaque and the soft tissue response were evaluated using modified indexes by Silness and L e and papilla index by Jemt at the follow-up visits.

Results: One hundred and fifteen implants have been placed in 84 patients. Seventy-six patients completed the 1-year follow-up, 68 the 2-year and 55 the 3 years follow-up. Three centers have completed the 1, 2 and 3-year follow-ups. In a fourth center, 3-year follow-ups are ongoing for 17 patients. Ten patients withdrew from the study. Two implant failures in two patients, occurred during the first 6 months resulting in a cumulative survival rate of 98.3% (2 year). The mean bone level at implant insertion, 6 months, 1, 2 and 3 years follow-ups was reported as 1.20 mm (SD 0.71, n = 114), 0.81 mm (SD 0.81, n = 106), 0.78 mm (SD 0.84, n = 100), 0.76 mm (SD 0.99, n = 89), 0.73 mm (SD 0.94, n = 79), respectively. The mean change in bone level from implant insertion to 1, 2 and 3 years were -0.36 mm (SD 0.99, n = 99), -0.38 mm (SD 1.01, n = 88) and -0.37 mm (SD 0.62, n = 78). Soft tissue parameters studied exhibited an improvement in the majority of the implants.

Conclusions and clinical implications: The NobelDirect implant tested in daily clinical situations has the ability to preserve both hard and soft tissue architecture. This study has been supported by Nobel Biocare Services AG, Study code: T-128.

Peri-implant soft tissue alterations in relation to different periodontal biotypes and abutment connection surgical techniques

Presenter: Michailidou V

Department of Periodontology & Implant Biology, School of Dentistry, Aristotle University of Thessaloniki, Thessaloniki, Greece

Co-authors: Michailidou V, Vouros I, Konstantinidis A

Department of Periodontology & Implant Biology, School of Dentistry, Aristotle University of Thessaloniki, Thessaloniki, Greece

Background: The surgical technique applied at the second stage surgery may influence the periimplant soft tissue morphology and subsequently the aesthetic outcomes of implant therapy. However, information on the effect of different surgical approaches at the abutment connection stage is limited.

Aim: The aim of this study was to investigate the effect of four surgical techniques for abutment connection on the peri-implant soft tissues according to the periodontal biotype including mid-crestal incision, c-shaped palatal-lingual incision, soft tissue punch removal and papilla preservation (Palacci technique).

Methods: Fifty-seven patients, aged 20–62 years, partially edentulous, scheduled for restoration with implant-supported fixed constructions were included in the study (total of 86 implants). The prosthetic restoration was placed approximately 1 month after abutment connection. The participants were randomly allocated to each surgical technique for abutment connection. The location of the periimplant marginal soft tissue as well as the thickness and width of the keratinized mucosa were assessed at baseline during abutment connection, 1 and 4 months after placement of the supraconstruction. Mean values and standard deviations were assessed for each variable and time interval, using the implant as the statistical unit.

Results: Four months after prosthesis installation a mean apical displacement of the labial soft tissue margin of 0.7 ± 0.25 mm was observed for all included sites. In 27.3% of the implants a soft tissue recession at the vestibular implant site was recorded in patients with thin biotype, while in the thick biotype the corresponding value was 7.1%. Among the different surgical techniques that were utilized for abutment connection, the simple crestal incision technique presented the most satisfying results, in both biotype groups in terms of peri-implant soft tissue recession and increase of keratinized mucosa. Smoking was strongly correlated with soft tissue recession.

Conclusions and clinical implications: Alterations of peri-implant soft tissues after second stage surgery for abutment connection are strongly related to periodontal biotype. The conventional crestal incision seemed to provide the most satisfying results among the four investigated surgical techniques.

Effect of off-axial loading on peri-implant marginal bone loss

Presenter: Moon I-S

Department of periodontology, Gangnam Severance Hospital, College of Dentistry, Yonsei University, Seoul, Republic of Korea

Co-authors: Moon I-S, Lee D-W, Lee D-W

Department of periodontology, Gangnam Severance Hospital, College of Dentistry, Yonsei University, Seoul, Republic of Korea

Background: Based on several clinical studies, it has been suggested that there could be a positive relationship between excessive loading and peri-implant bone loss. Finite element analysis demonstrated that high stress concentration occurs at the marginal part of the implant, when off-axial loading was generated. However, there were conflicting animal experiments and clinical studies. The relationship between crestal bone loss and off-axial loading is still controversial.

Aim: The present clinical trial was designed to evaluate the possible influence of off-axial loading by calculating correlation between crown width/fixture width ratio (Cr/Fx ratio) and marginal bone loss around Astra single dental implants placed in the first molar.

Methods: Twenty implant (Astraosseospeed, Astra Tech, Sweden) were used for analysis. A two-stage surgical protocol was used. The prostheses were delivered 3 weeks after the second surgery. Bone loss was measured by comparing the radiographs taken immediately after prosthesis delivery with those taken 1 year after functional loading. Bone loss was measured at the mesial and distal peri-implant sites. Perpendicular distances from the center of the fixture to the most mesial and distal aspect of the crown were added (Crown width, Cr). Fixture width (Fx) was calculated from the known diameter of fixture. Spearman correlation analysis was used to analyze the correlation between crown width/fixture width ratio (Cr/Fx ratio) and crestal bone loss.

Results: Correlation between crown width/fixture width ratio and crestal bone loss were not statistically significant.

Conclusions and clinical implications: The findings of current 1-year study indicate that increased nonaxial loading from Cr/Fx ratio increase did not result in peri-implant marginal bone loss during functional loading.

Buccal Fat Pad, an option in the treatment of complications in advanced surgeries: a retrospective clinical study

Presenter: Moraes E

UNIFESO, Teresopolis, Rio De Janeiro, Brazil

Co-authors: Moraes E

UNIFESO, Teresopolis, Rio De Janeiro, Brazil

Background: Recently, several publications have reported that adipose tissue contains a population of cells able to differentiate into different cell types, including adipocytes, osteoblasts, myoblasts, and chondroblasts. By placing the Buccal Fat Pad (BFP)

between fast-growing fibrous tissue and the defect itself, slow-growing osseoprogenitor cells can migrate into the bone defect. The buccal fat pad flap (BFPF) technique provides adequate blood supply to the flap and some authors used BFP flap to cover grafts in corrections of maxillary defects and closures of oroantral communications. The literature reported the use in complex implants surgeries to repair large perforation in sinus augmentation surgery and in complex zygomatic implant surgery to treat and prevent complications.

Aim: The aim of this presentation is to demonstrate clinically that BFP pedicled flap is an option to treat and prevent complications in oral implantology.

Methods: Between May 2005 to July 2009 a total of 17 patients, four females and 13 males with mean age of 56 years were submitted to complex implants surgeries. The patients were divided in two groups. Group A ($n=9$) the patients were submitted to zygomatic implants surgery and Group B ($n=8$) patients submitted to sinus augmentation. The BFP flap technique was used in all patients to treat and prevent complications. In the Group A the technique was used to prevent thread implants exposure by mucosa fenestration or to closure of oroantral communications promoted by loss of sinus walls. In the Group B, the technique large perforation of Schneiderian membrane and protect grafted materials.

Results: In Group A the total of 17 zygomatic implants were covered by BFP pedicled flap implants and in four sinuses the technique was used to closure of oroantral communications associated to ZI. In Group B, 13 sinuses presented large membrane perforation and the BFPF technique was used to protect grafted materials and implants. All patients in both groups were rehabilitated with fixed prosthesis and osseointegration success criteria of according Albrektsson and colleagues and Buser and colleagues. The patients were followed-up in a minimum period of 12 months from the time of prosthesis installation and none patient presented postoperative complications.

Conclusions and clinical implications: The BFP pedicled flap is a simple technique and demonstrated success in advanced and complex implant surgeries. In this study it was suggested that the use of adipose tissue in the protection or repairing of fibrous and bone structures promoted good results.

Retrospective study comparing a new minimally invasive sinus lift by buccal access with the traditional sinus lift technique

Presenter: Morales D

Buccal, Valladolid, Spain

Co-authors: Morales D, Alvarez Placer JL, Rueda GC

Buccal, Valladolid, Spain

Background: Approaching the sinus from the buccal allows us to take advantage of the minimally invasive protocol when performing lateral window sinus lift. This procedure can be done at the same time as flapless implant placement, tooth extractions, and bone splitting. While there are many studies evaluating graft materials, different osteotomies, success and failure rate of implants in grafted sinuses, there are no articles

comparing the modified buccal approach (MISBA) to the traditional crestal incision in lateral window sinus lift.

Aim: Five year (2005–2010) retrospective study to evaluate the clinical outcome of three different access to perform lateral window sinus lift: (a) The classic, traditional crestal approach with vertical releasing incisions (TSL). (b) Vertical minimally invasive buccal approach (MISBA-V). (c) Horizontal minimally invasive buccal approach (MISBA-H).

Methods: A total of 658 consecutive standard sinus lift with lateral osteotomy were performed. Three different approaches were used, traditional approach with crestal incision (TSL), Minimal lateral invasive approach with vertical incision (MISBA-V), Minimal lateral invasive approach with horizontal incision (MISBA-H). Clinical variables such as intraoperative complications, postoperative complications and implant success rate for each technique were studied.

Results: A total of 1247 implants were placed in the grafted sinuses with a survival rate of 97.99%. From the 658 sinus lift surgeries, 261 surgeries were done using TSL approach, 208 were done using MISBA-H and 189 were done using MISBA-V. For both MISBA-V (22.75%) and MISBA-H (21.15%) the amount of intraoperative complications such as sinus membrane tearing were more prevalent than for the TSL (15.70%). Less amount of postoperative complications such as inflammation, hematoma and infections were reported when using any of the MISBA techniques (13.48% for MISBA-V, and 15.86% for MISBA-H) compared with the TSL (15.89%). The most common postoperative complication was inflammation. 22.98% for TSL, while for MISBA was 13.55% (12.69% for MISBA-V, and for MISBA-H 14.42%). Also the incidence of infections were less while using the MISBA approach (1.24%) compared with the TSL approach (3.06%).

Conclusions and clinical implications: The new access to perform lateral sinus lifts proposed in this article have proven to be comparable with the TSL. However, when performing any of MISBA approaches the incidence of postoperative complications were reduced. Approaching the sinus from the buccal, allows us to perform simultaneously with the sinus lift technique procedures like: molar extractions, bone spreading or flapless implant surgeries, because the incision to gain access to the sinus does not interfere with the above mentioned surgeries.

abutment connection upon their integration is still incompletely studied.

Aim: Comparative evaluation of crestal bone level during healing period of two-stage dental implants inserted in two and in one surgical step without flap rising.

Methods: A clinical controlled study was planned. Twenty-two partially edentulous patients of which there were 14 men and 8 women had 59 two-stage dental implants inserted into lower jaw. Twenty-eight of them were inserted by two-steps flapless method (control) and 31 were installed by one-step and with immediate healing abutment connection (test). Implant sides of each group were subdivided into anterior and posterior ones. Periotest values (Periotest Classic, Siemens AG, Bensheim, Germany; at the end of the healing period) and radiographic indices (Autodesk Design Review 2011) have been analyzed at the beginning and the end of the healing period. Evaluation of crestal bone level in the healing period for both groups was performed. Statistical analysis was made by calculating mean values, standard errors, indices of Student's paired *t*-test and Mann–Whitney *U*-test with signification level equal $P < 0.05$.

Results: After an average healing period of approximately 4.9 ± 0.3 months, crestal bone loss for implants in the test and control groups had the following values: for anterior sides 0.683 ± 0.126 and 0.831 ± 0.191 mm ($P > 0.05$), for posterior sides 0.706 ± 0.117 and 0.755 ± 0.226 mm ($P > 0.05$). Values of Mann–Whitney *U*-test were: *U* calculated = 348.5 for anterior sides and 434 for posterior sides ($P > 0.05$). Differences between crestal bone levels of test and control groups do not have significant values. Mean Periotest values were -5.59 ± 0.18 (test) and -5.33 ± 0.33 ($P > 0.05$, control). The gum around healing abutments showed no pathological signs.

Conclusions and clinical implications: The results achieved prove that one-step flapless placement of two-stage dental implants with immediate connection of a healing abutment for the entire healing period does not influence negatively the crestal bone level around implants. The given method permits avoiding of the second surgical step, reducing tissue trauma and rehabilitation time of a patient.

177 | Implant Therapy Outcomes, Surgical Aspects

One-step placement of two-stage dental implants without flap

Presenter: Mostovei A

State Medical and Pharmaceutical University, Chisinau, Republic of Moldova

Co-authors: Mostovei A¹, Topalo V²

¹State Medical and Pharmaceutical University, Chisinau, Republic of Moldova, ²State Medical and Pharmaceutical University, Chisinau, Republic of Moldova

Background: Recent studies have demonstrated the advantages of flapless placement of two-stage dental implants in comparison with the conventional method. The influence of flapless one-surgical-step insertion of implants with immediate healing

178 | Implant Therapy Outcomes, Surgical Aspects

Immediate function of astra implants in the anterior dental arch – 2-year data

Presenter: Neffe BA

Private Practice For Oral Surgery, Lindau/lake Constance, Germany

Co-authors: Neffe BA¹, Noelken R^{1,2}, Kunkel M³, Wagner W²

¹Private Practice For Oral Surgery, Lindau/lake Constance, Germany,

²Clinic for Oral and Maxillofacial Surgery, Medical Center, University Mainz, Mainz, Germany, ³Clinic for Oral and Maxillofacial Surgery, University Hospital Bochum, Bochum, Germany

Background: To overcome the disadvantages of staged implant surgery and treatment, immediate loading concepts as well as flapless surgery approaches have been introduced in recent years. Specifically, promising results in terms of high success rates and remarkable esthetic outcomes have been reported for

implants placed in extraction sockets and immediately loaded via provisional crowns and prostheses restorations.

Aim: The study examined the clinical performance of Astra Tech OsseoSpeed implants and its transgingival components, the preservation of peri-implant soft tissues and dimensions of keratinized mucosa in a one-stage procedure with immediate provisionalization in the anterior dental arch.

Methods: Seventy-one Astra Tech OsseoSpeed implants were inserted in 37 patients. 58 implants were placed into extraction sockets, 13 implants in healed sites. Facial bony defects (19 partial, three total losses of the facial lamella) were reconstructed immediately with autogenous bone chips without raising a flap. All patients received immediate provisionalization. Primary outcome variables were implant success, marginal bone levels and Pink Esthetic Score.

Results: Mean primary stability at time of implant insertion was 24 Ncm; seven further implants had to be excluded because of insufficient primary stability for immediate provisionalization (below 15 Ncm). There were three implant failures (one implant lost, two implants with major bone resorption). Overall cumulative success rate was 95.6%. Mean follow-up for surviving implants was 24 months (range 3–30 months), 65 implants have reached the 2-year follow up. Marginal bone loss averaged about 0.3 mm from the time of implant insertion to the final follow-up. Mean PES ratings improved from 10.3 preoperatively to 11.6 at the final examination. In 81% of the implant sites it was possible to keep the gingival esthetics stable or even to improve it from the pre-operative examination to the final follow-up.

Conclusions and clinical implications: Survival rates and esthetic results suggest proof of principle for immediate function with Astra OsseoSpeed implants. Marginal bone levels show only small adaptive changes within a mean follow-up of 24 months and PES ratings remained largely stable or even improved in the vast majority of patients.

Conscious Sedation for Implant Dentistry – a review of techniques, training and legislative requirements

Presenter: Neil C

Confident Dental Care, Stroud, Gloucestershire, United Kingdom

Co-authors: Neil C^{1,2,3}

¹*Confident Dental Care, Stroud, Gloucestershire, UK,* ²*Sedation Department, Guy's, King's & St Thomas's Hospital, London, UK,*

³*Clinical Lead for Sedation Course, University of Central Lancashire, Uclan, Preston, UK*

Background: Nearly 50% of the UK population express anxiety regarding dental care (Nuttall et al., 2001). Sedation is a technique where drug(s) depress the central nervous system, enabling treatment with continuous verbal contact. Sedation techniques should have a wide safety margin so loss of consciousness is unlikely. Sedation has been advocated for patient comfort in implant procedures lasting 90 min or more (Palmer & Palmer, 1997). Given continued growth in the implant dental field, it is hypothesised that there may be a mismatch in the availability of

implant surgical training vs. accessibility to appropriate conscious sedation techniques training.

Aim: Examine existing evidence to establish suitable sedation techniques for adult dental patients undergoing surgical implant procedures

Investigate training and legislative implications of these sedation techniques for dental practitioners.

Methods: Literature on sedation, relating to implant dentistry was reviewed, considering the evidence relating to the initial research questions: (1) What sedation techniques are most appropriate for adult dental patients undergoing surgical implant related procedures? (2) What are the training and legislative implications of these sedation techniques? Furthermore, an email survey of experts in their field was conducted to supplement the available literature.

Results: A limited number (67 papers) and quality of relevant human clinical trials were identified. Training in basic/standard sedation techniques is readily available to the motivated graduate. However, UK and international courses available for sedation training did not provide easy access to advanced sedation training or clinical experience with alternative/advanced techniques.

Conclusions and clinical implications: Sedation has significant anxiolytic, amnesic benefits for evenplacement of single implants in moderately anxious patients, or in otherwise relaxed patients where their treatment involves grafting procedures or osteotome “malletting” to compress maxillary bone, or manipulate the sinus (Summers, 1994) as this can be unpleasant for the patient emotionally and physically and may be associated with benign paroxysmal positional vertigo (Penarrocha et al., 2001). In the majority of patients requiring sedation for implant related surgery, intravenous Midazolam is the method of choice. Some patients may not be adequately relaxed using this technique, so various alternative/advanced techniques have been developed. Advanced techniques may work very well in the hands of the expert(s) who developed them, but provision of both published evidence and access to training to disseminate these techniques to appropriately trained and experienced dental sedationists wishing to develop their skills are presently both insufficient.

Maintenance of marginal hard and soft tissue support at immediately provisionalized osseospeed profile implants – 1-year results

Presenter: Noelken R

Private Practice For Oral Surgery, Lindau/lake Constance, Germany

Co-authors: Noelken R^{1,2}, Neffe BA¹, Kunkel M³, Wagner W²

¹*Private Practice For Oral Surgery, Lindau/lake Constance, Germany,*

²*Clinic for Oral and Maxillofacial Surgery, Medical Center, University Mainz, Mainz, Germany,* ³*Clinic for Oral and Maxillofacial Surgery,*

University Hospital Bochum, Bochum, Germany

Background: To overcome the disadvantages of staged implant surgery and treatment, immediate loading concepts as well as

flapless surgery approaches have been introduced in recent years. Specifically, promising results in terms of high success rates and remarkable esthetic outcomes have been reported for implants placed in extraction sockets and immediately loaded via provisional crowns and prostheses.

Aim: In the anterior maxilla the extraction socket anatomy is sloped in a lingual to buccal direction and the placement of a regular implant is not optimal. A dental implant with a sloped marginal contour, OsseoSpeed Profile (Astra Tech AB, Mölndal, Sweden), has been developed to optimize implant placement in such situations.

The study examined the clinical performance of Astra Tech OsseoSpeed Profile implants and its transgingival components in a one-stage procedure with immediate insertion and provisionalization in the anterior maxilla.

Methods: Eighteen OsseoSpeed Profile implants were inserted in 13 patients. All implants were placed immediately into extraction sockets. Facial bony defects (one total, seven partial losses of facial lamella) were reconstructed immediately with autogenous bone chips without raising a flap. All patients received immediate prosthetic restorations. Primary outcome variables were implant success, marginal bone levels and Pink Esthetic Score.

Results: Mean primary stability at time of implant insertion was 24 Ncm; three further implants had to be excluded because of insufficient primary stability for immediate provisionalization (below 15 Ncm). Mean follow-up was 12 months (range 11–14 months). There was one implant loss. Cumulative survival rate according to Kaplan–Meier was 94.4%.

Marginal bone level remained stable from the time of implant insertion to the final follow-up. In 81% of the implant sites it was possible to keep the gingival esthetics stable or even to improve it from the preoperative examination to the final follow-up.

Conclusions and clinical implications: Results of survival rate, marginal bone stability and esthetic improvement suggest proof of principle for immediate provisionalization of Astra OsseoSpeed Profile implants.

181	Implant Therapy Outcomes, Surgical Aspects
-----	--

Atraumatic implant explantation, is it possible?
Description of a novel technique and a case series study

Presenter: Orive G

Private Practice in Implantology and Oral Rehabilitation, Vitoria, Spain

Co-authors: Anitua E, Orive G

Private Practice in Implantology and Oral Rehabilitation, Vitoria, Spain

Background: In many situations, although the implant is successfully osseointegrated, it must be removed due to an incorrect inclination, infection or the impossibility to be rehabilitated.

Aim: This study reports a new approach for implant extraction. The new technique facilitates extraction in a convenient, fast and atraumatic way preserving the walls of the alveolar housing intact and allowing the placement of a new implant during the same surgical time.

Methods: The new BTI extraction kit consists on a new wrench that allows a counter torque force of 200 Ncm (the wrench breaks back at that force and alerts us when that value is exceeded), an internal connection extractor, an extractor for external connection, and a set of ratchet handle extension pieces to adapt into different clinical situations. In this study, a total of 200 cases showing extraction of different types of implants using the BTI extraction kit are reported.

Results: All implants could be removed using the BTI extraction kit. The extraction torque ranged from 80 to 200 Ncm. In those cases in which implant removal torques exceeded 200 Ncm, a 2 mm depth incision was done using a new set of atraumatic trephines and the extractor with the aim of avoiding too high counter torque forces. The small trephine incision around the implant was enough to reduce the removal torque by half. In 20 cases a new implant was placed in the extraction sites.

Conclusions and clinical implications: The possibility of extracting osseointegrated implants opens new doors in oral implantology. The new extraction kit allows dentists to retreat cases and improve the final results, achieving the best outcomes for patients.

182	Implant Therapy Outcomes, Surgical Aspects
-----	--

Therapy for severely resorbed alveolar crests with zimmer one-piece implants

Presenter: Palancioglu A

Department Of Oral and Maxillofacial Surgery, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Palancioglu A¹, Kirli I¹, Can T¹, Cakarar S¹, Mutlu D², Yaltirik M¹, Keskin C¹

¹Department Of Oral and Maxillofacial Surgery, Faculty of Dentistry, Istanbul University, Istanbul, Turkey, ²Department of Prosthodontics, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Background: Atrophy is most severe during the first month of postextraction in the anterior maxilla and mandible with the degree of horizontal bone resorption being nearly twice as high as that of vertical bone resorption. The loss of the buccal alveolar plate, following tooth extraction may lead to palatal positioning of the implants and causes aesthetic problems. To recover this problem, there are many options, such as preprosthetic reconstructive surgery or immediate one-piece implant placement.

Aim: The aim of this study was to evaluate prosthetic and functional rehabilitation by using Zimmer[®] One-Piece Implants (Winterthur, Switzerland) for severely resorbed alveolar crests.

Methods: Advantage of one-piece implants is their narrow diameter that provides to use them in severely resorbed crests without any augmentations. In this study, we treated six patients with 12 Zimmer[®] One-Piece Implants. Full crown preparations were performed following prosthodontic guidelines restoring both single teeth and multiedentulous situations.

Results: Survival rate of therapy with Zimmer One-Piece Implants[®] on severely resorbed crests is 100%, after up to 1 year of loading.

Conclusions and clinical implications: Some surgical techniques have been proposed aiming both to aid the prosthetic rehabilitation and to increase the bone mass. However, some complications

are associated with these procedures, such as: exposition and/or severe resorption of the bone graft, fractures, fistulas and sensorial defects. Within the limit of the present study, we have been suggested one-piece small diameter implant placement, as it would reduce the time period and the number of surgical intervention and yield higher patient satisfaction. High implant survival rate and favorable tissue response of the one-piece implant can be recommended for clinical use.

183 | Implant Therapy Outcomes, Surgical Aspects

Retrospective study of implants with a moderately rough surface

Presenter: Petttersson P
Colosseumkliniken, Mölndal, Sweden
Co-authors: Petttersson P
Colosseumkliniken, Mölndal, Sweden

Background: A moderately rough implant surface (TiUnite) was introduced on the market several years ago demonstrating osseointegrative properties and facilitating excellent bone response in the early healing phase. However, most studies report on the short-term outcome with this implant surface.

Aim: The aim of the current mono-centric study was to retrospectively evaluate bone level changes and survival for oxidized titanium implants with a moderately rough surface, all placed by a single dental practitioner.

Methods: Three hundred and forty-four (Replace Select tapered, Nobel Biocare) moderately rough implants were placed in 112 consecutively included patient, treated between 2003 and 2007. The patients received in total 148 fixed prosthetic reconstructions of which 53% were partial restorations, 32% single tooth restorations, 13% full-arch restorations and 3% were connected to natural teeth. The majority of implants (278) were placed in the maxilla and 66 implants in the mandible applying a 2-stage surgical technique for 85% of the implants. Most implants (89%) were placed in sites where the tissues had healed for 6 weeks or more. Eleven percentages were placed in extraction sockets. Marginal bone level was evaluated from radiographs taken at implant insertion and then yearly thereafter. In this retrospective analysis of radiographic results and implant survival with a mean follow-up of 3 years and 4 months (range 2.08 years – 6.75 years) are summarized.

Results: During the study period 26 patients were withdrawn due to death/serious illness (unrelated to the implant treatment), poor compliance or due to move away from the area. One implant failed 4 months after insertion, resulting in a cumulative survival rate of 99.7%. The mean marginal bone remodeling during the first year of function was -0.65 mm (SD 1.67, $n=179$), from implant insertion to 2-year follow-up -0.32 mm (SD 2.19, $n=187$), from implant insertion to 3-year follow-up -0.43 mm (SD 2.34, $n=151$), from implant insertion to 4-year follow-up 0.07 mm (SD 1.87, $n=93$) and from implant insertion to 5-year follow-up -0.11 mm (SD 1.73, $n=54$). No adverse events were reported during the study period, other than the one implant failure.

Conclusions and clinical implications: The results from this retrospective study show that implants with moderately rough surface

(TiUnite) maintain stable marginal bone levels over time and high survival rates.

184 | Implant Therapy Outcomes, Surgical Aspects

2 years follow-up with Atratech Osseospeed rehabilitation and Straumann Bone Ceramic of patients with implant failure by perimplantitis

Presenter: Piemontese M
University of Seville, Seville, Spain
Co-authors: Piemontese M^{1,2}

¹University of Seville, Seville, Spain, ²Department of Clinical Specialistic and Dental Sciences, Politechnic University of Marche, Acona, Italy

Background: Peri-implant diseases are inflammatory conditions that affect the soft and hard supporting tissues around implant fixtures and finally led to failure.

Aim: The aim of this study was to evaluate the outcome of a surgical procedure based on removing of dental implant lost for peri-implant diseases immediately followed by Atratech Osseospeed rehabilitation and bone reconstruction with use of Straumann Bone Ceramic.

Methods: The 20 subjects involved in this study presented clinical signs of peri-implantitis and implant mobility at one or more dental implants (i.e. ≥ 10 mm pockets, bleeding on probing and/or supuration and radiographic evidence of ≥ 7 mm bone loss). The patients were treated with a surgical procedure based on removing the implant lost and pocket granulation tissues. Atratech Osseospeed were placed and the peri-implant bone defect were reconstructed with Straumann Bone Ceramic mixed with blood using submerged technique. Routine clinical assessments and intraoral radiographs of all implants were performed and then assessed by a blinded clinician who had not been involved in the treatment.

Results: The prosthesis (cemented or screw-retained) was placed within the 8 months post-surgery. The mean RFA values increased between the moment of insertion (66 ± 7) and the 8-month post-surgery (79 ± 8). The Mean marginal bone level at the moment of provisional loading was 0.0 ± 0.18 mm. The 2-year cumulative survival rate was 100%. At 2 years mean bone loss was $-0.47 (\pm 0.55)$ mm.

Conclusions and clinical implications: Within the limitations of this clinical study Atratech Osseospeed implants placed with Straumann Bone Ceramic to correct bone defects and gingival bump could be successfully used for the immediate rehabilitation of implant lost due to peri-implantitis.

185 | Implant Therapy Outcomes, Surgical Aspects

One-stage implant surgical protocol with immediate soft tissue graft

Presenter: Torres JMP
Clínica Pinheiro Torres, Porto, Portugal
Co-authors: Torres JMP, De Sousa RB
Clínica Pinheiro Torres, Porto, Portugal

Background: With the increasing popularity of one-stage dental implants in fresh sockets, came the need to create protocols

specifically for single-stage surgery. This single surgical protocol shows that with proper implant positioning and immediate provisional restoration, the buccal gingival level can be maintained in association with connective tissue grafting, regardless of the initial gingival biotype, using a minimally invasive technique with virtually no need for flaps or sutures. Nevertheless, careful patient selection and treatment planning, as well as spotless execution by skillful clinicians, are required to achieve a successful result.

Aim: The aim of this report is to present a one-stage dental implant surgical protocol for highly demanding cases with the use of an immediate implant placement with soft tissue graft and immediate restoration. This technique optimizes implant placement and soft tissue esthetics while providing the patient with an immediate fixed restoration.

Methods: Thirteen implants were placed in esthetically demanding sites in 13 patients (six women, seven men; age range of 20–59 years, mean 37.7 years, nonsmokers), following a one-stage approach. All implants were placed immediately after extraction. Provisional titanium ($n = 11$) and zirconia abutments ($n = 2$) were used, and a provisional crown immediately placed. All patients were clinically observed at 1, 2, 3, 4, 6, 12, 18, and 24 months, and photographs were made perpendicularly to the facial aspect of the teeth at abutment placement to record soft tissue changes.

Results: Thirteen implants in total were evaluated to present date. Two over a period of 6 years, three over 5 years, two over 4 years, four over 3 years and two over 1 year. All implants were successfully osseointegrated and definitive restoration was placed after 4 months. For all cases, the gingival level remained stable at 24 months. Meaning, no significant soft tissue volume reduction was observed.

Conclusions and clinical implications: Within the limits of this study, this protocol seems to be reliable and to allow above-average soft tissue outcomes, together with immediate patient satisfaction.

Dental, Leuven Belgium) combined with the Navigator-System™ (Biomet 3i™, Florida, USA) using tooth supported surgical guides. All implants (Biomet 3i NanoTite™) were inserted in a flapless approach and immediately restored with prefabricated splinted provisional restorations. Post-operatively pick-up impressions were taken and implant positions of master casts were matched with the pre-operative casts. Implant deviations were evaluated with a 3-dimensional optical laser scan providing distances and angulations between implants.

Results: The deviation between preoperative and postoperative implant position along the x-axis amounted to a mean value of 0.27 mm (SD: ± 0.19 , min = 0.04 mm, max = 0.6 mm). The respective values were 0.15 (SD: ± 0.13 mm, min = 0 mm, max = 0.34 mm) in the y-axis and 0.28 mm (SD: ± 0.19 mm, min = 0.02 mm, max = 0.59 mm) in the z-axis. Rotational deviation of the implants was 14° (SD: ± 11.6 min = 0.09° , max = 36.47°). The mean total displacement was 0.46 mm (SD: ± 0.21 mm, min = 0.09 mm, max = 0.85 mm).

Conclusions and clinical implications: The results of this pilot study demonstrated precise transformation of implant position by means of CT-based planning and transmucosal implant insertion. The deviation at the abutment level was comparable to recently published data (Vasak et al. 2011). Further studies are needed to identify appropriate measurement techniques to evaluate precision of 3-dimensional planning systems.

Vasak, C., et al. (2011). Computed tomography-based evaluation of template (NobelGuide)-guided implant positions: A prospective radiological study. *Clinical Oral Implants Research*. Jan 18, 2011. doi: 10.1111/j.1600-0501.2010.02070.x. [Epub ahead of print]

187	Implant Therapy Outcomes, Surgical Aspects
-----	--

A prospective pilot study of the use of short implants to obviate the need for sinus augmentation: preliminary results

Presenter: Platzer S

Co-authors: Platzer S, Bertha G, Heschl A, Clar V, Wegscheider WA, Wimmer G, Lorenzoni M

Department of Dentistry and Maxillofacial Surgery, Division of Prosthodontics, Restorative Dentistry, Periodontology and Implantology, Graz, Austria

Background: Sinus augmentation procedure is frequently needed to allow the placement of dental implants in posterior atrophic maxillae. From a patient's point of view a functional fixed prosthesis without the need of augmentation procedures would be desirable, thus reducing the risk of complications and patient's discomfort without increased risk of implant failure. The use of short and wide implants (Renouard & Nisand 2005) has been introduced as an alternative technique.

Aim: The aim of this prospective pilot study is to evaluate marginal bone level changes, implant success and survival rates of short implants (7 mm) placed into maxillary sites exhibiting minimal bone height (6–9 mm) requiring sinus augmentation according to standard protocols.

Methods: A total of 11 patients (10 female, 1 male) participated in this prospective pilot study. All patients exhibited a preoperative bone height of 6–9 mm and were treated in a submerged

186	Implant Therapy Outcomes, Surgical Aspects
-----	--

Three-dimensional accuracy in guided implant insertion: a prospective pilot study

Presenter: Platzer S

Department of Dentistry and Maxillofacial Surgery, Division of Prosthodontics, Restorative Dentistry, Periodontology and Implantology, Graz, Austria

Co-authors: Platzer S, Bertha G, Heschl A, Clar V, Wegscheider WA, Wimmer G, Lorenzoni M

Department of Dentistry and Maxillofacial Surgery, Division of Prosthodontics, Restorative Dentistry, Periodontology and Implantology, Graz, Austria

Background: Proper planning before implant placement and its exact intraoperative transfer are keys for successful implant supported rehabilitation of partially or totally edentulous patients.

Aim: The aim of this study was to evaluate the deviation between planned implant position preoperatively transformed to a cast and actual postoperative implant position using an optical laserscan.

Methods: A total of five patients, receiving 15 implants, were examined. The planning software was SimPlant 12.0 (Materialise

approach. The implants used in this study were Biomet 3i™ NanoTite™ parallel walled external connected implants (4/7 and 5/7 mm). The preliminary data were collected at insertion (0 months), reentry (3 months) and delivery of restorations (5 months). Additionally a new discomfort index (VAS) was evaluated during the postoperative period.

Results: A total of 11 patients (10 female, 1 male) were treated with 22 short implants in the posterior maxilla. The dimensions of the inserted implants were 5/7 mm in 8 cases and 4/7 mm in 14 cases. The mean bone level at the time of surgery amounted to 0.04 mm (min: -1.27 mm, max: 0 mm, SD: +0.196 mm). The respective data were 0.15 mm (min: -1.36 mm, max: 0 mm, SD: +0.4 mm) 3 months postoperatively and -0.58 mm (min: -2.02 mm, max: 0 mm, SD: +0.732 mm) at the time of restorative treatment (5 months postop). Periotest values at re-entry surgery demonstrated a mean of -3.4 PTV (min: -7, max: 2 SD: +2.7). One implant was lost 5 months after surgery. The mean discomfort index was 1.4 (SD: 0.3; min: 1.1; max: 2.3) and demonstrated little invasiveness of the surgical procedure.

Conclusions and clinical implications: Within the limits of this pilot study placement of short implants can be simpler, cheaper and less invasive without jeopardizing implant integration. Further studies are needed to evaluate the long-term success rate of short implants in the atrophic posterior maxilla compared with standard protocols.

Renouard, F., et al. (2005) Short implants in the severely resorbed maxilla: A 2-year retrospective clinical study. *Clinical Implant Dentistry Related Research* 7 (Suppl 1): S104-S110.

188 | Implant Therapy Outcomes, Surgical Aspects

Influence of mucosal tissue thickening on the crestal bone stability around bone level implants. A pilot study

Presenter: Puisys A

Vilnius Implantology Center, Vilnius, Lithuania

Co-authors: Puisys A^{1,3}, Linkevicius T^{1,2,3}, Vindasiute E^{1,3}, Maslova N^{1,3}

¹Vilnius Implantology Center, Vilnius, Lithuania, ²Vilnius University, Vilnius, Lithuania, ³Vilnius Research Group, Vilnius, Lithuania

Background: Mucosal tissue thickness is an important factor in the etiology of early crestal bone loss around dental implants. Few animal studies have shown that thin mucosal tissues during implant placement may influence a greater postoperative crestal bone loss due to the biologic width formation. Recently, a prospective controlled clinical study reported that if tissue thickness at the crest was 2 mm or less, all implants, irrespectively to their position to the bone, developed 1-1.5 mm crestal bone loss within 1-year of follow-up. Mucosal tissue thickness becomes very important in short implant placement also. In regions with a very limited bone height, when only 6 mm or less implant can be placed, every part of the millimeter of the bone support is significant for the survival and stability of the implant. Sometimes when a limited bone height is accompanied on the thin tissue biotype, the risk to loose crestal bone around short implants is very high.

Aim: To test how implants maintain crestal bone stability after thickening of the peri-implant tissues with allogenic membrane.

Methods: This study evaluated 12 implants (Bone level implants, Institut Straumann AG, Basel, Switzerland) in seven patients. Mucosal tissue thickness was measured with periodontal probe during implantation. All patients in the study had thin mucosal biotype (<2 mm) and were divided into two groups: control (no tissue thickening during implantation) and test (mucosal tissue thickening using allogenic membrane during one stage implant placement). Dental radiographs were taken right after the surgery and 2 months postoperative and used for the evaluation of the crestal bone height (mesially and distally) according to the neck of the implant. The crestal bone loss in 2 months postoperative period was determined for every implant.

Results: Crestal bone loss after two months of observation: control group mesially 0.26 ± 0.17 and 0.70 ± 0.46 mm distally, test group 0.10 ± 0.22 mm mesially and 0.21 ± 0.23 mm distally.

Conclusions and clinical implications: This clinical pilot study compared crestal bone loss around implants with thin (control group) mucosal tissues and thin, but thickened (test group) with allogenic membrane during implantation. Greater crestal bone loss was observed when mucosal tissues were thin. Soft tissue thickening procedures during implantation could be important because they might reduce the postoperative crestal bone loss, which is a crucial factor in predictable implant function and esthetics.

189 | Implant Therapy Outcomes, Surgical Aspects

Post-extractive single implant with immediate provisionalisation: 92 consecutive cases

Presenter: Redemagni M

Studio Redemagni, Private Practice, Lomazzo (co), Italy
Co-authors: Redemagni M¹, Garlini G¹, D'amato S²

¹Studio Redemagni, Private Practice, Lomazzo (co), Italy, ²Head and Neck Dpt-2nd University of Naples, Napoli, Italy

Background: Immediate loading of endosseous root form implants has been described in the literature for eliminating the 3- to 6-month healing period. The technique has been described in combination with mandibular bar-retained overdentures, complete arch implant-supported prostheses, and partial edentulism. Whereas most clinical studies have retrospectively examined implant survival rate after immediate loading, a few initial studies of immediate implant loading have shown clinical results similar to the conventional 2-stage loading protocol. Histologic evaluation from human beings regarding implants that received immediate loading has shown evidence of osseointegration, but actually, according to the dental literature, we have a few numbers of studies regarding the single implant immediate loading.

Aim: The aim of the present retrospective study was to evaluate the immediate nonfunctional loading of 92 single post-extractive Xive implants (Dentsply, Friadent, Mannheim, Germany) placed by three oral surgeons between January 2003 and January 2009.

Methods: The length of the implants ranged from 9.5 and 15 mm, and between 3 and 5.5 mm of diameter according to the different clinical situations. The study population, which

was comprised of 76 patients (31 males and 45 females) who needed post extractive implant insertion, was selected from consecutive patients seeking treatment in the Author's private offices. All the postextractive implants were loaded with a screw-retained provisional crown at the same time of the surgery and with a full ceramic, metal-ceramic or zirconia crowns after 6 months. The patients were visited at regular intervals: 1 week and 1, 6, 12, months after the surgery and then every 6 months from at least 1 to 7 years for the older cases.

Results: All the patients healed without complications. All the implants were stable at every subsequent follow-up examination. No implant failed during the observation period. The cumulative survival rate after 7 years was of 100%. The marginal bone loss at 6 month after surgery was, on an average, found to be 0.93 mm as compared with the radiograph made immediately after surgery. The corresponding marginal bone loss after 1 year was on average of 1.49 mm.

Conclusions and clinical implications: This treatment approach seems to provide high level of survival rate and good aesthetic result. The extraction of the tooth and the subsequent implant insertion is quite complex and it must be performed by skilled oral surgeons. However, a meticulous case selection is still needed, with particular attention to primary implant stability, host and occlusal factors.

190	Implant Therapy Outcomes, Surgical Aspects
-----	--

Use of short implants (6 mm) in fixed partial dentures in posterior sites. A prospective clinical study with a 1-year follow up

Presenter: Ricci E

University, Bologna, Italy

Co-authors: Ricci E¹, Rossi F¹, Marchetti C¹, Botticelli D²

¹*University, Bologna, Italy,* ²*Ardek, Rimini, Italy*

Background: In replacing missing teeth, osseointegrated implants have become a viable option, especially in the restoration of partial edentulism. Such situations may require additional and complex surgical interventions to augment insufficient bone volume. An alternative therapy in situations with limited amounts of bone available is the installation of short implants, simplifying the restoration of posterior segments.

Aim: To evaluate the clinical and radiographic outcome and the survival rate of two 6 mm long implants supporting a fixed partial denture (FPD) placed in the posterior sites, in partially edentulous patients with a 1-year follow-up.

Methods: Forty SLActive Straumann short (6 mm) implants were placed in 20 consecutively treated patients. Eleven implants, 4.8 mm in diameter, and 29 implants, 4.1 mm in diameter, 14 mandibular and 26 maxillary were installed, supporting a 2- or 3-element FPD. Implants were loaded after 6 weeks of healing. Implant survival rate, marginal bone loss and resonance frequency analysis (RFA) were evaluated at different intervals. The clinical crown/implant ratio was also calculated.

Results: None of 40 implants were lost before loading. Hence, the survival rate at 1 year before loading was 100%. No further

technical or biological complications were encountered during 1-year follow-up. The mean marginal bone loss before loading was 0.35 ± 0.39 mm. After loading, the mean marginal bone loss was 0.18 ± 0.29 mm at the 1-year follow-up. The RFA values increased between insertion (70.2 ± 9) and the 6-week evaluation (74.8 ± 6.1). The clinical crown/implant ratio increased with time from 1.3 at the delivery of the prosthesis to 1.6 after 1 year of loading.

Conclusions and clinical implications: Two splinted short implants (6 mm) with a moderately rough surface loaded early (after 6 weeks) during healing yielded high implant survival rates and moderate loss of bone after 1 year of loading. Longer observation periods are needed to draw more definite conclusions on the reliability of short implants supporting FPD, in order to avoid complicated bone augmentation procedures.

191	Implant Therapy Outcomes, Surgical Aspects
-----	--

Survival rates of implants with a highly crystalline phosphate enriched surface – a literature review

Presenter: Rieben AS

Nobel Biocare Services AG, Kloten, Switzerland

Co-authors: Rieben AS¹, Alifanz J², Jannu AS²

¹*Nobel Biocare Services AG, Kloten, Switzerland,* ²*Nobel Biocare USA, Mahwah, USA*

Background: Dental implants with a highly crystalline, phosphate enriched surface that are manufactured by spark anodization (TiUnite[®]) have been introduced to the market several years ago. The surface is moderately rough and has osseointegrative properties that promote osseointegration.

Aim: The present literature-based research aimed to analyze the cumulative survival rate of implants exhibiting this specific surface.

Methods: The present research reviewed clinical articles published between January 2003 and November 2010 in peer-reviewed journals and listed in MEDLINE. Articles were considered when they met the following inclusion criteria: (i) 10 patients or more, (ii) all patients followed 1-year or more, (iii) radiographic assessment, (iv) written in English language, (v) implants with a highly crystalline, phosphate enriched surface (TiUnite[®]). Reported Cumulative Survival Rates were extracted and an overall weighed mean on implant level was calculated.

Results: The search yielded 6912 publications whereof 64 articles met the inclusion criteria. These articles reported on 6562 implants placed in 2396 patients and covering a follow-up period of up to 5 years. The weighed mean for cumulative survival rate at the 1-year follow-up was calculated to 98.5% (62 studies, 6302 implants, 2333 patients), at the 2-year follow-up to 98.4% (24 studies, 2166 implants, 765 patients), at the 3-year follow-up to 97.5% (15 studies, 1406 implants, 558 patients), at the 4-year follow-up to 94.6% (five studies, 447 implants, 133 patients), and at the 5-year follow-up to 98.3% (four studies, 456 implants, 185 patients).

Conclusions and clinical implications: This analysis showed very high survival rates of implants with highly crystalline phosphate enriched surface that are manufactured by spark anodization (TiUnite[®]) indicating that these implants are a safe and viable treatment option.

Survival and success rate of implants in augmented maxillary sinus with Bio oss after 2 years

Presenter: Rokn AR

Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran

Co-authors: Rokn AR, Ghohroudi AAR, Hajhemati E

Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran

Background: It is not uncommon for the placement of endosseous dental implant in the maxillary jaw region to be complicated by the pneumatization of the maxillary sinus. When this occurs the residual bone between the floor of the sinus and crestal ridge is inadequate for the placement of implant. Maxillary sinus lift is a surgical procedure performed to increase the volume of bone mass so that dental implants can be placed in the maxillary arch. Several materials have been suggested to be used for this procedure.

Aim: The aim of this study is the comparison of the survival and success rate of the implants placed in transplanted sinuses with Bio oss and implants in native bone after 2 years of loading.

Methods: Twenty-five implants of reconstructed sinuses with BioOss and 30 implants placed in posterior of maxilla, which had enough bone and no need for sinus augmentation PPD – BOP and plaque indexes in both groups measured and bone loss was calculated by the aid of standard OPG radiographs, right after the surgery and during the study, in both groups. Also the survival rate of implants in both was compared groups.

Results: In the present study the amount of bone loss around the implants and the survival rate of implants inside and outside of sinus is the same. PPD–BOP and plaque indexes in both groups had no significant difference.

Conclusions and clinical implications: After 2 years of implant loading in two groups all the indexes include PPD–BOP and bone loss and survival rate were the same and no significant difference were detected. It means that Bio oss alone is a good bone substitute for sinus augmentation, and the necessary time for new bone maturation in this method is 9 months. For long-term evaluation the cases will be reported after 5 years.

Efficacy of the re-adapted cortical bone plate in implant surgery

Presenter: Sahin S

Dep. Of Periodontology, Gulhane Military Medical Academy, Ankara, Turkey

Co-authors: Sencimen M¹, Gulses A¹, Altug HA¹, Bayar GR¹, Ozkan A¹, Sahin S²

¹Department of Oral & Maxillofacial Surgery, Gulhane Military Medical Academy, Ankara, Turkey, ²Department of Periodontology, Gulhane Military Medical Academy, Ankara, Turkey

Background: Rehabilitation of the jaws via endosseous implants after surgical removal of cysts or tumours is a challenging procedure due to the lack of adequate residual bone volume.

Autogenous bone grafting, distraction osteogenesis and biomaterials are widely used to improve the quality and quantity of bone. The technique proposed herein allowed obtaining an adequate bone volume for implant surgery.

Aim: The present study reports the treatment of partially edentulous mandible via endosseous implants following the reconstruction of the enucleated cyst cavity by re-adapting the removed cortical bone plate.

Methods: Dentigerous cyst of a 17-year-old male patient was enucleated by accessing the lesion via removal of the adjacent bone cortex. The cortical bone plate was readapted into its original position and secured with titanium mini plates. Six months after enucleation the radiologic assessment revealed that the osseous healing was totally completed and two dental implants were inserted in the edentulous area.

Results: The readaptation of the bone cortex allowed us to obtain a prosperous osseous healing, minimized the bone loss secondary to cyst removal and resulted in a successful prosthetic rehabilitation via endosseous implants.

Conclusions and clinical implications: The treatment of partially edentulous mandible via endosseous implants following the reconstruction of the enucleated cyst cavity by readapting the removed cortical bone plate is a safe, simple and low costing procedure.

Surgical therapy of advanced ligature-induced peri-implantitis defects. Cone-beam computed tomographic and histologic analysis

Presenter: Sahn N

Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Co-authors: Sahn N, Mihatovic I, Becker J, Schwarz F

Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Background: While intraoral radiography has been routinely used to evaluate bone level changes after surgical therapy of peri-implantitis, cone-beam computed tomography has not been validated for this indication.

Aim: To evaluate radiographic (RBG) (i.e. cone-beam computed tomography, 90 kV, 3.1 mA, voxel size 0.2 mm) and histologic bone levels (HBL) after surgical therapy of advanced ligature-induced peri-implantitis in dogs employing (i) a particulated bone filler (NBM) (\pm rhBMP-2) at the intrabony-(i) (all defects), and (ii) an equine bone block (EB) (\pm rhBMP-2) or implantoplasty (P) at the supracrestal (s) component.

Methods: Defect sites were randomly allocated in a split-mouth design to the following groups: (1) NBM (i)/EB (s) (i.e. EB and EB + rhBMP-2), or (2) NBM (i)/P (s) (i.e. P and P + rhBMP-2). The sites were left to heal in a submerged position for 12 weeks.

Results: Mean HBL values were highest in both EB + rhBMP-2 and P + rhBMP-2 groups, reaching statistical significance between EB and EB + rhBMP-2 groups. Within group comparisons

revealed a close correlation between RBL and HBL values in both P and P + rhBMP-2 groups.

Conclusions and clinical implications: It was concluded that (i) all groups failed to predictably obtain complete defect resolution, (ii) rhBMP-2 soak-loaded EB and NBM may have the potential to improve HBL, and (iii) RBL closely correlated with HBL, but EB scaffolds may impair the precision of CBCT scans.

Changes in stability during healing of immediately loaded dental implants

Presenter: Simunek A

Department of Dentistry, Charles University in Prague, Faculty of Medicine, Hradec Kralove, Czech Republic

Co-authors: Simunek A¹, Kopecka D¹, Brazda T¹, Strnad J², Capek L³, Slezak R¹

¹*Department of Dentistry, Charles University in Prague, Faculty of Medicine, Hradec Kralove, Czech Republic,* ²*Lasak Ltd., Prague, Czech Republic,* ³*Department of Mechanical Engineering, Technical University of Liberec, Liberec, Czech Republic*

Background: Implant stability is considered one of the most important parameters in dental implantology. Its importance increases further in connection with modern treatment protocols that are generally known as the accelerated implant treatment.

Aim: To monitor the development of stability of immediately loaded implants during initial healing period.

Methods: A total of 90 interforaminally placed implants with an alkali-treated surface were considered. The stability of each implant was determined at baseline and 1, 2, 3, 4, 5, 6, 8, and 10 weeks after the surgery using resonance frequency analysis (RFA) and damping capacity measurement. The development of stability in view of dip of stability as well as stability development depending on primary stability (ISQo) was evaluated. For this purpose, the implants were divided into three groups: Group L (ISQo < 68), Group M (ISQo 68–72), and Group H (ISQo > 72). Stability curves were created for each group and they were statistically analysed. Results of the measurement of implant stability using RFA and damping capacity were compared. The Wilcoxon paired test and correlation coefficient were employed.

Results: The most pronounced dip of ISQ values occurred 1 week after implant placement with the mean decrease of 2.2 ISQ. During the 10-week experiment, stability rose by 5.5 ISQ in Group L, by 1.3 ISQ in Group M, and dropped by 1.8 ISQ in Group H ($P < 0.001$). The correlation coefficient between RFA and damping capacity measurement was $r = -0.25$ ($P < 0.001$) and thus the correlation of both was very low.

Conclusions and clinical implications: Implants with low primary stability showed a significant increase in stability during healing, while the high primary stability implants lost part of their stability over time. It may be hypothesized that shallow dip of stability localized in early weeks of healing may be attributed to alkali-treated surface of the implants, which accelerates the osseointegration.

Immediate single implant treatment: preliminary results of 10 consecutive cases

Presenter: Slagter K

UMCG, Groningen, The Netherlands

Co-authors: Slagter K, Meijer H, Vissink A, Raghoobar G

UMCG, Groningen, The Netherlands

Background: Immediate placement and provisionalization of single-toothimplants in the aesthetic zone has been shown highly predictable in terms of implant survival. In terms of the response of the peri-implant tissues additional assessments are needed.

Aim: To assess the response of the peri-implant tissues following immediate single implant treatment in the anterior maxilla.

Methods: Ten consecutive patients with a single failing maxillary anterior tooth were included (adjacent teeth were present).

The failing tooth was removed atraumatically, followed by immediate placement of an implant (NobelActive implant system) in the extraction socket without flap elevation. The gap between the implant and the buccal bone plate was filled with autologous bone and a xenograft (Bio-Oss). Next a subepithelial connective tissue graft was placed on the labial side of the implant site. Finally, the implant was provisionally restored with a non-occluding temporary crown which was placed within 24 hours after implant placement. After 3 months the temporary crown was replaced by a full ceramic crown, either retained with a screw or cemented on an individualized abutment. Clinical outcome measures were pocket probing depth, plaque index, bleeding index, soft tissue level, biotype and marginal bone level. Radiographical assessments were done on standardized X-rays. Furthermore standardized photographs were taken. Other outcome measures included, implant survival, patient satisfaction on a visual analogue (VAS) scale, and the aesthetic outcome, using the pink aesthetic score (PES) and white aesthetic score (WES). All measurements were done preoperatively, postoperatively and 6 months after implant placement.

Results: Immediate single implant treatment resulted in stable soft tissues and significantly increased papilla scores up to 6 months after implant placement. A larger gain in papilla volume was observed at the mesial than the distal site of the implant. No peri-implant bone loss was observed within the first 6 months, no implants were lost and patient satisfaction score on the VAS scale was 7.3 ± 1.6 . The aesthetic outcome had a mean total PES of 6.8 ± 0.83 and a mean total WES of 6.3 ± 1.27 .

Conclusions and clinical implications: Within the limitations of this study (6 months evaluation) it can be concluded that, immediate single implant treatment of a single tooth in the anterior maxilla shows favorable results as is obvious from the satisfied patient and good health of the peri-implant tissues. Additional studies are required.

Immediate loading of postextractive implants inserted with a bone supported computer planned guide: six cases

Presenter: Storelli S

Università degli Studi di Milano, Milan, Italy

Co-authors: Storelli S, Amorfini L, Romeo E

Università degli Studi di Milano, Milan, Italy

Background: Immediate loading of full arch fixed prostheses is well validated in the literature. The implementation of computer base planning software may allow to precisely insert the implants were they are needed, speeding up the surgery and allowing the fabrication of a provisional even before the surgery, thus allowing a faster and easier immediate loading. Once this procedure will be validated, the clinicians will have the possibility to offer a substantial change in the rehabilitation of their patients.

Aim: Valuate the reliability of immediate loading of postextractive implants inserted with the help of a computer-generated guide.

Methods: Six patients who needed full-arch restorations were treated. After a conebeam tomography and software planning (Simplant, Materialize), a bone-supported stereolithographic templates were obtained. The study of the models and the bone stereolithographic reconstructions allowed the setting up of the provisionals. After elevating a full thickness flap, the guide was set on the bone and 43 Straumann™ implants were placed in postextractive sites. Eventual postextractive gaps were filled with demineralized bovine bone particles (Bioss). The same day, two maxillary and four mandibular arches received a screw-retained fixed provisional prostheses. After 16 weeks six total screw-retained fixed definitive prosthesis consisting of CAD/CAM titanium framework and composite veneering were delivered to the patients. Implant indexes and standardized radiographs were performed at prosthesis delivery and after 6 and 12 months.

Results: All implants and restorations were still in function after 1 year. No clinical problems were reported. The mean marginal bone loss was measured on the xray comparing the levels at implant insertion and after 1 year of function. Mean MBL was 0.3 mm (SD 0.71) after 1 year in function.

Conclusions and clinical implications: The short-term results indicate this procedure is reliable. This sophisticated technology requires substantially more financial investment and effort but appears superior on account of its potential to eliminate possible manual placement errors and to systematically achieve treatment success. However, further studies are required to confirm the prosthodontic longevity and long-term success of implants placed using computer-assisted techniques.

Immediate implant placement following odontogenic cyst enucleation – a case report

Presenter: Sušić M

Department of Oral Surgery, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

Co-authors: Sušić M¹, Brozović J², Čatić A³, Katanec D¹, Pandurić DG¹

¹Department of Oral Surgery, School of Dental Medicine, University of Zagreb, Zagreb, Croatia, ²Private Dental Office, Split, Croatia³Department of Prosthodontics, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

Background: Odontogenic cysts are among main causes of jaw destruction. Radicular cyst is the most common diagnosis of all odontogenic cysts and a fairly easily diagnosed entity with approximately equal sex distribution. While odontogenic cysts are one of the main causes of jaw destruction, it is mandatory to detect these lesions as early as possible to minimize any necessary surgery.

Aim: The case of a bone defect restoration after a radicular cyst enucleation using guided bone regeneration procedure with immediate implant placements in the first premolar postextraction alveolus and in the first molar region is presented.

Methods: The patient was a 50-year old female with an odontogenic cyst of the first premolar in the right maxilla and a second molar root resorption caused by an impacted third molar. Patient had undergone local anesthesia and the extractions of the maxillary first premolar and second molar with partially resorbed roots were carried out. Enucleation of the cyst was performed after a full-thickness periosteal flap creation and an immediate implant was placed. The remaining bone defect was filled with a xenogenic bone substitute and covered with a bioresorbable collagen membrane. Surgical extraction of the impacted maxillary third molar was performed and immediate implant placement in the postextraction alveolus was performed.

Results: A histopathological analysis was performed on the enucleated specimen which confirmed the diagnosis of a radicular odontogenic cyst. No significant clinical or subjective problems were noted during the interim partial denture wearing period. After a healing period of 6 months, osseointegration of the inserted dental implants was assessed with a resonance frequency analysis. Implant stability quotient mean scores for the first premolar and first molar implants were 74 and 78, respectively. The implants were further used as a base for a fixed partial denture.

Conclusions and clinical implications: The patient exhibited neither clinical nor radiological complications throughout the following 12-month period of clinical monitoring after the final prosthodontic rehabilitation and functional loading of the inserted implants.

Bone resorption after immediate installed dental implants

Presenter: Tai C-Y

National Taiwan University, Taipei, Taiwan

Co-authors: Tai C-Y¹, Jeng M-D², Chen K³

¹*National Taiwan University, Taipei, Taiwan*, ²*Jin-Pin Dental Clinic, Taipei, Taiwan*, ³*Coaching Implant Center, Taipei, Taiwan*

Background: The implant therapy is a generally accepted treatment after extraction of teeth; the benefits of implants are beyond description, but some of the disadvantages including bone loss and esthetic issues may terrify clinicians to place implants at the esthetic region. Immediate implantation can reduce surgical procedures and healing time but the esthetic result is more uncertain than that of delay implantation because of the unpredictable resorption of buccal bone. Some authors proposed the immediate implantation can prevent bone resorption but there is no scientific evidence could support it.

Aim: The purpose of this study is to observe the alveolar bone change around an immediate implant, to investigate the correlation between the thickness of bone and the amount of bone resorption at buccal and lingual sites after 6 months of immediate implantation, and to help clinicians considering esthetic issues for further treatment planning.

Methods: Eleven implants at areas of incisors, canines and premolars were recruited in this study from three private clinics. Implant treatment was determined by the finding in CT scan before extraction, and another CT scan was taken by the same CT device at least 6 months after the immediate implantation without bone graft. The two CT scans were compared at the cervical, middle and apical parts of the implant by Image J to analyze the dimensional change of the buccal and lingual bone.

Results: After the implantation, the resorption of bone at buccal cervical area (0.80 ± 0.80 mm) and buccal middle area (0.62 ± 0.31 mm) of the implants is significant ($P < 0.01$) while the resorption of bone at buccal apical and at lingual cervical, middle, and apical zones of the implants is not significant ($P > 0.05$). There is a significant correlation between the small thickness of bone (< 1 mm) before implantation and nearly no bone left after 6 months at buccal middle site of the implants. The widths of buccal cervical bone of all implants maintain < 1.5 mm, and the heights of buccal bone decrease (0.77 ± 0.49 mm) significantly ($P < 0.01$) after remodeling.

Conclusions and clinical implications: The buccal bone is doomed to resorption; averagely, the cervical part reduces the most. The heights of buccal bone decrease after 6 months so submerging implants 1 mm below the crestal bone is recommended to avoid dehiscence. When the thickness of buccal bone is < 1 mm, it is inappropriate to do immediate implantation without bone graft because of the incidents of fenestration and dehiscence which will cause esthetic and support problems.

Clinical and radiological outcomes of 1- and 2-stage surgical approach: a randomised, controlled, 1-year study

Presenter: Tallarico M

Private Practice, Rome, Italy

Co-authors: Tallarico M, Vaccarella A, Marzi GC

Private Practice, Rome, Italy

Background: One-stage implant placement has been reported to be preferable since it avoids a second surgical intervention and shortens treatment times, but divergent results have been reported.

Aim: The aim of this study was to compare the clinical and radiological outcomes of a 1- vs. 2-stage implant placement procedures.

Methods: Forty-seven patients were randomly allocated to a 1- or 2-stage treatment group immediately after implant placement. A total of 89 TiUnite[®] Brånemark System implants were placed (41 MKIII Groovy[™] and 48 NobelSpeedy[™] Groovy). Twenty-nine patients received 38 1-stage implants and 18 patients received 51 2-stage implants. All implants were early loaded (12 weeks). Primary outcome measures were failures of implants and/or prosthesis, and complications. Secondary outcome measures were pain score and peri-implant bone level changes at implant loading (12 weeks) and at the 1-year follow-up. Intra-oral digital radiographs were taken at implant placement, at 12 weeks and at 1-year.

Results: After 1 year, no drop-outs occurred. In the 1-stage group, two implants (one patient) failed to osseointegrate vs. none in the 2-stage group. Two complications were reported in the 1-stage group vs. only one in the 2-stage group. Four out of five complicated implants occurred in periodontally compromised patients. Two failed implants were not replaced, while all complications were successfully treated and the implants completed the follow-up. At 1 year 97.75% of the implants were osseointegrated. Regarding complications, the 1-stage group showed minor cumulative success rate (89.5%) compared with the 2-stage group (98%), however, no failure of the definitive prostheses were reported, accounting an overall 1-year survival rate of 100%. No statistically significant differences was found for peri-implant bone level changes and pain score between groups ($P > 0.05$).

Conclusions and clinical implications: The results suggest that the submerged technique is not a prerequisite for osseointegration. In selected patients the 1-stage technique can be considered the gold standard, although 1-stage implant placement might be at slightly higher risk for early failures. The implants used seem to be suitable when an immediate/early function is required.

A gold standard technique and material for ridge preservation of immediate loading/placed single dental implant

Presenter: Tallarico M

Private practice, Rome, Italy

Co-authors: Tallarico M, Vaccarella A, Alviani A, Campana V

Private Practice, Rome, Italy

Background: Resorption of the alveolar ridge is common after tooth extraction and represents a clinical challenge for ideal tridimensional implant placement, especially in the aesthetic area, and to achieve primary stability.

Aim: The aim of the present study is to evaluate soft tissue and radiological outcomes of immediate single implants placed and loaded in esthetic sites.

Methods: Five consecutive patients that required an immediate restoration of a fractured and nontreatable upper premolar were recruited for atraumatic tooth extraction, immediate placement/loading of TiUnite[®] Nobel Active[®] (Nobel Biocare AB, Göteborg, Sweden) dental implants according to an appropriate tridimensional bone-to-implant relationship, and ridge preservation procedure performed with Bio-Oss[®] biomaterial (Geistlich Pharma AG, Wohlhusen, Switzerland). Outcome measures were: failures of implants and/or prosthesis, complications, radiographic bone level changes (BLC), implant stability quotient (ISQ), and bucco-palatal distance (BPD) as measured on plaster casts. All measurements were recorded at implant placement/loading and at the 6-months follow-up.

Results: No implant failed to osseointegrate resulting in a cumulative success rate at 6-months of 100%. After 6-months of function, the mean radiographic bone crest resorption was 0.07 ± 0.31 mm (2.35%). Despite an implant insertion torque ≥ 55 Ncm, a moderate initial ISQ value was found at implant placement, subsequently ISQ values increased significantly during the 6 months after placement (73.10 ± 3.21 ; 82.00 ± 1.27 ; $P = 0.0004$). The mean change of BPD after 6-months was 0.25 ± 0.16 mm (2.23%).

Conclusions and clinical implications: These preliminary results from a relatively small sample size suggest that the present technique and materials can be considered a viable treatment option for immediate placement/loading of dental implants in esthetic sites.

Multiple implant placement with surgical guides, success rates and accuracy of surgical guides

Presenter: Tekin U

School of Dentistry Department of Oral and Maxillofacial Surgery, Ege University, Izmir, Turkey

Co-authors: Tekin U¹, Güngör MA², Akay MC¹, Artunç C²

¹*School of Dentistry Department of Oral and Maxillofacial Surgery, Ege University, Izmir, Turkey,* ²*School of Dentistry Department of Prosthodontics, Ege University, Izmir, Turkey*

Background: Implant position is a key determinant of esthetic and functional success. The ideal placement may be difficult in multiple implant procedures. Achieving the goal of ideal

implant position may be affected by case selection, prosthodontically driven treatment planning, site preparation, surgeon's experience and surgical guide use. The use of computer technology in implantology has been a major advance.

Aim: This study aimed to evaluate the clinical effectiveness of surgical guides and describes the requirement of surgical guides in placement of multiple implants.

Methods: A total of seven patients who had multiple implant sides were considered for this study. Implants were planned with the aid of computer technology and 3 D models. The surgical guides were designed with the help of Stentcad 3D implant programme. After 2 year follow-up period all patients were overviewed. All positive and negative aspects of the surgical guides were evaluated and noted.

Results: Thirty-seven dental implants were placed on six patients with surgical guides. The Stentcad 3D implant programme provides a perfect positioning, angulation and depth of implants without disruption of important anatomical structures. The patients had no signs of postoperative sensory changes in the lip or chin region. None of the implants failed to integrate. There has been no complications during the prosthodontic procedures.

Conclusions and clinical implications: Surgical guides of various configuration have been proposed to aid implant placement. The ideal placement of multiple implants can be difficult without surgical guides. The major advantages of using surgical guide are to reduce the duration of implant surgery and complications and to obtain parallelism of implants.

Assessing the evidence in research related to zirconia dental implants

Presenter: Theodosiadi S

Department of Dentoalveolar surgery, Implantology @ Oral Radiology, Dental School, Aristotle University, Thessaloniki, Greece

Co-authors: Theodosiadi S, Lillis T, Veis A

Department of Dentoalveolar surgery, Implantology @ Oral Radiology, Dental School, Aristotle University, Thessaloniki, Greece

Background: It has been shown that Zirconia is a ceramic material that is capable to osseointegrate. Zirconia dental implants have been used in the past decades as an alternative of titanium implants.

Aim: The aim of the present study was the verification of the evidence-based research published in dental journals about zirconia dental implants.

Methods: A systematic search was carried out in Medline during periods 1990–2010 using the following key-words: "dental implants" AND "zirconia" limited in "Dental Journals" and "English language". Studies were classified into reviews (meta-analysis, systematic and narrative), clinical and basic research studies. Clinical studies were further classified into case reports, case series, cross sectional, cohort, case-control and clinical trials. Notices, letters to the editor and summaries of conference abstracts were excluded. Studies about zirconia abutments on titanium implants were excluded as well.

Results: Initial search in Medline yielded 157 publications. Inclusion criteria were met by 47 publications; 32 basic research studies (10 *in vitro* and 22 *in vivo*), 10 clinical studies (six case reports and four cohort studies) and four reviews (three systematic and one narrative). No meta-analysis was identified. Thirty-eight studies were published in journals with impact factor.

Conclusions and clinical implications: There are few long-term studies about clinical success of zirconia dental implants. The major number of the studies was related to the use of zirconia in the form of dental implant abutments. Within the limits of the present study, it can be concluded that there is low evidence based research regarding the use of zirconia dental implants in clinical practice.

204 | Implant Therapy Outcomes, Surgical Aspects

Tissue-level implants in overdenture applications: a 3-year clinical follow-up

Presenter: Thoolen P

Oisterwijkkliniek, Oisterwijk, The Netherlands

Co-authors: Thoolen P, Brouwers J

Oisterwijkkliniek, Oisterwijk, The Netherlands

Background: A straight walled, self-tapping implant, with a 3 mm transmucosal machined collar, was designed to be placed using a one-stage surgical protocol in cases where prosthetic rehabilitation with for example an overdenture is necessary. Thus, a second surgical procedure to uncover the implant is avoided.

Aim: To evaluate clinical performance of tissue-level implants placed in edentulous patients scheduled for treatment with an overdenture.

Methods: Two clinics performed a retrospective analysis with regard to this implant type. All implants placed during 2006 with a radiographic follow-up of at least 1 year were consecutively included in this retrospective analysis. Implants were placed in edentulous maxillae and mandibles. Descriptive statistical analysis of available data was performed, including life table calculations to derive cumulative survival rate (CSR).

Results: Forty-eight (48) patients were treated with 132 implants (Replace Select TC, Nobel Biocare, Sweden). Four implants (3%) were placed in the maxilla and 128 implants (97%) were placed in the mandible. Four implants (3%) were placed in healed sites 9 months after extraction, whereas 128 implants (97%) were placed 3 months after extraction. No bone grafting was performed, either at implant surgery or before the surgery. Surgical techniques included flap surgery only. Final prosthetic delivery was performed at 9 weeks (80%) or 12 weeks postsurgery (20%), depending on the clinical procedure of the respective center. Existing prosthetics were modified to facilitate stress-free healing, during the healing period.

All patients received their permanent prosthetics: 30 overdentures were connected to two implants and 18 were connected to four implants. All overdentures were connected using bar attachments. All patients had dentures in the opposing jaw.

All patients were followed for an average of 34 months (range 20–47 months, SD = 6.0). One of the 132 implants included in the

analysis failed (at prosthetic delivery), resulting in a CSR of 99.2%.

Conclusions and clinical implications: The results of this retrospective study, with an average 3-year follow-up, indicate that a straight walled, self-tapping implant with a 3 mm transmucosal machined collar can be considered a safe and viable implant for edentulous patients.

205 | Implant Therapy Outcomes, Surgical Aspects

Influence of vertical implant position and connection between fixture/abutment in crestal bone loss

Presenter: Tsaousoglou P

Department of Periodontology & Implant Biology, School of Dentistry, Aristotle University, Thessaloniki, Greece, Thessaloniki, Greece

Co-authors: Tsaousoglou P¹, Mikrogiorgis G², Vouros I¹, Konstantinidis A¹

¹*Department of Periodontology & Implant Biology, School of Dentistry, Aristotle University, Thessaloniki, Greece, Thessaloniki, Greece,* ²*Department of Endodontics, School of Dentistry, Aristotle University, Thessaloniki, Greece, Thessaloniki, Greece*

Background: Several factors have been implicated in peri-implant marginal bone loss observed around two-piece dental implants, including surface topography, platform-switch, connection design between fixture and abutment, and vertical implant placement in relation to the alveolar crest.

Aim: The objective of the present study was to evaluate peri-implant marginal bone level changes using clinical and radiographical measurements, in relation to crestal or subcrestal implant placement and the type of fixture/abutment connection.

Methods: In this randomized controlled trial, 62 two-piece implants were placed in 34 patients following a one-stage surgical procedure and were assigned into four study groups. In the first and second groups, 15 implants with an internal connection design were placed subcrestally and crestally, respectively. In the third and fourth groups, 16 implants with an internal conical seal connection were placed subcrestally and crestally, respectively. Standardized periapical digital radiographs were taken at the day of implantation (baseline) and 3 months later. The vertical distance between fixture/abutment junction and alveolar crest was measured on the mesial and distal sites of each implant utilizing subtractive radiography. Clinical outcomes including probing depth, modified plaque index, and modified sulcus bleeding index were recorded after 3 months. Statistical analysis was performed with the Mann-Whitney test for independent samples and the implant site was set as the statistical unit.

Results: Peri-implant bone loss was 0.94 ± 0.72 mm for the first group (internal connection, subcrestal placement), 0.81 ± 0.58 mm for the second group (internal connection, crestal placement), 0.55 ± 0.57 mm for the third group (conical seal, subcrestal placement), and 0.38 ± 0.51 mm for the fourth group (conical seal, crestal placement). The statistical analysis revealed significant differences in bone resorption between the first and third groups, the first and fourth groups, the second and third groups, and the second and fourth groups. No statistically significant differences were detected between the four groups in

relation to the peri-implant probing depth and the bleeding index. However, statistically significant differences were observed in the modified plaque index. The highest plaque score was recorded in the second group and the lowest was found in the fourth group.

Conclusions and clinical implications: The highest peri-implant marginal bone loss was detected in the subcrestal internal connection group and the smallest in the crestal conical seal group. Vertical implant placement in relation to alveolar bone level and the connection between fixture/abutment, significantly affect peri-implant marginal bone resorption.

206	Implant Therapy Outcomes, Surgical Aspects
-----	--

Clinical, radiographic, immunological and microbiological findings of flapped vs. flapless implants

Presenter: Tsoukaki M

Department of Periodontology & Implant Biology, School of Dentistry, Aristotle University, Thessaloniki, Greece
Co-authors: Tsoukaki M¹, Kalpidis C¹, Sakellari D¹, Tsalikis L¹, Mikrogiorgis G², Konstantinidis A¹

¹*Department of Periodontology & Implant Biology, School of Dentistry, Aristotle University, Thessaloniki, Greece,* ²*Department of Endodontics, School of Dentistry, Aristotle University, Thessaloniki, Greece*

Background: Placement of dental implants is a traumatic procedure associated with a postsurgical inflammatory reaction and bone resorption. Consequently, the introduction of minimally invasive techniques is gaining increasing popularity among implant surgeons.

Aim: The objective of this study was to compare the placement of flapped vs. flapless dental implants utilizing clinical, radiographic, microbiological and immunological parameters.

Methods: Thirty dental implants were placed following a one-stage protocol. The implants were randomly assigned into two study groups: control group with 15 flapped implants and test group with 15 flapless implants. The follow-up time was 3 months. At baseline and on the 1st, 2nd, 6th, and 12th post-operative week, the modified plaque and gingival indices were recorded and peri-implant sulcular fluid and subgingival plaque samples were collected. Peri-implant sulcus depth was recorded at the 6th and 12th week. Standardized periapical radiographs were taken at baseline and 12 weeks post-operatively. Sulcular fluid samples were analysed with ELISA for detection and quantification of both sRANKL and MMP-8. The checkerboard DNA-DNA hybridization technique was utilized for detection of *Porphyromonas gingivalis*, *Tannerella forsythia* and *Treponema denticola* in the peri-implant plaque samples. Digital subtractive radiography was used for detection and quantitation of crestal bone loss. On the 1st post-operative week, patients evaluated their pain experience by completing a visual analogue scale. Statistical analysis was performed with the Mann-Whitney test for independent samples, Wilcoxon test for paired samples and the related samples Friedman's two-way analysis test for repeated measurements.

Results: Peri-implant sulcus depth was significantly deeper in flapped implants at both time points. Approximately 50% of flapped implants showed crestal bone loss (0.2–0.3 mm), whereas no bone resorption was detected around any of the flapless implants. At 6 weeks, MMP-8 values were higher to a statistically significant level in the control compared with the test group. However, MMP-8 reached similar values for both groups at the end of the study. sRANKL results were not consistent. In the test group, the presence of *P. gingivalis* was significantly higher at the 2nd week, whereas the counts of *T. forsythia* were significantly elevated during the whole study period, possibly indicating an earlier formation and maturation of the peri-implant sulcus. Patients reported more pain after flapped implant placement.

Conclusions and clinical implications: Flapless implant placement yielded improved clinical, radiographic and immunological outcomes compared with flapped implantation. In addition, patients seem to better withstand flapless implant placement.

207	Implant Therapy Outcomes, Surgical Aspects
-----	--

Implant surgery by undergraduate students: preliminary 1-year outcome

Presenter: Vandeweghe S

University of Ghent, Ghent, Belgium
Malmö Högskola, Malmö, Sweden

Co-authors: Vandeweghe S^{1,2}, De Bruyn H^{1,2}

¹*University of Ghent, Ghent, Belgium,* ²*Malmö Högskola, Malmö, Sweden*

Background: The increasing demand for implant treatment requires that dentists are properly informed and trained. However, there is some concern that introducing implant surgery in the undergraduate program would encourage students to perform implant surgery beyond their level of skill.

Aim: To evaluate benefits and clinical outcome of an educational undergraduate implant program, including surgery and prosthetics.

Methods: All last term undergraduate students received theoretical and preclinical (pig cadaver) courses on the principles of implant surgery. Following careful examination and presurgical/prosthetic planning, the students placed one implant (NanoTite Tapered Certain) with an Encode abutment (Biomet 3i, Palm Beach Gardens, FL, USA), by enlarge in a one-stage surgery. After 3–6 months the crown was restored on an individual abutment. Bone loss was measured on peri-apical radiographs, taken at baseline and 1 year. Patients and students scored a questionnaire, to rate their opinion on a Visual Analogue Scale, ranging from 0 (=very negative) to 100 (=very positive).

Results: Twenty-one implants were placed (18 maxilla, 3 mandible) in 16 patients (3 male, 13 female), mean age 46 years (range 25–64). Four were light smokers (<10 cig/day). Four implants were submerged during healing and three were placed into extraction sockets. All implants reached 35–60 Ncm

stability. Compared with the planned implants, 52.4% of the placed implants had a different dimension. Overall, the students planned for a shorter implant. After 1 year, mean bone loss was 1.33 mm (SD 0.50, range 0–2.10) and no failures had occurred. The patients' reasons for choosing implant treatment were problems with esthetic appearance (13), eating (7), speaking (2) or broken provisional prosthesis (1). They were informed about implants by dentists (7), family or friends (3), the media (4) or the periodontist (2). They reported minimal postoperative pain (80.4/100), would definitely undergo the treatment again (90.4/100) and advise it to others (91.7%). Overall, students were very positive about the project, but realized that more additional training and education is necessary to perform implant surgery independently.

Conclusions and clinical implications: Although the clinical outcome was good, the students realized that implant surgery can be complicated and additional training is needed. The fear for overconfidence seems to be limited. Overall, patients were pleased with the treatment and students thought it was a valuable contribution to their education.

208 | Implant Therapy Outcomes, Surgical Aspects

Clinical study of NobelReplace tapered implants using the NobelGuide concept

Presenter: Vasak C

Department of Oral Surgery, School of Dentistry, Bernhard Gottlieb University, Vienna, Austria

Co-authors: Vasak C¹, Kohal R², Zechner W¹, Rohner D³

¹*Department of Oral Surgery, School of Dentistry, Bernhard Gottlieb University, Vienna, Austria,* ²*Division of Prosthodontics, Dental School, University Hospital, Freiburg, Germany,* ³*Oral & Maxillofacial Surgery, Hirslanden Medical Center, Aarau, Switzerland*

Background: NobelGuide[®] is a method of planning/placing dental implants through individualized surgical guides manufactured via a CAD/CAM technique. The treatment is planned using 3D CT-scan data in a virtual 3D environment. In this study the NobelGuide[®] concept for partially/fully edentulous jaw has been initiated using the tapered implant system (Nobelreplace[®] tapered groovy; Nobel Biocare).

Aim: The aim of the study was to radiographically evaluate treatment planning after 1 year, utilizing the NobelGuide[®] concept. Furthermore soft tissue conditions and failures are also reported.

Methods: This is a multicenter prospective study. Both implant insertion and prosthetic treatment were carried out according to the procedure utilizing the NobelGuide[®] concept. In three centers, 163 implants restoring full edentulous or partially edentulous sites in 30 treated patients were included. A single stage procedure was used with immediate provisionalization within 24 h after surgery for the placement of 98 implants where a fixed final or provisional prosthetic reconstruction was seated the same day of surgery. In 65 implants a healing abutment was placed and the final prosthesis was delivered after healing. The definitive prosthesis was delivered within 6 months of insertion. Marginal bone level was evaluated on radiographs made at implant insertion and at the 1-year follow up. An independent

radiologist performed radiographic evaluation by relating the bone level to a reference point on the top of the implant. The bone level coronal or apical to this point, was recorded with positive or negative values respectively. Patients were followed for 12 months after receiving their prosthetic restorations. Clinical parameters including pain and infection, gingival mucosa, pocket depth, survival rates, esthetic and functional evaluation were registered.

Results: Thirty subjects with 161 implants have completed the 1-year follow-up. Two anterior implant failures, in two patients, occurred during the first 3 months resulting in cumulative survival rate of 98.8% (1 year). The mean bone level at implant insertion and at the 1-year follow-up was reported as 0.17 mm (SD 1.24, $n = 125$) and -1.39 mm (SD 1.27, $n = 110$), respectively. The mean change in bone level from implant insertion to 1 year was -1.44 mm (SD 1.35, $n = 98$). Clinical parameters improved in a majority of the implants.

Conclusions and clinical implications: Radiographic evaluation of this implant using the NobelGuide concept demonstrates a high predictability of success at the 1-year time point. The marginal bone level was maintained well above the level of the first thread.

This study (T-119) has been supported by Nobel Biocare Services AG

209 | Implant Therapy Outcomes, Surgical Aspects

Implant survival rate in microvascular transplants

Presenter: Virnik S

Department of Oral and Maxillofacial Surgery, Klagenfurt, Austria

Co-authors: Virnik S¹, Gaggl A², Chiari F¹

¹*Department of Oral and Maxillofacial Surgery, Klagenfurt, Austria,* ²*Department of Oral and Maxillofacial Surgery, Salzburg, Austria*

Background: For the reconstruction in the MKG surgery the microvascular transplants represent an important aspect to social, working and aesthetic functions for patients after a tumor or trauma. It is possible to create very small microvascular transplants (e.g. 2 cm) for patients to get implants. It is a solution, if other augmentation technologies does not work. This study compares three different microvascular transplants.

Aim: The aim is to investigate the survival rate of dental implants in microvascular transplants.

Methods: Between 2001 and 2008 patients received a microvascular transplants from pelvis (seven), Fibula (four) or Femur (seven) and treated with implants. All of them were compared and evaluated. Out of 16 patients with 75 implants only one had an implant loss of 4%. We achieved a healing rate of 96%.

Results: Between 2001 and 2008 patients received a microvascular transplants from pelvis (seven), Fibula (four) or Femur (seven) and treated with implants. All of them were compared and evaluated. Out of 16 patients with 75 implants only one had an implant loss of 4%. We achieved a healing rate of 96%.

Conclusions and clinical implications: Microvascular transplants can be used successfully to reconstruct the alveolar ridge. The transplant can be adjusted individually in order to carry out an implant with a strong supply.

Bone quality and quantity of the anterior maxillary trabecular bone in dental implant sites

Presenter: Wakimoto M

Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama, Japan
Co-authors: Wakimoto M¹, Matsumura T¹, Ota A¹, Ueno T², Mizukawa N¹, Yanagi Y³, Iida S¹

¹Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama, Japan, ²Fukui University Medical School, Fukui, Japan, ³Okayama University Hospital, Okayama, Japan

Background: For successful dental implant treatment, the alveolar bone quantity encompassing both the alveolar shape and the bone volumes at implant sites is an important factor. The alveolar bone quantity can directly influence a number of factors in the overall implant treatment plan, such as bone augmentation, implant type, implant length, and implant installation angle. On the other hand, the bone quality, which comprises the thickness of cortical bone as well as the characteristics and patterns of trabecular bones, is also an important factor because this factor contributes to the stability of implants. Therefore, a proper assessment of both factors, bone quantity and bone quality, is important in any treatment plan involving implants.

Aim: The aim of this study was to investigate the characteristics of implant sites on the edentulous alveolar ridge in the anterior maxilla. We studied the bone quantity and quality of implant sites at the anterior maxilla using CT images for the 58 implant sites on patients who underwent dental implant therapy in our Department since 2006.

Methods: Computed tomography (CT) images of 33 patients (20 females: 13 males) encompassing 58 implant sites were chosen and examined. The recipient sites for implant placement were determined based on CT data using an implant planning software (Simplant 11.0). The mean bone density values in Hounsfield unit (HU) were recorded using Simplant for both the simulated implant areas and the trabecular bone width. We classified the edentulous alveolar ridge and bone quality according to a classification based on Lekholm and Zarb.

Results: Incisors had higher bone densities than canines. Females had lower bone densities than males. Younger females had higher bone densities than older females, though this difference was not observed for males. Canines displayed greater trabecular bone width ratios and alveolar bone widths than incisors. No maxillary sites were judged to have a bone quality of 1 in this group. Quality 3 accounted for 68.9% of the total samples.

Conclusions and clinical implications: An assessment of bone quality in the anterior alveolar ridge may well reflect age-related systemic pathologic conditions and should be used in dental implant treatment planning to avoid associated risk factors.

CBCT aid in immediate loading 7-year follow up: A clinical case report

Presenter: Wu Y-T

Nobel Dental Clinic, Kaohsiung, Taiwan
Co-authors: Wu Y-T, Chen J

Nobel Dental Clinic, Kaohsiung, Taiwan

Background: Recent decades have witnessed the CT of a wide array of assessment modalities into dental implant treatment plans. For preimplantation bone assessment computed tomography was superior to peri-apical and panoramic radiography (Stratewann et al. 2008). The 3-D images had several informations to preview the implant site whether there were huge defects to impact the achievement of primary stability. Shorten of the treatment time by providing immediate function through immediate restoration and loading of dental implants has been shown the result in favorable treatment outcomes when applied in specified situations (Del Fubbro et al. 2006; Esposito et al. 2009). Immediate loading of dental implant had proved similar successful to that of conventional loaded implants (Rocci et al. 2003; Glauser et al. 2006). The advantages of immediate loading include reduced treatment times, increase of masticatory function and improvement of patient comfort and psychological conditions (Gnales & Wismeijer 2004).

Aim: The aim of this clinical report is to present how to use the CBCT 3-D images for the treatment planning and decision made for the immediate loading protocol.

Methods: Three cases were included in this report in immediate loading. The implants were placed in healed sites and some in fresh extraction sites. The primary stability were confirmed by the drilling machine. If the primary stability ≥ 30 Ncm, the implants received immediate loading. If the primary stability < 30 Ncm, the implants were submerged not received immediate loading. At the extracted sites the socket defected were GBR with Bio-Oss bone substitute. Covered with resorable membrane or not depend on the defects range. All the implants connected with temporary abutments and temporary prostheses. The temporary prostheses were cemented with definitive cement and received immediate loading. All implants were definitively restored with PFMs after 3 months immediate loading.

Results: One implant failed in maxillary arch at early phase of loading. The caused of failed may be due to poor bone quality and smoking habits. The survival rate was 95% during the functional loaded period. After definitive prostheses delivery all the implants functional well no implants failed during this function loaded periods, the survival rates is 100%.

Conclusions and clinical implications: The conclusions of the clinical report revealed that used CBCT for the preimplantation treatment planning can let the clinician to make the strategical decisions and to improve the favorable outcomes of immediate loading.

Dental implant therapy in 248 periodontal disease patients with type II diabetes: an observation study

Presenter: Wu D

China Dental Implantology Center, Chengdu, Sichuan Province, China

Co-authors: Wu D

China Dental Implantology Center, Chengdu, Sichuan Province, China

Background: We searched 1240 periodontal disease outpatients to follow up 248 periodontal disease patients with confirmed Type II diabetes from 2000 to 2008 after dental implantation. In the patients, 136 are male and 112 are female, whose ages are from 28 to 93 years old. We controlled the fasting blood-glucose level below 7.4 mmol/L in all patient before the operation. The total dental implants number of Type II diabetes with periodontal disease patients are 1190 (857 CDIC implants and 333 Replace implants). After 8 years follow-up, only six implants lost before the crowns were rehabilitated. 1-year subsistence ratio of the implants is 98.4%, 5-year subsistence ratio of the implants is 95.4%, 8-year subsistence ratio of the implants is 89.4%. The blood sugar of all the patients was controlled stably. Most patients were satisfied with the effects of the implant.

Aim: To discuss the effectiveness, risk and therapeutic strategy of dental implant integrative therapy in periodontal disease patients with diabetes with 8 years follow-up.

Methods: We searched 1240 periodontal disease outpatients to follow up 248 (20%) periodontal disease patients with confirmed Type II diabetes from 2000 to 2008 after dental implantation. The total dental implants number of Type II diabetes with periodontal disease patients are 1190 (857 CDIC implants and 333 Replace implants). In 248 patients, 136 are male and 112 are female, whose ages are from 28 to 93 years old. The fasting blood-glucose level were from 6.3 to 12.3 mmol/L. We controlled the fasting blood-glucose level below 7.4 mmol/L in all patient before the operation. The local bone conditions of all the patients were evaluated to accord the basic request of implantation operation. Immediate implanting or delayed implanting were used by flapless and bone expanding techniques with CDIC or Replace implants. The clinical decision making are based on doctor's experience and patients' will. The time of crowns rehabilitation are at least 6 months after implantation. Individual glycaemic control therapies throughout dental implant process are essential for subsistence ratio.

Results: After 8 years follow-up, only six implants lost before the crowns were rehabilitated. One-year subsistence ratio of the implants is 98.4%, 5-year subsistence ratio of the implants is 95.4%, 8-year subsistence ratio of the implants is 89.4%. The blood sugar of all the patients was controlled stably. Most patients were satisfied with the effects of the implant.

Conclusions and clinical implications: Periodontal disease patients with Type II diabetes can also have the opportunity to accept the dental implant with good subsistence ratio, when the operation risk factors are evaluated and controlled strictly.

Vascularized bone graft for reconstruction of jaws with serious defects and dental implant rehabilitation

Presenter: Xia H

Department of Oral Implantology, School and Hospital of Stomatology, Wuhan University, Wuhan, China

Co-authors: Xia H¹, Shi B¹, Liu B², Shang Z²

¹Department of Oral Implantology, School and Hospital of Stomatology, Wuhan University, Wuhan, China, ²Department of Oral and Maxillofacial Surgery, School and Hospital of Stomatology, Wuhan University, Wuhan, China

Background: Jaw trauma, tumor or other diseases often lead to serious defects in the upper and lower jaw, then how to reconstruct oral and maxillofacial contour and function has been the difficulty and challenges for oral rehabilitation.

Aim: This study aimed to investigate the clinical outcome of vascularized bone graft for jaw reconstruction and dental implant restorations.

Methods: Twelve cases of jaw serious defects were repaired with the free osseous myocutaneous flap of ilium or fibula. The surgery templates were used to position the graft bone for patients with dentition defects. Seven patients combined with immediate dental implantation using the surgery guide. Five patients performed delayed implants insertion after 4–6 months. The superstructure restorations were placed 3–4 months later, of which four cases received the implant overdentures, the other eight cases with implant fixed dentures.

Results: All cases of vascularized autogenous bone grafts were successful. The PTV values of implants are -5.6 to -1.2 when the healing abutments were placed on the implants at stage two surgery. During 6–30 months clinical observation after the implant restoration, X-rays indicated no radiolucencies between the grafting bone and the implants, two cases occurred peri-implant soft tissue proliferation, patients reported being satisfied with the contour and functional recovery.

Conclusions and clinical implications: The vascularized bone graft combined with implant denture restoration for the jaw severe defects in functional reconstruction obtained good clinical outcome, the long-term effect needs further observation.

Computed tomographic observation of bone allograft after osteotome sinus floor elevation

Presenter: Yamaguchi K

Ark Dental Clinic, Tokyo, Japan

Co-authors: Murase R¹, Nishida K¹, Yamaguchi K^{1,2}

¹Ark Dental Clinic, Tokyo, Japan, ²Department of Periodontology, Nihon University School of Dentistry, Tokyo, Japan

Background: Alveolar bone resorption of the maxillary posterior edentulous region and increased pneumatization of the sinus cavity can result in insufficient bone support for dental implants. This problem can be overcome by grafting the maxillary sinus floor using a sinus lift procedure. The most common technique used is to elevate the sinus floor by inserting a bone graft through

a window opened in the lateral antral wall, although less invasive techniques with osteotomes have been used.

Aim: The aim of this study was to evaluate the transformation of mineralized freeze-dried bone allograft (FDDBA) after osteotome sinus floor elevation using cone beam computed tomography (CBCT).

Methods: The study population comprised 21 patients in whom 25 implants were inserted with the osteotome sinus floor elevation technique. The indication for sinus floor elevation was that the bone height below the maxillary sinus was considered to be 8 mm or less. The osteotome sinus floor elevation procedure was performed, and FDDBA was used as the augmentation material. Implants, 5.0 mm in diameter and 11.0 mm long, were placed in the bone regenerated following osteotome sinus floor elevation. Second stage surgery was carried out 6 months after implant placement. The patients were evaluated radiographically before implant exposure. CBCT examinations were performed preoperatively, just after the first stage implant operation and at the second stage implant operation.

Results: Most of the patients experienced no severe pain, swelling, or nose bleed after the first stage implant operation. The grafted FDDBA was in the shape of a dome around the fixtures on the CBCT image at the first stage implant operation. In all cases, the grafted area apical to the implants undergoes shrinkage and remodeling, but at least 3 mm of grafted FDDBA was seen around the implant fixtures on CBCT at the second stage implant operation. The border between the grafted augmentation material and the existing bone was indistinct. The implant survival rate was 100%.

Conclusions and clinical implications: The result suggested that sufficient allogeneic bone graft material change into bone support an implant. Therefore, FDDBA is useful for osteotome sinus floor elevation for implant placement. Long-term radiographic and clinical observations may be necessary.

215 | Implant Therapy Outcomes, Surgical Aspects

Dimensional assessment of crestal approached sinus augmentation with composite graft

Presenter: Yamamoto M

Department of Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan

Co-authors: Yamamoto M, Shiota M, Kon K, Munakata M, Fuchigami K, Kasugai S

Department of Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan

Background: The sinus floor augmentation is the commonly used technique to implant in the posterior atrophied maxilla. However, optimal augmentation technique and grafting material have remained incompletely understood. Especially, time depended dimensional change of augmented area is not yet known, though it is considered to be practically associated with the prognosis of implants.

Aim: The aim of this study was to calculate the height and the volume of augmented area at immediately and 1 year after the

augmentation. Secondly, the availability of the crestal approached sinus augmentation with simultaneous implant placement was evaluated.

Methods: Four patients (two males and two females) with a residual bone height of 4.4–7.5 mm in posterior edentulous maxilla (unilateral molar missing) underwent sinus lift procedures performed with crestal approach. A composite of hydroxyapatite particles (Calcitite) and autogenous bone (in the proportion of 90% of hydroxyapatite to 10% of autogenous bone) was applied as grafting material and implants were simultaneously placed. Augmented height and augmented volume around implants (the second molar site) were calculated at immediately and 1 year after the surgery by cone-beam CT (3DX) using DICOM viewer software (OsiriX). Paired *t*-test was used for statistical analysis.

Results: No complications were observed in all patients through the follow-up period. The mean original bone height was 6.2 mm. The mean augmented height was 6.2 mm at surgery and 6.5 mm after 1 year. It did not show a statistically significant change. On the other hand, the mean augmented volume decreased from 5.2 mm³ at surgery to 5.0 mm³ after 1 year. However, there was no statistically significant change.

Conclusions and clinical implications: This study showed that the adequate amount of augmentation was achieved with the crestal approach and its dimension was chronologically maintained with the application of hydroxyapatite as a major graft material. The subtle decrease of augmented volume is considered physiologic shrinkage and consolidation of augmented area. The crestal approached sinus augmentation with a composite graft is seemed to be a reliable alternative for severely atrophied maxillary sites receiving implant procedures.

216 | Implant Therapy Outcomes, Surgical Aspects

Simultaneous sinus augmentation and implant placement with minimal crestal bone

Presenter: Yokoue S

Fukuoka Dental College, Fukuoka, Japan

Co-authors: Yokoue S, Kido H, Sakai T, Okano Y, Irie A, Matsuura M

Fukuoka Dental College, Fukuoka, Japan

Background: A staged approach is recommended for sinus augmentation in patients with residual alveolar bone height of < 5 mm. Our department has performed simultaneous sinus augmentation and implant placement in many patients with severe alveolar bone resorption.

Aim: We report here a clinical examination of simultaneous sinus augmentation and implant placement in the maxillary molar region.

Methods: The subjects were 47 patients (129 implants) who had undergone simultaneous sinus augmentation and implant placement at the Fukuoka Dental College and Dental Hospital between January 2006 and December 2008 and who were being followed up periodically as outpatients. In each patient, a lateral window was created and implants were simultaneously placed with autogenous bone used as a filler material. The alveolar

bone heights at the implant sites, implant survival rates, and types of implants were examined.

Results: The alveolar bone heights at the implant sites ranged from 1.0 mm to 10.0 mm. There were 61 implants placed in bone with a height of < 5 mm and 68 implants placed in bone with a height of 5 mm or more. There were 123 implants that survived out of 129 implants. Six implants were lost, and all were lost at the time of abutment connection. The survival rate was 95.3% at follow-up 2 years after loading. At the sites of implant loss, the alveolar bone heights were 3 mm (one lost implant), 4 mm (one lost implant), 5 mm (two lost implants), 6 mm (one lost

implant), and 7 mm (one lost implant). The survival rate was 96.7% for implants placed in bone with a height of < 5 mm and 94.1% for implants placed in bone with a height of 5 mm or more. There were no differences in the survival rate by implant type or length.

Conclusions and clinical implications: We used simultaneous sinus augmentation and implant placement, which yielded results similar to those for staged approaches in the literature to date. Our results suggest that implant success rates are not affected by the distance between the alveolar crest and the floor of the maxillary sinus.

Posters: Implant Therapy Outcomes, Prosthetic Aspects (Abstracts 217–292)

217 | Implant Therapy Outcomes, Prosthetic Aspects

Full mouth oral rehabilitation for medically compromised patient: -case report

Presenter: Al Dosari

Director of Dental Implant and Osseointegration Research Chair, Riyadh, Saudi Arabia

Co-authors: Al Dosari AAF^{1,2}

¹*Director of Dental Implant and Osseointegration Research Chair, Riyadh, Saudi Arabia*²*Assistant Professor and Consultant of Prosthodontics and Implantology, Riyadh, Saudi Arabia*

Background: The benefits of full mouth implant reconstruction include increased chewing ability, bone preservation, improved speech, and an improved aesthetic for an edentulous patient. Full mouth rehabilitation for a medically compromised patient is complex and often requires a comprehensive multidisciplinary approach. Here is the report of a case of a 62-year-old man who presented with a chief complaint of loose dentures in the upper and lower jaws. On examination, the patient had severe periodontitis and most of the remaining teeth were mobile. The patient is under medication for hypertension (past 15 years) and diabetes (past 30 years), and he has already undergone six by-pass surgeries. He has been smoking cigarettes for the past 35 years and currently smokes upto 30 cigarettes per day. His current medical condition was stable and it was decided to rehabilitate the patient with implant-supported fixed prostheses.

Aim: Complete functional and esthetic rehabilitation of the medically compromised heavy smoking patient with implant-supported fixed prostheses.

Methods: After the extraction of the remaining teeth, 24 Osseotite[®] Implants (3i, Implant Innovations Inc., West Palm Gardens, FL. USA) implants were placed in the maxilla ($N = 12$) and the mandible ($N = 12$). The sizes of implants used are 5×10 , 4×15 , 3.75×13 and 3.75×10 mm. Different sizes of implants were used based on the anatomical site of placement. The maxillary fixed prosthesis was fabricated and four of the maxillary implants were used for retention. The mandibular overdenture was retained with five implants. The prosthesis was loaded immediately and occlusal splints were provided. Functional occlusion and esthetic appearance were restored with maxillary and mandibular implant supported porcelain-fused-to-metal restorations. Patient was advised to quit tobacco and was also referred to a tobacco cessation clinic.

Results: Radiographic assessments of the implants were performed at regular intervals. There was good primary stability for the implants with minimal bone resorption at the end of the 5-year follow-up period. An excellent predictability was observed between the planned procedures and those obtained post treatment. Complete functional and esthetic rehabilitation of the patient was obtained. No adverse events occurred during the treatment phase and the patient was highly satisfied with the final esthetics of the prosthesis.

Conclusions and clinical implications: The patient's speech, masticatory efficiency, and swallowing dramatically improved after treatment. The presence of chronic diseases required additional care, but with careful treatment planning, desired results can be achieved.

218 | Implant Therapy Outcomes, Prosthetic Aspects

Two-years short-term follow-up of a new, easy-to-repair esthetic implant-supported crown

Presenter: Chen J-H

Kaohsiung Municipal Hsiaokang Hospital; School of Dentistry, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan

Co-authors: Chen J-H

Kaohsiung Municipal Hsiaokang Hospital; School of Dentistry, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan

Background: The cumulative incidence of ceramic veneer fractures was 4.5% whether metal-ceramic or all ceramic material is used in implant-supported fixed partial dentures by the review article of Elliot Abt. Because of the brittle nature of ceramic, a new way to achieve a stable and easy-to-repair esthetic restoration which combined composite resin veneer with zirconium ceramic core was developed recently.

Aim: The aim of this report is to present 2-years follow-up result of this new and easy-to-repair esthetic implant-supported crown when compared with the traditional design.

Methods: This randomized controlled clinical trial was to compare the clinical outcome of implant-supported metal-ceramic crowns and implant-supported CAD/CAM Zirconia-resin composite crowns. Thirty patients were randomly divided into two groups of 15 subjects each. Both groups received crowns on titanium or gold abutments. The low gold metal-ceramic crowns and CAD/CAM Zirconia-resin composite crowns were fabricated and cemented. Two-years follow-up results related to patient satisfaction, the fracture rate of crowns, the color stability, the abrasive wear and the plaque and gingival index scores around the crowns were evaluated and measured.

Results: The patient satisfaction, fracture rate of crowns, color stability, abrasive wear and the plaque and gingival index scores around two designs were equivalent. The majority of CAD/CAM Zirconia-resin composite crowns and metal ceramic crown survived during the 2-year period, although one CAD/CAM Zirconia-resin composite crowns and one metal-ceramic crown experienced the fracture of the veneering porcelain. But the repair of CAD/CAM Zirconia-resin composite crowns was easy to made and appeared stable after 9-year follow-up. Some patients showed slight color change to darker shade and abrasive wear in CAD/CAM Zirconia-resin composite group.

Conclusions and clinical implications: This 2-years short-term study demonstrates that the easy-to-repair CAD/CAM

Zirconia–resin composite crowns have comparable early clinical outcome to metal–ceramic crowns, including patient satisfaction, fracture rate of crowns and periodontal effect of implant abutments. The color stability and abrasive wear seemed less satisfied in some patient but not statistically significant in overall comparison.

219 Implant Therapy Outcomes, Prosthetic Aspects

Immediate loading and gingival management using CAD/CAM restorations

Presenter: Aladağ A

Department of Prosthodontics, School of Dentistry, Ege University, Izmir, Turkey

Co-authors: Aladağ A¹, Çömlekoğlu E¹, Dündar M¹, Güngör MA¹, Tekin U²

¹*Department of Prosthodontics, School of Dentistry, Ege University Izmir, Turkey,* ²*Department of Oral and Maxillofacial Surgery, School of Dentistry, Ege University, Izmir, Turkey*

Background: Immediate loading avoids the requirement for a removable prosthesis, improves treatment efficiency and immediately enhances the esthetic appearance of the patient. Recent advances in computer-aided design/computer-aided manufacturing (CAD/CAM) technology have improved the efficiency, accuracy and predictability of the prosthetic treatments. When implants are loaded immediately, changes in the hard and soft tissues occur, therefore, it is important to guide the clinical outcome through optimum quality and stability of the restorations.

Aim: The aim of this clinical case series is to present the preliminary clinical outcome of immediate, provisional implant-supported fixed dental prostheses (FDPs) in edentulous maxilla and/or mandible fabricated by a CAD/CAM system.

Methods: Three patients (two women and one man; mean age 46 years, minimum 37 years, maximum 58 years) with a need for replacement of missing maxillary/mandibular teeth participated in this study. Each patient received 2/4 implants (Straumann, Switzerland; Bego Semados, Germany). After intraoral scanning process, implant-supported fixed provisional prostheses from PMMA blocks (TelioCAD, Ivoclar Vivadent, Liechtenstein) were fabricated using Cerec 3D (Sirona, Germany) system at the day of surgery. After a mean healing time of 16 weeks, the patients received definitive, solid/angled-screw retained, implant-supported, ceramic fixed prosthesis. Clinical examination was made and resonance frequency analysis (RFA) evaluations were recorded by Osstell Mentor (Integration Diagnostics AB, SE-Göteborg) after 1 month of loading with the implant-supported fixed prostheses as well as 12 months after implant placement. Radiological examinations were made at implant placement and after 12 months.

Results: The mean RFA values at 1st month were 69 ± 1.4 while the mean values at 12-month follow-up were 82 ± 2.2 . No failures or complications were recorded in association with the implants and their restorations throughout the observation period.

Conclusions and clinical implications: Immediately loaded implants by immediate provisionalization using CAD/CAM technology exhibited successful survival rates after 12 months.

Immediate provisionalization after dental implant placement is an esthetic and treatment modality since gingival tissue managing can be established more predictably by CAD/CAM technology.

220 Implant Therapy Outcomes, Prosthetic Aspects

Two-year clinical outcome of immediately and conventionally loaded dental implants

Presenter: Artunç C

Department of Prosthodontics, School of Dentistry, Ege University, Izmir, Turkey

Co-authors: Kaya E¹, Günbay T¹, Çömlekoğlu E², Çömlekoğlu MD², Artunç C²

¹*Department of Oral and Maxillofacial Surgery, School of Dentistry, Ege University, Izmir, Turkey,* ²*Department of Prosthodontics, School of Dentistry, Ege University Izmir, Turkey*

Background: Studies on dental implantology have been focused on immediate and early loading procedures in recent years. However, limited clinical studies exist on osseointegration of immediately versus conventionally loaded implants.

Aim: To investigate the clinical outcome of immediate and conventional loading in dental implants having two different surface features, clinically and radiographically.

Methods: A total of 106 implants were consecutively placed in 18 patients (eight male, 10 female; age range: 41–64 years, mean age: 51 ± 1.4) over a 2-year period. Each patient received a minimum two implants (Straumann, Switzerland) with different surface characteristics (SLA-sandblasted and acid etched (S) ($n = 51$) and SLActive (SL) ($n = 54$)) either with bone augmentation or not. The distribution and number of implants placed were: maxilla (52), mandible (54), anterior (40), and posterior (66). All implants were inserted with a torque of maximum 56 Ncm and primary stability was assessed by resonance frequency analysis (RFA (ISQ); Osstell Mentor, Sweden). Implants having over 65 ISQ were loaded immediately within 48 h after surgery with provisional splinted fixed dental prostheses while implants assigned lower than this value were conventionally loaded. RFA related with bone type (Type 2, 3 and 4) was made during implant insertion and before final prosthetic rehabilitation in immediate loading group and RFA measurements at surgery (T₀), and at weeks 2(T₁), 4(T₂), 6(T₃), 8(T₄) and third month (T₅) were made in conventional loading group. Final prosthetic rehabilitation after 3–6 months was performed in conventional loading group. Statistical analyses were made (ANOVA, Bonferroni, *t*-test, SPSS 16.0, USA).

Results: One implant failed associated with occlusal trauma. Implant surface characteristics did not have a significant effect on mean RFA values (ISQ \pm SD) for all groups ($P > 0.05$). In conventional loading group, differences in RFA between all time periods (T₀: 59.65 ± 12.8 ; T₁: 61.65 ± 12.08 ; T₂: 66.82 ± 9.5 ; T₃: 71 ± 6.7 ; T₄: 73 ± 5.7 ; T₅: 75 ± 4.9) were significant ($P < 0.05$). For immediate loading group, differences in RFA between baseline (T₀: 72.76 ± 11.6) and third month (T₅: 79.13 ± 11.7) were significant ($P < 0.05$). In terms of bone quality, conventionally loaded implants with SL surface had

significantly higher mean RFA values (72.37 ± 6.7) than immediately loaded SL surface mean RFA values (67 ± 7.4) ($P < 0.05$) for Type 2 bone. Type 4 bone revealed a higher success rate with conventionally loaded SL implants at third month (78 ± 9.3) than baseline (41 ± 9.7).

Conclusions and clinical implications: Both immediate and conventional loading were clinically successful at the end of loading periods. Hydrophilic implant surface characteristics added to the success of loading in cases with poor bone quality. Immediate functional loading may be used successfully, when the primary stability is high and initial loading is minimized.

221 | Implant Therapy Outcomes, Prosthetic Aspects

Two-years comparative study with nobelreplace tapered groovy implants in diabetic and non-diabetic patients

Presenter: Aspriello SD

Department of Clinical and Dental Sciences, Polytechnic University of Marche, Ancona Torrette, Italy

Co-authors: Aspriello SD¹, Rasicci P², Ciolino F¹, Zizzi A³, Rubini C³, Procaccini M¹, Piemontese M¹

¹*Department of Clinical and Dental Sciences, Polytechnic University of Marche, Ancona Torrette, Italy,* ²*University of Aquila, Aquila, Italy,*

³*Department of Neurosciences, Pathologic Anatomy and*

Hystopathology, Politechnic University of Marche, Ancona Torrette, Italy

Background: The use of dental implants in patients with diabetes mellitus remains controversial because of altered osseointegration and higher susceptibility to infections, periodontitis and impaired wound/bone healing. The NobelReplace Tapered Groovy Implant (Nobel Biocare AB, Gothenburg, Sweden) is suitable for all clinical indications and feature a porous phosphate-enriched titanium oxide (TiUnite) surface, which has been create to increase surface area and its osseointegrative properties speed up bone healing.

Aim: The aim of this study was to compare the clinical and radiographic outcomes of NobelReplace Tapered Groovy implants in diabetic and nondiabetic patients.

Methods: Twenty-eight partially edentate subjects without periodontitis, 14 with Type II diabetes (mean age 61 years, HbA1c $> 6 < 7$) and 14 without diabetes (mean age 57, HbA1c < 6) received, respectively, 22 and 24 Nobel Replace implants. Implants were loaded with single crowns after a submerged healing period of 4–6 months. Clinical – full-mouth plaque score and bleeding score- and radiographic parameters were evaluated at baseline, at implant loading and at the 2-year follow-up visit. Marginal bone levels (MBL) were assessed by obtaining distances from the implant shoulder to the most coronal bone to implant contact measured on X-rays with a millimeter ruler to the nearest 0.5 mm. Two measurements, mesial and distal, were taken for each implant and then averaged.

Results: Mean full-mouth plaque score and full-mouth bleeding score and implant location were similar for the two groups. Mean marginal bone level at the moment of provisional

loading was -0.18 ± 0.31 mm for the nondiabetic group and -0.33 ± 0.4 mm for the DM-group. Implants were functionally loaded after 6 months. At 2 years, the mean bone loss was 0.89 ± 0.73 mm for type II diabetic patients and 0.74 ± 0.97 mm for nondiabetic patients. The implant survival rates did not present statistically significant differences between the two groups ($P > 0.05$).

Conclusions and clinical implications: Within the limitations of this clinical study NobelReplace Tapered Groovy implants could be successfully used in patients with well-controlled type II diabetes. No evidence of diminished implant survival rate or higher complication rate related to implant treatment was found between the two groups.

222 | Implant Therapy Outcomes, Prosthetic Aspects

Immediate loading of NobelActive implants in postmenopausal osteoporotic women: 2-years follow up study

Presenter: Aspriello SD

Department of Clinical and Dental Sciences, Polytechnic University of Marche, Ancona Torrette, Italy

Co-authors: Aspriello SD¹, Rasicci P², Ciolino F¹, Zizzi A³, Rubini C³, Procaccini M¹, Piemontese M¹

¹*Department of Clinical and Dental Sciences, Polytechnic University of Marche, Ancona Torrette, Italy,* ²*University of Aquila, Aquila, Italy,*

³*Department of Neurosciences, Pathologic Anatomy and*

Hystopathology, Politechnic University of Marche, Ancona Torrette, Italy

Background: Postmenopausal osteoporosis is a physiologic condition that may affect the process of osseointegration. The NobelActive implant (Nobel Biocare AB, Göteborg, Sweden) allows outstanding primary stability – even in compromised bone situations and it is particularly suited for use in the upper esthetic zone. NobelActive implants feature a porous phosphate-enriched titanium oxide (TiUnite) surface, which has been created to increase surface area and its osseointegrative properties speed up bone healing.

Aim: Aim of the present study was to assess the survival rate of and marginal bone change around NobelActive implants when immediately loaded in postmenopausal osteoporotic women.

Methods: Thirty-eight partially edentate postmenopausal osteoporotic women without evidence of active periodontitis (mean age 57 years) received 98 NobelActive implants mainly placed in the anterior region of the upper jaw. Osteoporotic status was defined on the basis of bone mineral density (BMD) score utilizing World Health Organization criteria. Treatment outcomes were assessed at month 24. Routine clinical assessments and intraoral radiographs of all implants were performed and then assessed by a blinded clinician who had not been involved in the treatment.

Results: Implants were immediately functionally loaded (implant stability quotient [ISQm] > 70). If a provisional had not been fabricated in advance, impressions were taken during surgery. The prosthesis (cemented or screw-retained) was placed within the first 48 hours postsurgery. The 2-year cumulative

survival rate was 100%. At 2 years mean bone loss was $-0.32 (\pm 0.84)$ mm. Despite fairly low plaque levels (19%), overall peri-implant bleeding was quite prevalent (31%). Mean peri-implant probing depth was 3.7 mm.

Conclusions and clinical implications: Within the limitations of this clinical study, the immediate loading of NobelActive implants placed in anterior maxilla of postmenopausal osteoporotic women is a predictable treatment option.

223 | Implant Therapy Outcomes, Prosthetic Aspects

Prosthetic crown, jaw morphology and implant position in virtual implant planning

Presenter: Avrampou M

Department of Prosthodontics, School of Dental Medicine, University of Bern, Bern, Switzerland

Co-authors: Avrampou M, Katsoulis J, Gholami H, Mericske-Stern R

Department of Prosthodontics, School of Dental Medicine, University of Bern, Bern, Switzerland

Background: Posterior maxillary bone resorption, often causes unfavorable relationship between prospective crown position, jaw morphology and implant location. 3-D virtual implant planning software allows for a detailed presurgical analysis of this complex configuration. However, as of today, this technology is not yet fully utilized.

Aim: To investigate the prospective clinical crown position in the posterior edentulous maxilla and its implication with respect to jawbone atrophy and implant axis.

Methods: Computed data from 43 edentulous patients (24 females and 19 males) with a mean age of 62 ± 8 years, were available and analyzed by a calibrated examiner using an implant planning software. All patients were edentulous for at least 1 year and asked for an implant-supported prosthesis. Computed-tomography with a radiographic guide that was duplication of a well-fitting denture was obtained from all patients. This denture was based on a correct set-up that fulfilled all prosthetic criteria regarding esthetics, tooth axis, occlusion and vertical dimension. Implants of minimum 3.5 mm diameter and 10 mm intraosseous length were virtually planned in the optimal 3-D prosthetic position of each posterior tooth. The planned implant axis was planned for direct screw access. The following measurements were performed in the cross-sections in the middle of each first premolar, second premolar and first molar: (1) Clinical crown position: vertical distance (VD) from the implant center to the central occlusal fossa of the prospective crown. (2) Clinical crown position: horizontal distance (HD) from the implant center to the central occlusal fossa of the prospective crown. (3) Angulation: (Ang) between implant axis and crown axis in the sagittal plane. Data analysis included descriptive methods and ANOVA (Bonferroni correction) to test for genders differences.

Results: Mean values for VD were 11.6 mm (11.3–12 mm, 95% Confidence Interval, CI) and for HD were 1.6 mm (1.4–1.8 mm, 95% CI). Male patients had significantly higher VD values than females in all posterior teeth positions (ANOVA $P < 0.001$). The

mean value for Ang was $1.7^\circ (1^\circ-2.4^\circ, 95\% \text{ CI})$ with a range from 0° to 35° .

Conclusions and clinical implications: In some patients oversized prospective crown height, particularly in males, is expected. The VD and Ang values indicate a lateral cantilever effect and should be considered by the occlusal scheme.

224 | Implant Therapy Outcomes, Prosthetic Aspects

In vitro study: comparison between three impression techniques

Presenter: Barba J

University of Sevilla, Sevilla, Spain

Co-authors: Barba J¹, Daemi R¹, Rios V¹, Bullón P¹, Lázaro P¹, Garcia E¹, Fernández A¹, Herrero M¹, Falcao C^{1,2}

¹*University of Sevilla, Sevilla, Spain* ²*University of Fernando Pessoa, Oporto, Portugal*

Background: In the prosthesis over implants treatment sequence, the final impression takes on great importance in the success of the final restoration.

Aim: *In vitro* study that compares three different impression techniques to evaluate the existence of significant differences in the reproducibility reliability of the implant position to a master cast.

Methods: A master cast reference model with four parallel Klockner Essential Cone 4×10 mm implants (A, B, C, D) was fabricated. Three impression groups were defined: Group A: Individualised closed tray reposition technique Group B: Individualised closed tray with plastic impression coping technique Group C: Individualised open tray with screwed metallic impression coping technique Five impressions with polyether (Impregum duosoft 3M) were taken of the master cast reference model with each of the three impression techniques. A total of 15 impressions were made. A stereomicroscope (Leica S8, APO) and its corresponding software was used for all the measurements: distance A–B, B–C and C–D were measured (distance from centre of one implant to the other) in the reference and duplicate models. The measurements of each of these distances in the reference model were repeated 15 times, and the measurements of each of these distances in the duplicate models were repeated 10 times. The amount of distortion between the reference model and the duplicate models was evaluated, therefore relating the impression technique with a greater or lower distortion. Statistical analysis: Shapiro Wilks test to see if there was a normal distribution. *T*-student test and ANOVA were used for the parametric tests and Welch test for the nonparametric tests.

Results: The variations of group A in relation to the reference model are small, and only significant in A–B and B–C. There are no significant differences in Group B, and Group C is the worse (variations of 0.1, 0.5 and 0.3).

	Reference model	Group A	Group B	Group C
Distance a–b (mm)	11.883	0.127	0.158	–0.111
Distance b–c (mm)	13.013	–0.162	0.16	–0.478
Distance c–d (mm)	12.193	0.008	–0.102	–0.291

Conclusions and clinical implications: It is not possible to obtain an exact reproduction of implant position even under ideal conditions. In our study group, B technique seems to be the most precise in the transference of implant position to a cast model. We should analyse if the discrepancies obtained in the models with the three techniques affect the clinical success of implant-retained suprastructures.

225 Implant Therapy Outcomes, Prosthetic Aspects

Long-term outcome of one-piece implants:
a systematic literature review

Presenter: Diez JMB

*Department of Prosthodontics, School of Dentistry,
University of Freiburg, Germany, Freiburg, Germany*
Co-authors: Diez JMB, Att W, Strub JR

*Department of Prosthodontics, School of Dentistry, University of
Freiburg, Germany, Freiburg, Germany*

Background: One piece implants are defined as implants by which the transmucosal abutment is an integral part of the implant. They are usually placed in a nonsubmerged approach. Despite multiple advantages over two-piece implants, there is no clear information about the long-term performance of one-piece implants.

Aim: The purpose of this systematic review was to evaluate the long-term clinical performance of one-piece implants.

Methods: An electronic MEDLINE search complemented by a manual search was conducted to identify randomized controlled clinical trials as well as prospective and retrospective clinical studies about one-piece implants. Additional inclusion criteria were: the mean follow-up time of at least 5 years and the proportion of patients/implants followed for more than 5 years is over 80% of the initial sample. The main keywords used were: dental implant [MeSH], longitudinal study [MeSH], one-piece, nonsubmerged, microgap, bone remodeling, flapless, single stage, randomized controlled trial, prospective and retrospective.

Results: Fifty-seven studies from an initial yield of 591 titles were selected and the data was extracted. Of the 57 full text articles examined, 25 were excluded from the final analysis. A total of 32 articles were finally selected. All of the studies were published between 1984 and 2010. Three different study designs were included: 4 randomized controlled trials, 22 prospective and six retrospective studies. The studies were divided into three main categories according to the type of edentulism: complete edentulism (15 articles), partial edentulism – including single-tooth loss – (11 articles) and type of edentulism not specified (six articles). Information about implant type, implant surface, implant length, implant diameter, loading protocol, implants lost before and during function, implant stability measurement method, type of prosthesis, implant and prosthetic survival rates, biological and technical complications were extracted from all the mentioned articles and tableized. The survival rates in completely edentulous patients ranged between 91.9% and 100% with observation periods between 5 and 8.6 years, whereas it ranged between 90.5% and 100%, with

observation periods between 5 and 10 years in partially edentulous patients. In cases where the type of edentulism was not specified, the survival rates varied between 84.6% and 100% after observation periods between 5 and 14.1 years. Owing to the heterogeneity in study design, especially in the type of implants, implant surfaces and loading protocols, it was not possible to perform a statistical comparison of the data obtained.

Conclusions and clinical implications: Within the limits of this systematic review, it can be concluded that high long-term survival rates can be observed with one-piece implants. Further randomized clinical trials are needed to provide more information about the outcome of different variables associated with one-piece implants.

226 Implant Therapy Outcomes, Prosthetic Aspects

A new prosthetic approach for post-extraction
implant placement in aesthetic area: A prospective
study

Presenter: Bruno V

Dental School, University of Ferrara, Ferrara, Italy
Co-authors: Bruno V¹, Badino M², Sacco R³, Catapano S¹
¹Dental School, University of Ferrara, Ferrara, Italy²Private Practice,
Pinerolo (to), Italy³Private Practice, London, UK

Background: One of the major problems encountered after tooth extraction, is the loss of hard and soft tissue. Therefore, efforts are necessary to establish an aesthetic soft tissue contour around implants with an intact papilla and a gingival margin, in harmony with the gingival margins of the adjacent dentition. It has been previously shown that the papilla was always present when the distance from the contact point to the bony crest was a minimum of 5 mm or less.

Aim: To illustrate the fabrication of a provisional restoration, based on periapical radiograph and diagnostic cast, as well as a prosthetic template to transfer the position intraorally. To assess in a prospective clinical study, the 1-year follow-up aesthetic outcome with such a technique.

Methods: Twenty-one consecutive patients with a total of 27 teeth scheduled for extractions and immediate implant placement (NobelActiveTM and Replace[®] Select Tapered, NobelBiocare), were included in the study. A radiographic template was fabricated to measure the distance between the osseous peak and the radiopaque landmark. This template, once modified, was used as a surgical template. The measurements were transferred onto the cast. An ideal resin provisional restoration was then fabricated with the contact point at 5–6mm from the osseous peak. A prosthetic guide template was also made to transfer the exact position of the provisional restoration. Jemt's papilla index, before placement and at 1-year follow-up was assessed. Descriptive statistics were used to report data.

Results: In all patients the restoration was delivered at time of tooth extraction and implant placement. At 1-year follow-up all implants were *in situ* accounting for a cumulative survival rate of 100%. No evident radiographic bone loss was present. At 1-year follow-up the mesial papilla index and the distal papilla index reached the optimal result (score 3) in 55% and 41%,

respectively. In detail, the mesial papilla index improved or kept unchanged in all patients except two (7%); in one patient decreased from score 2 to 1 and in another one increased from score 2 to 4. The distal papilla was improved or unchanged in all patients except four (15%); in two score decreased from 2 to 1 and another two from 3 to 2.

Conclusions and clinical implications: Within the limitations of this study, the presented procedure for fabricating a provisional which respects the distance of the contact point from the osseous peak seems to be a viable approach to maintain or improve a good aesthetic outcome, particularly with regards to the papilla.

227	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Effect of open margin in the crestal bone remodeling around implant-supported cement retained single crowns: a retrospective study

Presenter: Chen C

Chimei Medical Center, Liouying, Tainan, Taiwan

Co-authors: Chen C, Gallucci G

Chimei Medical Center, Liouying, Tainan, Taiwan

Background: The marginal fit of a dental restoration is important to its long-term success. Marginal discrepancies cause increased plaque accumulation followed by secondary caries and change in the prevalence and type of bacteria which induce periodontal disease. Meanwhile, misfit of tooth-supported dental prostheses causes microleakage and is associated with potentially detrimental effects to the abutment teeth and supporting periodontium. Dental caries is not applicable to implants either when there is open margin or cement washout. However, the accurate fit of implant prostheses is equally important for the success in the long-term. As far as cement-retained implant prostheses is concerned, there are scarce data on the effect of the iatrogenic misfit (open margin/overhang) on the peri-implant bone loss.

Aim: The objective of the study was to compare bone loss around implants supported single crowns that have over hang/open margin and those that are accurately fitted.

Methods: A total of 17 subjects having cement-retained implant support single crowns and follow-up more than 1 year after crown delivery were included in this study. The subjects were divided into two groups according to the radiographic analysis results: misfit crowns (test group) ($n = 10$) and accurately fitted crowns (control group) ($n = 7$). Distance from the implant shoulder to the alveolar crest of was measured through radiography at baseline and the follow-up visit. The difference between different time points was also calculated.

Results: The mean bone level at baseline for the test group was 2.45 ± 0.83 mm and for the control group was 1.87 ± 0.98 mm. There was a significant difference in the bone level at baseline between these two groups ($P = 0.013$). Also, at follow-up there was a statistically significant difference between the two groups ($P = 0.010$). The mean bone level at follow-up for the test group and control group were 2.72 ± 0.94 and 1.88 ± 0.89 mm, respectively. On comparing the average difference in bone level

between the two groups the mean bone loss in the test group was -0.27 ± 0.28 mm and for the control group was -0.01 ± 0.36 mm. This difference was also statistically significant ($P = 0.037$).

Conclusions and clinical implications: Within the limitations of this study, a misfit single implant support crown might cause more crest bone loss than actually fitted crown after 3 years functioning.

228	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Endosseous implant rehabilitation for edentulous mandible using customized abutment and high-strength ceramics with CAD/CAM

Presenter: Cho Y-W

Department of Biomaterials & Prosthodontics, School of Dentistry, Kyung Hee University, Seoul, Republic of Korea

Co-authors: Cho Y-W, Leesungbok R, Park S, Ahn S-J,

Lee S-W

Department of Biomaterials & Prosthodontics, School of Dentistry, Kyung Hee University, Seoul, Republic of Korea

Background: It is challenging for the clinician and laboratory technician to attain a passive fit between implant abutments and suprastructures. Recently, coupled with the development of computer-aided design/computer-assisted manufacture (CAD/CAM), computer numeric-controlled techniques of duplication have increased the accuracy of fit of these framework. The CAD/CAM system allows fabrication of single-and multiple-unit framework as well as implant components.

Aim: The advantages, properties, and clinical applications of the all-ceramic components and materials used with Zirkonzahn system, based on scientific evidence, are discussed in this article. The featured case presentation, a full mouth rehabilitation, demonstrate the versatility and esthetic capabilities of the CAD/CAM system.

Methods: *Surgical phase:* All implants were placed using a one-stage approach with the proper height of healing abutments to be at or above tissue level. The mandibular implants were placed with 35–50 Ncm to ensure primary stability. One week later, temporary titanium copings were attached to the abutments and the previously prepared denture with implant placement accesses was inserted and checked for proper occlusion and clearance. *Prosthetic phase:* 2 months later, six direct abutments were milled parallel with two degree angle and transferred to the mouth using an abutment jig after radiographic verification. The scanning of resin framework was performed using Optical scanner s600 (Zirkonzahn). Yttrium-stabilized tetragonal zirconia polycrystals (Y-TZP zirconia) was used to be CAM-milled. To keep the strength of the individual unit, polycrystalline ceramics with pressable glass-ceramic crowns were used. Resin cement was used to bond the restorations to the framework. Finally, final restoration was cemented on the all abutments with resin cement.

Results: Occlusion was refined, and the final esthetic outcome was acceptable to the patient. Functionally the patient was able to eat any food without difficulty in chewing. Follow-up was

carried out at regular intervals to ensure access closure integrity, document alveolar bone levels, access hygiene measures, and check for ceramic chipping.

Conclusions and clinical implications: The ease of obtaining a properly fitting framework makes this technique easier than conventional cast frameworks. The use of immediate loading for the temporary restorations has become an important treatment, greatly reducing the time and difficulty associated with traditional 2-stage technique. Combination of these technologies will propel traditional implant treatment forward, enhancing patient satisfaction by reducing treatment time and increasing the level of precision.

229 | Implant Therapy Outcomes, Prosthetic Aspects

Full-arch implant supported zirconia bridges using Zirkonzhan prettau

Presenter: Choi J-Y

Department of Prosthodontics, School of Dentistry, Chonbuk National University, Jeonju, Republic of Korea

Co-authors: Choi J-Y, Song K-Y, Park J-M, Ahn S-K

Department of Prosthodontics, School of Dentistry, Chonbuk National University, Jeonju, Republic of Korea

Background: As growing needs for aesthetic restorations with mechanical strength, it is preferred to fabricate all-ceramic prosthesis especially using zirconia that improves the strength of ceramics. But zirconia ceramic have been at risk of chipping of veneering porcelain. A zirconia full-coverage crown without veneering dental porcelain was recently released (Zirkonzahn prettau; Zirkonzahn GmbH, Italy). The zirconia full-coverage crown without veneering dental porcelain has advantages in that no dental porcelain is fractured due to the absence of an upper structure in it. In addition, it has greater transparency than that of the previous zirconia, and it provides a color liquid that can express the dentin's color tone and a stain that can be directly applied to the zirconia.

Aim: This case report describes a patient restored with implant-supported fixed bridges using Zirkonzhan prettau® to achieve aesthetic and functional rehabilitation.

Methods: A 39-year-old male patient with fully edentulous state on bi-maxilla required prosthetic restoration. Fourteen Astra Tech dental implants (eight of maxilla and six of mandible) were placed. After 4–6 months of healing period, second surgery was done. The patient got temporary restorations, which were carefully adjusted through periodic check-up. After resin set up model was evaluated intraorally, final prosthesis was fabricated using MAD-MAM system.

Results: The patient was satisfied with the restorations and maintained in good oral health condition after treatment. The zirconia full-coverage bridges showed high strength. There have been no chipping and the implants appear to be stable. The latest result of the 1-year-recall is functionally and esthetically satisfactory.

Conclusions and clinical implications: In full mouth rehabilitation case, the implant-supported fixed bridge using Zirkonzhan prettau® could be used as a treatment alternative. It provides more aesthetic restoration and higher satisfaction to the patient.

Before the material and technique can be recommended for general use, longer follow-up studies involving larger number of patients are needed.

230 | Implant Therapy Outcomes, Prosthetic Aspects

Early loading of oral implants with advanced surgery: case series

Presenter: Çömlekoğlu E

Department of Prosthodontics, School of Dentistry, Ege University, Izmir, Turkey

Co-authors: Çömlekoğlu E¹, Çömlekoğlu MD¹, Sağırkaya E², Kaya E³, Günbay T³

¹Department of Prosthodontics, School of Dentistry, Ege University, Izmir, Turkey²Department of Prosthodontics, School of Dentistry, Ordu University Ordu, Turkey³Department of Oral and Maxillofacial Surgery, School of Dentistry, Ege University Izmir, Turkey

Background: Information on early loading protocols with advanced surgical techniques is limited.

Aim: The aim of this clinical case series is to present the preliminary clinical outcome of early loaded implant-supported full-arch fixed dental prostheses (FDPs) in edentulous maxilla and mandible.

Methods: Total/partially edentulous three patients (age range: 55–61) received a total of 48 sand-blasted, large-grit and acid-etched implants (SLA and SLActive-Straumann, Switzerland; Bego, Germany) were placed in the maxilla ($n = 24$) and in the mandible ($n = 24$) and loaded 6 weeks after surgery with implant-supported metal-ceramic FDPs. In two cases advanced surgical procedures (bimaxillary sinus lifting, grafting) were also performed. Resonance frequency analysis (RFA) evaluations were recorded at surgery, at fifth week. Calculations of marginal bone loss (MBL) were performed in radiographs taken at placement and sixth week and 6 months of loading.

Results: The mean RFA values at surgery and fifth week were 64 ± 1.8 , and 78 ± 1.4 , respectively. MBL (mm) for advanced surgery applied implants were higher (0.8 ± 0.1) than implants placed without advanced surgery (1.1 ± 0.4) during the follow-up.

Conclusions and clinical implications: Early loading of implants placed with advanced surgical techniques and fixed dental prostheses demonstrated a good short-term clinical outcome, however, long-term studies should be conducted.

231 | Implant Therapy Outcomes, Prosthetic Aspects

Bone resorption around upright and tilted implants supporting All-on-Four immediate full-arch rehabilitation. A prospective study

Presenter: Corbella S

Department of Health Technologies – Centre for Research in Oral Implantology, University of Milan, Milan, Italy

Co-authors: Corbella S, Del Fabbro M, Taschieri S, Francetti L
Department of Health Technologies – Centre for Research in Oral Implantology, University of Milan, Milan, Italy

Background: Tilted implants are actually considered as a viable alternative in the rehabilitation of edentulous arches.

Aim: The aim of this prospective study was to assess clinical outcomes and peri-implant bone level changes around tilted and axial fixtures supporting full-arch fixed immediate rehabilitations (All-on-For) up to 60 months of loading, also evaluating the influence on bone resorption of smoking and periodontal status before surgery.

Methods: Thirty-seven full arch-rehabilitations, in a cohort of 33 patients (14 men and 19 women), supported by a combination of straight and tilted implants, both mandibular and maxillary, were included in the study. Follow-up were scheduled at 6, 12, 18, 24 months and then yearly. At each follow-up visit periapical radiographs with individualized tray were taken and subsequently analyzed using a software to assess bone level. The presence of peri-implant inflammatory disease was registered.

Results: A total of 148 anodized implants (NobelSpeedy™; Nobel Biocare, Kloten, Switzerland) of 4 mm diameter were evaluated. The weighted mean follow-up was 23.1 months (Range 6–60 months) in the mandible and 18.4 months (Range 6–48 months) in the maxilla. No implant was lost. Bone loss was significantly higher around upright implants in mandibular restorations compared with tilted ones at 12 months (0.63 ± 0.56 vs 0.54 ± 0.42 mm) and at 36 months (1.17 ± 0.67 vs 0.83 ± 0.67 mm) ($P < 0.05$). Higher mean values of bone loss were reported for mandibular implants but no statistically significant difference was found between upper and lower jaw. Smoking and a history of periodontitis were related to higher values of bone loss without causing implant failure.

Conclusions and clinical implications: The use of a combination of upright and tilted implants supporting a full-arch immediately loaded rehabilitation was a viable treatment for edentulous jaws also in patients exposed to important risk factors as smoking and periodontal disease.

232 | Implant Therapy Outcomes, Prosthetic Aspects

Clinical and radiographic evaluations of anatomical head-neck profile implants. Ten year follow-up

Presenter: Corcolis I

Corcolis Ioannis, Milan, Italy

Co-authors: Corcolis I

Corcolis Ioannis, Milan, Italy

Background: To respect or recreate the natural scalloped appearance of dentogingival complex is an essential element in implant dentistry.

Aim: The aim of this study was to compare a scalloped head-neck profile implant, following a healthy bone-crest shape around teeth, with a current flat-top one for implant success, aesthetic, radiographic and clinical outcomes.

Methods: Between June 2001 and September 2002, 120 scalloped head-neck profile implants, named Curved Connection Implants (CCIs) were used to replace missing teeth in 84 patients (Group I). The sites were: 24 upper and lower premolars, eight inferior molars, 67 in maxillary and 21 in mandibular frontal areas. As many normal flat top implants (Nobel Replace, Nobel Biocare, Group II) were used on patients for comparison. The following parameters were compared: (1) clinical implications, (2) success rates, (3) marginal bone loss measured on

standardised radiographs taken at placement and for nine consecutive years, (4) probing depth (PD) measurements using millimetric probes on the buccal (B), mesial (M) and distal (D) aspects of the implants, (5) aesthetic indices evaluated clinically and on digital photographs.

Results: During placement and component management no particular difficulties were registered for CCIs compared with conventional implants. Easier abutment positioning and stability was found on Group I. Similar success rates were seen during the 9-year observation period: CCI 98.4%: Group II 97.5%. The radiographic comparison showed no significant difference in marginal bone loss between the two groups. In the 9-year follow-up no differences were recorded between the two groups for Modified Plaque and Bleeding Index. Probing depth measurements on M and D aspects were similar for the two groups. On the buccal aspect PD was average $2.5 \text{ mm} \pm 0.62$ (SD) for Group I, and $3.47 \text{ mm} \pm 0.71$ (SD) for Group II, with mean difference of 0.97 mm ($P > 0.05$). Aesthetic Indices like patient satisfaction were similar. Nine of Group II implants (7.5%) showed metal exposure on the buccal aspect. In Group I, two implants (1.66%) showed this.

Conclusions and clinical implications: This investigation did not show relevant differences in long-term success and clinical management between current flat-top implants and CCI. Furthermore, the use of anatomical profile implants may help in recreating the scalloped appearance of tissues, being closer in design to that shape, and in reducing the risk of metal exposure on the buccal aspect in certain cases.

233 | Implant Therapy Outcomes, Prosthetic Aspects

Four-years evaluation of different retention systems for implant-supported overdentures

Presenter: Cristache CM

Concordia Dent Clinic, Bucharest, Romania

Co-authors: Cristache CM¹, Iliescu AA², Cristache G¹, Burlibasa M², Carcu CM¹

¹*Concordia Dent Clinic, Bucharest, Romania, ²University of Medicine and Pharmacy, Bucharest, Romania*

Background: The multitude of benefits from mandibular two implant overdentures to the edentulous population is well known, overwhelming in improved function, emotional stability, physical health, and esthetics.

Aim: The aim of our study is to compare, in a prospective controlled clinical trial, the Locator® System with two other types of stress-breaking retention (Retentive Anchors and Magnets) for implant supported overdenture in atrophic edentulous mandible, with the use of Straumann Dental Implant System.

Methods: The study was divided in two parts – in the first part of the study 46 fully mandibular edentulous patients were enrolled (age 42–84 years, mean – 60.6). Each patient received two screw-type Straumann standard implants $\varnothing 4.1 \text{ mm}$, SLA surface in the canine region of the mandible, placed in a 1-stage nonsubmerged procedure according to a strict protocol. After 6-weeks healing period implants were early loaded and the patients were randomly assigned to one of two main groups:

Group B-23 patients received retentive anchors and Group M-23 patients received magnets. The two groups of patients were compared in the second part of the study with 23-patients (age 49–80 years, mean – 65) receiving Locator system abutments (Group-L) following same research protocol (ClinicalTrials.gov Identifier: NCT01034930). New mandibular overdenture with metal reinforcement was made. Total costs of the surgical, prosthetic and maintenance procedure were calculated for the three attachment systems used after 48 months. Patient satisfaction was assessed with the aid of questionnaires adapted (translated in Romanian) from the index OHIP-EDENT, initial (before surgery-with the original denture), at 1 and 4-years follow-up.

Results: Four implants failed before loading were replaced and healed uneventfully (97.1% success rate after 4 years).

Surgical and prosthetic costs were similar, but components costs were highest at M group and lowest at B group.

Patient satisfaction improved significantly in the three groups across all variables including esthetics, except ease of cleaning – the B and L-group had higher maintenance necessities. M-group scored lower stability but also lower maintenance requirements.

Conclusions and clinical implications: Implant-supported overdenture improves retention and stability, provides better esthetics, phonetics, bone preservation, increased comfort, better psychosocial state, and enhanced nutrition, all resulting in an improved quality of life. The choice of the retention system used is determined by the special requirements of each patient. Implant-supported mandibular overdenture is a simple, predictable, and cost-effective treatment for edentulous patients.

Acknowledgment: Study supported by Grant 316/2003 and 507/207 from ITI Foundation for the Promotion of Oral Implantology, Switzerland.

234 | Implant Therapy Outcomes, Prosthetic Aspects

In vitro study: comparison between two pouring techniques

Presenter: Daemi R

University of Sevilla, Sevilla, Spain

Co-authors: Daemi R¹, Barba J¹, Garcia E¹, Falcao C¹, Rios V¹, Bullón P¹, Lázaro P¹, Fernández A¹, Herrero M¹

¹University of Sevilla, Sevilla, Spain, ²University of Fernando Pessoa, Oporto, Portugal

Background: In the prosthesis over implants treatment sequence, the final impression takes on a vital role in the success of the treatment. The correct pouring of the impression is also essential to maintain a reliability that guarantees the correct transfer of the implant positions to the master cast. Klockner Essential cone prosthodontic system presents a sheath, which allows the removal of the implant–abutment analogs, and their posterior replacement without losing their initial position, therefore, facilitating the lab technician’s work in areas where access is difficult. The anti rotation plane of the sheath and analog, allows the analog to only have one position, hence reassuring its correct replacement. No data in the literature evaluates if its use can negatively influence the reliability of the casts obtained.

Aim: *In vitro* study that compares two pouring techniques (with and without the use of sheaths) regarding the reproducibility reliability of the implant position in a master cast.

Methods: A master cast reference model with four parallel Klockner Essential Cone 4 × 10 mm implants (A, B, C, D) was fabricated. Forty impressions were made with the open-tray technique. These impressions were divided in two groups depending on the pouring technique: Group A: Coping-implant abutment analog (20) Group B: Coping-implant abutment analog connected to sheath (20) A stereomicroscope (Leica S8, APO) and its corresponding software was used for all the measurements: Distance A–B, B–C and C–D (distance from centre of one implant to the other). The measurements of each of these distances in the reference model were repeated 15 times, and the measurements of each of these distances in the duplicate models were repeated 10 times. The median was registered. The amount of distortion between the reference model and the duplicate models was evaluated, therefore relating the pouring technique with a greater or lower distortion. Pearsons product-moment correlation coefficient was used. *T*-Student was used to complete analysis after Shapiro Wilks test to see if there was a normal distribution.

Results: Measurements of group B are more similar to the reference model measurements. Practically all the differences were significant except two (***)

	Reference model	Group A (without sheath)	Group B (with sheath)
Distance a–b (mm)	11,883	11,933***	11,735
Distance b–c (mm)	13,013	13,436	13,188
Distance c–d (mm)	12,203	12,442	12,203***

Conclusions and clinical implications: No significant differences were found between the two techniques, and the use of sheaths offers greater reproducibility reliability, allowing the technician to work the interproximal areas of the restoration more finely.

235 | Implant Therapy Outcomes, Prosthetic Aspects

Immediate rehabilitation of the edentulous mandible using Ankylos SynCone telescopic copings and intra-oral welding: a pilot study

Presenter: Degidi M

Private Practice, Bologna, Italy

Co-authors: Degidi M¹, Piattelli A²

¹Private Practice, Bologna, Italy, ²University of Chieti, Chieti, Italy

Background: In 2006 Degidi et al. published a protocol for the immediate-loading of multiple implants by welding a premanufactured titanium bar to implant abutments performed directly in the oral cavity, in order to create a customized metal-reinforced provisional restoration. The intraoral welding technique subsequently proved to be a successful option in the rehabilitation of the edentulous mandible with a fixed permanent restoration delivered on the same day as implant placement, using both butt-joint and tapered connection implants.

Aim: The aim of this prospective study was to assess the suitability of the immediate rehabilitation of the edentulous

mandible using SynCone copings and the intraoral welding technique.

Methods: Patients with an edentulous mandible were fitted with a removable restoration supported by an intraorally welded titanium bar. Copings were connected to their respective SynCone 5° abutments and then welded to a titanium bar using an intraoral welding unit. This framework was used as a support for the final restoration, which was placed on the same day as implant placement. Restoration success and survival, implant success and biological or technical complications were assessed immediately after surgery, and at 6- and 12-month follow-up examinations. Twenty-two patients, with a mean age of 55.2 years (SD = 11.3; $n = 22$), were consecutively treated with 88 immediately loaded implants.

Results: No resin fractures or radiographically detectable alterations of the welded framework were present in the 22 restorations delivered. One implant (1.1%) failed 1 month after surgery. All remaining implants (98.9%) were clinically stable at the 12-month follow-up.

Conclusions and clinical implications: Within its limitations, this pilot study has demonstrated that it is possible on the same day as surgery to successfully rehabilitate the edentulous mandible with a definitive restoration supported by an intraorally welded titanium framework and SynCone 5° abutments.

236 | Implant Therapy Outcomes, Prosthetic Aspects

Patients's perception on implant rehabilitation

Presenter: Çömlekoğlu MD

Department of Prosthodontics, School of Dentistry, Ege University, Izmir, Turkey

Co-authors: Çömlekoğlu MD, Çömlekoğlu E, Aladağ A, Parlar A, Güngör MA

Department of Prosthodontics, School of Dentistry, Ege University, Izmir, Turkey

Background: Functional, esthetic, phonetic and psychological problems cause discomfort for the patients with edentulism.

Aim: The objective of this study was to evaluate the perception of patients treated with implant-supported prostheses.

Methods: One hundred and thirty-eight patients treated with 289 dental implants (Straumann, Switzerland; Bego, Germany; Astra, Sweden, Friadent, Germany) were included in the study. Patients were asked to fill out a questionnaire regarding function, phonetics, hygiene, esthetics, overall satisfaction and cost.

Results: Overall patient satisfaction was reported to be 91.4% for function while dissatisfaction was 7.3% regardless of the denture type. Implant-supported removable denture wearers reported a satisfaction ratio of 73.6% while 81.1% of fixed partial denture wearers were satisfied. The majority of the patients (83.7%) exhibited high satisfaction regarding esthetics and phonetics. The majority (81.8%) of the patients reported no difficulties in cleaning their dentures. A ratio of 93.1% revealed that implant therapy fulfilled the expectations of most of the patients. 84.4% of the patients reported they would recommend a similar treatment to their friends and relatives. The cost of implant treatment was acceptable for most of the patients (64.1%).

Conclusions and clinical implications: The patients' perception on implant therapy was found to be favourable. Implant therapy has become a routine treatment option for the patients.

237 | Implant Therapy Outcomes, Prosthetic Aspects

Interim implant-supported restorations

Presenter: Skondras E

University of Athens, Athens, Greece

Co-authors: Skondras E, Skondra E, Roussou I, Kourtis S

University of Athens, Athens, Greece

Background: Restoration of function and esthetics is the ultimate goal of implant therapy after osseointegration. Implant-supported provisional restorations can be screw-retained or cemented, supporting single or multiple implants. Several types of interim restorations can be used in order to ascertain patient comfort and proper soft tissue healing when a two-stage implant surgery has been used.

Aim: The aim of this poster is to present the types of interim implant-supported restorations, the mode of fabrication and the benefits from the use of them.

Methods: Clinical cases, where implant-supported interim prostheses were used, are presented. The available types of provisional restorations are classified depending on the mode of fabrication and on the type of the material which was used.

Results: Through the use of provisional implant supported restorations proper healing of the peri-implant tissues is achieved, resulting in a favorable aesthetic outcome. Besides, they are a useful guide, which offers a predictable control of the final restoration.

Conclusions and clinical implications: Implant-supported provisional restorations are beneficial in determining the suitable prosthetic design, allowing for a successful permanent prosthesis. Moreover soft tissue evaluation and manipulation can be achieved. Finally in cases where the bone quality is compromised, implant-supported interim restorations can be used in order to test the osseointegration before placing the definitive prosthesis.

238 | Implant Therapy Outcomes, Prosthetic Aspects

Implant treatment in angle class iii edentulous patients

Presenter: Foundouka L

Private Practice, Katerini, Greece

Co-authors: Foundoukas D, Foundouka L

Private Practice, Katerini, Greece

Background: Patients with Class III malocclusion face both functional and aesthetic problems as well as psychological and social ones. The correction of the malocclusion and the improvement of their esthetics allow them to recover their self-esteem. Orthognathic surgery can treat such deformities and solve functional and aesthetic problems, but the following postoperative discomfort forces older patients to ask for an implant solution.

Aim: Mouth rehabilitation of edentulous Angles Class III patients using implants for stable and aesthetic results is very often the main demand of the patients themselves. The relation between the jaws is contraindicated to construct fixed prostheses (bridges) over implants and there is also the crucial problem of restoring facial aesthetics. The use of an overdenture on implants and the securing of its stability by the conical crown system SYNCONe – ANKYLOS FRIADENT is the goal of our case presentation.

Methods: Two edentulous patients presented themselves at our clinic asking for a treatment based on implants to replace the missing teeth and solve the resulting aesthetic problems. Clinical and radiographic examination indicated skeletal malocclusion Angle Class III. Both were treated by hybrid prostheses fixed on implants (short without palatal plate overdentures), well stabilized on SYNCONe ANKYLOS telescopic crowns, precise prefabricated components. The above malocclusion was treated by acrylic teeth arranged in normal articulation and the use of buccal, like full denture's, acrylic flanges improved their aesthetic outlook.

Results: The use of implants allowed us to construct stable prostheses with normal tooth articulation and facial improvement. The SYNCONe system provided us with the proper interarch space for us to be able to fix the artificial teeth in a position of normal articulation, as Angle Class I. Our patients were very satisfied with this treatment and they loved their new facial appearance.

Conclusions and clinical implications: Solving articulation irregularities and facial impairments can provide Angle Class III edentulous patients with the necessary conditions for recovering their self-esteem.

practitioner (GDP) in a general private practice setting remains to be investigated.

Aim: The aim of this study was to evaluate the clinical and aesthetic outcomes of single tooth restorations on bone level implants with a chemically modified surface (SLActive) that underwent early placement in the anterior maxilla by a GDP.

Methods: This prospective case series present the results of 10 single tooth implants in the anterior maxilla of 10 consecutive patients that were placed and restored by a single GDP following a standardized treatment protocol consisting of: (1) Atraumatic extraction of the failing tooth, (2) Placement of an SLActive bone level implant at 6–8 weeks post extraction with simultaneous guided bone regeneration, (3) Loading of provisional restoration at 2–3 months following implant placement, (4) Production of a customized impression coping, (5) Loading of the final all ceramic abutment and all ceramic crown at 6 months after the delivery of the provisional restoration. The outcomes were assessed at 1 year following loading of the final restoration using standard clinical parameters; pink (PES) and white aesthetic scores (WES).

Results: All the implants were successfully integrated presenting 100% survival and success rate. The aesthetic assessment provided mean averages of 7.9 for the PES and 7.0 for the WES.

Conclusions and clinical implications: General dental practitioners with appropriate postgraduate training are able to provide clinically successful and aesthetically pleasing single tooth implant restorations in the anterior maxilla when utilizing the specific standardized treatment protocol.

Single tooth implants in the aesthetic zone by general practitioner

Presenter: Furze D

Strand on the Green Dental Practice, London, UK

Co-authors: Furze D^{1,2}, Byrne A³, Donos N², Mardas N²

¹Strand on the Green Dental Practice, London, UK, ²Eastman Dental Institute, London, UK, ³Byrnes Dental Laboratory, Oxford, UK

Background: Aesthetically pleasing outcomes present a clinical challenge in implant dentistry especially in the anterior maxilla where aesthetic failures are common. Recent studies have shown that anterior maxillary single-tooth implant restoration is a successful and predictable in terms of aesthetic outcomes treatment if the correct restorative driven implant placement is achieved and combined with a simultaneous guided bone regeneration (GBR) procedure to rebuild esthetic facial hard and soft tissue contours and a carefully designed temporary and final restoration. It could be claimed, however, that the highly experienced specialist clinicians who performed the treatments and the strictly regulated and controlled university clinical settings where the treatment was performed is the major contributor to the high levels of success. Whether similar success levels could be achieved by less experienced general dental

Provisional restoration and customized bridge impression on adjacent implants

Presenter: Furze D

Strand on the Green Dental Practice, London, UK

Co-authors: Furze D¹, Byrne A²

¹Strand on the Green Dental Practice, London, UK, ²Byrnes Dental Laboratory, Oxford, UK

Background: The aesthetic replacement of multiple teeth with a fixed solution within the aesthetic zone is considered one of the most challenging treatments. This clinical report describes a method in which all the maxillary incisors were replaced with an implant supported bridge. Following restoratively driven implant placement, a provisional phase of 6 months was undertaken to produce the optimum soft tissue profile of both the implant emergence and the pontic site. A customized impression coping was fabricated for both implant and pontic sites for accurate reproduction of the soft tissues on the final casts. A definitive screw retained bridge was placed.

Aim: This clinical report aims to photographically document a technique of provisional restorations to condition the soft tissue, followed by a customized bridge impression designed to give the technical team the correct emergence profiles of both the implant and pontic sites.

Methods: The unrestorable incisor teeth were minimally traumatically removed with out raising a muco-periosteal flap,

consistent with an early implant placement protocol. An immediate composite resin bonded bridge with metal wings on both canines was modelled to support the interdental papilla. Implant placement in the central incisor positions according to early implant protocol utilizing a surgical stent with simultaneous guided bone regeneration. The ridge was contoured at both the implant and pontic sites, and a bilayered cross-linked collagen membrane in a two-layered technique. A closed tray impression technique was taken and a composite provisional bridge manufactured. Following 6 months of tissue conditioning, a customized bridge impression was taken. The provisional bridge is removed and replaced onto the initial cast. A light bodied fast setting addition silicone impression is then taken of the apical half of the provisional bridge. Bis-acrylic temporary crown and bridge material is used to customize the impression copings to provide an exact replica of the provisional bridge. An open tray polyether impression is taken.

Results: In customising the impression copings the soft tissues are supported while completing the impression. This information is replicated on the master casts. The accuracy of the impression technique is shown by the immediate support of the soft tissues with no blanching of the tissues at any point.

Conclusions and clinical implications: This clinical report describes a simple, fast and effective impression technique that accurately replicates the soft tissue emergence from the implant as well as the soft tissue sculpturing of the pontic site.

241 | Implant Therapy Outcomes, Prosthetic Aspects

Oral rehabilitation of an ectodermal dysplasia patient with implant-supported prostheses: a clinical report

Presenter: Ghozezi R

188 Hobson, Auckland, New Zealand

Co-authors: Ghozezi R

188 Hobson, Auckland, New Zealand

Background: Ectodermal dysplasia represents a group of inherited disorders characterized by dysplasia or aplasia of tissues of ectodermal origin. Oral findings often are significant and can include multiple tooth abnormalities (such as anodontia and hypodontia), loss of vertical dimension and lack of normal alveolar ridge development.

Aim: This clinical report describes the prosthodontic treatment of a patient with ectodermal dysplasia.

Methods: An 18-year-old girl presented to the faculty of dentistry, Tehran University, with the chief complaint of unaesthetic appearance and inefficiency of dentition. Clinical and radiographic examination corroborated that the patient was missing maxillary and mandibular permanent central and lateral incisors, canines and second premolars. After preliminary impressions and an interocclusal relation evaluation, the trial arrangement of the teeth was completed and evaluated intraorally to verify tooth position, esthetics, and proper occlusion. The trial denture was converted to a radiographic guide for the computerized tomographic scan. The patient underwent the surgery, which included the insertion of six implants in the maxilla and five in the mandible, with bone material graft to the maxilla because of the thin alveolar ridge. Six months after

surgery, acrylic resin fixed provisional restorations were installed over implants. Two months later, cemented metal-ceramic restorations were fabricated.

Results: The patient has been followed for 2 years without any prosthetic complications.

Conclusions and clinical implications: This clinical report depicted the use of metal-ceramic implant-supported fixed prostheses to rehabilitate successfully function and esthetics of ectodermal dysplasia patient.

242 | Implant Therapy Outcomes, Prosthetic Aspects

The effect of a veneered zirconia abutment on marginal peri-implant soft tissue color: A controlled clinical trial

Presenter: Happe A

Department of Oral and Maxillofacial Plastic Surgery, University of Cologne, Cologne, Germany

Co-authors: Happe A^{1,2}, Schulte-Mattler V², Rothamel D¹

¹Department of Oral and Maxillofacial Plastic surgery, University of Cologne, Cologne, Germany, ²Private Practice, Münster, Germany

Background: Although the use of all-ceramic abutments for single-tooth implants in the esthetic zone is proposed by various authors, the clinical benefit in terms of soft tissue discolorations have rarely been investigated. Few studies exist in terms of color properties of soft tissue around titanium dental implants.

Aim: The purpose of this controlled clinical study was to investigate the difference in optical appearance of the soft tissue labial to dental implants with a veneered zirconia abutment.

Methods: Twelve patients with 15 single titanium implants in the maxillary anterior region were recruited. All implants ($N = 15$) were restored with zirconia abutments veneered with fluorescent ceramic and all-ceramic crowns. Color measurements of the peri-implant mucosa of the test sites were made at the facial aspect of the teeth using a spectrophotometer. The gingiva of a contralateral or adjacent natural tooth served as control. The color data (CIELAB color coordinates; L, a, b) in five incremental areas of 1×2 mm from the gingival margin toward the apical direction were obtained three times in both test and control sites. Mean values of triple measurements were calculated and used for statistical data evaluation (SPSS Inc., IBM). To compare the visibility and general appearance of the differences, ΔE -values were calculated for each patient. The alpha error was set at $P < 0.05$.

Results: The color of the test site (peri-implant mucosa) demonstrated lower mean values of L, a and b than the control site. There was a significant difference between the test site and control site in the a and b values in all five incremental areas ($P < 0.05$, Student's T-Test). However, no significant difference was found for the L values. All ΔE -values in the five incremental areas showed significant greater values than the clinical perceptual threshold of 3.6 ($P < 0.05$, Student's T-test).

Conclusions and clinical implications: Though there was still a color difference between natural teeth and the implant restorations that was significant, the tested abutment design lead to a brightness of the peri-implant soft-tissue that did not differ significantly from natural teeth.

Three-dimensional accuracy of transfer impression techniques for dental implants

Presenter: Heschl A

Division of Prosthodontics, Restorative Dentistry, Periodontology and Implantology, Graz, Austria

Co-authors: Heschl A, Clar V, Platzer S, Wegscheider W, Lorenzoni M

Division of Prosthodontics, Restorative Dentistry, Periodontology and Implantology, Graz, Austria

Background: A range of different results concerning the three-dimensional accuracy of different transfer impression techniques for dental implants can be found in the literature.

Aim: The aim of this *in vitro* study was to compare the accuracy of the reposition (RT) and pick-up (PT) impression techniques utilizing a 3D-laserscan.

Methods: An Exacto-Form reference model with one FRIADENT implant analog (D 5.5) was fabricated. A sandblasted EstheticBase abutment was connected with an occlusal reference point. Impressions of the reference model were made using Impregum® Penta® (3M ESPE AG, Seefeld, Germany). Ten stone casts were fabricated using the reposition and 10 using the pick-up technique. Measurements by means of 3D-laserscan (WILLYTEC) were performed and the data of each individual model ($n = 20$) were compared with the reference model.

Results: No significant differences between both techniques could be determined. The smallest deviation from the reference model was evaluated along the x-axis, with an average value of 0.008 mm RT (SD = 0.003 mm) and 0.013 mm PT (SD = 0.022 mm). The mean deviations in y-axis direction amounted 0.019 mm RT (SD = 0.02 mm) and 0.051 mm PT (SD = 0.067 mm) in z-axis direction 0.031 mm RT (SD = 0.022 mm) and 0.016 mm PT (SD = 0.019 mm).

Conclusions and clinical implications: Within the limitations of this study, no significant differences could be ascertained between the reposition and the pick-up technique.

Immediate provisional rehabilitation of the edentulous mandible

Presenter: Heschl A

Division of Prosthodontics, Restorative Dentistry, Periodontology and Implantology, Graz, Austria

Co-authors: Heschl A, Clar V, Payer M, Platzer S, Wegscheider W, Lorenzoni M, Lorenzoni M

Division of Prosthodontics, Restorative Dentistry, Periodontology and Implantology, Graz, Austria

Background: In order to shorten the treatment time implant prosthetic concepts focus on immediate loading protocols.

Aim: Aim of this prospective case series was to evaluate the results of an immediate loading concept using four XiVE® S plus implants in the edentulous mandible, after a period of up to 10 years of clinical function.

Methods: Thirty patients were treated with 120 implants placed interforaminally and provisionally restored within 1 week. Radiographic bone levels, implant survival and success were recorded annually from implant insertion (baseline) up to 10 years after final restoration.

Results: A total of 120 XiVE® S plus implants were placed in the interforaminal region. All implants were inserted with an insertion torque of more than 32 Ncm. A significant coronal bone loss was recorded within the first 8 years of function ($P < 0.05$). Within the next years no further significant increase of bone resorption was observed. Two losses (1.7%) occurred before permanent restoration (1 and 3 months post-insertion), resulting in a survival rate of 98.3% over the entire observation period. Four implants were recorded as failures due to excessive bone resorption, resulting in an overall success rate of 95%.

Conclusions and clinical implications: The results of this study indicate that in selected patients immediate restoration of dental implants in the edentulous mandible will achieve a clinically predictable outcome.

Influence of crown-to-implant ratio on peri-implant hard- and soft tissue in the esthetic zone

Presenter: Hof M

Bernhard Gottlieb University of Dentistry, Vienna, Austria

Co-authors: Hof M, Pommer B, Strbac G, Watzek G, Zechner W

Bernhard Gottlieb University of Dentistry, Vienna, Austria

Background: Dental implant success is dependent on soft- and hard tissue response as well as on related suprastructure. Owing to functional loading, occlusal loads are transferred through the implant crown to the surrounding tissues. Increased crown-height may act as a lever and force magnifiers which transfer the occlusal load to the surrounding tissue. Therefore, an increased crown-to-implant ratio may introduce significant forces on the implant and surrounding crestal bone when the implant restoration is subjected to lateral forces. This may lead to peri-implant bone loss and subsequent impaired soft tissue outcome.

Aim: Aim of this study was to determine the effect of different crown-to-implant ratios on peri-implant bone loss and soft tissue outcome in the esthetic zone.

Methods: Records at the Department of Oral Surgery (Medical University of Vienna) were screened for patients provided with implants in the esthetic zone of the maxilla. Patients were scheduled for a recall visit and subjected to clinical and radiological examination. The following variables were assessed: pocket depths, bleeding on probing, peri-implant bone loss, crown-to-implant ratio, Pink Esthetic Score and Papilla Index. Crown-to-implant ratio (CIR) was defined as the relationship between crown and implant length. Pink Esthetic Score (Fürhauser et al. 2005) and Papilla Index (Jemt 1997) was evaluated using standardized intraoral

photographs of implant supported single crowns and adjacent peri-implant soft tissue.

Results: Eighty-five single-tooth implants in the anterior maxilla were evaluated. Time between implant placement and follow-up visit ranged from 1.2 to 8.1 years (mean: 4.1 ± 1.9 years). The majority of implants (60%) were placed in incisor positions. Bleeding on probing was seen in 59.4% of sites and associated with high pocket depths ($P < 0.001$). Radiologic peri-implant bone loss was 1.2 ± 0.7 mm on the mesial and 1.4 ± 0.9 mm on the distal side. The mean crown-to-implant ratio accounted 0.83 ± 0.18 . Neither pocket depth ($P = 0.238$), nor crown-to-implant ratio ($P = 0.575$) were associated with marginal bone loss. Objective evaluation of implant esthetics resulted in a mean Pink-Esthetic-Score (PES) of 10.1 ± 2.5 (range: 3–14) and a median Papilla Index (PI) of 2 for both the mesial (IQR: 1–3) and distal (IQR: 2–3) papilla. A significant correlation between the two indices was observed ($r_s = 0.57$, $P < 0.001$). Significant correlations were observed between crown-to-implant ratio and PES ($r_s = -0.28$, $P = 0.009$) as well as PI ($r_s = -0.49$, $P < 0.001$).

Conclusions and clinical implications: Esthetic results can be achieved in the anterior maxilla for single-tooth implants with different crown-to-implant ratios. A significant correlation between CIR and soft tissue (PES, PI) could be observed. CIR was not associated with peri-implant bone loss.

246 | Implant Therapy Outcomes, Prosthetic Aspects

Implant-supported CAD/CAM restorations in partially edentulous patients

Presenter: Kanat B

Department of Prosthodontics, School of Dentistry, Ege University, Izmir, Turkey

Co-authors: Güngör MA¹, Tekin U², Kanat B¹, Çömlekoğlu E¹, Artunç C¹

¹*Department of Prosthodontics, School of Dentistry, Ege University, Izmir, Turkey* ²*Department of Oral and Maxillofacial Surgery, School of Dentistry, Ege University, Izmir, Turkey*

Background: Implant superstructures with computer-aided design/computer-aided manufacturing (CAD/CAM) system provides better passive fit, marginal adaptation, aesthetics and cost-effectiveness and reduces fabrication steps, fabrication errors and overall labor hours required. However, clinical outcome on recent technique with yttrium-stabilized zirconium oxide blocks is limited.

Aim: The aim of this clinical case series is to present the preliminary clinical outcome of CAD/CAM fabricated implant supported single crowns and three-unit bridges in maxilla and mandible.

Methods: Partially edentulous nine patients (age range: 30–57) received a total of 22 sand-blasted, large-grit and acid-etched implants (Bego, Germany; Astra Tech, Sweden; Straumann, Switzerland). These implants were placed in the maxilla ($n = 12$) and in the mandible ($n = 10$) and loaded 6 weeks – 4 months after surgery with implant-supported full ceramic

single crowns and bridges. Thirty yttrium-stabilized zirconium oxide (IPS e.max ZirCAD, Ivoclar Vivadent, Amherst, NY, USA) substructures were fabricated with CAD/CAM system (CEREC 3D, Sirona Dental Systems, Charlotte, NC, USA) and veneered using the powder build-up technique. All restorations were cemented with a dual-cure resin cement (Panavia F 2.0, Kuraray). All the patients were followed up to 12 months.

Results: CAD/CAM fabricated implant-supported yttrium-stabilized zirconium oxide crown and bridges showed a high precision, fit and good tissue response. All patients were satisfied with CAD/CAM advantages and prosthetic outcome. No failure in the superstructures and implants was observed.

Conclusions and clinical implications: The preliminary results of this clinical investigation indicate that this technique appeared to be reliable and simple with reduction of errors and time as compared with conventionally fabricated FPDs. Implant-supported zirconia-based crowns and three-unit bridges with CAD/CAM demonstrated a good short-term clinical outcome, however, long-term studies should be performed.

247 | Implant Therapy Outcomes, Prosthetic Aspects

Traumatic avulsion of upper central incisal. Prosthetic considerations and rehabilitation

Presenter: Katsavochristou A

School of Dentistry, National Kapodistrian University of Athens, Athens, Greece

Co-authors: Katsavochristou A¹, Kouveliotis G¹, Roussou I^{1,2}

¹*School of Dentistry, National Kapodistrian University of Athens, Athens, Greece*, ²*Lecturer, Department of Prosthetic Dentistry of the University of Athens, Athens, Greece*

Background: A 23-year-old man had an accident with his motorcycle. As a result, he was injured in the anterior region with ensuing avulsion of the upper left central incisal followed by destruction of the periodontal tissues and part of the palatal plate.

Aim: The purpose of this clinical case was the restoration of the missing incisal by the placement of an implant, with parallel rehabilitation of the surrounding soft tissues.

Methods: The patient's clinical parameters were recorded. Radiographs of the bone and photos of the soft tissue were taken. A soft tissue plan was designed focusing on the aid of the acrylic provisional fabrication. The patient entered a 1-month recall. The remodelling progress of the soft tissues was determined through the pressure of the provisional crown, which was every time adjusted.

Results: A Biomet 3i, OSSEOTITE Certain 4 mm implant was placed. Once osseointegration was achieved the prosthetic rehabilitation began. With a screw retained provisional restoration the remodelling of the soft tissues started. The temporary restoration would apply pressure to the soft tissues guiding their remodelling around it. Once optimum soft tissue esthetics was achieved, the restoration of the final metaloceramic restoration began. The final crown was a

cemented restoration with an emergence profile such as to support the soft tissue remodelling achieved with the temporary restoration.

Conclusions and clinical implications: The use of a provisional restoration can help the clinician to preserve or remodel the soft tissues in the anterior area, and avoid a surgical management in certain cases. Moreover, its use can provide the desirable esthetics, along with the biological preservation of the periodontal tissues.

248 | Implant Therapy Outcomes, Prosthetic Aspects

Evaluation of screw loosening in 2-unit fixed prostheses connecting one IIHC and one IEHC after 1 year loading

Presenter: Kim J-H

Mokdong YE Dental Hospital, Seoul, Republic of Korea
Co-authors: Kim J-H¹, Lee H-C¹, Choi J-Y¹, Kim K-S²

¹Mokdong YE Dental Hospital, Seoul, Republic of Korea, ²Namsang Dental Office, Seoul, Republic of Korea

Background: Implant systems with internal hexagonal connection (IIHC) have significant settling after loading, on the other hand, implant systems with external hexagonal connection (IEHC) have low settling after loading. If one IEHC and one IIHC were connected with 2-unit fixed prosthesis, there would be discrepancy in the amount of settling. In addition, there might be screw loosening of the abutment screw of IEHC due to cantilever-like movement of 2-unit fixed prosthesis. Therefore, if screw loosening could be detected, it can be concluded that fixed prostheses connecting both IEHC and IIHC are not recommended.

Aim: The aim of this study is to verify the settling effect of IIHC abutments on IEHC abutment screw loosening, in 2-unit fixed prostheses connecting one IEHC and one IIHC after 1 year loading.

Methods: Four patients with 2-unit implant prostheses of one IEHC and one IIHC in posterior dentition were examined. Removal torque of IEHC abutment screws, which had been tightened at 20 N cm, were measured with 3i torque controller. Each abutment screw was checked whether it was already loosened. If it had not been loosened, loosening was tried at 10 N cm by torque controller, if not by 20 N cm.

Results: No abutment screw loosening was found in four 2-unit fixed prostheses connecting one IEHC and one IIHC.

Conclusions and clinical implications: It can be concluded that settling effect of IIHC abutments on IEHC abutment screw loosening, in 2-unit fixed prostheses connecting one IEHC and one IIHC, was not significant. It might be due to rigidity of fixed prostheses offset settling or due to relatively long length of prostheses compared with about 20 μm settling. Within the limit of this study, it is allowed to connect IEHC and IIHC with fixed prostheses.

249 | Implant Therapy Outcomes, Prosthetic Aspects

Comparison of implant torque controllers using detorque value

Presenter: Kim D-G

Department of Prosthodontics and Research Institute of Oral Science, Gangneung, Republic of Korea

Co-authors: Kim D-G^{1,2}, Hun Y-H¹, Ko G-H¹, Lee J-H¹, Cho L-R¹, Park C-J¹, Park C-J¹

¹Department of Prosthodontics and Research Institute of Oral Science, Gangneung, Republic of Korea, ²Department of Periodontology, Gangneung, Republic of Korea

Background: The purpose of tightening screws on restorative components of osseointegrated implants is to develop a preload tension in that system, thereby be clamping the components together. The preload generated by torque controllers must be sufficient to prevent loosening of abutments and prostheses when subjected to functional loads.

Aim: The purpose of this investigation was to measure and compare the accuracy of the implant torque controllers.

Methods: Eighty resin block specimens with external connection implant system were prepared. And four types of torque controllers were used; torque limiting device, torque indicating device and contra-angle torque device, electronic torque controller. Electronically controlled, customized measuring set was employed to measure the detorque values. Twenty cycles of tightening and loosening abutment screws were repeated with each torque controller. All of measurements were statistically analyzed by repeated measured ANOVA test (95% confidence interval).

Results: All the implant torque controllers have shown some errors and decreased detorque values. Using the torque limiting device was revealed the most inaccurate detorque values. In mean and maximum values, no significant differences were shown torque controllers ($P > .05$) except the torque limiting device ($P < .05$) In minimum values, the electronic torque controller and the torque limiting device have shown higher error rates than others ($P < .05$).

Conclusions and clinical implications: As implant torque controllers have inherent torque errors, it is important for that to be selected and used precisely in securing implant screws.

250 | Implant Therapy Outcomes, Prosthetic Aspects

An implant supported fixed prosthesis in a mandibular reconstruction patient: a case report

Presenter: Kim KH

Department of Prosthodontics, School of Dentistry, Seoul National University, Seoul, Republic of Korea

Co-authors: Kim KH, Kwon HB, Lim YJ, Kim MJ, Kim SK
Department of Prosthodontics, School of Dentistry, Seoul National University, Seoul, Republic of Korea

Background: Advanced tumors of the tongue and floor of the mouth often require extensive resection of the mandible, floor of the mouth, and tongue, causing significant functional disabilities and cosmetic disfigurement. Reconstruction of mandibular

defects was often a lengthy process that required multiple surgeries, first to enhance the soft-tissue bed and later to restore the bony continuity of the mandible. The development of microvascular free flaps and endosseous implants have greatly improved the reconstructive and rehabilitative results, also.

Aim: The aim of this presentation was a case report that the patient who underwent partial mandibulectomy rehabilitated with surgical reconstruction and implant prosthesis.

Methods: A 39-year-old male with diagnosis of osteosarcoma had the mass excision, right neck dissection and reconstruction of the pectoralis major free flap. He had the secondary reconstruction with R-plate and left fibular free flap and the six implants (MKIII TiUnite, Nobel biocare, Sweden) with left iliac bone graft were placed. Because of continuous gingival regrowth, distal two implants was submerged. The provisional prosthesis was fabricated with hybrid denture. The patient had felt discomfort, especially tongue bite, because the prosthesis encroached on the tongue space. A few months later, however, he adapted to the prosthesis. During the follow-up period, the patient maintained good oral hygiene. So, the final prosthesis was made a fixed implant-supported prosthesis.

Results: During follow-up periods, both clinical and radiographic evaluations were performed and any sign of peri-implant tissue was not observed. The patient was satisfied with the treatment outcome although the prosthesis was unesthetic.

Conclusions and clinical implications: Although the outcome of rehabilitation with surgical reconstruction and implants on the mandibular defect was get satisfactory functionally, it was difficult to get esthetic result because the implants were placed unfavorable region due to complicated surgical reconstruction.

as a control. The immediate loading was performed within 2 days after the GS III implant (Osstem, Seoul, Korea) placement for both arches. The occlusal loading condition was controlled by shimstock and Acufilm articulating paper and varied according to the opposite arch status and loading period. Success rate and crestal bone level was evaluated at 3, 6, 12 months of loading.

Results: Mean follow up period was 13.8 months for immediate loading and 11 months for conventional loading. In case of immediate bilateral loading with presence of occlusal stop at opposite side of the same arch, occlusal gap to opposing arch was average $23.8 \pm 11.2 \mu\text{m}$ when teeth were occluded lightly in immediate loading group. Success rate of immediate loading and conventional loading was 95.23% and 100% for each. Of immediate loading group, two implants were failed 6, 8 weeks after loading in mandible. Mean crestal bone resorption at the latest follow up was $0.01 \pm 0.02 \text{ mm}$ for immediate loading and was $0.01 \pm 0.04 \text{ mm}$ for conventional loading. At 3, 6 months of loading, amount of crestal bone loss was significantly higher in immediately loaded group than in conventionally loaded group ($P < 0.05$). At 12 months, however, no statistically significant difference was found in crestal bone resorption between groups ($P > 0.05$).

Conclusions and clinical implications: Immediate loading of GS III implant provided satisfactory success rates under the controlled occlusion conditions. Within the limitation of this study, intimate functional occlusal contact might be applied to immediate loading.

Prospective study on immediate loading of GS III implant under the controlled occlusion condition

Presenter: Kwon M-J

Department of Prosthodontics, Section of Dentistry, Seoul National University Bundang Hospital, Sung-nam, Republic of Korea

Co-authors: Kwon M-J¹, Yi Y-J¹, Kim Y-K¹, Choi Y-H¹

¹*Department of Prosthodontics, Section of Dentistry, Seoul National University Bundang Hospital, Sung-nam, Republic of Korea,*

²*Department of Oral & Maxillofacial Surgery, Section of Dentistry, Seoul National University Bundang Hospital, Sung-nam, Republic of Korea,* ³*Department of Conservative Dentistry, Section of Dentistry, Seoul National University Bundang Hospital, Sung-nam, Republic of Korea*

Background: Micromotion control is the key factor to obtain osseointegration of the immediately loaded implants. However, there has been no guideline for occlusion of immediate loading protocol.

Aim: The aim of this study was to evaluate success rate of immediately loaded implant with controlled occlusal loading protocol.

Methods: Thirty-three patients took part in the study. Seventeen for immediate loading, 15 for conventional delayed loading

New winged implant specially designed for post extraction immediate loading

Presenter: Laster Z

Poriya Hospital, Tiberias, Israel

Co-authors: Laster Z

Poriya Hospital, Tiberias, Israel

Background: Immediate loading of implants requires at least 40 N cm torque for initial stability. In case of implantation at the extraction site, the bone to implant contact is reduced considerably and it is very often difficult to achieve the desired torque.

Aim: To introduce a new winged implant specially designed for immediate postextraction loading.

Methods: Finite element analysis showed a considerable reduction of the stress distribution and the displacement under loading at a 20 degrees force. One hundred and eighty-five winged implants were implanted at the maxilla and the mandible in extracted sockets and immediately loaded with temporary crowns or reinforced temporary bridges. The bridges were preformed or made 24 h postimplantation. One hundred and fifty-three winged implants were inserted in the maxilla between the second premolar to the second premolar on the opposite side. Thirty-two winged implants were inserted in the mandible between first molar to first molar. At the first lower molar sockets, 23.8 winged implants were inserted only if the space was 14 mm or more. At the lower

molar area the prosthetic rehabilitation was either molar crown or two premolar crowns. All 185 implants reached 40 N cm and more at any site.

Results: From all the 185 rehabilitated winged implants during 18 months, only five implant at the right upper canine area failed 4 weeks postimplantation.

Conclusions and clinical implications: In conclusion, after checking the concept theoretically with finite element analysis, the new designed winged implant proved to achieve high initial stability, and high rate of success of immediate loading of implants inserted into extraction sockets.

253	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Immediate loading using trans-gingival implants in the edentulous jaw. Clinical evaluation of 32 implants

Presenter: Lenzi CC

Private Practice, Bologna, Italy

Co-authors: Lenzi CC

Private Practice, Bologna, Italy

Background: The predictability of original treatment protocol for osseointegration has led to developments aimed at simplifying techniques, reducing healing time and minimizing the delay between the surgical and prosthetic phases. With a transmucosal implant it is possible to avoid the second surgery but this will not completely resolve the intolerable situation for the patient during the healing period. Good results have been achieved with immediate loading techniques, particularly using implants placed in the anterior mandible and several protocols have been proposed which allow the patient to wear a fixed prosthesis during the osseointegration period without compromising long-term success. Four immediately loaded implant-retained mandibular overdentures are generally inserted into the intraforaminal area. They are rigidly connected with a U-shaped bar to minimize micro motion, thus guaranteeing the correct osseointegration, and then loaded with prosthetic rehabilitation. Depending on each clinical situation and the patient's requests, it is also possible to achieve three different prosthetic solutions, starting with the same surgical procedure.

Aim: Aim of this study is a long term clinical and X-ray evaluation about 32 trans-gingival implants.

Methods: After an X-ray (TC when necessary) examination, the patients underwent the same surgical protocol: a crestal incision was made and a mucoperiosteal flap was raised. Then four transmucosal implants were placed in the intraforaminal area. Good primary stability after placement is considered a basic requirement for success (at least 30 N). In the immediate loading protocol an impression using vinyl polysiloxane was taken after surgery and the prosthesis was fitted to the patient within 24 hours. Depending on each clinical situation and the patient's requests, mandibular overdentures on a U-shaped bar or Fixed Prostheses with or without pink gum are customised. A rigid connection is always used to minimize micro-motion and guarantee the correct osseointegration.

Results: After a 24-month clinical and X-ray follow-up, all 32 implants showed great success, no bone loss and patient satisfaction.

Conclusions and clinical implications: As the literature shows, the rehabilitation of the mandible by immediate loading using four implants connected by a rigid bar can be a predictable and reliable method with a high survival and success rate, and the use of trans-gingival implants can simplify the techniques.

254	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Stereolithographic surgical template for immediate implantation after extraction. A modification of double scanning technique

Presenter: Lomzynski L

Department of Prosthodontics, Medical University of Warsaw, Warsaw, Poland

Co-authors: Lomzynski L, Mierzwinska-Nastalska E

Department of Prosthodontics, Medical University of Warsaw, Warsaw, Poland

Background: The authors describe a novel technique of modifying a radiographic template necessary for the double scanning technique. It allows the use of the implant planning software system and the fabrication of the stereolithographic templates in patients prepared for immediate implantations after extraction of teeth, which formerly was the main contraindication for the use of the implant planning software-based stereolithographic surgical templates.

Aim: The use of implant planning software systems with the possibility of stereolithographic templates fabrication becomes a method of choosing in numerous implant indications, allowing the optimal positioning of implants and performing the surgical stage in a minimally traumatic flapless procedure. The main contraindication for the use of the implant planning software-based surgical templates was the immediate implantation after extraction of a teeth. The reason for the above was the lack of possibility of preparing the radiographic guide with the sufficient support for the drill sleeves present in the surgical stereolithographic guide in the area of the teeth to be extracted and immediately replaced by dental implants.

Methods: The authors present a simple procedure of modifying the radiographic guides used in the double scanning technique using the vinyl polysiloxane impression material which has the feature of radiopacity. This allows the fabrication of the stereolithographic surgical template basing on the three dimensional visualisation of the modified radiographic template.

Results: The presented technique is a simple and inexpensive method of preparing a proper stereolithographic template for the immediate implant placement after the extraction of a tooth, or performing the complete planning and stereolithographic surgical template preparation without the necessity of removing the FPDs before the diagnostic procedures. The described technique is also useful to modify the thickness of the radiographic guide or its shape using the vinyl polysiloxane impression material by adding it selectively to the radiographic template before the second CT scanning.

Conclusions and clinical implications: The presented technique widens the indications for the use of the three dimensional implant planning software systems, allowing for preparing the stereolithographic surgical templates with sufficient drill guide support in cases of immediate implantations after extractions where the proper implant positioning and the precise preparation of the implant site is of the utmost importance. The sleeves in the stereolithographic surgical template prepared with the proposed technique guide the drills in the planned implant position in the proximity of the extraction socket, thus allowing a more predictable preparation of the implant site, basing on the three dimensional virtual planning of the implant position in the planning software.

255 | Implant Therapy Outcomes, Prosthetic Aspects

Implant-supported rehabilitation in a young adult with ectodermal dysplasia

Presenter: Loureiro R
Maloclinic, Lisbon, Portugal

Co-authors: Malo P, Loureiro R, Lopes A, Rodrigues A
Maloclinic, Lisbon, Portugal

Background: Ectodermal dysplasia is an hereditary disease characterized by a congenital dysplasia of one or more ectodermal structures. Common manifestations include defective hair follicles and eyebrows, prominent supraorbital ridges, prominent lips and nasal bridge depression. Intraorally, anodontia or hypodontia are common findings. Consequently, multidimensional restrictions of skeletal craniofacial growth are seen affecting oral rehabilitation dramatically.

Aim: The aim of this case report is to describe clinical implications to the implant supported rehabilitation in ectodermal dysplasia patients as well as providing a functional and high aesthetic option different than the conventional prosthodontic approaches.

Methods: After clinical and radiographic examination, two standard implants NobelSpeedy RP 4 × 10 mm (Nobel Biocare) and two extra-maxillary implants Nobel Speedy extra-long 5 × 40 mm were placed in the maxilla and four standard implants NobelSpeedy RP 4 × 15 mm were placed in the mandible following the All-on-4 protocol. Immediate all-acrylic implant supported bridges (Heraeus Kulzer GmbH, Germany) were delivered in the day of the surgery. Post-operative appointments were performed 10 days after surgery and every 2 months till the sixth month for oral hygiene and clinical and radiographic control of the implants. Six months after surgery an implant supported bridge with a Procera titanium framework and 12 individual cemented Procera crowns (Procera titanium Framework, Procera crowns, Nobel Rondo ceramics, Nobel Biocare AB) was placed in the maxilla and an implant-supported bridge with a Procera titanium framework (Procera titanium Framework; NobelBiocare) and 12 acrylic resin teeth (Heraeus Kulzer GmbH) was placed in the mandible. Clinical and radiographic control was performed 15 months after surgery.

Results: Fifteen months clinical and radiographic follow-up show an aesthetic and functional implant-supported rehabilitation with healthy peri-implant tissues.

Conclusions and clinical implications: Within the limitation of this case report, the All-on-4 standard and the All-on-4 extra-maxilla protocols represents a successful approach for the rehabilitation of severe bone atrophy common in ectodermal dysplasia patients. Furthermore, it allows immediate function reducing therefore the treatment period and provides a functional and high aesthetic outcome.

256 | Implant Therapy Outcomes, Prosthetic Aspects

Direct laser metal forming (DLMF) implants: a prospective clinical study

Presenter: Mangano F
Private Practice, Como, Italy

Co-authors: Mangano F¹, Mangano C², Eccellente T³, Briguglio F⁴, Figliuzzi M⁵, Rapani C⁶

¹Private Practice, Como, Italy, ²University of Varese, Varese, Italy,

³Private Practice, Caserta, Italy, ⁴Private Practice, Milan, Italy,

⁵University of Catanzaro, Catanzaro, Italy, ⁶Private Practice, Chieti, Italy

Background: Until now, dental implants have been produced by machining titanium rods, with subsequent postfabrication processing and application of surface treatments or coatings, with the aim to promote osseointegration. In the last few years considerable progress has been made in the development of rapid prototyping (RP) methods, including direct laser metal forming (DLMF). DLMF is a timesaving and costless metal forming procedure in which a high power laser beam is focused on a metal powder bed and programmed to fuse particles according to a CAD file, thus generating a thin metal layer. Apposition of subsequent layers gives shape to a desired three-dimensional form with the need of minimal postprocessing requirements.

Aim: This prospective study evaluated the survival rate and the implant-crown success of single-tooth direct laser metal forming (DLMF) titanium dental implants (TiOs^R, Leader Novaxa, Milano, Italia) after 1-year of functional loading.

Methods: At the 1-year scheduled follow-up examination, several clinical, radiographic and prosthetic parameters were assessed. Success criteria included absence of pain, sensitivity, suppuration, exudation; absence of clinically detectable implant mobility; absence of continuous peri-implant radiolucency; distance between the implant shoulder and the first visible bone contact (DIB) < 1.5 mm; absence of prosthetic complications.

Results: One hundred and ten implants (65 maxilla, 45 mandible) were placed in 82 patients (44 males, 38 females; aged between 26 and 67 years) in seven different clinical centers. Prosthetic restorations were 110 single crowns (SCs). The sites included anterior ($n = 32$) and posterior ($n = 78$) implants. After 1-year of functional loading, the implant survival rate was 99.1%, with one implant loss (maxilla: 98.4%, one implant failure; mandible: 100%, no implant failures). The mean distance between the implant shoulder and the first visible bone contact (DIB) was 0.60 mm (± 0.32). Among the surviving

implants (109), three could not fulfil success criteria, for an implant-crown success of 97.2%.

Conclusions and clinical implications: Direct laser metal forming (DLMF) titanium dental implants seem to represent a valid treatment option for single-tooth restorations, in the maxilla and in the mandible. Further studies are needed to evaluate the long-term performance of these implants.

257 | Implant Therapy Outcomes, Prosthetic Aspects

Disparity in patients' and dentists' satisfaction regarding implant restorative treatment

Presenter: Martens F

Department of Periodontology and Oral Implantology, Faculty of Medicine and Health Sciences, Dental School, University of Ghent, Ghent, Belgium

Co-authors: Martens F¹, Vandeweghe S², De Bruyn H^{1,2}

¹*Department of Periodontology and Oral Implantology, Faculty of Medicine and Health Sciences, Dental School, University of Ghent, Ghent, Belgium,* ²*Department Prosthodontics, University of Malmö, Malmö, Sweden*

Background: Cross-arch fixed implant prostheses have a good prognosis. However, information on prosthetic quality and patient's opinion on treatment outcome is scarce.

Aim: The aims of this retrospective study were to describe patient-centered outcomes regarding quality and patient's opinion of full arch bridges placed on Biomet3i dental implants (Palm Beach Gardens, Fl, USA) and to compare these with the dentist's opinion.

Methods: Patients consecutively treated over the last 4 years with mandibular or maxillary full-arch fixed prostheses on four to seven implants were recalled for an independent quality evaluation and to score patient's satisfaction. All implants were immediately loaded with a screw-retained metal reinforced acrylic provisional bridge within 48 hours after surgery by one operator. Prosthetic treatments were performed by trainees or staff members. Implant survival, marginal bone level, measured from the abutment-implant interface, quality of implant and prosthetic treatment and patients' opinion were assessed by means of validated check-lists and OHIP-14 questionnaire. By enlarge, the latter focused on satisfaction and well being.

Results: Sixteen of twenty-two patients attended the examination; 5/120 (4.1%) implants were lost before final reconstruction. During a mean follow-up of 26 (7-48; SD 13.6) months, no further losses occurred, only one provisional bridge needed to be repaired. Mean marginal bone level was 2.1 mm (0-3.9; SD 0.7); mean probing pocket depth 3.4 mm (2.5-5.5; SD 0.71); 30% of the sites were plaque-free and 11% showed no bleeding. For patients' opinion see table 1. The clinician rated the prostheses perfect in 37% for design, 50% for fit, 46% for occlusion/articulation and 31% for esthetics. The overall score was perfect in 31%. The mean satisfaction score for the dentist and patient were, respectively, 39% and 72%. There was a significant discrepancy in quality assessment on esthetics and overall score between clinician and patient ($P < 0.005$ - Wilcoxon signed-rank test).

Table 1. Patients' opinion about their prosthesis

Variable	Never a problem (%)
Eating	50
Speaking	75
Well-being	56
Social embarrassment	88
Easiness for oral hygiene	69
Esthetics	81
Comfort	81

Conclusions and clinical implications: Patients deem their full-arch fixed prostheses on implants as satisfactory and of acceptable quality. Most patients overrated the esthetical aspect and overall score compared with the dentist. Implant and prosthetic failure rates are within acceptable limits after a mean functional loading of 2 years certainly given the fact that immediate loading was performed.

258 | Implant Therapy Outcomes, Prosthetic Aspects

Single lower molar, randomized prospective split-mouth clinical study of immediate vs. delayed loading

Presenter: Meloni SM

University Hospital of Sassari, Sassari, Italy

Co-authors: Meloni SM¹, De Riu G¹, Pisano M¹, De Riu N², Tullio A¹

¹*University Hospital of Sassari, Sassari, Italy,* ²*University of Sassari, Sassari, Italy*

Background: There are not many studies available that are prospectively assessing in a split-mouth design immediate loading of implants vs. the conventional approach.

Aim: To compare the outcome of immediate versus delayed implant loading, when replacing single lower molars bilaterally.

Methods: Fifteen consecutive patients of both sexes and a mean age of 46 (range 28-70) missing first mandibular molars bilaterally were randomly assigned to the two approaches: one edentulous space was restored with a nonoccluding temporary crown delivered within 24 h after implant placement, while the other side was restored according to a two-stage procedure, after 3 months. Final restorations with zirconia or metal-ceramic crowns were provided 6 months after implant placement. All implants were installed in healed sites. Follow-up visits were conducted at 3, 6 and 12 months after implant placement. Main outcome measures were radiographic marginal bone-level changes and implant survival rate. Marginal bone was measured at baseline (day of surgery) at 6 and 12 months.

Results: A total of 30 NobelReplace Tapered Groovy implants (NobelBiocare AB, Goteborg, Sweden), were installed bilaterally replacing the lower first molars. All implants were placed in healed sites with an insertion torque of 35-45 N cm. In each patient one implant was immediately loaded while the other was loaded after 3 months. After 1 year follow-up cumulative implant survival rate was 100%. In the immediate loading arm, mean marginal bone loss was 0.83 ± 0.16 mm, while in the two-stage delayed loading

arm it was 0.86 ± 0.16 mm, with no statistically significant difference between the two groups ($P > 0.05$).

Conclusions and clinical implications: Within the limitations of this study the present findings seem to confirm that immediate loading of single lower molar implants restored with a nonoccluding temporary crown is a viable option comparable to conventional two-stage delayed loading approach.

259	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Immediate load in the mixed aesthetic therapy

Presenter: Minciarelli A

ANDSh Nacional Albanian Dental Association, Tirana, Albania

MAIPA Poliambulatorio, Bari, Italy

Co-authors: Minciarelli A^{1,2}, Deodato E⁴

¹*ANDSh Nacional Albanian Dental Association, Tirana, Albania,*

²*MAIPA Poliambulatorio, Bari, Italy,* ³*D.I.O.S. Dental Implantology Oral Surgery, Tirana, Albania,* ⁴*Studio Deodato, Bari, Italy*

Background: In the implantary rehab the bone integration of the fixture, of the provisory crown with the conditioned tissue, the biologic mymethism with natural teeth and the recovery of the lost functionality are the basic concepts of a correct management that goes to an excellent aesthetic result.

Aim: The prosthetic crown must be integrated, camouflaged with the other dental elements, giving feeling of natural teeth, this through the reflection of the light (stratification of the ceramics), form and position of the definitive elements. Into frontal teeth the predominance volume of the two central elements, in comparison with the lateral one, results to be the key element that will be able to camouflage the prosthetic profile.

Methods: It comes to our observation a 38-year-old patient with a serious problem of the smile line. It underlines fixed crowns on frontal elements that introduces a discord among the right side and the left one. Treatment plan: extraction of 1.2 and fixed provisory crown rehabilitation on implants in 1.2 and 2.2 site with single crowns in Zirconium/Ceramic into the four anterior teeth. Intervention of gum plastique on the 1.1 and 2.1, during the intervention will be proceeded with a bone plastique in the 2.2 site. Two months later the intervention is programmed with immediate load of the two fixtures AT 3.5/11 proceeding with the temporary abutment. After 3 months from the positioning of the fixtures, the temporary crowns will be removed and through a direct technique of personalization of the transfert the definitive imprint is taken. On the imprint master it will be created new provisory crowns and will be planned the abutment with Atlantis Programme into implants and CAD/CAM system into natural teeth. At least it will be proceeded with the definitive crown.

Results: The optimal bio-mymethism of the prosthetic crown into natural teeth and implants, permits a natural semblance. The smile line has been changed radically so also the relationship of the patient.

Conclusions and clinical implications: In the right side (1.1) the intervention of gum plastique could be managed differently. The provisory of the 1.2, has compressed the papilla among

the 1.1 and 1.2, creating a least gum retire that has slightly modified the gum profile and changed the zenith of the parable of the 1.1. The final aesthetic, has not been in some way modified by this small drawback that has given a final personalization to the smile.

260	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Biting ability alteration accompanied by extraction and implant restoration in second molar

Presenter: Moon I-S

Department of periodontology, Gangnam Severance Hospital, College of Dentistry, Yonsei University, Seoul, Republic of Korea

Co-authors: Lee D-W, Nam D-H, Moon I-S

Department of periodontology, Gangnam Severance Hospital, College of dentistry, Yonsei University, Seoul, Republic of Korea

Background: The second molar is one of the most frequently lost teeth. However, the missing second molars sometimes are not treated with implant due to anatomic limits, such as maxillary sinus and inferior alveolar nerve, masticatory function and financial problem. The self-reported masticatory ability is dependent on the number of teeth present. In addition, the masticatory performance and efficiency, the maximum molar bite force, and the maximum activity in jaw elevator muscles are positively correlated with the occlusal contacts and the occlusal area of natural teeth, and the number of posterior teeth. **Aim:** The aim of the present study was to analyze biting ability alteration following extraction and implant restoration in second molar. In addition, the study aimed at showing the possible impact of the extraction and implant treatment of second molar on the subjective level.

Methods: In 20 extraction patients, biting ability was recorded objectively just before tooth extraction, after 1 week and 1 month after extraction to allow adaptation. Evaluation of biting ability on subjective level was conducted at before tooth extraction and after 1 month. In 21 implant patients, biting ability was recorded objectively before cementation of implant supported single crowns, just after cementation and 1 month after cementation to allow for adaptation. Evaluation of biting ability on subjective level was conducted at before cementation and 1 month after cementation. Biting ability was recorded by pressure sensitive sheet foil (Dental Prescale Film 50H, type R, GC, Fuji Film, Tokyo, Japan). Subjective level evaluation was conducted through the questionnaire. Same investigator performed all examination and process in the patient. Kruskal-Walis's test was used to analyze the difference in the occlusal load (Pa), the load-bearing contact area (mm²) and the maximum bite force (N) among the three tests. Wilcoxon's signed ranks test was used to analyze the difference in the sum of questionnaires score between the two surveys.

Results: After extraction, contact area (mm²), maximum biting force (N) was increased. After implant restoration, contact area (mm²), maximum biting force (N) was increased. There was no statistical significance, though. According to questionnaires result, patient's satisfaction was increased with statistical significance in both groups.

Conclusions and clinical implications: Treatment of missing second molar with implant is an effective method for biting ability reinforcement and patient's satisfaction increase.

261 | Implant Therapy Outcomes, Prosthetic Aspects

Immediate vs. delayed single implantation treatment in the anterior maxilla. 2-year results

Presenter: Mylonas T

Private, Thessaloniki, Greece

Co-authors: Mylonas T

Private, Thessaloniki, Greece

Background: Long-term studies have reported almost perfect survival rates for single tooth implant restorations. In the anterior zone the success of such a therapy is determined by the aesthetic outcome. Is the immediate implantation a treatment strategy for an optimal outcome?

Aim: The objective of this clinical study was to evaluate the aesthetic outcome following immediate and delayed implantation treatment in the anterior maxilla.

Methods: Fifteen patients with immediate implantations and 15 patients with delayed implantations to restore the anterior maxilla were selected. Prerequisites for immediate implantation were the appropriate bone volume, the absence of acute inflammation and the intact socket walls. Both immediate and delayed implantations performed with a minimal mucosa flap elevation until the crestal bone level. Both groups were provisionally restored using an acrylic tooth bonded to the adjacent teeth without any contact to the mucosa. 2.5 months following implant placement, definitive prosthetic rehabilitation was performed. Implant survival, bone level and the aesthetic result using the pink (PES) and the white aesthetic score (WES) were assessed after 2 years. The subjective appreciation was also recorded.

Results: None of the implants failed. In both groups only a small amount of bone loss was measured. The bone level in the second group appeared to be more stable than in the first, but the mid-facial mucosa in this group demonstrated more recession in relation to the contralateral tooth. The aesthetic failures were high for both groups (>25%) but a high satisfaction score (>75%) was reported.

Conclusions and clinical implications: Immediate implantation is a viable treatment option but an aesthetically perfect outcome is determined by a number of factors.

262 | Implant Therapy Outcomes, Prosthetic Aspects

Free-end saddle-bridge with transitional mini-implants for edentulous atrophic maxilla

Presenter: Nagata M

Nagata Dental Clinic, Kagoshima, Japan

Co-authors: Nagata M

Nagata Dental Clinic, Kagoshima, Japan

Background: Implant treatment of the highly resorbed posterior maxilla is thought to be complex. Augmentation procedures with a high volume of bone graft materials are invasive in

character. With the nongraft technique with immediate loading by the main implants, not only could the risk of failure remain, but it is also not so easy to recover if the treatment fails. Nowadays, the treatment method, which reduces the risks of failure and improves the QOL of the patients is in demand.

Aim: The free-end saddle-bridge (FESB), which was developed by Izikowitz in the 1980s, is a complex prosthetic appliance which consists of anterior fixed bridge and posterior free-end mucosal-support dentures. The purpose of this study is to show the outcome and efficacy of the combination therapy of transitional mini-implants and FESB for the treatment of highly resorbed posterior maxilla.

Methods: Nine FESBs were applied, in association with several transitional mini-implants each in the highly resorbed maxilla. At the time of main implant installation ($n=76$), the transitional mini-implants were placed in the anterior and premolar area of the maxilla ($n=33$). The implant placement with the sinus lift procedure was performed by crestal approach in the posterior area of the maxilla ($n=48$). The FESBs were immediately cemented to the transitional mini-implants with intact relation to the underlying main implants, and the distal-ends of the denture were positioned on the maxillary tuberosities. Occlusal contact was defined in the antero-premolar area, and did not apply to the posterior area.

Results: FESBs were maintained by the transitional mini-implants during the treatment period. The removal of the transitional mini-implants took place 6 months later on average, and the FESBs were changed in form, and were supported by the anterior main implants. After the abutment-connection to the posterior main implants, extension denture bases were removed. The average period from implant placement was 11.9 months. The survival rate of the main implant was 98.6% in contrast with the 33.3% loosening of the transitional mini-implant. Quality of life of all the patients was properly maintained during the treatment periods.

Conclusions and clinical implications: Within these assessments, the FESB supported by transitional mini-implants was effective for treatment with highly resorbed posterior maxilla.

263 | Implant Therapy Outcomes, Prosthetic Aspects

A 5 years follow-up of immediately loaded implants and restorations manufactured with the intra-oral welding technique

Presenter: Nardi D

Private Practice, Bologna, Italy

Co-authors: Nardi D¹, Degidi M¹, Piattelli A²

¹Private Practice, Bologna, Italy, ²Full Professor, University of Chieti, Chieti, Italy

Background: Mondani (Mondani & Mondani 1982) was the first to introduce a time-effective technique to intraorally weld titanium implants and components in order to create a fixed restoration without the need of long laboratory procedures. More than 20 years after the paper published by Mondani, Degidi (Degidi et al. 2006) published a protocol for the immediate loading of multiple implants by welding a premanufactured titanium bar to implant

abutments performed directly in the oral cavity, in order to create a customized metal-reinforced provisional restoration.

Aim: The aim of this study was to evaluate the 5-year effectiveness of the intra-oral welding technique in both partial and full restorations.

Methods: All patients received a fixed final restoration reinforced by an intraorally welded titanium framework created directly in the patient mouth using a commercially pure Grade 2 titanium bar. Both partial and full restorations were placed always on the same day as surgery. Success and survival rate for restorations and implants, biological or technical complications and any other adverse event were recorded at yearly follow-up up to 5 years after surgery.

Results: A total of 239 implants were consecutively placed in 51 patients the period between February 2004 and January 2006. The restorations examined achieved a cumulative 78.44% success rate and 100% survival rate. The implants achieved a cumulative 96.08% success rate and 98.04% survival rate. None of the titanium joints examined evidenced signs of impairment up to 5 years of full load. The fracture of the resin superstructure is the most common adverse event to be expected and no significant connection was found between the opposite dentition and the prosthesis failures reported.

Conclusions and clinical implications: The intraoral welding technique proved to be a predictable technique to successfully rehabilitate the partial and the full edentulous patient with a final fixed prosthesis up to 5 years after surgery.

264 | Implant Therapy Outcomes, Prosthetic Aspects

Treatment options for single tooth narrow interradicular edentulous space

Presenter: Natri L
Second University of Naples, Naples, Italy
Co-authors: Natri L¹, Miraldi G²

¹Second University of Naples, Naples, Italy, ²Private Practice, Naples, Italy

Background: A congenital hypodontia or the narrowing of an extraction site in the mesiodistal direction are common conditions that explain a narrow interradicular edentulous space. An adequate bone volume and quality determine whether or not an implant can be placed; the vertical amount of bone and buccolingual width are main criteria to select length and diameter of the implant. Bone augmentation techniques, guided bone regeneration and grafts, have been described to enhance with success width or height at the implant site. A sufficient mesiodistal distance is the third and conditioning factor for a proper positioning of an implant. Nevertheless, the distance between two teeth at the edentulous site is often hardly modifiable. Leaving sufficient distance between implant and teeth is important for blood supply, necessary for osseointegration, and to allow maintenance of adequate interproximal bone. To maintain periodontal/peri-implant health a minimal distance of 1.25–1.5 mm between the implant and teeth has been advocated.

Aim: Authors propose three alternative solutions for replacing single missing teeth with narrow interradicular space: 3 mm

implant restoration for 5.5 mm horizontal interradicular space, Procera zirconia Maryland bridge or Procera zirconia three units bridge where the interradicular space is too narrow for implant restoration. Instead of metal conventional framework, zirconia offers better aesthetic results both in implant restorations both in three units and Maryland bridges, giving new rise to “old” prosthetic solutions.

Methods: Six clinical cases are analyzed according to Pink Esthetic Score/White Esthetic Score described by Belser (highest possible score of 20).

Results: All cases treated for edentulism with very narrow interradicular spaces obtained a very high score (mean 18.5 ± 1.3). The lowest score was for a 3.0 implant crown, where the distal papilla was incomplete because of the existing preimplant bone peak and the titanium abutment notably conditions value and colour of the final restoration, even so with an optimal final result.

Patient	PES					WES					Total
	Mesial papilla	Distal papilla	Curvature of facial mucosa	Level of facial mucosa	Root convexity, soft tissue colour, texture	Tooth form	Tooth volume/outline	Colour	Surface texture	Translucency characterization	
1	2	2	2	1	2	2	2	2	2	2	19
2	1	1	2	2	2	2	2	2	2	2	18
3	2	2	2	2	2	2	1	2	2	1	18
4	2	1	2	2	1	2	2	1	2	1	16
5	2	2	2	2	2	2	2	2	2	2	20
6	2	2	2	2	2	2	2	2	2	2	20

Conclusions and clinical implications: Clinicians must be aware of the treatment complexity for anterior edentulous areas where the mesiodistal distance is too narrow for a standard implant. Despite the implant restoration of a single tooth by an implant should nowadays be the preferred choice, the authors present clinical cases with a detailed photographic and radiographic documentation, analysed for the different treatment options and with huge attention to the aesthetic outcomes according to the current criteria, suggesting tools and alternatives to solve a frequent though often neglected condition.

265 | Implant Therapy Outcomes, Prosthetic Aspects

Implant treatment planning for edentulous patients

Presenter: Nikolsky V
Kirov State Medical Academy, Kirov, Russian Federation
Co-authors: Nikolsky V¹, Maksyutov A², Nikolskaya L³, Nikolskaya G¹

¹Kirov State Medical Academy, Kirov, Russian Federation, ²Moscow Dental Business Implant Training Center, Moscow, Russian Federation, ³Samara State Medical University, Samara, Russian Federation

Background: It is really difficult to choose the implant treatment method for edentulous patients. From two to 14 and even more implants should be offered, deferent types of removable or fixed prostheses should be used for oral rehabilitation of these patients.

Aim: The aim of the retrospective study is comparative examination of deferent types of implant treatment planning for oral rehabilitation of edentulous patients.

Methods: There were 48 patients with total absence of teeth, including eight patients with two edentulous jaws. Implant insertion was only in healed sites. Two hundred and fifty-eight implants are offered. Two-stage implant protocol was used and abutment connection was in 2–3 months after implantation. Six patients received eight complete dentures supporting on two implants with O-ring abutments. Five patients had on two implants, but with round bar retention for seven complete dentures. Sixteen overdentures were made for 15 patients with four implants connected by a rigid bar and four removable prostheses for edentulous low jaws with three implants. One type of fixed restorations was full arch bridges, supporting on eight implants for 12 patients (14 edentulous jaws) or with support on six implants for three patients. Another type was single crowns in anterior region and 3–4-unit bridges in posterior region for two patients (three edentulous jaws) with 12 implants and one patient with 10 implants.

Results: The patients satisfaction, esthetic and functional outcomes were analyzed. The implants were from 3 to 15 years in function, the average follow-up of implants was 7.2 years. Only one implant with O-ring abutment was lost after loading and one overdenture was unsuccessful. No one implant was lost and all prostheses were successful for other types. Overall survival rate for implants placed in the edentulous jaws was 99.6% and success rate of oral rehabilitation was 98.2%. The mean change of bone level and Periotest value were following: 1.4 mm and – 1.4 for overdentures with O-ring abutments, 1.1 mm and – 1.8 for round bar retention with two implants, 0.8 mm and – 3.7 for three or four implants connected by a rigid bar, 0.5 mm and – 4.5 for full arch bridges on six or eight implants, 0.5 mm and – 4.4 for single crowns and bridges on 10 or 12 implants.

Conclusions and clinical implications: The complete dentures supporting on two implants with O-ring abutments is the worst type of oral rehabilitation for edentulous patients. The overdenture supporting on three or four implants connected by a rigid bar is best variant of removable prosthesis, but the patient satisfaction is not excellent. Fixed restorations of edentulous patients may be considered the optimal concept of implant treatment planning for a valid and predictable long-term success. Three or four implants with bar and six to eight implants with full arch bridges are adequate strategies for cost-effectiveness.

266 | Implant Therapy Outcomes, Prosthetic Aspects

Clinical investigation of prosthodontic treatment after removal of compromised implants

Presenter: Okano Y

Fukuoka Dental College, Fukuoka, Japan

Co-authors: Okano Y, Kido H, Yokoue S, Sakai T, Irie A, Sato H, Matsuura M

Fukuoka Dental College, Fukuoka, Japan

Background: Implant treatments have become common practice and have been used widely because of their highly predictable results. Many reports to date have shown successful and excellent results, but there are also reports in which the implants were removed due to poor results. There are a few

reports of prosthodontic treatments after the removal of implants. The investigations of what type of prosthodontic treatment patient's desire after implant removal are important to evaluate the effects of implant treatments.

Aim: In this study, we investigated patients who received prosthodontic treatment after their implants had to be removed.

Methods: The patients had implants placed at previous clinics and had them removed at our department between January 1999 and October 2010. These implants were removed due to poor results. The subjects were 70 of these patients who were able to be followed-up. The subjects' ages ranged between 30 and 87 years. We investigated the types of prosthodontic treatment that were performed in these patients after implant removal.

Results: After implant removal, dentures were delivered to 41 patients, a bridge was delivered to one patient, implant treatments were given again to 25 patients, and no prosthetic treatment was given to three patients. All patients in their 30s desired implant replacement and received subsequent implant treatment. For patients in their 70s or older, four patients received implant treatment again, but dentures were delivered in 15. Among 30 patients whose blade implants were removed, nine had implant replacement and removable dentures were delivered to 21 patients.

Conclusions and clinical implications: The removal of blade implants involves extensive bony defects regardless of the severity of the peri-implantitis. Thus, it was thought that dentures were delivered to a relatively large number of patients as prostheses after the blade implant removal. It was speculated that dentures were delivered to many patients in their 70s or older because of the invasiveness of surgery and the advanced age of patients in whom blade implants were placed. Prosthodontic treatment after implant removal was thought to be affected by various factors including the patient's age, number of implants that had been placed, type of implant body, and cost of retreatment.

267 | Implant Therapy Outcomes, Prosthetic Aspects

Three years follow-up study of egg-shaped Dolder bar and ball anchors retention devices for implant-supported overdentures

Presenter: Palarie V

State University of Medicine and Pharmacy, N. Testemitanu, Chisinau, Republic of Moldova

Co-authors: Palarie V

State University of Medicine and Pharmacy, N. Testemitanu, Chisinau, Republic of Moldova

Background: The edentulous status is considered a handicap, which deregulates oral functions and makes an impact on quality of life. Poor retention of complete denture is one of the main physiological problems in the edentulous persons. For an edentate inferior jaw one of the best possibility of treatment is implant-supported overdenture. The success of using two implants has been clearly demonstrated and intends to become the standard clinical protocol treatment of the edentulous elderly patient in daily practice.

Aim: The aim of proposed research work was to compare the 3 years follow-up results of the retention devices from implant supported prosthesis at patients with edentulous mandible. Retention devices in these cases were: egg-shaped Dolder bar and ball anchors. To evaluate the efficiency of the two treatment modalities it was used the clinical implant performance (CIP) scale emphasis by Wismeyer (2002).

Methods: There were studied 20 patients with full edentulous mandible. Patients were divided in two groups of study after retention system on implants for overdenture: group A – egg-shaped Dolder bar; group B – ball anchors. Patients received two SLA Straumann implants by 4.1 mm in diameter and 12 mm in length, in the interforaminal region. After 6 weeks of healing period of implants, the retention devices have been made for each group of patients. Follow-up results were collected: before surgery, immediate after implants placement, 1 week after surgery, after 1 month, after 3 months, after 6 months, 1 year, 2 and 3 years. During clinical measurements the following parameters were assessed: the modified Loe and Silness gingival index, the Mombelli plaque index, calculus index and Muhlemann bleeding index. The stability parameters [implant stability quotient (ISQ), and Periotest value (PTV)] were documented during each follow up procedure.

Results: After 3 years of clinical service, two implants were lost in one patient due to acute trauma. The Dolder system brought up eight prosthetic complications, especially the need for change of the male parts (CIP score 2). Patients from group B showed four complications, in view to change the plastic components (CIP score 1). Biologic complications and patients oral health-related life quality showed no significant difference among the two experimental groups. The stability parameters noted a good primary and secondary stability of implants from both groups, with medium values for PTV-5 and ISQ 61.

Conclusions and clinical implications: Prosthodontic maintenance was restricted to loss of retention for all systems. Within the observation period of this study, the ball attachments system showed a higher rate of maintenance and CIP score than the egg-shaped Dolder bar. The patients oral health-related life qualities as well as the biologic parameters do not differ in both groups.

268 | Implant Therapy Outcomes, Prosthetic Aspects

Clinical accuracy of implant impressions and casts for edentulous patients

Presenter: Papaspyridakos P

Harvard School of Dental Medicine, Boston, USA

Co-authors: Papaspyridakos P^{1,2}, White GS², Lal K², Weber H-P³, Gallucci G¹

¹Harvard School of Dental Medicine, Boston, USA, ²Columbia University College of Dental Medicine, New York, USA, ³Tufts University School of Dental Medicine, Boston, USA

Background: The accuracy of implant casts generated with various impression techniques has only been investigated *in vitro* and clinically relevant data are scarce.

Aim: The aim of this study was to investigate the accuracy of implant casts produced with standardized *in vivo* impression

and pouring techniques in edentulous patients. The null hypothesis was that no difference exists in the accuracy of casts generated with splinted and nonsplinted techniques.

Methods: The implant casts that had been used for the prosthetic rehabilitation of 12 edentulous jaws with CAD/CAM zirconia, implant fixed complete dental prosthesis (IFCDP) were included in this study. Intraoral acrylic jigs were made to fabricate index casts (prosthesis fabrication cast). Splinted and nonsplinted, open-tray techniques had been used to generate implant casts. Optical scanning acquisition of the x-, y-, and z-coordinates of the implant positions for each individual cast was done. The "best fit" algorithm was used with computer software to superimpose the scanning datasets. Thus, group I ($n = 12$) included casts from splinted impression technique vs. acrylic jig casts, and group II ($n = 12$) included casts from non-splinted technique vs. jig casts. The clinical accuracy was evaluated indirectly by assessing the fit of zirconia prostheses on the respective casts.

Results: Wilcoxon's Signed Ranks-test was used to compare the 3-D discrepancies within and between groups I (splinted vs. jig) and II (nonsplinted vs. jig), respectively. Significant difference was found at the x-, y-axis and 3-D between groups I and II ($P < 0.05$), but not in the vertical z-axis ($P > 0.05$). Within-subject, global 3-D discrepancies between groups I and II were significantly different ($P < 0.05$), corroborated by *in vivo* observations of clinical fit. Implant position in the arch affected the 3-D accuracy of casts for both anterior and posterior implants ($P < 0.05$). Out of the 12 casts of test group II (splinted) one cast presented with 3-D deviations statistically significant from the group I (control). Out of the 12 test group III (nonsplinted) six casts showed deviations statistically significant from the group I (control).

Conclusions and clinical implications: The splinted technique generated more accurate master casts than the nonsplinted technique for one-piece IFCDPs in edentulous jaws and the null hypothesis was rejected. The clinical implications demonstrate clinical supremacy of splinted impression technique over the nonsplinted technique. For the external connection system used, a threshold of $59 \mu\text{m}$ of 3-D misfit may be considered as the maximum for acceptable clinical fit with one-piece IFCDPs!

269 | Implant Therapy Outcomes, Prosthetic Aspects

Restoring missing maxillary incisors with implants

Presenter: Pappa E

Dental School, University of Athens, Athens, Greece

Co-authors: Pappa E, Petropoulou A, Pelekanos S, Madianos P, Papazoglou E, Vlachodimitri M

Dental School, University of Athens, Athens, Greece

Background: Restoring missing maxillary incisors with implants is a challenging and demanding therapy for the clinician. Decisions concerning the number, the position and the diameter of implants are crucial, in order to achieve an optimal esthetic result, especially in patients with increased overjet and overbite.

Aim: The purpose of this poster is to present a clinical case where two narrow implants were placed in the position of the

lateral incisors of the maxilla, for the restoration of the four missing incisors.

Methods: A male 45 years old, was referred to our clinic with a dental history of trauma, root resorption and resisting periapical lesions which led to the extraction of the four maxillary incisors. At the same time, ridge preservation was ensured with bovine xenograft and collagen membrane. Six months later, two narrow neck implants were placed at the lateral incisor sites with the use of a surgical guide. At stage two, a subepithelial connective tissue graft was placed for to augment the soft tissues. An interim screw retained restoration was placed and composite resin was added in frequent intervals at the pontics, creating a convex cervical shape. Because of excessive overbite, the more palatal positioning of the ovate pontics, at the centre of the alveolar ridge, was limited. The convex shape of the pontics contributed to the illusion of a scalloped soft tissue line, compensating in part for the tissue flattening, subsequent to tooth loss. Customized impression copings were used to ensure the accurate transfer of the emergence profile created during provisionalization. The final prosthesis was a four unit, screw retained, porcelain fused to metal fixed partial denture. Interdental porcelain mini-wings were designed in order to compensate for the deficiencies in the soft tissues at the interdental level.

Results: This prosthetic treatment can solve a variety of esthetic problems and provides the most predictable outcome even in compromised clinical cases.

Conclusions and clinical implications: The restoration of the four missing maxillary incisors with two narrow neck implants in the lateral incisor sites constitutes a low esthetic risk solution. This therapeutic treatment provides the clinician with the possibility of creating a proper emergence profile and portions between the lateral and central incisors, with modifications of the provisional restorations.

270	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

A prospective clinical trial on the Mg-incorporated oxidized clinical implants

Presenter: Park C-J

Department of Prosthodontics and Research Institute of Oral Science, College of Dentistry, Gangneung-Wonju National University, Gangneung, Republic of Korea

Co-authors: Park C-J¹, Cho L-R¹, Kim D-G¹, Im S-M¹, Lee J-H¹, Ko G-H¹, Lee J-K², Um H-S², Seo J-I³

¹*Department of Prosthodontics and Research Institute of Oral Science, College of Dentistry, Gangneung-Wonju National University, Gangneung, Republic of Korea,* ²*Department of Periodontics and Research Institute of Oral Science, Gangneung, Republic of Korea,* ³*R&D center, Shinhung MST, Wonju, Republic of Korea,*

Background: Biomechanical interlocking and biochemical bonding are believed as to be the mechanism of osseointegration. In animal study, magnesium (Mg)-incorporated oxidized implants showed significant enhancement of the bone response compared with clinical implants such as an oxidized commercially available TiUnite implant, and a dual acid-etched surface

Osseotite implant. Treatment success and stabilization of supporting tissues over time require clinical documentation.

Aim: The purpose of this prospective controlled study was to evaluate changes in bone level and clinical stability of Mg-incorporated oxidized implants.

Methods: The experimental protocol was approved by Institutional Review Board of the Dental Hospital. A total of 50 patients received 101 Mg-incorporated oxidized implants (Implant M, Shinhung, Seoul, Korea). Implants were placed into healed sites without bone graft (32 implants at maxilla and 69 at mandible). Clinical and radiographic evaluations of treatment success, crestal bone levels were performed at the time of placement and after 1, 3, 6, and 12 months. Implant stability quotient (ISQ) was measured using the Osstell™ device. Marginal bone level was evaluated using a long cone paralleling technique. Bone loss was compared using the repeated measured analysis of variance and post hoc Tukey test ($\alpha = 0.05$).

Results: One year cumulative survival rate was 100%. ISQ of all implants increased through the evaluation time. The mean ISQ values increased continuously with time lapse from 68.4 at fixture installation to 71.5 at 12 months after loading. Implant stability correlated with gender, fixture diameter, bone quality and implant sites. ISQ of woman was lower than that of man. ISQ of posterior area was highest among the installation site. ISQs of wide diameter and Type II bone quality were higher than those of regular diameter and Type IV bone. Crestal bone level was very stable through the time. Mean change in bone level was -0.38 mm for maxillary implants, and -0.021 mm for mandibular implants. The Mg-incorporated oxidized implants showed high survival rates as well as stable bone level and implant stability after 1 year, and may be recommended for clinical use.

Conclusions and clinical implications: Within the limitations of this study, 1 year success rate of Mg-incorporated oxidized implant was satisfactory. The implant stability and marginal bone level were excellent. However, further longer clinical studies will be needed to confirm the success of Mg oxidized clinical implant.

271	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Clinical outcome of two piece-zirconia implants: preliminary data after 12 months of clinical function

Presenter: Payer M

Department of Oral Surgery & Radiology, School of Dentistry, Medical University of Graz, Graz, Austria
Co-authors: Payer M¹, Kirmeier R¹, Koller M², Arnetzl V², Heschl A², Arnetzl G², Lorenzoni M², Jakse N¹

¹*Department of Oral Surgery & Radiology, School of Dentistry, Medical University of Graz, Graz, Austria,* ²*Department of Prosthodontics, School of Dentistry, Medical University of Graz, Graz, Austria*

Background: Zirconia has been increasingly discussed and questioned as implant material. So far no reliable clinical data are available on zirconia implants.

Aim: Aim of this prospective controlled pilot study was to evaluate the clinical outcome of two-piece zirconia implants treated according to a conventional standard protocol.

Methods: Thirty-one implants (16 zirconia/15 titanium) were inserted primary stable ($>30\text{Ncm}$), in the maxilla (seven) and mandible (24) of 20 patients (13 male/7 female) requiring neither bone nor soft tissue augmentation. Implants were restored adhesively with all-ceramic crowns (4 months) after placement. Radiographic coronal bone levels, implant survival and success were evaluated after a minimum of 12 months of clinical function.

Results: Measurements of mean marginal bone levels 12 months after surgery showed a significant bone loss ($P<0.05$) in both groups. One zirconia implant was lost 5 months after restoration. No further complications were recorded resulting in an overall survival and success rate after of 93.75% for zirconia and 100% for titanium implants after a period of 12 months in clinical function.

Conclusions and clinical implications: So far no final conclusions can be drawn from this pilot trial. Larger long-term RCTs are needed to confirm predictability and evidence of two-piece zirconia implants as an alternative to titanium implants.

272	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Implant restoration in a patient on holistic therapy

Presenter: Petropoulou A

Dental School, University Of Athens, Athens, Greece

Co-authors: Petropoulou A, Sykaras N, Pelekanos S

Dental School, University Of Athens, Athens, Greece

Background: The restoration of missing teeth at the anterior maxilla is considered to be a highly demanding treatment, especially nowadays that patients' expectations are increasing. In addition to that, it is very common to treat patients being under various therapies, such as the holistic therapy that could affect our treatment planning. According to the holistic therapy each tooth corresponds to an organic system and it is not recommended to place any kind of metal in the mouth.

Aim: The purpose of this presentation is to describe a clinical case where modifications to the treatment plan were necessary due to the fact that the patient waiting for an anterior implant to be restored, decided to go on holistic therapy.

Methods: Female patient, 40 years old, came to the Graduate Prosthodontic clinic with an implant in site #21, in order to replace the missing #21 and #22. After the placement of an interim restoration and the effort to manage, as much as possible, the soft tissues, we decided to proceed with a screw-retained restoration, made by a gold alloy casted framework. During the try-in of the framework, the patient mentioned that she was on holistic therapy, in order to become pregnant. According to holistic therapy's concepts the incisors are related to the genetic system. For that reason she refused to receive the framework, made by a different alloy and she asked for an all ceramic restoration or a Ti-based one, being of the same alloy as the implant. In this case the

treatment plan had to be modified. A zirconia framework was CAD/CAM fabricated, duplicating the metal framework and was then luted to an angulated titanium abutment with resin cement.

Results: The left central and lateral incisors were restored with an implant supported fixed restoration with a cantilever. The framework was made combining a titanium abutment with a zirconia superstructure, which in this case was a favorable treatment option, because of the lack of occlusal contact points and the increased horizontal overlap.

Conclusions and clinical implications: Patient esthetic and functional needs were successfully addressed with an alternate treatment plan. Knowledge of components' biomechanics and techniques' compatibility allow flexibility in treatment options to cover the clinical restrictions.

273	Implant Therapy Outcomes, Prosthetic Aspects
-----	--

Provisional restorations in implant therapy during osseointegration

Presenter: Prionisti M

Dental School, University of Athens, Athens, Greece

Co-authors: Prionisti M, Tzanetou P, Skondra E, Roussou I, Kourtis S

Dental University of Athens, Dental School, Athens, Greece

Background: Nowadays, dental implants are routinely utilized to support fixed or removable restorations in order to replace single or multiple teeth. This type of treatment requires an osseointegration period up to 6 months according to the classical protocol of conventional loading. During this period, several types of provisional restorations can be used. The selection of the suitable type for each case depends on the existence or absence of natural teeth. In partially edentulous patients the number and the clinical condition of the remaining teeth are the important factors determining the selection.

Aim: The aim of this poster is to summarize the existing types of provisional restorations, categorize them and present the indications of each group.

Methods: Through the presentation of several clinical cases, the available types of provisional restorations are presented and classified depending on their support (implant, tooth and/or tissue supported). The selection criteria based on the clinical characteristics of each case and the demand of the patient are analyzed.

Results: Provisional restorations satisfy biological, functional and aesthetic requirements. Furthermore, they play a versatile role in cases where different loading protocols are applied and during hard and soft tissue healing, following bone grafting or alveolar ridge augmentation procedures.

Conclusions and clinical implications: The main indication of provisionilization during the osseointegration period is the aesthetic and functional restoration of the patient. More specifically, the aforementioned types of prostheses offer occlusal stability, adequate function, and shaping of the soft tissues fulfilling the clinician's and patients demands.

The new system of Thai dental implant: case report on implant-supported single crown

Presenter: Saelim T

Department of Prosthetic Dentistry, Faculty of Dentistry, Hatyai, Songkhla, Thailand

Co-authors: Janruksukoom T¹, Pattanaprechakul N¹, Saelim T¹, Panyayong W¹, Nuangsri K¹, Kittidumkerng W²

¹*Department of Prosthetic Dentistry, Faculty of Dentistry, Hatyai, Songkhla, Thailand,* ²*Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Hatyai, Songkhla, Thailand*

Background: Dental implants are currently the aesthetic and functional alternative for tooth replacement. The PW Plus dental implant system has been developed since 2007 by Advanced Dental Technology Center (ADTEC). The manufacturer claims that the new connector (Octa-torx) is ease to use and can protect the micro-movement and micro-gap between the implant fixture and abutment. The system is designed to improve osseointegration by acid etching and sand blasting surface. For thread design, there are three feathers, microthread, reverse buttress thread, and condensed thread to provide surgical procedures and good biomechanics aspect. However, there are only few cases of clinical reports.

Aim: To report the two-stage surgical protocol and delayed loading on implant supported single crown (PW+ system).

Methods: A 39-year-old woman presented with chewing deficiency on left side. Clinical and radiographic examination indicated edentulous area on 26 with adequate inter-arch space but presented pneumatization of maxillary sinus. The surgical plan was simultaneous implant placement with sinus lift and grafted procedure with Bio-Oss. The 3.75 × 10mm. implant size had been selected. After 4 months, the stage II surgery was performed with healing abutments. Three weeks later, the peri-implant tissue was not inflammable in gingival cup, and then the final porcelain fused to metal crown restorations was made and inserted. Follow-up period was conducted at 1, 3 and 6 months respectively.

Results: After the follow-up periods, both clinical and radiographic evaluations were performed and the implant had osseointegration and no infection of peri-implant tissue. The patient was satisfied with treatment outcome.

Conclusions and clinical implications: The PW+ system is the new system with simple procedure. This system can be used for implant-supported single crown successfully with the simple procedure.

Implant supported removable partial dentures

Presenter: Sava K

Dental School, University of Athens, Athens, Greece

Co-authors: Sava K¹, Chronopoulos V¹, Tsoutis K¹, Kourtis S¹, Nagy W²

¹*Dental School, University of Athens, Athens, Greece,* ²*Baylor College of Dentistry, Dallas, Texas, USA*

Background: The standard clinical protocol for the restoration of completely edentulous patients with implants includes fixed restorations supported on five to six implants or implant supported overdentures with two to four implants. Implants placement in the posterior areas often requires extensive surgical procedures for bone augmentation, because of excessive bone loss. Implant-supported overdentures are not always well accepted by patients, which have to accept the presence of a metal bar or ball attachment when the overdenture is removed.

Aim: The purpose of this poster is to present the use of implant-supported fixed restorations in combination with removable partial dentures as a treatment option for the restoration of the fully edentulous patients.

Methods: A female patient with severe periodontitis presented for treatment. All maxillary and mandibular teeth were considered hopeless. Because of the patient's objection to surgical procedures for bone augmentation in the posterior areas for the placement of additional implants to support a fixed restoration, the final treatment plan included fixed implant supported partial dentures in the anterior segments and bilateral distal extension removable partial dentures in both arches.

Results: Simplified clinical and laboratory procedures based on the classic principles of fixed-removable prostheses were followed. The patient was completely satisfied with the prosthesis function, esthetics and phonetics. Retentive element maintenance was similar to conventional removable partial dentures.

Conclusions and clinical implications: The use of implant supported fixed partial dentures in combination with removable partial dentures in the posterior areas may offer an alternative treatment option for the edentulous patient.

'AllOnFourTM' protocol and computer-guided surgery: immediate loading rehabilitation of severe sinus pneumatization

Presenter: Scorca A

University of Bari, Bari, Italy

Co-authors: Scorca A¹, Deodato E¹, Minciarelli A²

¹*University of Bari, Bari, Italy,* ²*Private Practice, Bari, Italy*

Background: Case presentation of a 60-year-old male patient with fully edentulous jaws and severe mesial maxillary sinus pneumatization. The patient, suffering from cardiopathy and odontophobia, requested implant-supported fixed prosthesis rehabilitation. Overmore, the patient asked for a rapid treatment with minimum discomfort and Immediate Function.

Aim: Aim of this work is to report a successful Immediate Function rehabilitation in a case of severe maxillary sinus pneumatization with "AllOnFourTM" treatment protocol and computer-guided flapless implant surgery.

Methods: As result of AllOnFourTM protocolplanning, a flapless computer-guided implant surgery with 3D software planning (NobelGuideTM, Nobel BiocareAB, Göteborg, Sweden) was performed using the surgical guide. Immediately after surgery the patient received upper and lower immediate provisional full-arch fixed bridges (patient's previous total prostheses modified with Temporary Abutment Engaging Titanium and Temporary Coping Multi-unit Titanium). The upper and lower provisional full-arch fixed restorations were supported by four axial implant (NobelSpeedyTM Groovy, Regular Platform 13 mm; Nobel Biocare) and four distal tilted implants (NobelSpeedyTM Groovy, Regular Platform 15 mm; Nobel Biocare); as implants primary stability was reached, Immediate Loading could be performed. The patient was then monitored with follow-up visits every 2–3 weeks for 5 months.

Results: According to patient needs, bilateral maxillary sinus lift, bone grafting and regeneration procedures could be avoided with the support of 3D planning. Second temporary restorations were delivered 45 days after implant placement and CAD/CAM, screw-retained, ceramo-metal definitive restorations were delivered 5 months after surgery (ProCera[®] Implant Bridge Titanium; Nobel Biocare). A 1 month and 3 months follow-up visits were carried out checking and adjusting occlusion; no adverse clinical signs or symptoms were reported. Surgical trauma, pain, edema and treatment length were minimized; the patient was satisfied by the immediate rehabilitation and regained correct masticatory, phonetic and esthetic functions.

Conclusions and clinical implications: The conclusion of our report is that "AllOnFourTM" treatment protocol combined with computer-guided flapless implant surgery and immediate loading rehabilitation is a modern and predictable procedure that allows the immediate fixed rehabilitation even of patients with severe osseous atrophy and that significantly decreases treatment time and patient discomfort.

277 | Implant Therapy Outcomes, Prosthetic Aspects

Full mouth rehabilitation in edentulous patient with Wilson's disease: case report

Presenter: Shin M

Department of Prosthodontics¹, Dentistry², Han-Gang Scared Heart Hospital, Graduated School of Clinical Dentistry, Hallym University, Seoul, Republic of Korea
Co-authors: Shin M, Cho J-B, Lee U, Kim M

Department of Prosthodontics¹, Dentistry², Han-Gang Scared Heart Hospital, Graduated School of Clinical Dentistry, Hallym University, Seoul, Republic of Korea

Background: Wilson's disease, also called progressive hepatolenticular degeneration, is a rare inherited autosomal recessive disorder caused by excessive copper deposition in various tissues and organs including brain, liver, and kidney. The disease is characterized by degenerative changes of the central nervous system, liver cirrhosis, renal dysfunction, and in many cases

osseous changes including osteoporosis, osteoarthritis, osteomalacia, and others.

Aim: The purpose of this presentation is to report a clinical case and the result of Prosthodontic treatment where implant surgery was performed in an edentulous patient with Wilson's disease.

Methods: Following the Top-Down treatment principle, we treated temporary upper and Lower completed denture. And two fixture installation in mandible used surgical stent like lower temporary denture in atrophic-edentulous patient.

Results: The patient showed normal healing and good osseointegration after implant surgery that made it possible for Prosthodontic treatment and maintenance.

Conclusions and clinical implications: The bone and soft tissue changes in Wilson's disease patient range from mild to severe. With proper diagnosis and treatment planning according to the severity of the disease, implant restoration seems to be one of the methods of oral rehabilitation in edentulous patients with Wilson's disease.

278 | Implant Therapy Outcomes, Prosthetic Aspects

Effect of overload in peri-implant bone – review

Presenter: Pereira MS

Faculdade de Medicina Dentária da Universidade do Porto, Oporto, Portugal

Co-authors: Pereira MS¹, Correia FDC¹, Costa FIP¹, Costa AMCL¹, Almeida RMCLFE¹, De Campos Felino AC¹, Carvalho JFC¹

¹Faculdade de Medicina Dentária da Universidade do Porto, Oporto, Portugal, ²Universidade Católica Portuguesa, Centro Regional das Beiras, Viseu, Portugal

Background: The process of osseointegration may be jeopardised by a variety of factors associated with surgical trauma or preparation of implant sites. Thus, tissue necrosis may result during early phases of healing, leading to the loss of the implant. Usually, these implant failures are referred to as early failures and are generally not encountered beyond a period of 3–6 months following implant installation. However, the causes for late implant complications leading to failure, i.e. tissue disintegration following functional loading, are still under exploration (Heitz-Mayfield et al. 2004). Speculations regarding occlusal overload being a causative or contributing factor in late implant failures continue to be a point of discussion (Sanz et al. 1991; Quirynen et al. 1992). However, evidence for this theory is almost completely lacking. On the contrary, in the absence of infection, neither statically nor dynamically applied forces in experimental models have resulted in the induction of peri-implant bone loss (Gotfredsen et al. 2001a, 2001b, 2001c, 2002). Heitz-Mayfield et al., shows in the presence of a peri-implant healthy mucosa, in a period of 8 months with implants in overload there is loss of osteointegration or loss of marginal bone when compared with implants not placed in load (Heitz-Mayfield et al. 2003).

Aim: The objective of this review is to expose the influence and effect of overload on the longevity of dental implants and the peri-implant bone.

Methods: To carry out this literary review we used the database Pubmed combined with two combinations of keywords: "overload dental implant" and "excessive occlusal load". The limit established was the articles published in the last 10 years and in English. The words must be in the title or abstract.

Results: Using the combination of keywords "overload dental implant" and "excessive occlusal load" we found 35 articles in total. After reading the abstract, 24 articles were excluded since it did not refer to influence of overload in the peri-implant bone. In the final we have 11 articles.

Conclusions and clinical implications: The occlusal overload remains a topic that generates enough disagreement in the scientific community because if on one hand we have studies that involve the overload in the loss of peri-implant bone, on the other hand, have studies indicate that in the absence of inflammation there is no loss. More study's are needed to establish the effect of overload in peri-implant bone.

279 Implant Therapy Outcomes, Prosthetic Aspects

Conversion of a denture into a fixed implant-supported prosthesis: materials and techniques

Presenter: Sykaras N

School of Dentistry, University of Athens, Athens, Greece
Co-authors: Patras M², Sykaras N¹, Martin W²

¹*School of Dentistry, University of Athens, Athens, Greece,* ²*Center for Implant Dentistry, Department of Oral and Maxillofacial Surgery, University of Florida, College of Dentistry, Gainesville, FL, USA*

Background: Conventional and immediate loading of dental implants in the edentulous mandible is well-documented in the literature. In many situations, the denture conversion concept has been widely accepted as it offers a simplified approach that may be easily incorporated into most clinical practices. Whether utilizing the conventional 2-stage protocol or immediate loading, the fixed implant-supported prosthesis offers superior comfort and function when compared with a soft-tissue supported conventional denture.

Aim: The aim of this presentation is to describe various step by step approaches to transitioning patients from complete dentures to implant-supported fixed restorations.

Methods: The clinical technique for the conversion process will require a well fitting denture, temporary implant components and the ability to index the implants to the denture base. Guidelines and recommendations for selection and modification of these components in addition to denture preparation and consequent prosthesis fabrication will be presented. A clear understanding on how to work with dental implants that were recently placed will be critical to success performing an immediate load denture conversion. Considerations and various interim hybrid designs according to the number and distribution of the dental implants will be highlighted.

Results: The denture conversion techniques offer various advantages that can lead to predictable results in the treatment of edentulous patients with dental implants. Rapid modification and conversion of a complete denture following surgical uncovering or placing of dental implants provide specific benefits

to the patients leading up to the delivery of the definitive prosthesis. One distinct benefit allows for the patient to evaluate the comfort, function and esthetics of the interim prosthesis allowing for feedback before fabrication of the definitive one. Considering the patient feedback on comfort, oral hygiene maintenance and appearance will help facilitate the design of the final prosthesis and proper modifications can easily and effectively be communicated to the laboratory.

Conclusions and clinical implications: This technique incorporates conventional implant components and may be used with most commercially available implant systems. Dental practitioners may fabricate the prosthesis chair-side, or by using simplified indirect methods on a working cast, via the incorporation of provisional cylinders or other prefabricated components to the existing denture base. Proper diagnosis and coordinated treatment can ensure the success of the final outcome in a cost-effective way.

280 Implant Therapy Outcomes, Prosthetic Aspects

Consideration of temporary restoration of immediately loaded implants in full edentulous maxilla

Presenter: Tamaki H

Nihonbashi Implant Center, Tokyo, Japan

Co-authors: Tamaki H

Nihonbashi Implant Center, Tokyo, Japan

Background: One of main failures of the immediately loaded implants in full edentulous maxilla is fracture of resin only temporary restoration among functional temporary periods.

Aim: The aim of this study is to introduce our immediately loaded temporary restoration (ILTR) method and its character in the completely edentulous maxilla currently performed in our office and to estimate its methods.

Methods: Twenty-five nonsmoker patients (15 female and 10 male) aged 40–78 (mean 57.8) without general diseases, and no need of major bone augmentation were chosen for the study, 20 completely edentulous maxilla were examined. Based on the diagnosis template, 156 solid screw Straumann SLA surface implants (contained TE implants) were installed, immediately impression and bite registration was taken as conventional method to make ILTR. These contained abutment part and connection one made of dental casting gold silver palladium (12%) alloy, which were already cast made before operation. These were welded to connect each other as metal flame, and custom-made acrylic resin was adhered to them by dental technicians. These were torque-tighten by 35 N cm to implants which were obtained more than 25 N cm enough first stability and were performed immediate loading on the same day. Bone quality for this study was set to all type 2, 3 and 4. The patients were followed for a period ranging from 4 to 12 months before definitive prostheses.

Results: All ILTRs were not fractured and all implant except two were osseointegrated. These ILTRs were very thin and comfortable for patients.

Conclusions and clinical implications: Our ILTR method is introduced, which is very useful and comfortable for patients, but it needs more sample numbers.

Crown-implant ratio measured on digital dental casts and intraoral radiographs

Presenter: Telleman G

Department of Oral and Maxillofacial Surgery and Maxillofacial Prosthetics, University Medical Center Groningen, Groningen, The Netherlands

Co-authors: Telleman G^{1,2}, Raghoobar G¹, Vissink A¹, Meijer H^{1,2}

¹*Department of Oral and Maxillofacial Surgery and Maxillofacial Prosthetics, University Medical Center Groningen, Groningen, The Netherlands,* ²*Department of fixed and removable prosthodontics, University of Groningen, Groningen, The Netherlands*

Background: Implant companies manufacture ever decreasing implant lengths, possibly resulting in increasing crown-implant ratios. Two different definitions are used for crown-implant ratio: *anatomical crown-implant ratio*, calculated by dividing the length of the anatomical crown by the length of the implant and *clinical crown-implant ratio*, calculated by dividing the length of that portion of crown and implant above the alveolar bone by the length of the implant portion within the alveolar bone. Both ratios are measured on radiographs. The clinical crown-implant ratio is said to offer a more realistic clinical scenario. However, measuring crown height on a radiograph is not the most realistic height from a clinical perspective, as the most coronal part of the crown may not be point of the crown that is in function. More realistic could be to determine the actual contact point with the antagonistic tooth and calculate the distance to the top of the implant or the first bone-to-implant contact. The development of digitizing dental casts offers new possibilities in measuring in a three-dimensional space.

Aim: The aim of this study was to compare crown-implant ratio calculated on an intraoral radiograph with crown-implant ratio calculated on digitized dental casts with determination of a functional contact point with an antagonistic tooth.

Methods: Fifty patients (86 implants, length 8.5 mm) with single, implant-supported crowns in the posterior region of maxilla and/or mandible were included. Intraoral digital radiographs were analyzed using computer software to perform linear measurements and crown-implant ratios were calculated. The dental casts with implant analogue(s) and the dental casts of antagonistic jaw were digitized. Contact point of implant-supported crown with antagonistic tooth was recorded clinically and marked in the three-dimensional articulating models. Height of the crown from implant analogue to contact point was measured and crown-implant ratio was calculated.

Results: Mean crown height measured on radiographs was 10.99 ± 1.78 mm, resulting in a crown-implant ratio of 1.29 ± 0.21 . Mean crown height measured on digitized casts was 9.83 ± 1.57 mm, resulting in a crown-implant ratio of 1.16 ± 0.19 . Although there is a difference between the methods, the

Bland and Altman plot showed a strong agreement in this difference per patient (95% confidence interval).

Conclusions and clinical implications: Crown height measured on radiographs gives higher values compared with measurements on digitized casts. Realistic crown-implant ratios should be measured on a combination of a radiograph (for determination of marginal bone level) and digitized casts (for determination of contact point with antagonistic tooth).

Mandibular overdenture design for the atrophic mandible

Presenter: Trajkovska-Zareska I

Dentizar, Skopje, Macedonia

Co-authors: Trajkovska-Zareska I¹, Kovacevski A²

¹*Dentizar, Skopje, Macedonia,* ²*Impacta Dental, Skopje, Macedonia*

Background: The number of elderly people is increasing worldwide, as well as their need to continue a well fulfilled and active life. Although many of them already suffer from chronic systematic diseases like cardiovascular, osteoporosis, diabetes etc., the loss of their teeth gives them another handicap in the aesthetic, social and dietary aspects. Owing to bone aging and resorption, placement on implants is limited on the anterior region in atrophic mandible. Overdentures supported by implants increase the patients' self-confidence, bite force and chewing efficacy.

Aim: The aim of our study was to determine the period of adaptation to mandibular overdentures supported by implants and their osseointegration in two different groups of patients.

Methods: This study covers 20 patients, from both sexes of the ages 65–72. The first group included 10 patients who had worn total mandibular prostheses for 5–10 years. The second group of ten patients possessed periodontally compromised anterior teeth and mobile prosthesis for the posterior teeth. All front teeth had to be removed before the implant treatment. New total mandibular prosthesis was made in both groups. In the first group, we inserted two implants in eight patients and four implants in two patients. In the second group, we inserted two implants in two patients, three implants in two patients and four implants in six patients. A late loading protocol on the implants was carried out. All patients were examined and filled questionnaires on appointments taken in the first week after implantation, and 2, 6 months and 1 year afterwards, during which we noticed the implant stability, the retention and the stability of the prosthesis and chewing ability.

Results: The results were statistically analyzed with Student's *t*-test. The obtained results showed that the patients from the first group had shorter period of adaptation, regardless if they had two or four implants. In contrast, the patients from the second group with only two implants had longer period of adaptation to overdentures than those with three and four implants.

Conclusions and clinical implications: In conclusion, we suggest the inserting of more implants in the interforaminal regions for patients who have just lost the remaining teeth, because they slowly adjust to lower bite force and new occlusal scheme of total prosthesis.

Root submergence in the esthetic zone. A technique for pontic site esthetic enhancement in full mouth implant restorations

Presenter: Tsoutis K

University of Athens, Athens, Greece

Co-authors: Tsoutis K^{1,2}, Sava K¹, Markou N¹, Chronopoulos V¹, Mattheos N¹

¹*University of Athens, Athens, Greece*, ²*Griffith University, Griffith, Australia*

Background: Achieving high esthetic results in the pontic sites of fixed implant-supported restorations is a challenging task for the clinician and requires appropriate surgical and prosthodontic management of the soft tissues. In order to obtain an esthetic soft tissue frame, the underlying alveolar bone must be present to support it. Socket preservation and soft tissue augmentation techniques have been suggested to maintain the ridge contour at the pontic site. The root submergence is another technique that has been proposed instead of the commonly used bone and soft tissue augmentation procedures. The root is sectioned at the level of the bone and covered with a buccal or buccolingual flap. The attachment apparatus of the natural root maintains the contour of the alveolar ridge and prevents bone resorption and soft tissue collapse that are observed after extraction of a tooth.

Aim: The aim of this poster is to present a clinical procedure that can obtain high esthetic results in the pontic sites of fixed implant restorations, utilizing the root submergence technique.

Methods: A 71 years old male with a severely compromised dentition presented for treatment. The patient had high esthetic demands and desired fixed restorations. The suggested treatment included fabrication of cement retained Fixed Dental Prostheses supported by six implants in the maxilla and a screw retained hybrid bridge supported by five implants in the mandible. The upper canines and central incisors, despite their poor prognosis, were maintained temporarily in order to support a fixed transitional restoration for the osseointegration period. All implants osseointegrated successfully and a screw-retained implant-supported transitional restoration was fabricated in the maxilla. The crowns of the canines were sectioned at the level of the bone and the roots were submerged. The central incisors were extracted due to excessive root caries. Selective pressure was applied at the soft tissues of the pontic sites with the provisional restoration. A natural scallop of the soft tissues was formed and the fabrication of the definitive Fixed Dental Prostheses with ovate pontics was followed.

Results: After 3 years in function, no biologic complications on the natural submerged roots were observed. The esthetic appearance of the restorations at the pontic sites was excellent.

Conclusions and clinical implications: The utilization of the root submergence technique in the pontic sites of fixed implant restorations is a predictable clinical procedure, which maintains the alveolar ridge contour and enhances the final esthetic result.

Single tooth implant restorations with CEREC 3D 'Replication Mode' after socket preservation: a case report

Presenter: Turkoglu P

Istanbul University, Istanbul, Turkey

Co-authors: Turkoglu P, Gultekin A, Yalcin S

Istanbul University, Istanbul, Turkey

Background: The main goal of implant therapy in the anterior maxilla is to reproduce natural teeth at all points. The first stage of the treatment is about protecting hard and soft tissues. Preservation of the alveolar socket with different biomaterials after tooth extraction is essential especially in the anterior region. Second stage of the treatment is about fabricating esthetically satisfactory implant-supported crown restorations. CAD/CAM technology has made steady inroads into the practice of dentistry. The "Replication" mode in CEREC 3D chair-side is an optional design technique for all ceramic veneers and crowns. This mode opens the possibility of using contralateral teeth of the patient as an aid in designing implant or tooth supported crown restorations.

Aim: The aim of this case report was to present successful approach to alveolar socket preservation using intentionally exposed nonresorbable high-density polytetrafluoroethylene membranes with mineralized allografts and also reproducing tooth-like implant-supported restorations with CAD/CAM technology.

Methods: The patient with a mobile reconstructable maxillary central incisor applied to our department. Tooth extraction was performed and socket preservation method was applied using with allograft and nonresorbable d-PTFE (dense polytetrafluoroethylene) membrane. A metal-ceramic maryland bridge was adhesively cemented during healing period of bone in order to provide function and esthetics. After healing period of 4 months implant placement was constructed to the site and metal-ceramic maryland bridge was again used with anatomically shaped adjustable pontic enabling soft tissue healing. Following soft tissue levelling zirconia abutment preparation and crown restoration were performed using Cerec 3D "Replication Mode" with patient's adjacent central incisor.

Results: Based on dental volumetric tomographic measurements, the hard tissue volume and contour were largely preserved at socket site with allograft and nonresorbable d-PTFE membrane. Cerec 3D "Replication Mode" showed great success to mimic the natural adjacent tooth. The patient was fully satisfied with the esthetic and function of the construction, which has been in use for 1 year without further complication.

Conclusions and clinical implications: The fabrication of an all-ceramic crown utilizing the CEREC 3D technology can lead to esthetically pleasing, functional outcomes with great patient and clinician satisfaction especially on the anterior region. If the restoration will be supported by an implant it is necessary also to mimic the soft tissue by means of preserving extraction sockets with biomaterials like allograft and nonresorbable d-PTFE membranes and using provisional adhesive bonded bridges with adjustable anatomically shaped pontics. However, long-term results are necessary to substantiate these findings.

Implant treatment for two patients with lichen planus: a clinical report

Presenter: Turkoglu P

Department of Fixed Prosthodontics, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Karatasli B¹, Karatasli G², Turkoglu P¹

¹*Department of Fixed Prosthodontics, Faculty of Dentistry, Istanbul University, Istanbul, Turkey,* ²*Private Practice, Istanbul, Turkey*

Background: Oral lichen planus is a relatively common mucocutaneous disorder with chronic relapsing course of unknown aetiology for which there is currently no cure. OLP constituted of 16.2% of the patients with oral soft tissue lesions and presents clinically as bilateral and symmetrical papular, reticular, erosive lesions of the buccal mucosa, gingiva and tongue. For the patients with oral lichen planus, wearing a complete denture is quite difficult because of the painful lesions. However, oral lichen planus is generally considered to be a contraindication for the placement of dental implants. Implant-supported overdentures may be a predictable treatment for these patients.

Aim: The aim of this report was to evaluate the clinical success of implant-supported overdentures in oral lichen planus patients.

Methods: Patients with the clinical and histopathological diagnosis of oral lichen planus applied to our clinic. Oral lichen planus lesions which were erosive and atrophic type, located bilateral buccal mucosa. When asked about symptoms of lesions, both patients reported sore mouth, burning sensations and they stated difficulty in using mandibular complete dentures because of friability of oral mucosa. Two implants for each patient were placed in the anterior region of the mandibula to provide implant-retained mandibular overdentures. After 3 months of healing period all implants were uncovered for prosthetic rehabilitation. Two implant-supported ball attachment prosthesis were delivered.

Results: Clinical follow-up appointments were arranged for every 6 months. All implants were in function without complication and had high esthetic and functional satisfaction. Bone resorption around the implants in both patients was an average 0.6 mm for 3 years overall.

Conclusions and clinical implications: Implant-supported overdentures with lichen planus patients may be a reliable and predictable treatment choice for esthetic and functional demands. This process brings strict follow-up and high compliance of the patients to perform good oral hygiene. Long-term follow-up studies are needed to confirm the results of this study.

Design of Customized Ceramic Implant Abutments

Presenter: Tzanetou P

Dental School, Athens, Greece

Co-authors: Tzanetou P, Ravanis P, Kourtis S, Goussias I

Dental School, Athens, Greece

Background: Long-term functional and esthetic success with implant-supported restorations requires a comprehensive and interdisciplinary treatment approach. Especially for the front area ceramic abutments have an excellent esthetic potential. Furthermore they offer optimized biocompatibility compared with metal abutments. The clinician has the choice of either prefabricated or customized solutions. As the support of the surrounding tissues is the primary objective, custom-made abutments have offer a superior prosthetic outcome.

Aim: The purpose of this presentation is to describe the design and application of customized ceramic implant abutments in two clinical cases: Zirconia CAD/CAM systems and newer manufacturing techniques using heat pressed lithium disilicate were the materials of choice.

Methods: In this study, two patients were treated with implants in the esthetic zone. The first patient received with two implants in areas # 11, 21 and the second one, an implant in #11 (Xive) (Dentsply, Friadent, Mannheim, Germany). After 8 weeks of osseointegration period, final impressions were made. In the first case custom-made Zirconium abutments were fabricated with CAD/CAM technique (inCoris ZI, Sirona Inlab, Bensheim, Germany) and full ceramic restorations were constructed from the same material and cemented with resin cement (Panavia f 2.0) (Kuraray).

In the second case a customized implant abutment was constructed using heat pressed lithium disilicate (IPS e.max) (Ivoclar, Vivadent, Schaan, Liechtenstein). Followed by the cementation of an all-ceramic crown by lithium disilicate (IPS e.max). The following clinical parameters were evaluated: (a) biological response of the soft tissues and (b) esthetic outcome in the cervical region.

Results: Both zirconium and lithium-disilicate are materials with great biocompatibility, favorable esthetic performance and optimal mechanical properties. The two methods described in this study can be used for the manufacturing of ceramic abutments according to the individuality of each clinical case and also the technician's competence.

Conclusions and clinical implications: Ceramic abutments can be used in the anterior region achieving favorable aesthetic results. Customized ceramic abutments result in better integration of peri-implant tissues and superior esthetic outcome.

Evaluation of postorthodontic space creation for lateral incisors

Presenter: Vasant R

Eastman Dental Institute, London, UK

Co-authors: Vasant R¹, Hems E¹, Bassi S²

¹*Eastman Dental Institute, London, UK* ²*Eastman Dental Hospital, London, UK*

Background: In recent years, implant therapy has become the treatment of choice for replacing missing teeth. Space creation for missing lateral incisors involves a considerable amount of investment by the patient, orthodontist, and the other multidisciplinary team members. Some patients may be too young at the time of orthodontic intervention to receive implants. However, during treatment planning, it should be assumed that all patients will undergo implant therapy eventually.

There appears to be considerable difficulty in achieving sufficient space for implant treatment. Frequently, it has been found that debonding of brackets has occurred before full evaluation of the space available. This study sets out to evaluate the extent of the problem.

Aim: To evaluate the number of patients who received periapical radiographs before orthodontic debonding.

To measure the available space for implant placement following orthodontic treatment.

Methods: The notes of 45 patients who had been treated in the last 2 years on the Eastman Hypodontia clinic were assessed to look at the level of communication and the presence of periapicals.

The periapicals were evaluated and measured for the distance at two levels:

- between the root apices,
- at mid-crown level,

Results: Twenty-nine of seventy-four patients had long cone periapical radiographs before bracket debonding.

Evaluation of periapicals revealed that following orthodontic treatment, 21/74 patients had < 7 mm available space at mid-crown level, in at least one potential implant site.

Conclusions and clinical implications: The positioning of the crowns and roots of adjacent teeth to facilitate implant placement in hypodontia cases is absolutely essential. It allows optimal positioning of the implant based on a sound diagnostic wax up and implant surgery placement.

Further research and education of the multidisciplinary team is required to promote optimal aesthetics and longevity of implant restorations.

The influence of prosthetic socket preservation on the midfacial soft tissue level

Presenter: Weigl P

Department of Prosthodontics, Faculty of Oral and Dental Medicine, Goethe-University Frankfurt am Main, Frankfurt Am Main, Germany

Co-authors: Weigl P¹, Grizas E², Hess P², Trimpou G², Lauer H-C¹

¹*Department of Prosthodontics, Faculty of Oral and Dental Medicine, Goethe-University Frankfurt am Main, Frankfurt Am Main, Germany,*

²*Department of Oral Surgery and Implantology, Faculty of Oral and Dental Medicine, Goethe-University Frankfurt am Main, Frankfurt Am Main, Germany*

Background: Aesthetic outcomes (PES, WES) depend on stable midfacial soft tissue levels. A lot of factors and treatment concepts are discussed to achieve predictable and long lasting results.

Aim: The aim of the prospective clinical trial was to evaluate the midfacial soft tissue dynamics of a fresh extraction socket immediately sealed by an implant borne prosthetic component with an identical cervical dimension of the lost tooth.

Methods: In six patients, six platform switched implants were placed immediately into fresh, flapless gained extraction sockets. The jumping distance (JD) and the subcrestal implant position (SIP) were measured. The remaining defect was not filled with autologous bone or bone substitutes. After indexing the implant position all prosthetic working steps were done on the master cast – the customizing of the zirconia abutment and the manufacturing of a socket seal by the relined natural dental crown. If due to traumatic impact the tooth was not available, a naturally dimensioned crown restoration served as an alternative wound sealant. The used “one abutment one time” concept required a replica of the master cast to fabricate the final crown. Latter was cemented after a 3 months lasting implant loading without occlusal contacts. Papilla height (PH), the midfacial soft tissue level (MFL) Bleeding on Probing (BOP) and modified Plaque Index (mPII) were measured before tooth extraction, at the time of immediate and final restoration and every 6 months thereafter. The software based comparison of radiographs showed the time-related behavior of mesial and distal crestal bone heights.

Results: The mean value of the JD was oral 0.5 mm, buccal 2.08 mm. The SIP was on average 2 mm mesial, 1.58 mm oral, 2 mm distal and 1 mm buccal. The mean follow-up period was 7.5 months. The 6 months recall showed following mean values: BOP = 0.17 ± 0.37; mPII = 0.5 ± 0.76; crestal bone loss 0.12 ± 0.53 mm SD; vertical papilla loss 0.002 ± 0.26 mm SD; mid facial soft tissue loss 0.098 ± 0.105 mm SD.

Conclusions and clinical implications: Within the limits of the currently small group size the minimal invasive surgical and prosthetic protocol for sealing a fresh extraction socket like a reimplanted tooth appears to transfer the original emergence profile to an implant borne crown without any midfacial soft tissue loss.

Polygonal area of prosthesis support with upright and tilted implants

Presenter: Wentaschek S

University Medical Center, Mainz, Germany

Co-authors: Wentaschek S, Lehmann K, Behneke N, Scheller H

University Medical Center, Mainz, Germany

Background: The adoption of tilted implants for the rehabilitation of edentulous maxillae has been proposed as an alternative to bone grafting procedures. The aim is to place implants of conventional length and to increase the polygonal area of prosthesis support and reduce the cantilever length. Instead of using tilted implants, these regions would receive shorter implants. To that effect the increase of interimplant distance using tilted implants depends on the alternative implant length.

Aim: The aim of this study was to evaluate the increase of the polygonal area of prosthesis support by tilting distal implants in the edentulous maxillae in comparison of different lengths of upright implants.

Methods: Upright implants of 8, 10 and 12 mm and 45 degrees tilted implants with 12–16 mm in length were virtually planned in DICOM datasets of 20 edentulous maxillae with limited posterior ridge dimension. Each implant was positioned posterior as far as possible without bone graft procedure. In the region of lateral canine two reference implants were virtually positioned. After validation of the measuring tool of the 3D-planning software the differences of the polygonal area of prosthesis support were measured.

Results: The mean sagittal extent of the polygonal area of prosthesis support between reference implants and upright 12 mm implants was 9.2 mm (min 1.5 mm, max 16.6 mm, SD 4 mm) on maxillary right side and 9.4 mm (min 3 mm, max 18.1 mm, SD 4.1 mm) on maxillary left side. The increase using 10 mm implants was 1.4 mm (min 0.2 mm, max 5.6 mm, SD 1.3 mm) for the right and 1.8 mm (min 0 mm, max 5.4 mm, SD 1.5 mm) for the left side. The increase using 8 mm implants was 3.7 mm (min 1.3 mm, max 6.5 mm, SD 1.8 mm) for the right and 3.4 mm (min 0.9 mm, max 6.4 mm, SD 1.7 mm) for the left side. The increase using tilted implants was 5.9 mm (min 2 mm, max 10.4 mm, SD 2.2 mm) for the right and 5.7 mm (min 3 mm, max 8.6 mm, SD 1.8 mm) for the left side. The mean transversal distal extent of the polygonal area of prosthesis support with tilted implants was 39.4 mm (min 27.6 mm, max 45.2 mm, SD 4.3 mm), and 33.7 mm (min 16.7 mm, max 39.9 mm, SD 5.6 mm) with upright 12 mm implants.

The mean possible length of used tilted implants was 15 mm (min 12 mm, max 16 mm, SD 1.5 mm) for the right and left side, respectively.

Conclusions and clinical implications: The data of this study demonstrates that in edentulous maxillae an increased interimplant distance and thus a better load distribution may be achieved by using tilted implants in the maxillary posterior region.

Osseointegration of interforaminal implants – immediate vs. delayed loading

Presenter: Wildburger A

Department of Oral Surgery and Radiology, Medical University Graz, Graz, Austria

Co-authors: Wildburger A

Department of Oral Surgery and Radiology, Medical University Graz, Graz, Austria

Background: Retention by enosseous implants can improve functional and psychological comfort of patients with full dentures in the lower jaw. Using the Locatorsystem[®] implants can be loaded either immediately or delayed.

Aim: The aim of this randomised, prospective study was to evaluate osseointegration and position failures after immediate (group 1) and delayed loading (group 2) of four interforaminal implants.

Methods: The study population comprised 20 patients (>60 years, 9 female/11 male) with a severely resorbed, edentulous mandibula. After insertion of four interforaminal implants (Neoss Ltd., Harrogate, UK) patients were randomly immediately or delayed after 3 months supplied with the Locator[®] – abutment system. Osseointegration was evaluated clinically, radiologically and by means of Periotest[®] and Ostell[®] measurements during surgery, after 3 and after 6 months postoperative.

Results: Eighty implants were inserted. Over 6 months no failures and no relevant radiological bone loss was evaluated. The mean values of the Periotest[®] and Ostell[®] measurements increased over time in both groups. Periotest[®] values in group 1 were $-5.53 (\pm 1.48)$ intraoperative, $-6.28 (\pm 1.02)$ after 3 months and $-6.8 (\pm 0.89)$ after 6 months. Ostell[®] measurements were $76.15 (\pm 4.15)$ intraoperative, $81.71 (\pm 2.78)$ after 3 months and $82.05 (\pm 2.99)$ after 6 months. In group 2 the Periotest[®] – values were $-3.97 (\pm 2.05)$ intraoperative, $-5.77 (\pm 1.04)$ after 3 months and $-6.94 (\pm 0.86)$ after 6 months, and values gained via Ostell[®] were $74.45 (\pm 4.41)$ intraoperative, $78.28 (\pm 14.02)$ after 3 months and $80.75 (\pm 3.47)$ after 6 months. No significant statistical difference ($P < 0.05$) was found between the results of the two groups.

Conclusions and clinical implications: The immediate as well as the delayed loaded implants showed inconspicuous osseointegration over 6 months of observation. It can be concluded, that both protocols can be recommended for retention of lower total prostheses.

Removal of implant-supported single crowns using the KaVo CORONAFlex 2005

Presenter: Worni A

Department of Prosthodontics, University of Bern, Bern, Switzerland

Co-authors: Worni A¹, Jöhren P², Bayer S³, Marchand L¹, Kremer U¹, Mericske-Stern R¹, Enkling N^{1,3}

¹*Department of Prosthodontics, University of Bern, Bern, Switzerland,*

²*Department of Oral Surgery, University of Witten/Herdecke, Witten, Germany,*

³*Department of Prosthetic Dentistry, Propaedeutics and Material Science, University of Bonn, Bonn, Germany*

Background: Different types of cements are used for retention of single crowns on implants. Removal of cemented single crowns may be clinically necessary. For this indication several devices are available, e.g. the KaVo CORONAFlex 2005 (KAVO, Biberach, GER). However, scientific information of effort and psychological impact of CORONAFlex 2005 is scarce.

Aim: To evaluate the effort of removing cemented implant-supported single crowns by means of the KaVo CORONAFlex 2005 device (CF) and analyzing the psychological perception of the removal technique using a standardized questionnaire.

Methods: A prospective, double-blind, controlled clinical trial was designed. Twenty-one patients received 74 implants (SI-Cace, SICinvent AG, Basel, CH) in the posterior mandible. Four months after implant surgery, fully ceramic-veneered casted single crowns were cemented on standard titanium abutment, being individually shortened. Two provisional cements (HT=Harvard Temp, Harvard, Hoppegarten, GER; IMP=Improv, Alvelogro, Snoqualmie, USA) and one permanent cement (DUR=Durelon, 3M Espe, Seefeld, GER) were used. Eight months later, all implant crowns were removed by using CF, counting the number of activations (ACF) until the crowns had been removed. 12 months later, the patients answered a structured questionnaire to determine the retrospective psychological impact of the application of CF, i.e. the sum of ACF per patient (total-ACF). For statistical analysis, a linear regression model as well as a descriptive statistic was used.

Results: All 74 crowns could be removed by using CF; no technical or biological complications were observed. A mean ACF for HT of 3.7 ± 4.7 , for DUR of 4.3 ± 4.3 , and for IMP of 9.4 ± 11.1 was necessary. Towards ACF, abutment height ($P=0.019$) and cement type ($P=0.004$) were statistically significant, whereas the influence of cement-type was more pronounced than the abutment-height. Subjects received a total-ACF of up to 93 (mean 22.9). An increased total-ACF value did not or barely result in an increased remembered unpleasant sense of concussion, noise, pain or in an increase in dental fear.

Conclusions and clinical implications: The results showed a large scatter of ACF values, which is to be lead back to fluctuation in bonding capabilities of cements as well as the force transmission from the CORONAFlex 2005 device to the implant superstructure. The unscathed removing of implant-supported single crowns has a good chance of success when using cements with limited withdrawal strengths. The application of the CORONAFlex device was perceived mostly positive;

however, too many activations (over 40 total-ACF) lead to a more negative patient experience.

Patient-based assessment and masticatory performance in mandibular implant overdenture patients

Presenter: Yunus N

University of Malaya, Kuala Lumpur, Malaysia

Co-authors: Yunus N, Saub R, Salleh N, Tara T-A

University of Malaya, Kuala Lumpur, Malaysia

Background: Most clinical trials on implant overdentures focused mainly on ball and bar types of attachments and very few on unsplinted conus crown system.

Aim: To evaluate oral health related quality of life (OHRQoL), denture satisfaction and masticatory performance of complete denture patients provided with two implant mandibular overdenture retained with conical crown attachment.

Methods: Nineteen edentulous patients with mean age of 60 years (age range 48–71 years) received new set of complete dentures and 2–3 months later completed a set of questionnaires; Oral health Impact Profile Malaysian version (S-OHIP [M]) and denture satisfaction questionnaires. Masticatory performance was determined by having the patients to chew on temperature controlled two-colored paraffin wax cube for 10 strokes on the preferred chewing side. Mixing Ability Index (MAI) was then derived from the digital image analysis of the colour mixture and shape of the chewed wax. Two mandibular implants (Ankylos[®]) were surgically placed and after 4–6 weeks, conus crown abutments (Syncone[®]) were connected. Gold matrices were intraorally attached to the existing mandibular prosthesis using intraoral relin resin. Two to three months after overdenture conversion, patients answered the same set of questionnaires and performed chewing test. Before and after implant data were analyzed using SPSS version 12.0 (Chicago, IL, USA) with significance level at 0.05. Composite score was computed for the OHIP data, higher score indicated better OHRQoL. The paired *t*-test was used to compare the OHIP and MAI scores before and after implant. Denture satisfaction was analyzed as percentage distribution of patients satisfied with the prostheses.

Results: The total OHIP score was significantly higher after (63.89 ± 4.82) compared with before (56.36 ± 9.51); with significant improvement in the domains of functional limitation, physical pain, psychological discomfort, and physical disability ($P<0.05$). However, MAI showed no significant difference ($P>0.05$) in the score before (0.74 ± 0.49) and after (0.96 ± 0.63) implant. In terms of perceived chewing ability, comfort and retention, about half of the patients were satisfied before implant but almost all were satisfied after implant treatment. The percentage of patients reporting satisfaction with maxillary complete dentures and general appearance did not differ before and after treatment.

Conclusions and clinical implications: Two implants mandibular overdenture retained by conical crown attachments improves OHRQoL and denture satisfaction. However, no improvement in masticatory performance was observed before and after implant treatment.

Posters: Tissue Augmentation and Engineering (Abstracts 293–344)

293 | Tissue Augmentation and Engineering

Clinical evaluation of composite graft material in sinus lifting applications: a pilot study

Presenter: Ahmet S

Istanbul University, Istanbul, Turkey

Co-authors: Ahmet S, Alper Gultekin B, Cuneyt Karabuda Z

Istanbul University, Istanbul, Turkey

Background: The presence of pneumatized maxillary sinuses may limit the available bone height for dental implant installation. Maxillary sinus augmentation has proven to be a predictable way to correct deficiencies for implant placement with good predictability. Bone replacement materials have been used in the sinus lift procedure to avoid the drawbacks inherent in harvesting of autogenous bone. Biphasic calcium sulfate is a synthetic osteoconductive, bioresorbable novel bone replacement material that has been recently introduced for clinical use in sinus lift procedures.

Aim: The aim of this study was to evaluate the clinical effect of composite (biphasic calcium sulfate and anorganic bovine bone matrix) bone replacement materials in sinus lifting applications.

Methods: A total of 10 patients with insufficient bone height in the maxillary posterior area were included for the study. Following lateral window sinus lifting approach, composite graft material, anorganic bovine bone matrix and biphasic calcium sulfate with a mixed ratio 1:2, respectively, was used for sinus lifting application. Five months after grafting a trephine bone biopsy core was taken for histological analysis. Also dental volumetric tomography scans were taken as before operation, right after the procedure and lastly 5 months after healing for evaluation of available bone volume radiographically.

Results: No signs or symptoms of maxillary sinus disease were observed during the 5 months after sinus lift procedure. No complications were observed during the surgical procedures. High resorption rate in early healing phase in radiographic measurements and new bone formation in histological samples were detected.

Conclusions and clinical implications: Composite material appeared to be osteoconductive and support viable bone formation. Future studies are needed to confirm the ability of this bone replacement material with different mixture ratios and also for longer healing periods.

294 | Tissue Augmentation and Engineering

Autogenous block graft for the reconstruction of alveolar ridge defects: a case series

Presenter: Fistolera PA

Universitat Internacional de Catalunya, St. Cugat Del Vallès, Spain

Co-authors:

Fistolera PA^{1,2}, Cot AC², Panella AB^{1,3}

¹*Universitat Internacional de Catalunya, St. Cugat Del Vallès, Spain,*

²*Private Practice, Barcelona, Spain,* ³*Private Practice, Girona, Spain*

Background: Alveolar ridge defects are challenging and several techniques are described in the literature to correct them, like autogenous block grafts, guided bone regeneration or distraction osteogenesis. In moderate to severe defects, autogenous block grafts are routinely used in our protocol to solve them with predictability.

Aim: The aim of our study is to present our experience with a case series in which we have used autogenous block grafts for the management of horizontal alveolar ridge defects and to evaluate the results and the complications.

Methods: A case series of moderate to severe alveolar ridge defects is presented. The deficiencies were corrected with intraoral (mandibular retromolar area and symphysis) block grafts. The block grafts were obtained mainly with piezoelectric surgical device but also conventional burs were used. Blocks were fixed with an osteosynthesis screw, gaps were filled with a xenograft and covered with a collagen membrane. Tension-free suture was performed. After a 3–4 months healing period, dental implants were placed in all cases. A follow-up period of at least 6 months was performed. The results were analyzed depending on: device used for the osteotomy, location of donor site, morbidity of the donor site and possible complications.

Results: In our case series, uneventful healing happened in 100% of the cases. One of the cases presented a late complication and part of the block was removed. All the implants placed achieved a good primary stability and the block remained well integrated. The implants placed are successfully integrated, with an unpleasant gingival margin in the patient were part of the block failed. These results are in accordance with actual literature, in which the survival rates and the aesthetic results are very satisfactory.

Conclusions and clinical implications: The use of the intraoral autogenous bone block graft for the reconstruction of the alveolar ridge seems to be a predictable procedure associated with dental implants. Following the same protocol, the authors achieved good success and survival rates. These results have to be taken with caution, since a short follow-up period was evaluated.

Block allograft technique vs standard guided bone regeneration: a split mouth guided surgery case report

Presenter: Amorfini L

University of Milan, Milan, Italy

Co-authors: Amorfini L, Storelli S, Romeo E

University of Milan, Milan, Italy

Background: Bone augmentation techniques are well validated in literature and have demonstrated long lasting results. In the last few years the introduction of computer planning softwares have allowed to strategically place the implants but also to view in advance eventual bone defect and to accurately plan the augmentation procedures. Moreover, computerized surgical planning can produce stereolithographic models on which bone blocks can be shaped before surgery. Such an accurate planning could simplify and shorten the surgery.

Aim: To evaluate the clinical and radiographical outcomes of two guided bone regeneration techniques in a split mouth design.

Methods: A patient presenting bilateral edentulous areas in the mandible underwent a ConeBeam tomography, showing a major resorption and the necessity of a bone augmentation. A split mouth rehabilitation was performed. Four Straumann implants were placed using a computer-guided template in position 3.4, 4.4 (postextractive), 3.6 and 4.6. On one side, bone chips collected with a scraper mixed with Bio-Oss and reabsorbable membran have been used. On the left side a corticocancellous allograft block, shaped before surgery on the stereolithographic model of the patient's jaw, was secured with osteosynthesis screws and protected with a reabsorbable membran (Bio-Gide). Following a 6-month healing period, a second CBT evaluation was carried out. Two CAD-CAM zirconia bridges were cemented as definitive prosthesis.

Results: The preoperative and postoperative scans were then aligned pairwise using an iterative closest point algorithm, which allowed for comparison between planned and actual implant positions (Mimics, Materialise). Four parameters between each virtual and corresponding actual implant were measured: the mean coronal, apical, angular and vertical discrepancy were, respectively, 0.34 ± 0.29 ; 0.28 ± 0.30 mm; 2.29 ± 1.43 degrees; 0.15 ± 0.32 mm. The major discrepancies were reported by postextractive implants. With the same software it was possible to quantify the regenerated bone quantity: the allograft showed a bone resorption of 15% from the initial volume inserted while the conventional technique only 5%. Both the bone regeneration were successfully stable a 1 year follow-up.

Conclusions and clinical implications: The block allograft procedure has shorten surgical time and reduced postoperation morbidity. Further research is needed to determine whether the 3D block technique had survival rates equal to the others graft materials in term of long follow-up time. As with any regenerative technique, however, treatment of soft tissue will play a crucial role, and the surgeon must treat it skillfully to achieve success. The implants position has a good correspondence with the presurgical plannig.

Maxillary sinus lift with deproteneized bovine bone: a 2-year prospective study

Presenter: Anello T

University of Milan, Milan, Italy

Co-authors: Anello T, Rossi A, Tagliatesta L, Chiapasco M

University of Milan, Milan, Italy

Background: Maxillary sinus lift has become a predictable surgical technique to increase insufficient bone volume in the posterior maxilla. However, the results are difficult to compare because different surgical protocol and grafting materials were used and many publications frequently lack well-defined parameters concerning the initial clinical situation.

Aim: To evaluate the 2-year survival and success rate of implants placed in maxillary sinus grafted with deproteneized bovine bone and resorbable collagen membrane in patient with residual bone height up to 5 mm, residual bone width at least 5 mm and with a maintenance of acceptable vertical intermaxillary relationship.

Methods: Sixty patients (age 26–70 years) were selected for this study. Eight patients requiring bilateral sinus graft and 52 patients requiring monolateral sinus graft (total 68 sinus). Each patient showed a maintenance of acceptable maxillary relationship and bone volumes were measured in a preoperative computer tomography with a image processing program. The average bone height was 4.49 mm and the average bone width was 5.84 mm. All surgeries were carried out by the same oral surgeons team and with the same technique, consisting of sinus floor elevation with a lateral approach. Deproteineized bovine bone was the sole graft material and a resorbable membrane was placed over the lateral window. All implants (120) were placed in a delayed procedure after a healing period of 6 months (range 5–9 months). Prosthetic load was performed after 5 months (range 4–7 months) from implant placement.

Results: All sinus grafts showed a full engraftment. The most frequent intraoperative complication was the perforation of the sinus membrane (18%), but none was such to compromise the completion of the surgical reconstruction. The mean follow-up from prosthetic loading was 24 months. The marginal bone loss around dental implants was 0.85 mm ($ds \pm 0.35$ mm); only three implants showed a higher marginal bone loss and was considered as clinical failure (Albrektson criteria). No implants were removed during the follow-up period. The overall survival and success rates of implants were 100% and 97.5%, respectively.

Conclusions and clinical implications: Despite of the limited follow-up, the present study suggested that deproteneized bovine bone, used alone for maxillary sinus graft, is a reliable and predictable material for the survival and the success of dental implants placed in patients with residual bone height up to 5 mm, residual bone width at least 5 mm and with a maintenance of acceptable intermaxillary relationship.

Two-stage Split-crest technique with ultra-sonic bone surgery for controlled ridge expansion

Presenter: Anitua E

Private Practice in Implantology and Oral Rehabilitation, Vitoria, Spain

Co-authors: Orive G, Anitua E

Private Practice in Implantology and Oral Rehabilitation, Vitoria, Spain

Background: The use techniques for bone augmentation is essential. Some of this approaches include the use of appropriate growth factors, distraction osteogenesis (DO), guided bone regeneration, the use of revascularized bone grafts, and techniques for ridge expansion using bone expanders or osteotomes or the approach known as "split-crest".

Aim: The aim of this study was to evaluate the two-stage Split-crest technique with ultrasonic bone surgery for implant placement in patients with very narrow ridges, and to determine the status of soft and hard tissues and implant success rates.

Methods: During March 2008 and June 2009, six patients received nine implants (BTI Implants) after a two-stage Split-crest surgical technique. Plasma Rich in Growth Factors (PRGF) was used during first and second stages to promote tissue regeneration, all implants were humidified also with PRGF. Patients were recalled for a clinical evaluation at least 6 months after implant loading. Clinical assessment included the status of soft-hard tissues, and implants success rate.

Results: Nine implants in six patients were evaluated between November 2009 and October 2010. The status of soft tissues was good showing adequate plaque index, bleeding index and probing depth values. Implants success rate at the end of follow-up was 100%. Bone ridge was measured and compared at final examination showing a mean ridge expansion of 5.60 mm (SD = 1.9) apically, and 7.33 mm (SD = 1.73) occlusally.

Conclusions and clinical implications: Two-stage Split-crest with ultrasonic bone surgery can be considered a safe and predictable bone expansion technique for very narrow ridges.

Maxillary sinus augmentation with and without use of collagen membranes over the osteotomy window: a Randomized Clinical Trial

Presenter: Barone A

Istituto Stomatologico Tirreno, Camaiore, Italy

Co-authors: Barone A, Ricci M, Covani U

Istituto Stomatologico Tirreno, Camaiore, Italy

Background: When edentulous maxilla shows insufficient bone volume or quality, a bone augmentation procedure becomes an essential step for the completion of the treatment. Over the years, several modifications have been made to this surgical technique and the material used. However, in scientific literature, there is still controversy about the need for using a barrier concurrently with a graft in sinus augmentation procedures.

Aim: On this basis, the aim of the present clinical randomized study was to investigate the effect of resorbable collagen

membrane over the osteotomy window on maxillary sinus augmentation healing.

Methods: Patients who were referred to the Versilia Hospital from December 2008 to April 2010, were accurately evaluated, and only patients who met specific inclusion criteria were selected. After maxillary sinus grafting each randomization envelope was opened and indicated to the surgeons to include the sinus as a test or a control site according to the randomization list. After 6 months, one bone biopsy from each augmented maxillary sinus was harvested from the lateral window and sent to the histology laboratory. An accurate histological analysis was carried out. The *t*-test of Student for paired data was used for comparing the differences between the two groups. Statistical significance was set at 5%.

Results: The histomorphometric measurements revealed that newly formed bone occupied a mean percentage of $30.7 \pm 15.5\%$ of the total volume in bone biopsies from the membrane group (control). The average percentage of connective tissue was $50.6 \pm 18.7\%$ and residual graft percentage was $18.4 \pm 20.3\%$. On the other hand, data regarding the nonmembrane group (test) showed that the percentage of newly formed bone was $28.1 \pm 19.4\%$. The mean percentage of connective tissues was $59.3 \pm 15.4\%$ and $12.6 \pm 12.4\%$ for the residual graft particles. No significant difference was detected in the histomorphometrical evaluation between the two groups.

Conclusions and clinical implications: Our results showed that, compared with sites not covered, the use of the membrane did not substantially increase the amount of vital bone over a period of 6 months. On the other hand, the use of membrane seems to reduce the proliferation of the connective tissue and the graft reabsorption rate. It is plausible that blood supply of maxillary sinus can play a role in such a result. Further studies are needed to explore whether the use of membrane could really be advantageous for the sinus augmentation procedure and to evaluate what influence this method can have on the amount and quality of reconstructed bone.

Evaluation of PRGF to enhance bone formation and implant osseointegration

Presenter: Batas L

Department of Preventive Dentistry, Periodontology and Implant Biology, School of Dentistry, Aristotle University of Thessaloniki, Thessaloniki, Greece

Co-authors: Batas L¹, Stavropoulos A^{2,3}, Papadimitriou S⁴, Nyengaard J⁵, Konstantinidis A¹

¹Department of Preventive Dentistry, Periodontology and Implant Biology, School of Dentistry, Aristotle University of Thessaloniki, Thessaloniki, Greece, ²Department of Periodontology, School of Dentistry, Aarhus University, Aarhus, Denmark, ³Center for Experimental and Preclinical Biomedical Research (CEPBR), Athens, Greece, ⁴Department of Clinics – Companion Animal Clinics, School of Veterinary medicine, Aristotle University of Thessaloniki, Thessaloniki, Greece, ⁵Stereology and Electron Microscopy, Aarhus University, Aarhus, Denmark

Background: Autologous growth factors are currently evaluated for their potential to enhance bone formation.

Aim: To evaluate whether chair-side prepared autologous platelet-rich growth factor (PRGF) in a β -TCP carrier enhances bone formation and implant osseointegration.

Methods: Large box-type defects (10 mm \times 6 mm; W \times H) were prepared in the edentulated and healed mandibles of six Beagles. An implant (3.25 mm \times 11.5 mm; $\varnothing \times$ L) was placed in the middle of each defect leaving the coronal 6 mm uncovered by bone. The remaining defect space was then filled-out with chair-side prepared autologous PRGF in a β -TCP carrier and covered with a collagen membrane (PRGF + β -TCP + CM) (six sites) or left without a collagen membrane as control (PRGF + β -TCP) (five sites); five sites received only β -TCP with a collagen membrane. Evaluation of the outcome after 3 months of healing was performed histologically, and differences among groups were tested for significance with the Kruskal–Wallis test with P set at 0.05.

Results: Histological analysis showed variable amounts of new lamellar and woven bone formation and residual β -TCP particles within the defect space, as well as osseointegration of the previously uncovered portion of the implants, with no apparent qualitative differences among groups. In one implant in each group, in different animals, no osseointegration in the portion of the implant within the defect was observed. New mineralized bone formation and marrow fraction (%) within the defect was similar among groups and averaged 44.4 ± 9.6 , 45.8 ± 14.9 , 48.4 ± 7.6 in the PRGF + β -TCP + CM, PRGF + β -TCP, and β -TCP + CM groups, respectively. Relative bone-to-implant contact (%) within the defect space averaged 33.8 ± 14.3 in the PRGF + β -TCP + CM, 44.9 ± 15.7 in the PRGF + β -TCP, and 21.4 ± 8.6 in the β -TCP + CM group, the difference between the two latter groups being significant ($P = 0.004$).

Conclusions and clinical implications: Application of chair-side prepared autologous PRGF in a β -TCP carrier, with or without the use of a collagen membrane, does not enhance bone formation over β -TCP implantation alone in large peri-implant defects, but seems to enhance implant osseointegration. The present study was partially funded by Biomet 3i Inc., Florida, USA.

A 5-year randomized pilot study with chemically modified SLA implants

Presenter: Bernard J-P

Department of Stomatology and Oral Surgery, School of Dental Medicine, University of Geneva, Geneva, Switzerland

Co-authors: Nedir R¹, Nurdin N¹, Bischof M², Bernard J-P³, Reeners N⁴, Najm SA², El Hage M²

¹Ardentis Clinique Dentaire, Swiss Dental Clinics Group, Vevey, Switzerland, ²Ardentis Clinique Dentaire, Swiss Dental Clinics Group, Lausanne, Switzerland, ³Department of Stomatology and Oral Surgery, School of Dental Medicine, University of Geneva, Geneva, Switzerland, ⁴Ardentis Clinique Dentaire, Swiss Dental Clinics Group, Yverdon, Switzerland

Background: Chemical modification to a sandblasted, large-grit, acid-etched implant surface (SLA) demonstrated significant greater bone-to-implant contact during the first weeks of bone

healing in an experimental animal study (Buser et al. 2004). Oates et al. (2007) showed that modified surface (mod-SLA) might enhance healing process and decrease healing time when examining changes in implant stability over 6 weeks after placement. Until now, no study has been performed to compare long-term success rates of implants with mod-SLA and SLA surface.

Aim: (1) To evaluate the 5-year clinical performances of mod-SLA and SLA implants, (2) to compare crestal bone levels around implants.

Methods: This randomized controlled trial was approved by the Ethics Committee of Lausanne University (Switzerland). It was conducted with 14 patients. Each patient received one mod-SLA (SLActive) and one SLA implant (Straumann AG, \varnothing 4.1 or 4.8 mm, length 8 or 10 mm) in either posterior mandible or maxilla. Clinical and radiographic parameters allowing success rate evaluation were assessed at 5 years after loading. Crestal bone levels were evaluated at the mesial and distal implant sides using peri-apical radiographs. The distance, parallel to the implant axis, between the implant apex and the most coronal bone–implant contact was measured at 5 years and postoperatively. When the subtraction of the two values was negative, it indicated crestal bone loss; when positive, crestal bone gain.

Results: All 28 implants were successfully integrated and restored after 6 weeks of healing. At 5-year control, no patient complained about pain, suppuration or sinus-related pathology. All implants were clinically stable and fulfilled success criteria. Seventeen sides, either mesial or distal or both, of mod-SLA implants showed crestal bone loss (mean 0.81 ± 0.74 mm) and 11 mod-SLA implant sides showed bone gain (mean 0.54 ± 0.22 mm). Also 17 sides of SLA implants displayed bone loss (mean 1.08 ± 0.84 mm) whereas 11 SLA implant sides displayed bone gain (mean 0.54 ± 0.36 mm). The difference in bone loss and gain between mod-SLA and SLA implants was not statistically significant ($P > 0.05$).

Conclusions and clinical implications: This study showed that implants with mod-SLA surface could be placed using an early loading protocol and could achieve tissue integration over a period of 5 years. Crestal bone loss was limited with no significant difference between both implant types. The 5-year success rates were 100% for mod-SLA and SLA implants.

Ridge preservation following tooth extraction by using PRF (Platelet Rich Fibrin): a pilot study

Presenter: Bolukbasi N

Department of Oral Implantology, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Bolukbasi N, Kutun-Misirlioglu E, Ozdemir T
Department of Oral Implantology, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Background: The importance of growth factors in enhancing wound healing has become the focus of researches. Platelets contain large number of growth factors that have a key role in bone regeneration and soft tissue maturation.

Aim: The aim of this study is to evaluate the effectiveness of Platelet Rich Fibrin (PRF) on bone resorption after tooth extraction.

Methods: A total of 20 patients providing 28 extraction sides were included in the study. All extractions were done under local anesthesia with atraumatic tooth extraction techniques. After tooth extraction sockets were filled with PRF concentrations ensured from patients' own blood. PRF was prepared according to Choukroun protocol. Standardized peri-apical radiographs were taken to evaluate vertical resorption and periodontal probes were used to evaluate horizontal resorption. Measurements were made at the time of extraction and at the time of implant placement (2 months later after extraction).

Results: All extraction sights healed uneventfully. The clinical measurements 2 months after extraction revealed a loss of bone 0.2 ± 0.4 mm horizontally and 0.3 ± 0.5 mm vertically.

Conclusions and clinical implications: Within the limitations of this study it can be concluded that PRF is effective biomaterial for socket preservation before dental implant installation.

Toward efficient calcium phosphates in craniofacial bone regeneration: the role of magnesium ions

Presenter: Cabrejos-Azama J

Estomatología III, Facultad de Odontología, UCM, Madrid, Spain

Co-authors: Cabrejos-Azama J^{1,2}, Alkhraisat M², Torres J³, Rueda C², Blanco L¹, López-Cabarcos E²

¹*Estomatología III, Facultad de Odontología, UCM, Madrid, Spain,*

²*Química-Física II, Facultad de Farmacia, UCM, Madrid, Spain,*

³*Dep. de Estomatología, Facultad de Ciencias de la Salud, URJC, Alcorcón, Spain*

Background: Several calcium phosphates are increasingly employed to substitute the ideal autologous bone graft and large investments are dedicated to improve their efficiency in bone engineering. Magnesium ions are involved in various biological processes like cellular processes of proliferation and differentiation, cell-matrix interaction, normal function of parathyroid glands and metabolism of vitamin D. Thus, we consider the incorporation of Mg^{2+} ions presents a biological approach toward increasing the bioactivity of calcium phosphate-based scaffolds.

Aim: The purpose of this work is to incorporate Mg^{2+} ions in calcium phosphate cements and challenge them in bone regeneration.

Methods: Mg-substituted tricalcium phosphate (TCP) powder is synthesized and mixed with primary monocalcium phosphate to produce cement samples. The cements were then crushed and sieved to grain size between 0.5 and 0.8 mm. The bone substitutes were then sterilized and used to fill critical bone defects in rabbits calvaria. The samples were harvested after 8 weeks of implantation and processed for histological and histomorphometric analysis.

Results: All animals recruited for the study survived the surgeries and the recovery was uneventful.

1. Macroscopic evaluation: All cements were well incorporated to the adjacent bone and did not elicit an obvious inflammatory

reaction. Residual cement granules could be appreciated after 8 weeks of surgery.

2. Histological evaluation: Magnesium ions indeed improve the bone formation provoked by calcium phosphate implants and maintain the osteoconductive property of calcium phosphates.

Conclusions and clinical implications: The development of bone substitute with controllable biodegradable properties and improved bone regeneration is a step toward personalized therapy that can adapt to patient needs and clinical situations. Herein, we suggest and show that the employment of magnesium ions could improve the clinical efficiency of calcium phosphates and modify the pace of their biodegradation.

Sinus lift and the use of xenografts (porcine) – review

Presenter: Correia FDC

Faculdade de Medicina Dentaria da Universidade do Porto, Porto, Portugal

Co-authors: Correia FDC, Da Costa De Lemos Costa AMC, De Faria E Almeida RMCL, De Campos Felino AC, De Campos Felino AC

Faculdade de Medicina Dentaria da Universidade do Porto, Porto, Portugal

Background: The insufficiency of alveolar bone height at the posterior part of the maxilla, loss of alveolar bone, the pneumatization of maxillary sinus or a combination of both means that often need to undertake a surgical sinus lift at the posterior maxillary in order to place dental implants. To maxillary augmentation the use of Anorganic bovine and equine bone are the most used xenografts fields in alternative to autologous grafts (considered Gold Standard). Nowadays Porcine xenografts are being used as maxillary field too and its considered a good option.

Aim: The aim of this literature review is visualize the state-of-art on sinus lift procedures using xenografts of porcine origin: what we know at this moment, advantages, disadvantages and complications that can be associated to this material.

Methods: To carry out this literary review we used the database Pubmed combined with two combinations of keywords: "sinus lift porcine" and "maxillary augmentation porcine". The limit established was the articles published in the last 10 years. In the end, we had a manual introduction of a review paper from data base Cochrane.

Results: Using the combination of keywords "sinus lift porcine" and "maxillary augmentation porcine" we found 32 articles in total (one was common to the two combination of keywords). After reading the abstract, 25 articles were excluded since it did not refer to the use of the biomaterial we want to review (porcine). In the final we have seven articles. In the end we have do a manual introduction of one review, very important for our base lines of knowledge.

Conclusions and clinical implications: The porcine bone shows excellent osteoconductive properties and it may be used in safe and successful sinus lift augmentation procedures. No disadvantages and complications were found in the literature with the use of this biomaterial. In spite of the good results found,

more study's are needed to compare porcine xenografts to autologous grafts in maxillary augmentation and to know the survival rates of implants placed.

Sinus augmentation using rhBMP-2 in a standardized rabbit sinus model

Presenter: Choi Y

Yonsei University College of Dentistry, Seoul, Republic of Korea

Co-authors: Choi Y¹, Yun J-H², Kim C-S¹, Choi S-H¹, Chai J-K¹, Jung U-W¹

¹*Yonsei University College of Dentistry, Seoul, Republic of Korea,*

²*Inha University School of Medicine, Seoul, Republic of Korea*

Background: Clinical use of recombinant human bone morphogenetic protein-2 (rhBMP-2) with a absorbable collagen sponge (ACS) carrier was approved for sinus augmentation. However, since ACS is rapidly resorbed and has lack of structural stability, it may restrict in pressured site. The rabbit sinus model could be useful to verify the efficacy of biomaterials, because of its similar properties to human. In the present study, we have developed a standardized sinus model using a trephine bur in rabbits.

Aim: The purpose of this pilot study was to determine the osteoinductive effect of ACS loaded with *Escherichia coli*-expressed rhBMP-2 (ErhBMP-2) in a standardized rabbit sinus model.

Methods: The maxillary sinuses were prepared bilaterally in six male white rabbits. The windows were prepared using a 6-mm trephine bur, and circular bony windows were carefully removed. Following reflection of the sinus membrane, a saline-soaked ACS alone and an ErhBMP-2-loaded ACS were inserted into the left and right maxillary sinuses, respectively. After a healing period of 8 weeks, sections of the augmented sinus and surrounding bone were made and analyzed by micro computed tomography and histologically for signs of window closure and bone augmentation.

Results: Radiographic analysis revealed new bone formation in both groups of augmented sinus (i.e., with and without ErhBMP-2). The maximum augmented height did not differ significantly between the groups; however, window closure was significantly more advanced in the ErhBMP-2 group ($87 \pm 5\%$) than in the control group ($69 \pm 7\%$; $P < 0.01$). The defect was significantly deeper in the control group (1.17 ± 0.24 mm) than in the ErhBMP-2-treated group (0.64 ± 0.24 mm; $P < 0.01$). Histologically, the augmented site of the ErhBMP-2 group comprised mainly matured lamellar bone, and the window site was almost completely closed and in continuity. In the control group, the elevated area was filled mainly with fibrous connective tissue, and bony crater was formed at window area.

Conclusions and clinical implications: The rabbit sinus model used in the present study, created using a trephine bur, is a well-standardized method of evaluating objectively the effect of a bone substitute. ErhBMP-2 loaded ACS exhibited significantly high osteoinductive potential within the rabbit sinus cavity, especially with regard to closure of the bony window. However, the structural durability should be reinforced in cases wherein extensive augmentation is required.

Ridge alterations following immediate implant placement and the treatment of bone defects with Bio-Oss in an animal model

Presenter: Choi B-H

Professor, Department of Oral & Maxillofacial Surgery, College of Dentistry, Yonsei University, Seoul, Republic of Korea

Co-authors: Choi B-H¹, Xuan F², Kwon C-R², Kim H-J², Lee C-U², Jeong S-M³

¹*Department of Oral & Maxillofacial Surgery, College of Dentistry, Yonsei University, Seoul, Republic of Korea,* ²*Graduate, Department of Dentistry, Yonsei University Wonju College of Medicine, Wonju, Republic of Korea,* ³*Associate Professor, Department of Dentistry, Yonsei University Wonju College of Medicine, Wonju, Republic of Korea*

Background: Conflicting data exists on the outcome of placing Bio-Oss[®] into extraction sockets. It is, therefore, relevant to study whether the incorporation of Bio-Oss[®] into extraction sockets would influence bone healing outcome at the extraction sites.

Aim: The aim of this study was to assess peri-implant bone changes when implants were placed in fresh extraction sockets and the remaining defects were filled with Bio-Oss[®] particles in a canine mandible model.

Methods: Six mongrel dogs were used in the study. In one jaw quadrant of each animal, the fourth mandibular premolars were extracted with an elevation of the mucoperiosteal flap, implants were then placed in the fresh extraction sockets and the remaining defects were filled with Bio-Oss[®] particles. After 4 months of healing, micro-computed tomography at the implant sites was performed. Osseointegration was calculated as the percent of implant surface in contact with bone. Additionally, bone height was measured in the peri-implant bone.

Results: Average osseointegration was 28.5% (ranged between 14.8% and 34.2%). The mean crestal bone loss was 4.7 ± 2.1 mm on the buccal aspect, 0.4 ± 0.5 mm on the mesial aspect, 0.4 ± 0.3 mm on the distal aspect, and 0.3 ± 0.4 mm on the lingual aspect.

Conclusions and clinical implications: The findings from this study demonstrated that the placement of implants and Bio-Oss[®] particles into fresh extraction sockets resulted in significant buccal bone loss with low osseointegration.

Modification of soft tissue biotype for Peri-implant health

Presenter: Chung H-J

Chonnam National University, Gwangju, Republic of Korea

Co-authors: Chung H-J, Yang H-S, Lee S-W, Kim Y-J
Chonnam National University, Gwangju, Republic of Korea

Background: Recently, it is known that the thickness of marginal soft tissue and crestal bone around tooth or implant is important to maintain the periodontal and peri-implant tissue.

Dental implants have been one of important tools of daily practice for more than 20 years and we spend lots of time on their maintenance. We report some cases which include biotype modification in the management of peri-implant tissue complications and failing implants.

Aim: This report was to present the clinical outcome of biotype modification using connective tissue grafting (CTG) for peri-implant tissue maintenance and for peri-implantitis management.

Methods: In 65 years old female patient, three implants were placed on right lower edentulous region where the mucosal tissue was very thin and the zone of buccal attached gingiva was inadequate. The apically positioned flap procedure was done to increase the keratinized tissue zone (KT) during second stage surgery. At 1Y functioning, patient complained discomfort on the buccal mucosa of anterior implant, where the soft tissue was thin and apically displaced with $KT < 2$ mm. Recipient site was made via incision at mucogingival level, CTG was placed. The second patient (60Y, F) complained discomfort on #46 implant area at 4Y functioning, where thin buccal soft tissue margin was recessed with $KT < 2$ mm. Palatal CTG with epithelial collar was done. The third patient (50Y, F) was referred for the peri-implantitis on lower anteriors, which were functioning for 6 years. Radiographically, #42 implant was floating and the other #41–32 implants has 30–40% bone loss and the facial soft tissue were inflamed and purulent and facial KT was not present except #41 implant. Under periosteal flap, the mobile #42 implant was removed and the contaminated surfaces of three implants were cleansed with toothbrush. CTG was placed over facial bone and implant and covered with the overlying flap. Soft tissue margin and KT were evaluated.

Results: By biotype modification using CTG, soft tissue margin was stable or coronally migrated by 0.5 mm and the KT zone was increased by 1 mm during 2.5–4Y follow-up. In peri-implantitis treatment, the peri-implant tissue became healthy and maintained uneventfully. The soft tissue margin was apically displaced by 0.5–1 mm and KT was decreased by 1–1.5 mm during 9 M follow-up.

Conclusions and clinical implications: Biotype modification resulted in a stable peri-implant environment in quality and quantity, for implant maintenance. For peri-implantitis, tissue biotype modification could be promising, however, the soft tissue margin seems less stable than for maintenance care.

Clinical efficacy of application of synthetic bone graft and platelet-rich plasma mix while dental implantation. Aesthetic aspects

Presenter: Fefelova MA

Kirov State Medical Academy, Kirov, Russian Federation
Co-authors: Fefelova MA, Nikolsky VY

Kirov State Medical Academy, Kirov, Russian Federation

Background: Overwhelming majority of synthetic bone graft materials do not have enough osteoinductive effect. At the same time in case we are going to make small osteoplasty we should

not traumatize donor's zone taking a bone from it. To have high degree of osteoinduction, we use bone graft mixed with platelet-rich plasma. The concentration of platelet-derived growth factor and transforming growth factor, which have expressed osteoinductive effect, because chemotaxis, cell migration, proliferation and osteogenic differentiation of mesenchymal stem cells are regulated by them, is higher in platelet-rich plasma than in blood.

Aim: Study clinical efficacy of synthetic bone graft material and platelet-rich plasma mix while dental implantation.

Methods: For the last year 2009/2010 27 patients had dental implantation simultaneously with synthetic bone graft and platelet plasma, and 64 implants have been installed. While operation planing we indicate. After installation of titan implants, we have seen defect of the bone near implants cervix and wise deficit of alveolar process of maxilla and alveolar part of lower jaw. To correct volume of bone we used as bone plastic material mix of bone graft material and platelet-rich plasma. Major bone graft material was syntactic, calcium nano-sized calcium hydroxyapatite modified by oxide silicone "Nanobone"[®], Artoss, and allogenic bone graft material "Lyoplast". Rich platelet plasma has been obtained after two time low speed centrifugation of patient's blood. First time for 10min (speed 2400 rot/min), than for 15 min (3600 rot/min). Defect was filled by this mix and covered by biodegradable membrane. To control degree of osteointegration and bone regeneration we used X-ray images and visual control of gingival esthetics before implantation, 2 month after implantation and after prosthetic.

Results: Two month after installation osteointegration 64 implants occurred. Visual control showed rebuilding of gingival aesthetics, and aesthetic result of prosthetic stage. We have no cases with bone resorption near installed implants.

Conclusions and clinical implications: Application of synthetic bone graft material and platelet-rich plasma mix simultaneously with dental implantation is convenient and easy way to have good result of bone graft by giving it osteoinduction properties.

Palatal healing following connective tissue retrieval – comparison of three techniques

Presenter: Fischer K

University of Wuerzburg, Wuerzburg, Germany

Co-authors: Fickl S, Fischer K, Jockel-Schneider Y, Bechtold M, Schlagenhauf U

University of Wuerzburg, Wuerzburg, Germany

Background: Soft tissue augmentation prior or along with implant placement with subepithelial connective tissue grafts (SCTG) can be a necessary treatment approach when dealing with ridge defects in the aesthetic area.

Aim: To compare palatal wound healing and patient comfort following three different techniques [trap-door (TD), single-incision (SI), mod. single-incision (mSI)] for harvesting connective tissue graft from the palate.

Methods: Thirty-six patients (31 women/5 men) were selected for root coverage using SCTG. Patients were randomly assigned

to TD, SI or mSI group. One week following surgery, early wound-healing index (EHI; range from 1 = primary healing to 5 = full flap necrosis), sensibility, discomfort (0–3 = minor/4–7 = moderate/8–10 = intense pain), painkiller-intake (ibuprofen in mg) and variation of feeding habits (not restricted/restricted) were recorded. Follow-up was performed until complete epithelialisation (CE) was achieved. Statistical analysis was performed using ANOVA-testing. *P*-values of <0.05 were considered significant.

Results: One week after surgery, EHI was 3.33 for TD, 2.44 for SI and 2.14 for mSI (*P* > 0.05). Forty-two percent of all patients revealed negative or impaired sensibility, showing no statistical significance between treatment groups. Discomfort level ranged between 2.7 for TD, 2.1 for SI and 2.2 for mSI (*P* > 0.05) and accordingly painkiller intake was on average 5466 mg over 5.91 days for TD 3000 mg over 3.75 days for SI and 2866 mg over 2.91 days mSI (*P*_{ibuprofen} < 0.05/*P*_{duration} < 0.05). Over all, 27% of all patients showed an impairment of their feeding habits with no difference between treatment groups. On average, CE was achieved after 2.7 weeks for TD, 2.44 weeks for SI and 2.14 weeks for mSI (*P* > 0.05).

Conclusions and clinical implications: All investigated techniques can successfully be used to harvest SCTGs from the palate. TD technique showed more partial or full flap necrosis and therefore is associated with increased patient morbidity. SI- and mSI-approach seem to be less invasive and hence foster an uneventful healing, leading to minimal postsurgical impairment.

A simplified technique to augment horizontally the atrophic alveolar crest without any membrane

Presenter: Garlini G

Studio Odontoiatrico Associato, Milan, Italy

Co-authors: Garlini G¹, Redemagni M², Orsini G³, Rossini F⁴

¹*Studio Odontoiatrico Associato, Milan, Italy,* ²*Studio Redemagni, Lomazzo, Italy,* ³*University of Ancona, Ancona, Italy,* ⁴*Studio Rossini, Monguzzo, Italy*

Background: Guided bone regeneration is used for ridge augmentation before or in conjunction with osseointegrated implant placement, whether with a barrier membrane alone or in combination with bone grafts or bone substitutes. This technique offers predictability in providing bone augmentation simultaneously in both horizontal and vertical directions, however, it is technically complex, with the possibility of premature membrane exposure resulting in bacterial contamination. To overcome these problems, researchers and clinicians strive to develop less invasive surgical modalities that are technically less demanding. Thus, a technique that could eliminate the need for a barrier membrane, reducing the incidence of complications and increasing the patient's acceptance of the procedure.

Aim: The aim of this study was to investigate the clinical and histologic results of a simple technique for horizontal ridge augmentation using deproteinized bovine bone without any membrane.

Methods: Between January 2001 and January 2008, 10 patients were treated by a simplified technique for horizontal augmentation with delayed insertion (after 8 months) of 19 Xive Implants (Dentsply., Friudent, Mannheim, Germany) Patients were recruited, screened, and accepted or rejected sequentially based on specific inclusion/exclusion criteria. Ten months later, two-stage surgery and prosthetic rehabilitation were performed.

Results: During the follow-up period, all implants appeared clinically- and radiologically integrated. In one case, 21 months after DBBM grafting, with the patient's agreement, an explorative surgical flap was opened to evaluate the quality and quantity of regenerated bone. At the same time two samples of bone were taken, with a trephine bur of 3 mm diameter, for histological analysis. The histology samples revealed new bone formation, which was compact and well organized with a lamellar structure.

Conclusions and clinical implications: We must notice that the use of DBBM without a barrier determines more resorption of the graft than we had expected. For this reason it is necessary to over-correct the defect to obtain adequate bone in order to insert the implants. This simplified technique for horizontal ridge augmentation (STHA) seems to be an encouraging method of obtaining bone augmentation in compromised patients, avoiding the use of resorbable or nonresorbable membranes.

Guided bone regeneration for residual ridge augmentation: clinical, histologic and histomorphometric study in 82 patients

Presenter: Gisakis I

Dept Dental Implants Hygeia Hospital, Athens, Greece

Co-authors: Zabarar D, Gisakis I, Bouboulis S, Spanos A, Petsinis V

Department of Dental Implants Hygeia Hospital, Athens, Greece

Background: Guided bone regeneration is a surgical method used in implant dentistry to increase the quantity and quality of the host bone in areas of localized alveolar defects.

Aim: Aim of this study was to evaluate the quantity and quality of regenerated bone in bone deficiencies treated with guided bone regeneration methods before implant placement, by clinical, histologic and histomorphometric criteria.

Methods: Eighty-two adult patients (38 male, 44 female, aged 30–65 years) participated in this study. The augmentation procedures concerned: postextraction sockets (22 cases), horizontal augmentation (20 cases), sinus augmentation (25 cases) and two dimensional reconstructions (15 cases). The materials used were: (a) autologous bone, only (18 cases), (b) autologous bone in combination with platelet-rich plasma (PRP) (13 cases), (c) autologous bone in combination with allograft (25 cases), (d) autologous bone in combination with allograft and PRP (12 cases), (e) allograft, only (11 cases), while in three cases no bone graft was used. In 42 cases a resorbable collagen membrane and in 37 cases a nonresorbable e-PTFE membrane were used, while in three cases no membrane was used. After a healing period of 4–12 months, the bone collected from the augmented sites at

the time of implant placement by the trephine bur, was fixed in 10% buffered formalin, decalcified, and embedded in paraffin. Five-micron thick sections, stained with hematoxylin-eosin and Masson's trichrome, were used.

Results: Adequate bone volume was clinically observed in all cases. Bone augmentation was evident both in horizontal (3.8–7.8 mm) and vertical dimension (1.5–10.5 mm, sinus augmentation included). Microscopic and histomorphometric evaluation revealed predominance of new bone in all cases. Osteoid and residual graft material was occasionally seen, while inflammation was insignificant. Overall mean bone volume (MBV) was 60.1%. The MBV was higher in cases where combination of autograft with allograft was used (65.7%) ($P > 0.05$). In cases where PRP was used, clinical and radiographic evidences of bone maturation were earlier, but the addition of PRP in bone graft did not significantly increase MBV ($P = 0.823$ in comparison with autograft, $P = 0.897$ in comparison with the combination of autograft-allograft). The MBV where resorbable membranes were used was 62.3%, while with nonresorbable membranes was 56.4% ($P = 0.563$). Greater MBV was observed in cases of postextraction sockets (70.9%) and horizontal augmentation (62.8%) ($P < 0.05$). No statistically significant differences in MBV were observed regarding gender ($P = 0.696$), patients age ($P = 0.157$) and time until the second intervention ($P = 0.752$).

Conclusions and clinical implications: The combination of autologous bone with allograft revealed better results as bone graft material. The addition of PRP did not appear to significantly enhance bone formation. No important differences were observed regarding resorbable and nonresorbable barrier membranes. Overall, no serious complication was seen during the healing period, in all patients.

Comparison of bone grafting materials in human extraction sockets: clinical, histologic, and histomorphometric evaluations

Presenter: Gisakis I

Dept Oral & Maxillofacial Surgery, School of Dentistry, University of Athens, Athens, Greece

Co-authors: Gisakis I¹, Kalyvas D¹, Tosios K², Petsinis V¹, Alexandridis K¹

¹*Department Oral & Maxillofacial Surgery, School of Dentistry, University of Athens, Athens, Greece,* ²*Division Basic Biomedical Sciences & Oral Biology, School of Dentistry, University of Athens, Athens, Greece*

Background: Extraction socket wound healing is characterized by resorption of the alveolar bone. Although there are a number of bone graft materials that are currently available for clinical use, there are few studies that directly compare efficacy among graft treatments before implant placement.

Aim: The objectives of this randomized, controlled, clinical study were: (1) to compare the bone dimensional changes following tooth extraction alone vs. extraction plus ridge preservation using three different grafting materials and a collagen membrane; and (2) to analyze and compare histologic and

histomorphometric aspects of the extraction-alone sites to the grafted sites.

Methods: Thirty-two adult patients (26 male, 6 female, mean age 37.6 years) requiring an extraction and delayed implant placement were randomly selected to receive either extraction alone (EXT, control group, eight cases) or ridge preservation (RP) using: demineralised freeze-dried bone allograft (DFDBA, eight cases), deproteinized bovine bone mineral (DBBM, eight cases) or biphasic calcium sulfate (BCS, eight cases) and a collagen membrane. Following extraction and at the time of implant placement (IP), horizontal and vertical ridge dimensions were determined. After a healing period of 3 months, bone cores biopsies were collected, by a trephine bur, at IP. Five-micron thick sections, stained with hematoxylin-eosin and Masson's trichrome, were used. A total of 32 biopsies were processed for histomorphometric evaluation of the mean percentage of bone, residual graft and connective tissue by area.

Results: The width of the RP group decreased from 9.2 ± 1.2 to 8 ± 1.4 mm ($P > 0.05$), while the width of the EXT group decreased from 9.1 ± 1 to 6.4 ± 2.2 mm ($P < 0.05$). The vertical change at the buccal side for the RP group was a gain of 1.3 ± 2 mm vs. a loss of 0.9 ± 1.6 mm for the EXT group ($P < 0.05$). The biopsies from the grafted sites revealed formation and remodelling of trabecular bone, highly mineralized and well structured. New bone formation and connective tissues (CT) on and around graft particles was widespread. No inflammation was observed. The histomorphometric analysis revealed more bone in the EXT group, 70.1% vs. 68.2% in the RP group ($P > 0.05$). The RP group included both vital bone (58.9%) and nonvital (9.3%) graft fragments. In detail, analysis of the samples showed an average of: (a) DFDBA group: 58.7% vital bone (VB), 5.9% residual graft particles (RGP), and 35.4% CT, (b) BBM group: 59.1% VB, 12.6% RGP, and 28.3% CT, (c) BCS group: 61.3% VB, 4.1% RGP, and 34.6% CT, (d) Control group: 70.1% VB and 29.9% CT.

Conclusions and clinical implications: Ridge preservation using bone graft and a collagen membrane significantly limited the resorption of hard tissue and improved ridge height and width dimensions when compared with extraction alone. The quantity of bone observed on histologic analysis was slightly lower in preservation sites, although these sites included both vital and nonvital bone.

Porous titanium granules application in the treatment of peri-implantitis

Presenter: Gkogkos AS

Department of Periodontology, School of Dentistry, University of Athens, Athens, Greece

Co-authors: Gkogkos AS, Karoussis IK, Madianos PN, Vrotsos IA

Department of Periodontology, School of Dentistry, University of Athens, Athens, Greece

Background: Peri-implantitis occurs at an incidence ranging between 0.5% and 3% per year. Various therapeutic modalities

have been proposed. Regarding regenerative methods, resorbable, nonresorbable and autogenous bone grafting materials have been used to achieve intrabony defect resolution.

Aim: The aim of this case report is to evaluate the use of the porous titanium granules as bone grafting material for regenerative treatment of peri-implantitis related defects.

Methods: A 42-year-old woman, in good health, was referred to the Department of Periodontics for peri-implantitis treatment. Clinical and radiographic examination revealed intrabony defects around the implants replacing the central incisors. Two months after cause-related therapy, which consisted of mechanical debridement and Nd:YAG Laser application, surgical treatment was performed. The defect was filled with titanium granules and covered with a resorbable collagen membrane. The suprastructure was removed during peri-implantitis treatment and was placed back after suturing. Broad spectrum antibiotics were prescribed for 7 days. The patient was followed-up for 12 months after the operation. Clinical parameters such as probing depths, gingival index, and bleeding on probing were recorded. Periapical radiographs were taken to verify the graft position directly after the operation, and then after 6 and 12 months to estimate the radiographic defect fill.

Results: In this case despite the initial defect, the final clinical and radiographic result was considered satisfactory, due to the pocket elimination, the radiographic bone fill and the soft tissue volume maintenance, 12 months postoperatively.

Conclusions and clinical implications: In this case report, porous titanium granules were successfully used to regenerate bone in peri-implantitis defects. Further clinical and histological studies are needed to confirm osseointegration of surrounding bone and titanium granules.

313 | Tissue Augmentation and Engineering

Management of peri- implant bone loss occurred during osseointegration phase with porous titanium granules

Presenter: Ali Golami G

Department Periodontics, Shahid Beheshti Dental School, Tehran, Islamic Republic of Iran

Co-authors: Ali Golami G, Amid R, Aghaloo M

Department Periodontics, Shahid Beheshti Dental School, Tehran, Islamic Republic of Iran

Background: Osseointegration of dental implants considered as a predictable consequence of modern dentistry. However, in some clinical situations, it is not rare to find out minor or even major complications. Systemic unknown disorders which affect the bone healing sequences may be observed especially in elderly patients. Although these patients can be included as risky candidates for implant therapy, it is possible to give them a proper implant borne restoration provided that the clinicians modified the conventional treatment plan.

Aim: To evaluate the clinical effect of titanium granules on the compromised fixture during healing phase.

Methods: A mandibular second molar lost due to unrestorable caries replaced with a regular size implant. She had a stable

dentition with a healthy medical status. Sufficient bone volume detected via conventional radiography and clinical examinations. A two-stage procedure selected for inserting a regular diameter fixture. Three months later when she recalled for implant uncover phase, significant bone loss diagnosed in radiographic view. A circumferential vertical bone defect detected after a full thickness flap reflection. The treatment protocol included defect debridement, fixture surface decontamination and cleansing with titanium brush, and filling the bone defect by porous titanium granules. The implant submerged again for another 4 months.

Results: Non-resorbable particles of titanium granules remained stable during healing phase. Uncover and prosthetic phase scheduled in a regular manner. Final restoration derived after 5 months. All radiographic and clinical parameters showed a stable condition during 1 year follow-up. Unfortunately, we could not find out any reason for compromised healing of implant even after reviewing medical history and surgical operation note.

Conclusions and clinical implications: Non-resorbable titanium granules (Natix white) may be considered as a proper material for compromised healed implants. The long-term stability of these granules could be maintained during loading.

314 | Tissue Augmentation and Engineering

Clinical evaluation of socket augmentation with nonresorbable membranes: a pilot study

Presenter: Alper Gultekin B

Istanbul University, Istanbul, Turkey

Co-authors: Alper Gultekin B, Shiraliyev S, Yalcin S, Gur H
Istanbul University, Istanbul, Turkey

Background: Alveolar ridge resorption following tooth extraction is a physiological phenomenon that may decrease the short or long term success of implant supported reconstructions. Tooth extraction leads to loss of both horizontal and vertical dimensions of the alveolar ridge. Post extraction socket preservation is essential to ensure stabilization of hard and soft tissues.

Aim: The aim of this study was to evaluate the clinical effect of intentionally exposed nonresorbable high-density polytetrafluoroethylene membranes with mineralized allografts on bone graft healing and volume.

Methods: In this study 10 patient to be restored with fixed implant-supported prostheses, a total of 14 fresh sockets were grafted with mineralized cortical and cancellous chip allografts. Intentionally exposed nonresorbable high-density polytetrafluoroethylene membranes were used for sealing over the grafted sockets. Dental volumetric tomographic scans were applied right after the operation and 4 months after socket grafting. Core biopsies were also taken from grafted sockets before implant installation for histological evaluation.

Results: Based on dental volumetric tomographic measurements, the hard tissue volume and contour were largely preserved at all socket sites after 4 months healing. No additive bone graft material is needed for implant installations. New

viable bone and also remnants of graft material were detected in histological samples.

Conclusions and clinical implications: Intentionally exposed non-resorbable high-density polytetrafluoroethylene membranes associated with mineralized allografts may be reliable and predictable socket preservation method. Further investigations and a larger case size would give more strength to the findings of the study.

315 | Tissue Augmentation and Engineering

Free gingival graft for keratinized gingiva around implant

Presenter: Huh S-R

Periodontology, Chosun University College of Dentistry, Gwang-ju, Korea, Republic of

Co-authors: Huh S-R, Bang K-I, Kim B-O

Periodontology, Chosun University College of Dentistry, Gwang-ju, Republic of Korea

Background: Necessity of keratinized gingiva around a natural tooth has been controversial for a long time. Such controversy continues also in peri-implant mucosa and necessity of keratinized gingiva is not defined, same as that of a natural tooth. Indicating that different results have been drawn because factors affecting such studies are too variable, some authors mention that keratinized gingiva around an implant is essential in terms of a clinical situation.

Aim: The aim of this study is evaluating patients who had been lack of keratinized gingiva, after implant surgeries, which were restored by free gingival grafts.

Methods: This study is an analysis of three cases of patients treated with dental implants. Free gingival grafts were performed to those patients at implant placement, before implant exposure and at implant exposure respectively. After that, conventional prosthetic treatments were performed and then evaluations for keratinized gingiva were performed.

Results: There was no evidence of side effect after free gingival graft. In evaluation of keratinized gingiva after prosthetic treatment, it was observed that those were maintained well.

Conclusions and clinical implications: Although there are many controversial ideas regarding necessity of keratinized gingiva around an implant, this is essential in clinical and biologic view point, and this can be obtained by performing a free gingival graft.

316 | Tissue Augmentation and Engineering

Relapse before implant placement in alveolar distraction osteogenesis for dental implant of mandible

Presenter: Iwata M

Kishiwada Tokushukai Hospital, Kishiwada, Japan

Co-authors: Iwata M, Hidaka S, Shirakami K, Kamiyjo H, Kasai H, Asai Y

Kishiwada Tokushukai Hospital, Kishiwada, Japan

Background: Vertical alveolar distraction osteogenesis is an efficient method for augmentation before inserting dental

implants. But a relapse of the transport segment and decrease in bone height before implant placement is common.

Aim: In this study, we evaluated this alveolar distraction osteogenesis before implant placement, investigated the relapse in bone height. And we determined the overcorrection in alveolar distraction osteogenesis, period of implant placement.

Methods: The subjects were 35 patients, ranged in age from 21 to 61 years with the defect of the mandible (22 males and 13 females). In all cases we treated by vertical alveolar distraction osteogenesis. Active distraction was started after a latency period of 3 days with a rate of 0.5 mm twice daily. After the end of alveolar distraction osteogenesis, length of consolidation was 3 months, and distractors were removed. Bone height was measured on digital orthopantomographic radiographs, after distraction and before implant placement.

Results: Mean alveolar distraction was 12.3 mm. The mean relapse was 24% (12–29%) after the end of consolidation. One month after distractor removal, 14 patients were performed implant placement (Group A). The mean relapse was 6% (1% to 9%) at implant placement. On the other hand, 21 patients were performed distractor removal and implant placement at the same time (Group B).

Conclusions and clinical implications: The vertical alveolar distraction osteogenesis before dental implant placement is very useful but a considerable relapse must be confronted. This study indicated that implant placement performed at the same time of distractor removal if possible, and the need for overcorrection was more than 29%. In Group A, the need for overcorrection was more than Group B, more than 38%.

317 | Tissue Augmentation and Engineering

Bone regenerative efficacy of synthetic oligopeptide-coated bone in socket preservation

Presenter: Kim J-H

School of dentistry, Seoul National University, Seoul, Republic of Korea

Co-authors: Kim J-H

School of Dentistry, Seoul National University, Seoul, Republic of Korea

Background: To preserve or improve the dimension and contour of the ridge following tooth extraction, deproteinized bovine bone mineral has been widely used to graft extraction socket and the procedure has been suggested to facilitate bone formation in extraction sockets and minimize loss of bone height and width.

Aim: The aim of the present study was to evaluate the bone regeneration capacity of synthetic peptide-coated bone bovine (Ossgen-X15[®]) compared with the nonmodified deproteinized bovine bone in the extraction socket of maxillary teeth.

Methods: Twenty maxillary teeth were scheduled for extraction as a consequence of advanced periodontitis in each subject. At the time of surgery, the distance from the midpoint of the extraction site perpendicular to the line connecting the occlusal surfaces of adjacent teeth was recorded at the most occlusally situated point both buccally and palatally. In addition, the depth

of the extraction socket and the bucco-palatal width were also recorded. After measuring, graft particles (Experimental group: Ossgen-X15[®] Control group: Bio-Oss[®]) were filled and packed and resorbable collagen membrane (Bio-Gide[®]) was placed to cover the marginal portion of the alveolar socket wall. After 6 months follow-up, periapical radiograph was taken to identify the ossification of the socket, and re-entry surgery was done to measure the dimensional change. Three efficacy parameters were selected to compare the dimensional change between the two groups.

Results: In the aspects of clinical parameters, the average change in the height of bony wall was $+1.25 \pm 2.04$ mm in the experimental group and $+1.2 \pm 2.01$ mm in the control group, and the depth change was $+7.3 \pm 3.74$ mm in the experimental group and $+7.1 \pm 3.07$ mm in the control group. The average change in widths was -1.3 ± 1.33 mm in the experimental group and -1.4 ± 1.07 mm in the control group, and when the values were converted, the percentage of width reduction was $-13.15 \pm 12.92\%$ in the experimental group and $-15.19 \pm 10.87\%$ in the control group. Histologically, in the experimental group, the particles were surrounded by large amounts of woven bone in the entire socket from apical to coronal, especially in the middle and apical portions. And only some graft particles located at the coronal portions were intermingled with the connective tissue.

Conclusions and clinical implications: Peptide-coated bone mineral, used in the present study, is an effective bone substitute with the potential to enhance bone regeneration in the preservation of extraction sockets.

Quantitative assessment of bone graft quality following sinus lift using intraoral radiography

Presenter: Kim H

Private Practice, Tokyo, Japan

Co-authors: Kim H, Son M

Private Practice, Tokyo, Japan

Background: In previous studies it was shown that the image analysis of the bony structure on dental radiographs was valid to assess bone quality. The imaging parameters of the trabecular pattern on intraoral radiographs show correlations with the bone mineral density (BMD) as measured by quantitative computerized tomography (QCT).

Aim: The aim of this prospective study was to quantitate bone graft quality using the image analysis of intraoral radiographs. The reliability of the imaging parameters following sinus lift was assessed to examine whether the tested analysis could be used to quantitate graft incorporation.

Methods: Forty-two patients were treated with sinus lift before implant placement. A total of 48 sinuses were grafted with bovine hydroxyapatite and recombinant human platelet-derived growth factor-BB (rhPDGF-BB). Implant installation was performed after a mean healing period of 4 months. Intraoral radiographs of grafted sites were obtained preoperatively and at predetermined periods thereafter. The regions of interest were

selected for each radiograph stored on hard disk and binarized. A total of 32 parameters were measured using binary images to assess bone graft quality morphometrically. The reliability of the parameters at each phase was examined by means of Cronbach's alpha.

Results: More than 67% of the values of Cronbach's alpha for the parameters was <0.6 during the first 2 months. A significant increase in the values of alpha was measured 2 months postoperatively. Seventy-three percent of the values was at least 0.85 thereafter and 99% was at least 0.85 at 4 months and thereafter. The increases in the values of alpha leveled 4 months postoperatively and little further changes were measured.

Conclusions and clinical implications: The internal consistency of the imaging parameters was established at least 4 months postoperatively. This study indicates that a healing period of 4 months after bone grafting has already been sufficient for graft incorporation. The image analysis of intraoral radiographs potentially offers an alternative diagnostic tool to identify the optimal graft healing period and the timing of implant placement after grafting. These results need to be confirmed in the measurements of the parameters on a larger collection of radiographs of grafted sites using different filling materials.

Reconstruction with distraction osteogenesis after lost of whole alveolar ridge

Presenter: Kocar M

University Clinical Center Ljubljana, Ljubljana, Slovenia

Co-authors: Kocar M, Didanovic V, Hren NI, Kansky A, Sapundzhijev D, Andrejka E

University Clinical Center Ljubljana, Ljubljana, Slovenia

Background: Distraction osteogenesis (DO) is an established method to gain bone. Comminution fractures of jaw or resection of tumors are often reasons for losing whole alveolar ridge with adjacent teeth.

Aim: The aim of study is to find out is DO a proper surgical procedure to reconstruct a sufficient amount bone for dental implants with fixed prosthetics.

Methods: Reconstruction with DO was done at four patients (two male, three female), average age was 28 (18–40). Comminution fractures were presented at three mandible, one maxilla with lost of teeth (4–6). In one case resection of ameloblastoma with five teeth was done. After healing period clinical and X-rays examination was done. It was found out that 8–14 mm of bone was needed for rehabilitation. Temporary partial dentures were delivered preoperatively. In general anesthesia osteotomy and fixation of distractors (Medartis) were done. Bi- or mono-directional (3/2) distractor were used depend on clinical demanding. Distraction started 10 days later 0.5–0.75 mm per day. At two cases buccal angulation of distracted segment were added at the end. In healing period one distractor was removed due to loosening and fracture of irremovable bone and additional osteosynthesis were done in general anesthesia.

According to the protocol panoramic radiographs were done. Consolidation period were finished after 16 weeks, distractors were removed and 16 dental implants (Ankylos, Dentsply-Friadent) were inserted. Implants were uncovered 4 months later and fixed prosthetics were delivered.

Results: With DO 9–15 mm of bone deficiencies was gained and gave us conditions for rehabilitation with dental implants. Bi-directional distractor gave us opportunity for correction of distracted segment in better position. In any cases no extra augmentation procedure were need. Implantation were done immediately after consolidation period, 10/6 implants of 17/14 mm length. All of them were osteointegrated.

Conclusions and clinical implications: In all five cases with DO vertical deficiencies of alveolar ridge were anatomically corrected. Use of bi-directional distractors made the correction of buccal-lingual vector possible. The establish height of alveolar ridge made the insertion of dental implants possible. Partial dentures were used for additional stabilization of osteotomized segment. Fractures of stable segment happened due to thin residual bone which was in our case 4 mm and sharp angle between vertical and horizontal bone cut.

Use of a tooth as a bone graft on immediate implant placement: a case report

Presenter: Koray M

Department of Oral Surgery and Oral Medicine, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Koray M¹, Acikgoz MM², Celakil T³, Tanyeri H¹
¹Department of Oral Surgery and Oral Medicine, Istanbul, Faculty of Dentistry, Istanbul University, Turkey, ²Faculty of Dentistry, Istanbul University, Istanbul, Turkey, ³Department of Prosthodontics, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Background: Implant-supported oral rehabilitation is increasingly use whenever sufficient bone volume is available. The need for bone grafting to replace bone defects has become more prevalent recently. There are many bone graft options available for the surgeon each of which has specific biological and mechanical properties. Autogenous bone is the type of graft used most frequently in oral and maxillofacial surgery. It can be obtained from a host of sites in the body and can be taken in several forms. A tooth can be used for autogenous bone graft because of same structural properties with bone.

Aim: Our purpose is to describe the use of a persistent deciduous tooth as a bone graft material on immediate implant placement.

Methods: A 25-year-old female patient was referred to our clinic for treatment with implant supported crown prosthesis and aesthetic reasons. Her upper left deciduous canine was persistent. After extraction deciduous canine, the tooth's root was put into pieces and used as an autogenous bone graft. 3.7 × 10 mm implant was placed maxillary canine region. The root pieces were inserted between implant and alveolar bone defect.

Results: A new bone tissue was observed on the grafting area after 5 months. An implant-supported crown prosthesis was applied to left upper canine. The patient is still under control.

Conclusions and clinical implications: It is concluded that a tooth's root structure can be used as a bone graft on immediate implant placement.

Ridge preservation with calcium phosphosilicate putty in 12 consecutive cases

Presenter: Kotsakis G

Private Practice, Athens, Greece

Co-authors: Kotsakis G¹, Chrepa V¹, Katta S²

¹Private Practice, Athens, Greece, ²Product Manager, NovaBone Products, Alachua, FL, USA

Background: Several bone graft substitutes have been indicated for post extraction ridge preservation including autografts, allografts, xenografts and alloplasts. Graft resorption rate and the host's ability to regenerate bone capable of reassuring osseointegration for an implant to be placed in the shortest possible period of time varies.

Aim: The aim of this study was to evaluate clinically, radiographically and histologically, extraction sockets preserved with a calcium phosphosilicate putty. The density of the bone regenerated in the post extraction alveoli was obtained by measuring the primary implant stability achieved for implants placed 5 months after the extractions.

Methods: Ten consecutive patients underwent 12 flapless extractions following a specific protocol. After extraction the calcium phosphosilicate putty was placed, a collagen plug was used to occlude the sockets and stabilized with mattress sutures. Vertical resorption was calculated from periapical radiographs taken before extraction and at 5 months. Horizontal ridge dimensions were determined using an implant caliper 5 mm below the gingival margin of the crest. Implants were placed in seven of the 12 cases at 5 months. Before implantation a trephine bur was used to obtain tissue samples in the area of implantation. During implant placement the implant insertion torque was measured as an index of primary implant stability. The results obtained were analyzed using standard ANOVA statistical methods.

Results: Excellent bone fill was seen in all sockets radiographically. The average ridge width decreased by 1.1 mm (± 0.44), ($P > .05$) and the ridge height decreased by 0.83 mm (± 0.22). Histomorphometric analysis revealed very good bone regeneration (45%–53%) in the socket accompanied by rapid graft resorption (>90%). Implant insertion torque was greater than 35 N/cm² for all implants except in two cases where the stability was 20–30 N/cm² possibly due to their placement in posterior maxilla. The insertion torque is used as a guideline to measure initial implant stability and can be used as an index for estimating the density of the healed bone. All implants successfully osseointegrated with no failures and were loaded 3 months postimplantation.

Conclusions and clinical implications: Results indicate that ridge preservation using calcium phosphosilicate putty can be recommended to allow for the placement of standard diameter implants as early as 5 months postextraction.

Bone regeneration using porous titanium particles vs. bovine hydroxyapatite: a sinus lift study in rabbits

Presenter: Lambert F

Department of Periodontology and Oral Surgery, Faculty of Medicine, University of Liege, Liège, Belgium

Co-authors: Lambert F¹, Lecloux G¹, Léonard A², Sourice S³, Layrolle P⁴, Rompen E¹

¹*Department of Periodontology and Oral Surgery, Faculty of Medicine, University of Liege, Liège, Belgium,* ²*Department of Applied Chemistry, University of Liège, Liège, Belgium,* ³*Laboratory for Osteo-Articular and Dental Tissue Engineering, University of Nantes, Nantes, France,* ⁴*Laboratory of Physiopathology of Bone Resorption, Faculty of Medicine, University of Nantes, Nantes, France*

Background: The use of porous titanium particles as space filling biomaterials for intraoral bone regeneration might be of interest because of both the mechanical stability and nonresorbable properties. Titanium particles were recently described for bone regeneration in sinus lifts and in the treatment of peri-implantitis. Nevertheless, tissue integration and 3D bone regeneration with titanium particles were poorly explored in these previous reports.

Aim: The first objective of this study was to qualitatively and quantitatively assess the bone formation process, particularly the long-term behavior and 3D volume stability of subsinusal bone regeneration, using titanium or bovine hydroxyapatite granules, in a rabbit model. The second objective was to evaluate the effect of the hydration of the BHA particles with a therapeutic concentration of doxycycline solution on the osteogenesis and biomaterial resorption.

Methods: Rabbits underwent a double sinus lift procedure using one of three materials: grade 1 porous titanium particles (Ti), bovine hydroxyapatite (BHA) or chemically modified bovine hydroxyapatite (BHATTC). Animals were sacrificed after 1 week, 5 weeks or 6 months. Samples were analyzed using μ CT and nondecalcified histology.

Results: The materials used in each of the three groups allowed an optimal bone formation; bone quantities and densities were not statistically different between the three groups. At 6 months, more stable 3D volume stability was found with Ti and BHATTC ($P=0.0033$). At 5 weeks and 6 months, bone to material contact (BMC) corroborating osteoconduction was significantly higher with BHA and BHATTC than with Ti ($P<0.0001$).

Conclusions and clinical implications: Even though the studied biomaterials displayed different architectures, they are relevant candidates for sinus lift bone augmentation before dental implants because they allow adequate 3D stability and osteogenesis. However, to recommend the clinical use of Ti, both an observation on the drilling effects of Ti particles and clinical trials are needed.

Description of the bone-remodeling pattern after socket preservation procedures in human: a methodological study

Presenter: Lambert F

Department of Periodontology and Oral Surgery, Faculty of Medicine, University of Liege, Liege, Belgium

Co-authors: Lambert F¹, Vincent K¹, Vanhout V¹, Vandenberghe B², Lecloux G¹, Rompen E¹

¹*Department of Periodontology and Oral Surgery, Faculty of Medicine, University of Liege, Liege, Belgium,* ²*Department of Prosthodontics, KULeuven, Leuven, Belgium*

Background: The bone remodeling after tooth extraction can result in the loss of as much as 50% of the buccal wall and a global crestal reduction in width of 3.87 mm according to a recent systematic review. Multiple surgical protocols using biomaterials are proposed in order to limit the typical postextraction bone resorption. However, because of the heterogeneity of the studies and, more specifically, of the assessment methods, it is difficult to assert the superiority of one technique over another.

Aim: The objective of this study was to develop a new radiographic method to assess alveolar bone remodeling after socket preservation procedures.

Methods: Sixteen extraction sites (in 14 patients) localized in the upper anterior maxilla were treated with bovine hydroxyapatite (0.25–1 mm particles) and a saddled connective tissue graft. A radiographic 3-dimensional assessment of the hard tissues was performed at baseline and at 3 months after the procedure. Standardized horizontal measurements were taken at three coronal apical levels (–2, –5, and –9 mm) and at three mesio-distal level (Mesial, Center, and Distal) in the buccal and palatal aspects. Vertical measurements were also recorded in nine regions over the top of the alveolar crest.

Results: Extraction socket-preservation technique assessed in the present study significantly reduced horizontal bone remodeling. The horizontal dimension of the crest decreased by 1.6 mm (20%) in the cervical regions (–2 mm level), experienced a moderate decrease of 1 mm (12%) at the –5 mm level, and experienced a very low decrease of 0.5 mm (6%) in the apical (–8 mm) level. The losses were always significantly higher in the buccal than in the palatal aspect. Buccally, the maximal bone remodeling at the cervical level remained below 1 mm. Vertical bone resorption was homogeneous and was < 1 mm in the nine measured regions.

Conclusions and clinical implications: The radiographic measuring methodology proved to be accurate and reproducible. It can be applied in other clinical settings. Moreover, the surgical procedure evaluated in the present study, significantly limits the postextraction buccal bone remodeling compared with the data found in the literature for untreated extraction socket in the aesthetic area. However, a complete inhibition of the bone remodeling was not reached and the authors suggest a surgical technique using a “saddled” connective tissue graft to thicken buccal soft tissue biotype and consequently compensate for cervical bone loss.

Histomorphometric comparison of a MBCP and ABBM for maxillary sinus augmentation in human: a pilot study

Presenter: Lee J

Hangang Secred Hospital, Seoul, Republic of Korea

Co-authors: Lee J

Hangang Secred Hospital, Seoul, Republic of Korea

Background: Maxillary sinus augmentation technique has been considered as a routine procedure to achieve sufficient vertical bone height on the maxillary posterior region. As far as bone grafting material, it is still accepted that autogenous bone graft is the gold standard. However, many researchers have studied other bone substitutes, due to several limitations of autogenous bone. Particularly, macroporous biphasic calcium phosphate (MBCP) belongs to alloplast, consisting of 60% hydroxyapatite and 40% beta-tricalcium phosphate, while anorganic bovine bone matrix (ABBM) is manufactured from bovine bone mineral.

Aim: This study evaluated the efficacy of MBCP (MBCPTM) to ABBM (Bio-Oss[®]) in the histomorphometrical aspects of new bone formation in maxillary sinus augmentation.

Methods: Eight patients were selected after a medical and dental examination. Patients had the insufficient residual bone height (< 5 mm) for simultaneous installation of implant fixtures. They were divided into two groups as determined by randomization and underwent maxillary sinus floor elevation and bone grafting using MBCP ($n = 4$) or Bio-Oss ($n = 4$). After a healing period (average 6.5 months after surgery), bone cores were harvested and the implant fixtures were installed. These bone cores were decalcified and 5 μ m thick sections were cut along the longitudinal plane using microtome. All sections are stained with Hematoxyline-eosin and evaluated via light microscope coupled to a video camera. The percentage of the different components of the harvested tissue (i.e., new bone, residual bone particles, and soft/marrow tissue) were calculated and recorded.

Results: Healing process after sinus graft procedure was uneventful, even though small tear (< 5 mm) have occurred in two sinuses (One was MBCP group and the other ABBM group). Bone cores were obtained 22–36 weeks postsurgery. Histomorphometric analysis of four MBCP cores and four ABBM cores revealed an average of new bone of 26.94% and 28.94%, respectively. The percentage of residual graft particles was much less in MBCP (11.59% vs. 31.1% for ABBM) with more soft and marrow component (61.47% vs. 39.96% for ABBM). The amount of new bone does not seem to be related to the length of healing time. The gross histology was similar for the both graft materials: most of graft particles, both MBCP and ABBM, were surrounded by or embedded in new bone, and in close contact to surrounding new bone. The boundary between particles and new bone was irregular and the contact was close, implying the resorption of particles with the simultaneous apposition of new bone.

Conclusions and clinical implications: Since the number of patients and sinuses was limited, the data should not be considered conclusive. However, histological appearance showed that both materials have osteoconductive properties.

Both materials are, therefore, appropriate for maxillary sinus augmentation followed by dental implant placement.

Gradient biomaterials for bone tissue regeneration: the combination of calcium phosphate and calcium silicate

Presenter: Lucas-Aparicio J

Departamento de Quimica-Fisica II, Facultad de Farmacia, UCM, Madrid, Spain

Co-authors: Lucas-Aparicio J^{1,2}, Alkhraisat M¹, Cabrejos-Azama J^{1,2}, Rueda C¹, Torres J⁴, Gbureck U³, Ewald A³, Blanco-Jerez L², Lopez-Cabarcos E¹

¹*Departamento de Quimica-Fisica II, Facultad de Farmacia, UCM, Madrid, Spain,* ²*Departamento de Estomatología III, Facultad de Odontología, UCM, Madrid, Spain,* ³*Department of Functional Materials in Medicine and Dentistry, University of Würzburg, Würzburg, Germany,* ⁴*Departamento de Ciencias de la Salud III, Facultad de Ciencias de la Salud, URJC, Alcorcon-Madrid, Spain*

Background: The development of biomaterials with gradient properties will be the threshold toward the regeneration not only of tissues but also soft to hard tissue interface. We believe the combination in a cement system of calcium phosphate and calcium silicate will generate biomaterials that vary in their physico-chemical and biological properties. Clinically, the synthesis of such biomaterials could have an evolutionary outcomes in periodontal as well as craniofacial tissue regeneration. Herein, we report a cement system that employs silicon-containing ceramics to develop biocements with scaling-up properties.

Aim: The variation of silicon ions content in bioceramics will give result to a biocements with controllable properties and improved *in vivo* performance.

Methods: Silicon-doped calcium phosphate ceramics were mixed with acidic calcium phosphate to produce inorganic matrix of brushite and calcium silicate hydrate. After physical and pharmaceutical characterization of the novel cements, they were tested as templates for osteoblasts growth as well as bone substitutes in critical bone defects of rabbits calvaria.

Results: The developed materials grade in their setting and mechanical properties such that shorter setting time and lower tensile strength are associated with higher silicon content. Similarly, the kinetic of antibiotic release is switched from rapid release with an initial burst to zero-order release kinetic. Interestingly, osteoblasts grown on cement surfaces showed higher proliferation and activity at higher silicon content. The *in vivo* results showed the bone substitutes to interact efficiently with surrounding bone and induce the formation of more bone tissue as well as slower degradation rates. These properties scale up with the increase in silicon content.

Conclusions and clinical implications: The ultimate goal of both researchers and clinicians is to provide efficient techniques to restore function and aesthetics to damages tissue. However, such task is complicated in dentistry due to the necessity of soft-to-hard interface regeneration (periodontium). We think the development of biomaterials with gradient properties is a must in periodontal regeneration and silicon ions are chosen as task in our work due to their positive influence on both soft and hard tissue.

Bacterial contamination of the autogenous bone collected by bone filter during implant surgery

Presenter: Hashemi HM

Department of Oral and Maxillofacial Surgery Shariati Hospital, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran

Co-authors: Hashemi HM¹, BeshkarM^{1,2}

¹*Department of Oral and Maxillofacial Surgery Shariati Hospital, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran,* ²*Craniomaxillofacial Research Center, Shariati Hospital, Tehran, Islamic Republic of Iran*

Background: Autogenous bone is considered the gold standard for augmentation purposes around dental implants. There are different methods of collecting autogenous bone including harvesting blocks of bone from tuberosity and bone filtering.

Aim: The main goal of this study was to compare the level of microbial contamination of the autogenous bone collected by a bone filter to the autogenous bone harvested by a rongeur during implant surgery.

Methods: Thirty healthy patients underwent surgical insertion of dental implants. Throughout the surgery, a stringent aspiration protocol was employed to collect particulate bone with minimal risk of contamination with the oral flora. Furthermore, a fragment of the bone mainly from tuberosity was also harvested by using a rongeur. Samples from each of these two groups were sent to a microbiology lab for microbial count.

Results: All samples from both groups yielded viable microorganisms. There was no statistically significant difference between the number of aerobes in the bone filter vs. bone fragment group ($P = 0.879$). However, the number of anaerobes was significantly greater in bone filter group, compared with bone fragment group. The total number of microorganisms (both aerobes and anaerobes) was significantly greater in the bone filter group as compared with the bone fragment group ($P = 0.0001$).

Conclusions and clinical implications: Even with the use of a stringent aspiration protocol the level of bacterial contamination is significantly higher in collected bone debris as compared with the bone harvested by rongeur during implant surgery.

Experimental application of plasma rich in growth factors in guided bone regeneration (a dog study)

Presenter: Maroufidis N

School of Dentistry, Aristotle University of Thessaloniki, Thessaloniki, Greece

Co-authors: Maroufidis N, Veis A, Tsirlis A, Parissis N, Romanos G

School of Dentistry, Aristotle University of Thessaloniki, Thessaloniki, Greece

Background: Plasma Rich in Growth Factors (PRGF) is a blood product combined in a safe and easy manner with various biomaterials. It is considered to have positive effects in bone

regeneration although there are different producing protocols and devices.

Aim: The purpose of this study was to investigate whether or not PRGF improves the quality of bone regeneration at standard bony defects created bilaterally in dog's ilium.

Methods: The experimental material consisted of 12 dogs. Each dog underwent three artificial bony defects of 8 mm length, 6 mm width and 5 mm depth at each ilium. Totally, 72 defects were created. Twelve of those defects were left ungrafted and the others were filled with the following graft material combinations: PRGF, Autologous Bone (AB), Autologous Bone and PRGF (AB + PRGF), Autologous Bone and Bioactive Glass (AB + BG), Autologous Bone with Bioactive Glass and PRGF (AB + BG + PRGF). A complete histological and histomorphometrical analysis was performed after 2 and 4 months. Bone specimens of all grafted sites were received in order to evaluate bone density. Measurement were evaluated using the Least Significance Difference test at a significance level $P = 0.05$.

Results: Histological and histomorphometrical study revealed that bone density either in 2 or in 4 months was significantly higher in defects with AB, AB + PRGF, AB + BG and AB + BG + PRGF compared with the ungrafted defects and those with PRGF alone. Independently of time, the PRGF-treated sites (excluding the sites treated with PRGF alone) demonstrated significantly higher bone density than those treated without PRGF.

Conclusions and clinical implications: This study revealed that PRGF alone does not improve the quality of bone regeneration in a certain dog experiment model. On the contrary, the combined use of PRGF with Autologous Bone, Bioactive Glass and both of those grafting materials offers improved bone density.

Minimal invasive Connective Tissue Graft Technique (Envelope Technique) for root coverage: a case report

Presenter: Melo F

MALO Clinic - Prosthodontics Department, Lisbon, Portugal

Co-authors: Tocantins E¹, Melo F², Fernandes A², Rodrigues V², Rangel J²

¹*MALO Clinic - Surgery Department, Lisbon, Portugal,* ²*MALO Clinic - Prosthodontics Department, Lisbon, Portugal*

Background: Gingival recession associated with root surface exposure is a complex phenomenon that may present numerous therapeutic challenges to the clinician. This condition is increasingly becoming a more prominent problem in the oral health of many patients and should be treated at its earliest detection. There are a variety of regenerative procedures that have the potential to correct gingival recession defects, as well as to obtain partial or complete root coverage, via augmentation of the width and height of the keratinized gingiva. The "envelope technique", was firstly described nearly 20 years ago and offers an excellent alternative in managing gingival recession

defects with a single surgical procedure. This procedure, with an envelope design and a sub epithelial connective tissue graft, demonstrates early tissue healing, due to its increased blood supply, good aesthetics outcome and avoidance of secondary periodontal plastic surgery.

Aim: The aim of this case was to restore a patient gingival esthetics, using a minimal invasive sub epithelial connective tissue graft technique.

Methods: A 26 years old female patient reported with the complaint of sensitivity and gingival recession in relation to 2nd sextant teeth, caused by mechanical trauma (tooth brushing). Her chief complaint was lack of esthetics. The surgical treatment was accomplished with a single operation in two steps. The first step consisted in the preparation of the recipient area (preserving intermediate papillae). The second step consisted in the removal of the graft from the left posterior palatine area and its insertion through the "envelope technique".

Results: The surgical technique implemented provided excellent root coverage of Miller's Type I and II recessions and an increased amount of keratinized gingiva. It seems to be more predictable and demonstrates more satisfactory results comparing with other techniques.

Conclusions and clinical implications: The envelope technique seems to be a predictable and successful technique. This may be explained by the fact that the intermediate papillae remains intact, due to less trauma caused during preparation of the recipient site. At the end of the treatment, the patient seemed to be really satisfied with the esthetic outcome, which reflected on the way she smiled. Furthermore a decrease of sensibility was also observed.

Reconstruction of severely atrophied alveolar ridges with calvarial bone grafts and dental implants

Presenter: Mertens C

Department of Oral and Maxillofacial Surgery, University of Heidelberg, Heidelberg, Germany

Co-authors: Mertens C¹, Steveling H², Hoffmann J¹, Freier K¹

¹*Department of Oral and Maxillofacial Surgery, University of Heidelberg, Heidelberg, Germany,* ²*Private Practice, Gernsbach, Germany*

Background: Severely atrophied alveolar ridges are most commonly reconstructed with free autologous bone grafts from the iliac crest. The use of these grafts, however, is frequently associated with bone resorption after implant surgery and prosthetic loading as possible late complication. Other donor sites, especially intraoral donor sites show limited availability.

Aim: The aim of this present study was to evaluate the clinical and radiographical outcome of alveolar ridge reconstruction with bone from the calvarium and subsequent implant rehabilitation.

Methods: In case of severe and complex alveolar ridge defects induced by trauma or bone atrophy the reconstruction was performed by using calvarial split grafts. Fifteen patients were treated at 19 different intraoral recipient sites (15 sites in the

maxilla, 4 in the mandible). Autologous block grafts were used for combined vertical and horizontal grafting. After a 3-month healing period patients received dental implants. A total of 99 dental implants (OsseoSpeed, Astra Tech AB, Mölndal, Sweden) were inserted. At an average of 3 months later, the prosthetic implant-based rehabilitation was performed. Subsequently, patients were followed-up clinically and radiographically for a mean observation period of 25 months.

Results: No donor site complications occurred during or after surgery. At the intraoral recipient sites two infections occurred, leading to partial loss of the grafts. Implant placement, however, was possible in all cases. Two of 99 implants were lost in two patients before prosthetic loading. Patients were followed-up for an average observation period of 25 months. No signs of increased marginal bone loss could be documented.

Conclusions and clinical implications: Owing to the lower morbidity at the donor site and due to the good marginal bone stability in the reconstructed regions, calvarial bone grafts, represent another viable treatment alternative to grafts from the iliac crest.

Impact of an oily calcium hydroxide suspension on new bone formation in critical size defects

Presenter: Mihatovic I

Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany

Co-authors: Mihatovic I¹, Stratul S-I², Payer M³, Sculean A⁴, Becker J¹, Schwarz F¹

¹*Department of Oral Surgery, Heinrich Heine University, Düsseldorf, Germany,* ²*Department of Periodontology, Victor Babes University of Medicine, Timisoara, Romania,* ³*Department of Oral Surgery and Radiology, School of Dentistry, Medical University of Graz, Graz, Austria,* ⁴*Department of Periodontology, School of Dental Medicine, University of Bern, Bern, Switzerland*

Background: A major goal in oro-facial regenerative approaches is the introduction of surgical techniques allowing predictable reconstructions especially of large defects caused by resorption, cancer, trauma or metabolic diseases.

Aim: The present study was conducted to evaluate new bone formation after the application of an oily calcium hydroxide suspension (OCHS) into critical size defects.

Methods: Standardized defects (2 × 1.5 cm) were created into the bone marrow space of four Goettinger minipigs' tibiae. Thus, a total of 16 defects were randomly assigned to a test and control group. Test sites were filled with Osteora[®], an oily calcium hydroxide suspension (OCHS), whereas control sites were filled with venous blood. All defects were closed with a cortical lid. Animals were sacrificed after 4 and 8 weeks. The obtained sections were subjected to histological analysis.

Results: Healing was uneventful in all four animals. Mean percentages of mineralized tissue after 4 weeks were 23.01% in the test group vs. 43.45% in the control group. The mean value for residual OCHS was 7.11% at 4 weeks. After 8 weeks mean percentages of mineralized tissue were 28.15% in the test

group vs. 44.39% in the control group as well as 7.05% for residual OCHS. Thus, significantly ($P < 0.05$) lower amounts of mineralized tissue were present in the defects of the test group compared with control groups after both healing periods.

Conclusions and clinical implications: Within the present inductive animal model it was concluded that the application of OCHS may not have a beneficial effect on new bone formation in closed critical size defects. Future trials should clarify whether beneficial effects of OCHS observed in periodontal regeneration may be reproduced in the treatment of peri-implant diseases.

331 | Tissue Augmentation and Engineering

Remodeling of autogenous bone grafts after osteotome sinus floor elevation

Presenter: Nishida T

Department of Periodontology, Nihon University School of Dentistry, Tokyo, Japan

Co-authors: Nishida T^{1,2}, Murase R¹, Mori K¹, Ikeda M¹, Masuda H¹, Mizumura Y¹, Ito K^{1,2}

¹*Department of Periodontology, Nihon University School of Dentistry, Tokyo, Japan*, ²*Division of Advanced Dental Treatment, Dental Research Center, Nihon University School of Dentistry, Tokyo, Japan*

Background: Implant restoration of the posterior maxilla poses major challenges to the clinician, and several sinus augmentation approaches have been proposed for increasing the vertical dimensions of bone available during implant placement. Grafting the floor of the maxillary sinus has become the most common surgical intervention for increasing alveolar bone height before the placement of endosseous dental implants in the posterior maxilla. In 1986, Tatum introduced sinus floor elevation using an osteotome. This method uses an osteotome to tent the sinus membrane, after which a bone graft is placed through the osteotomy site.

Aim: This study assessed the radiographic appearance of bone graft domes longitudinally after osteotome sinus floor elevation using cone beam computed tomography (CBCT).

Methods: This study presents the radiological findings of a 6-month follow-up CBCT study in maxillary osteotome sinus floor elevation. We examined 68 patients with a crestal bone height of < 8 mm in the posterior maxilla who required sinus augmentation. Implants ($n = 106$) were subsequently placed in regenerated bone following osteotome sinus floor elevation; autogenous bone was used as the augmentation material. CBCT was performed before and just after the first implant operation and at the second implant operation.

Results: In all cases, the grafted augmentation material tended to be absorbed, but at least 1 mm of grafted augmentation material was recognized around the implant fixtures on CBCT at the second implant operation. The border between the grafted augmentation material and the existing bone was indistinct. The grafted area apical to the implants undergoes shrinkage and remodeling.

Conclusions and clinical implications: It was suggested that sufficient grafted autogenous bone changes into bone to support

an implant. Furthermore, CBCT can be useful for evaluating the grafted material and the tissue around the implant in the osteotome-elevated sinus floor.

332 | Tissue Augmentation and Engineering

The stem cells cultured conditioned media enhanced bone regeneration

Presenter: Osugi M

Department of Oral and Maxillofacial Surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan

Co-authors: Osugi M, Katagiri W, Yoshimi R, Inoue M, Hara K, Inukai T, Hibi H, Ueda M

Department of Oral and Maxillofacial Surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan

Background: Recently tissue engineering has become available as a treatment procedure for bone augmentation. We have been used platelet-rich plasma (PRP)/human mesenchymal stem cells (hMSCs) as a predictable bone graft materials. However, this procedure has several problems such as an expensive cost for capital investment and cell culture, complicated safety and quality management of cell handling and invasiveness of cell collection for patients. On the other hand, it was reported that the stem cells secreted many growth factors and chemokines during their cultivation and that could affect on the cellular characteristics and behavior.

Aim: We hypothesized that the stem cell cultured conditioned media which contains such factors enhanced the bone regeneration through the endogenous cell migration and osteogenesis. The purpose of this study was to evaluate an effect of the stem cell cultured conditioned media on bone regeneration *in vitro*, and *in vivo*.

Methods: Stem cell cultured conditioned media derived factors were extracted from basal media (BM) cultured hMSCs and stem cells from human exfoliated deciduous teeth (SHED). Rat mesenchymal stem cells (rMSCs) were cultured with BM, hMSCs-CM, SHED-CM for 48 h, and then assessed each cell proliferation by bromodeoxyuridine (BrdU) assay and cell migration by migration assay. The expressions of osteogenetic-related genes were quantified by real-time RT-PCR analysis. In addition, bone defects were prepared on the rat cranium surgically with 5 mm diameter trephine bur and implanted with the following materials: (i) collagen sponge, (ii) collagen sponge/hMSCs-CM, (iii) collagen sponge/SHED-CM, (iv) PRP/hMSCs, (v) control (defect only). After 2, 4 and 8 weeks, these samples were collected and assessed by micro CT, radiographical, and histological analysis.

Results: Cell proliferation and migration of rMSCs increased significantly by culture in hMSCs-CM and SHED-CM. The expressions of osteogenetic-related genes in rMSCs cultured in each CM were significantly higher than in BM. Collagen sponge/hMSC-CM group and collagen sponge/SHED-CM group had well-formed bone compared with the other groups. Moreover, these groups confirmed an equal newly formed bone compared with PRP/hMSCs group.

Conclusions and clinical implications: The findings of this study indicated that stem cells cultured conditioned media contained

the enhancers for migration and osteogenesis of endogenous MSCs, and that enhanced the bone regeneration without cell transplantation.

An *in vitro* model for analysis of barrier function and cellular reactions for different membranes in Guided Bone Regeneration

Presenter: Ristevski Z

Biomatcell, Department of Biomaterials, Institute of Clinical Science, Sahlgrenska Academy at University of Gothenburg, Gothenburg, Sweden

Co-authors: Ristevski Z^{1,2}, Dahlin C^{1,2}, Johansson A¹

¹*Biomatcell, Department of Biomaterials, Institute of Clinical Science, Sahlgrenska Academy at University of Gothenburg, Gothenburg, Sweden,* ²*Department of Oral and Maxillofacial Surgery, NÄL Medical Center, Västra Götaland Region, Trollhättan, Sweden*

Background: The exact mechanisms of barrier membranes are not yet fully understood. Although the hypotheses with membranes creating a secluded space for invasion of cells with osteogenic potential in many ways hold true, it cannot be the only reason for success. Another finding of great clinical interest is the fact that barrier membranes, even with lack of naturally space making facilities, placed over graft materials will minimize or totally prevent the resorption process. The tissue dynamics and interaction between membranes, hard and soft tissue needs to be better understood in order to develop optimally designed membranes for the future.

Aim: To understand the mechanism of guided bone regeneration and the early tissue dynamics with regard to barrier function and cell interaction.

Methods: A direct culture system was used. Human gingival fibroblasts (HGF-1) were cultured in conditioned medium and placed in wells where inserts with five different membranes were mounted. (BioGide (BG), Gore-Tex (GT), Dynamatrix (DM), Surgisis SIS, and PS(control) mixed in stated mixtures with limited number of cells per well Cell numbers viability, attachment and migration were analyzed by means of NucleoCounter and LD measurements at 13 and 28 days, respectively. Staining with ALP, von Kossa or Alizarian red were also performed.

Results: Migration of HGF cells at 28 d was 0.387×10^4 for BG, 0 for GT, 0.500×10^4 , 0.500×10^4 for DM, 0.040×10^4 for SIS. The LD/cell analysis (13 d) was 1.306×10^4 for BG, 0.72×10^4 for GT, 0.197×10^4 for DM, 0 for SIS.

Conclusions and clinical implications: Preliminary data implies that with regard to membrane permeability (barrier function), the Gore Tex (GT) was considered the most occlusive followed by the Surgisis SIS membrane. BioGide (BG) and Dynamatrix (DM) demonstrated higher number of cellular migration through the material. Toxicity tests (LD/cell) revealed higher numbers for BG and GT compared with DM and SIS membranes. Bioactive membranes manufactured without cross-linking seems to be less toxic still providing improved barrier function for GBR.

Sinus floor elevation using a sintered, natural bone mineral. A histomorphometrical case report study

Presenter: Rothamel D

Department of Oral and Maxillofacial Plastic Surgery, University of Cologne, Cologne, Germany

Co-authors: Rothamel D¹, Schwarz F², Smeets R³, Happe A^{1,4}, Fienitz T², Mazor Z⁵, Zöller J¹

¹*Department of Oral and Maxillofacial Plastic Surgery, University of Cologne, Cologne, Germany,* ²*Department of Oral Surgery, Heinrich-Heine University, Duesseldorf, Germany,* ³*Department Oral and Maxillofacial Plastic Surgery, University of Hamburg, Hamburg-Eppendorf, Germany,* ⁴*Private Practice, Muenster, Germany,* ⁵*Private Practice, Ra'anana, Israel*

Background: Implantological rehabilitation of the posterior maxilla often requires cranialization of the sinus floor to allow for long-term stability and permit the placement of sufficiently long implants. Well known as sinus floor elevation or sinus lift, this operation is one of the most common therapies for vertical deficits of the upper jaw.

Aim: The aim of the present study was the histological and clinical evaluation of the xenogenic bone substitute material (BEGO OSS, Bego Implant Systems, Bremen) for the indications one-stage and two-stage sinus floor elevation.

Methods: Twelve patients were included in the study, undergoing 15 simultaneous or staged sinus lift operations. Data were evaluated clinically and, for two-stage approaches, histologically and histomorphometrically after trephine harvesting during implant bed preparation.

Results: Healing was uneventful in all cases. All patients showed good hard tissue regeneration of the lateral window of the sinus. Neither resorption nor dislocation of the granular bone substitute material was observed. Radiologically, good volume stability of the graft was observed. Histologically, bone substitute particles displayed complete osseous integration in newly formed bone matrix. The proportion of newly formed bone within the graft was 25.8–49.6%, whereas the proportion of remaining bone substitute material varied from 28.6% to 38.5%.

Conclusions and clinical implications: It was concluded that BEGO OSS acts as an osteoconductive material to support hard tissue regeneration after sinus floor elevation. Showing excellent volume stability, it is integrated into newly formed bone matrix within a 6-month healing period. Direct comparison with other bone substitute materials requires further clinical studies.

Treatment outcome of implants placed in augmented vs. nonaugmented sites

Presenter: Santing H

UMCG, Groningen, The Netherlands

Co-authors: Santing H, Meijer H, Raghoobar G

UMCG, Groningen, The Netherlands

Background: Local bone augmentation is often needed in the anterior region to restore large osseous defects before implant

placement. Patients and clinicians are interested in whether restoring large osseous defects is a reliable and effective therapy to re-establish optimal function and aesthetics following the loss of an anterior tooth.

Aim: The aim of the study was to evaluate the influence of a large osseous defect and its augmentation on treatment outcome of patients in need of a single tooth implant in the aesthetic zone.

Methods: For this study, 49 consecutive patients (mean age 35.1 years, range 18–71) with a single missing maxillary lateral or central incisor were included. In 23 cases a local augmentation with a 1:2 mixture of Bio-Oss® and autologous tuberosity bone had to be performed due to a large osseous defect. A preshaped Bio-Gide® GBR membrane was carefully positioned over the reconstructed area. After 3 months, a dental implant (Straumann Bone Level Implant) was placed (Augmentation group). No augmentation before implant placement was needed in the Control group ($n=26$). Three months after implant placement, second stage surgery was performed and the implant was restored with a provisional crown. Three months after provisionalization, a definitive full ceramic crown was placed. Two weeks and 18 months after implant placement, clinical data were collected and standardized X-rays and photographs were taken. Outcome measures were radiographic marginal bone-level changes, survival, soft tissue aspects (probing depth, plaque-index, bleeding-index, soft tissue level), aesthetics and patient satisfaction.

Results: No significant differences were found between both study groups regarding marginal bone loss (Augmentation group 0.2 ± 0.27 mm, Control group 0.17 ± 0.33 mm), survival (100% in both groups), soft tissue aspects, aesthetic outcome and patient satisfaction.

Conclusions and clinical implications: Within the limitations of this study (sample size, follow-up duration), it was demonstrated that, for single implants in the anterior maxilla, the existence of a large osseous defect and its restoration before implant placement did not lead to less favourable results.

336	Tissue Augmentation and Engineering
-----	-------------------------------------

3D augmentation of the atrophic maxilla with autogenous bone grafts

Presenter: Sapundziev D

University Medical Centre Ljubljana, Ljubljana, Slovenia
Co-authors: Sapundziev D, Hren NI, Kansky A, Didanovic V, Kocar M

University Medical Centre Ljubljana, Ljubljana, Slovenia

Background: The atrophy of the jaws is a result of bone resorption after tooth loss or bone loss after traumatic injury. Insufficient bone quantity can present as inadequate bone wide and height that can seriously compromise the implant treatment outcome.

Aim: The aim of this pilot study was to show the short term success after 3D reconstruction of the atrophic alveolar process of the maxilla with autogenic bone block grafts from the mandibular ramus and subsequently implant placement in the grafted sites.

Methods: In four patients the 3D reconstruction with autogenous bone grafts from mandibular ramus was undertaken to gain adequate bone volume before implant placement. The cause for bone loss was a direct bone injury during car accident, in three patient and tooth extraction in one. The autogenous bone from the mandibular ramus was harvested. After tunnel preparation of the recipient site the block graft was split and fixed with two screws as on-lay and over-lay bone graft on the atrophic alveolar ridge. The space between block grafts and bone was filled with particulate bone graft from xenogenyc origin. The grafts were left to heal subperiostally without resorbable membrane. The wounds were closed with nonresorbable sutures that were removed after 1 week. All the patients received antibiotic treatment post operatively. The rentgenologic examination was performed 1 week and 6 mounts postoperatively to check for bone resorption. Six mounts after the ridge reconstruction implants were placed in all of the patients. The final restorations were delivered 4 months after implant insertion.

Results: In all patients we did not experienced any complications during site preparation, graft harvesting and graft fixation. We did not have postoperative complications such as sensitive disturbances in the donor site. In two patients we had soft tissue dehiscence in the early healing period that was treated with graft remodeling. We did not observe any complications in the rest of the patients. During the implant placement no soft tissue was found in the grafted site. No bone loss around the implants was observed in the first year after implants were put in function.

Conclusions and clinical implications: By using autogenous bone grafts can predictably and reliably restore bone loss in severely affected sites. Minimal morbidity of the donor site and not so demanding technique makes this procedure widely usable in ambulatory setting.

337	Tissue Augmentation and Engineering
-----	-------------------------------------

Computer-assisted sinus augmentation: a utility of guided surgery and novel two types drills

Presenter: Shibahara K

Division of Regenerative Oral Surgery, Nagasaki University, Nagasaki, Japan

Co-authors: Shibahara K¹, Shigehara S¹, Yamaguchi A², Asahina I¹

¹*Division of Regenerative Oral Surgery, Nagasaki University,*

Nagasaki, Japan, ²Wada Precision Dental Laboratories Co., Ltd., Osaka, Japan

Background: Backgroud: Lateral window technique is one of the surgical procedures to gain access to the maxillary sinus membrane for augmentation procedure. The position of window control difficulty of this procedure. CAS (Computer-Assisted Surgery) was utilized to determine the position of the window.

Aim: The aim of this study is to evaluate of utility of CASA (Computer-Assisted Sinus Augmentation) for maxillary sinus augmentation.

Methods: Sixty-five y.o. woman selected to operate this procedure. BioNa (Wada Precision Laboratories Co., Ltd., Japan), a computer simulation software was used to determine position of

a window of Lateral approach. We fabricated CAD/CAM-Surgical templates for the operation. For fenestration of window, we utilized a novel drill system, SLA (Forest One, Japan). And Apaceram AX (Hoya, Japan) was filled to augment maxillary sinus cavity. After 4 M of this procedure, CT scan and computer simulation was undergone for implant placement. Two implants (Nobel Speedy Groovy) were placed using novel drill, SCA (Forest One, Japan). We evaluated the position of implants by X-rays.

Results: With maxillary sinus augmentation of lateral window technique using this protocol, we decided easily the position of the window and performed simply fenestration of window without perforation of maxillary sinus membrane. And implants were placed proper position.

Conclusions and clinical implications: Two types of novel drills were very useful and CASA was powerful tool for the solution to the loss of posterior bone height.

The use of titanium granules as graft material in implant dentistry

Presenter: Steveling H

Private Practice, Gernsbach, Germany

Co-authors: Steveling H¹, Merkle K¹, Mertens C^{1,2}

¹Private Practice, Gernsbach, Germany, ²University, Heidelberg, Germany

Background: The collapse of the alveolar ridge after extraction makes it often difficult to achieve perfect esthetical results with dental restorations. There are different techniques to give the alveolar process the optimal contour.

Aim: This clinical study had the objective to evaluate the potential of porous titanium granules (PTG) as a graft material in the surgical treatment of osseous deficits in vertical and horizontal direction.

Methods: Sixteen patients with osseous deficits on the buccal side of implants (13) and with vertical deficits between two implants for a planned FPD (3) were treated with white titanium granules, following the instructions of the manufacturer. No membrane was used to cover the graft material. Sutures were removed after 1 week. All treated sides healed uneventfully with an instant improvement of the contour. After a healing period of 3 months, all patients received the restorations within a period of 7 weeks after the re-entry.

Results: All augmented sides remained stable over a follow-up period of 12 months without signs for loss of volume. There was no discolouration of the soft tissue at the augmented sides.

Conclusions and clinical implications: No adverse effects from PTG augmentation were observed. The granules are easy to shape and easy to use. The early results are promising and justify further clinical use.

Free gingival graft to increase keratinized mucosa around implant

Presenter: Suna K

Chonbuk National University, Chonju, Republic of Korea

Co-authors: Suna K, Soojung B, Sunhye P, Moontaek C, Hyungseop K

Chonbuk National University, Chonju, Republic of Korea

Background: Whether lack of an adequately attached gingiva compromises the maintenance of healthy marginal tissues around dental implants remains controversial. But, Adell et al. recognized that the protective role of peri-implant soft tissues is essential for maintaining the long-term osseointegrated status of implants. In animal experiments, Warrer et al. reported that if plaques were accumulated artificially in the vicinity of the implants and in the area lacking keratinized gingiva, the recession of gingiva and the loss of osseointegration would be significant.

Aim: In this research, the cases of free gingival graft for dental implant's long-term stability will be reported.

Methods: This report is based on three patients with insufficient keratinized gingiva who have visited periodontology department at Chonbuk National University Hospital. For the case of insufficient attached gingiva, free gingival graft was carried out during the time of either preimplantation period and maintenance period after prosthesis delivered. After the graft surgery made, regular follow-up was scheduled to observe and examine the attached gingival level and changes on peri-implant tissue.

Results: For all cases, increase of attached gingiva was observed, and peri-implant tissue was well maintained without inflammation after the surgery.

Conclusions and clinical implications: We ascertain that free gingival graft is predictable technique for increasing attached gingiva around implant. However, this report only covers short-term outcomes, and thus long-term observation on attached gingiva level and peri-implant tissue condition would be necessary.

Piezoelectric surgery for alveolar bone reconstruction of atrophic jaws

Presenter: Tagliatesta L

University of Milan, Milan, Italy

Co-authors: Tagliatesta L, Rossi A, Anello T, Seriola L

University of Milan, Milano, Italy

Background: Placement of dental implants is difficult in alveolar ridges with severe horizontal and vertical bone resorption. To augment the severely atrophic ridge, very different approaches had been proposed. A lot of studies are present in literature regarding tridimensional bone reconstruction using bone blocks harvested from intraoral sites. In literature there are different techniques of bone harvesting, but not many articles about piezoelectric surgery.

Aim: This clinical study try to compare if there is any difference in alveolar bone reconstruction depending from intraoral harvesting technique (piezosurgery device or traditional instruments like burrs, or saw, or chisels). The study try to analyze advantages and disadvantages of the piezoelectric surgery for the reconstruction of the alveolar processes with bone grafts taken from intraoral sites, and to compare survival and success rates of implant inserted in the regenerated areas

Methods: Twenty autogenous bone grafts taken from intraoral sites (mandibular ramus) have been used to correct intraoral tridimensional bone defects in 15 patients. All the harvested bone blocks had been performed using piezosurgery and all the patient have been treated by the same team and with the same harvesting protocol. The tridimensional reconstruction had been cover with bio-oss and whit a resorbable membrane. A total of 55 implants have been inserted in reconstructed sites after 4–6 months. Three to 6 months afterwards, implants have been loaded. The mean follow-up was 24.8 months [range: 18–31 months].

Results: The bone graft volume obtained vary from a minimum of 2.4–3 cm³ to a maximum of 7.1 cm³. The height average is 8 mm, length is 13 mm and depth is 2.3 mm. All bone grafts show a successful engraftment and no signs of resorption measured from the fixation screws. Donor and recipient complications rates were both 5%: one transitory paresthesia of alveolar nerve and one case of infection, respectively. The overall survival and success rates of implants were 100% and 98%, respectively (1/55 wound dehiscence).

Conclusions and clinical implications: This study seems to demonstrate that use of piezoelectric device for intraoral harvesting of bone taken from the ramus may be considered a valid alternative to the traditional techniques, reducing postoperative complications and discomfort of the patients.

The mirror study. A prospective randomized controlled study of Endobone used in maxillary sinus augmentation. histological evaluation

Presenter: Weinländer M

City Implant Vienna, Vienna, Austria

Co-authors: Weinländer M^{1,2}, Krennmair G³, Schmidinger S⁴, Plenk H², Piatelli A⁵

¹City Implant Vienna, Vienna, Austria, ²Bone @ Biomaterials

Research/Institute for histology and Embryology, Medical University

Vienna, Vienna, Austria, ³Department of Prosthodontics, Dental

School Vienna, Vienna, Austria, ⁴Private Practice, Wels, Austria,

⁵University of Chieti, Chieti, Italy

Background: Sinus augmentation has been proven to be a successful bone augmentation procedure in the oral-maxillofacial field. The goals of this procedure are the formation of vital bone in the pneumatized maxillary sinus as well as osseointegration and long-term stability of endosseous implants placed in this newly formed bone.

Aim: Particulate bone-replacement materials of xenogen origin are commonly used as augmentation materials in sinus

augmentation procedures. They serve as biofunctional foreign body materials which lead to a prolonged elevation of the sinus membrane and consecutive bone formation. It was the goal of this study to evaluate Endobone[®] a particulate bovine derived xenograft as a bone-replacement material in sinus augmentation procedures clinically and histologically.

Methods: In this prospective controlled study of sinus lift bone graft procedures four clinical centers in Austria performed maxillary augmentation procedures via lateral window approach in fully or partially edentulous patients needing unilateral or bilateral sinus augmentations. One of two particulate bovine derived xenografts (Endobone[®], BioOSS[®]) according to randomization were used. Four months after augmentation biopsies were taken during implant osteotomy preparation and forwarded for undecalcified histological (descriptive and morphometric) evaluation.

Results: A total of 72 biopsies (Endobone[®] 43/BioOSS[®] 29) were evaluated. Both xenografts demonstrated a osteoconductive behaviour with different amounts of newly formed bone (Endobone[®] 11.99 ± 7.76/BioOSS[®] 14.74 ± 6.72, $P = 0.1563$) in intimate contact with different amounts of graft particles (Endobone[®] 52.45 ± 13.88/BioOSS[®] 41.15 ± 12.25 $P = 0.0002$). Whereas resorption and remodelling of newly formed bone was visible no signs of resorption at both xenografts could be detected. Some areas of BioOSS[®] particles with soft tissue contact demonstrated a “pale” borderline zone. The space between the particles (Endobone[®] 35.38 ± 14.21/BioOSS[®] 44.04 ± 11.13, $P = 0.0028$) was occupied with soft tissue containing multinucleated cells partly acting as osteoclasts. No phagocytosed ceramic fragments could be observed in these cells. No inflammatory cell infiltrate could be detected. Whereas the statistical comparison of the newly formed bone in contact with the two xenografts showed no statistical difference the amounts of biomaterial used ($P = 0.0002$) and marrow spaces ($P = 0.0028$) were statistically significant.

Conclusions and clinical implications: Both used particulate bone xenografts appear to be highly biocompatible leading to substantial amounts of osteoconductive new bone formation. Opposing to some reports no visible resorption of any of the two used xenografts via osteoclastic activity at the 4 months period could be detected. Endobone[®] as a particulate bone replacement xenograft leads to comparable amounts of new bone formation in sinus augmentation procedures compared with a control xenograft (BioOSS[®]).

Comparative study of BMPS for alveolar augmentation/osseointegration and delivery strategies

Presenter: Wikesjo U

Georgia Health Sciences University, Augusta, GA, USA

Co-authors: Wikesjo U, Susin C

Georgia Health Sciences University, Augusta, GA, USA

Background: Bone morphogenetic proteins (BMPs) including BMP-2, OP-1 and GDF-5 have been extensively evaluated and

shown effective/preferred substitutes to autograft bone and bone biomaterials in preclinical and clinical settings.

Aim: The objective of this study was to using a purpose-designed dental implant surface as a delivery system for BMP-2, OP-1, and GDF-5 in the first side-by-side comparison evaluate the potential of these BMPs to support clinically relevant alveolar augmentation and osseointegration.

Methods: Routine supraalveolar critical-size peri-implant defects (*Journal Clinical Periodontology* 2006;33:846–54) in 30 young adult Hound Labrador mongrel dogs received implants coated with rhBMP-2 at 0.75, 1.5 and 3.0 mg/ml (30, 60 and 120 µg/implant), rhOP-1 at 1.5 and 3.0 mg/ml (60 and 120 µg/implant), rhGDF-5 at 30, 60, and 120 µg/implant, or served as sham-surgery controls (uncoated implants). The implant sites were evaluated (using radiographic and histologic parameters) for local bone formation/maturation, resident bone remodeling, implant osseointegration, and aberrant healing events.

Results: Implants coated with rhBMP-2 induced dose dependent, clinically relevant, significant bone formation compared with control ($P < 0.01$). Notably, rhBMP-2 dose was inversely associated with bone maturation and extensive seroma formation. Implants coated with rhOP-1 also exhibited robust bone formation/maturation. In contrast, there was a comparably modest induced bone formation for implants coated with rhGDF-5 and compared with control ($P < 0.05$).

Conclusions and clinical implications: BMP-2, OP-1 and GDF-5 induce dose dependent clinically relevant bone formation. Bone maturation and associated aberrant healing events appear inversely correlated with dose.

Dentoalveolar reconstruction using a sugar-coated bone regenerative approach: a micropig jaw model

Presenter: Yeo A

National Dental Centre, Singapore, Singapore

Co-authors: Yeo A¹, Bina R², Christina C¹, Simon C²

¹National Dental Centre, Singapore, Singapore, ²Institute Of Medical Biology, Singapore, Singapore

Background: Polycaprolactone (PCL)-based scaffolds have been extensively studied and demonstrated excellent results in bone tissue engineering applications. The use of customized polycaprolactone-tricalcium phosphate (PCL-TCP) displayed great potential from recent micropig jaw model study. As a prove of concept, our team demonstrated that following lateral ridge augmentation, using guided bone regeneration principles, of a challenging 1-wall defect, the new bone matrix and new bone marrow were in direct contact with the PCL-TCP scaffold rods and invading the interstices, suggesting good biocompatibility and high osteoconductivity. However, the efficacy of pure PCL-TCP scaffolds was reported to be only 50% when compared with autogenous block grafts.

Aim: In line with the promising results that were recently obtained, our team further planned to utilize a bioactive agent, heparan sulphate (HS), to recruit and stimulate endogenous growth factors that play an influential role in bone repair and regeneration. If proven successful, the need for autogenous bone

grafts in such dentoalveolar reconstruction can be dismissed. In addition, patient morbidity and “downtime” can be reduced.

Methods: A total of seven pigs were selected for the study. Four defects in each pig were randomly assigned to receive either one of the following guided bone regeneration (GBR) procedures for a period of three (four animals) and six (three animals) months:

PCL-TCP scaffold + collagen membrane,

PCL-TCP scaffold + 30 µg HS₃ + collagen membrane,

PCL-TCP scaffold + 10 µg BMP₂ + collagen membrane,

PCL-TCP scaffold + 30 µg HS₃ + 10 µg BMP₂ + collagen membrane,

Each micropig received one sample of each treatment and were subjected to microCT analysis upon sacrifice.

Results: MicroCT results demonstrated comparable new bone formation in the heparan sulphate alone group as compared with groups with added bone morphogenic proteins.

Conclusions and clinical implications: With the further anticipated augmentation of wound healing and bone regeneration by HS activity, a viable regenerative approach that is cheaper and more effective is very promising. Additional study with a larger sample size is required to further validate the results prior commencing on a pilot clinical trial.

Novel xenograft technique using the stem cells cultured conditioned media for bone regeneration

Presenter: Yoshimi R

Department of Oral and Maxillofacial Surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan

Co-authors: Yoshimi R, Katagiri W, Osugi M, Inukai T, Yamamoto A, Hibi H, Ueda M

Department of Oral and Maxillofacial surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan

Background: Allogeneic bone graft had never been first choice for the treatment of bone defects, because of infection, immunorejection, and unsatisfied bone regeneration compared with autograft. However, mesenchymal stem cells (MSCs) and stem cells from human exfoliated deciduous teeth (SHED) are multipotential cells and reported to be immunoprivileged as well as immunosuppressive, and these cells have possibility of cell source for allogeneic cell transplantation. Recently, some reports were published that allogeneic bone regeneration achieved measure of success using by these stem cells *in vivo*. Moreover, it has been revealed that the stem cells secreted many growth factors and chemokines during their cultivation. Therefore, we supposed that the media cultured these stem cells had osteogenesis potential for including the osteogenetic-related factors, and we studied these possibilities for bone regeneration.

Aim: We aimed to establish new allogeneic bone regeneration therapy by using the stem cells cultured conditioned media, and pre-estimate the osteogenesis potential of the media in xenograft periodontal bone defect model.

Methods: The stem cells cultured conditioned media (CM) were collected while human MSCs (hMSCs) and SHED was cultured in the basal media (BM). Dog MSCs (dMSCs) were

prepared, and cultured in hMSCs-CM or SHED-CM. These pretreatment dMSCs assessed cell proliferation by bromodeoxyuridine (BrdU), migration by migration assay, and osteogenic activity by ALP and von Kossa staining. In addition, periodontal bone defects were prepared of the canine mandible, and implanted by using the following graft materials: (1) agarose, (2) agarose/hMSCs-CM, (3) agarose/SHED-CM, and (4) control (defect only). After 4 and 8 weeks of implantation, each defect was radiologically and histologically assessed. Additionally, for evaluation about allergic reaction to these media, drug lymphocyte stimulation test (DLST) and patch test were practiced.

Results: Cell proliferation and migration of dMSCs showed a significant increase by cultured in hMSCs-CM and SHED-CM.

It was observed that dMSCs cultured in hMSCs-CM and SHED-CM differentiated into osteoblasts. In canine periodontal model, the bone regenerated by agarose/hMSCs-CM group and agarose/SHED-CM group was excellent compared with the other groups. The obvious allergic reaction to hMSCs-CM and SHED-CM had never observed.

Conclusions and clinical implications: The results of this study suggested the possibility of xenograft using the stem cell cultured conditioned media in periodontal bone defect. We expect this new technique is applicable in the socket preservation before the dental implant treatment as allogeneic transplantation. We will evaluate safety for allograft and osteogenesis potential.

Posters: Technical and Biological Complications (Abstracts 345–364)

345 | Technical and Biological Complications

Ex vivo bone morphogenetic protein-2 gene delivery using gingival fibroblasts promotes bone regeneration in rats

Presenter: Choi C-H

Department of Periodontology and Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Republic of Korea

Co-authors: Choi C-H¹, Lee E-H², Kim S-H¹, Koo K-T¹, Kim T-I¹, Seol Y-J¹, Ku Y¹, Rhyu I-C¹, Lee Y-M¹

¹Department of Periodontology and Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Republic of Korea,

²Healthcare System Gangnam Center. Seoul National University, Seoul, Republic of Korea

Background: Tissue engineering of alveolar bone using gene therapy may offer potential for optimal delivery of BMP molecules in the fields of periodontal and oral implant surgery. Jin et al. (2003) demonstrated the first successful evidence of periodontal tissue engineering using gene transfer of BMPs. In their study, the osseous lesions treated by bone morphogenetic protein-7 (BMP-7) gene delivery demonstrated rapid osteogenesis, cementogenesis and predictable bridging of the periodontal bone defects. In a later study by Dunn et al. (2005), treatment of dental implant fixtures with BMP-7 gene delivery resulted in enhancement of alveolar bone defect fill and new bone-to-implant contact.

Aim: The aim of the present study was to investigate bone regeneration following *ex vivo* bone morphogenetic protein-2 (BMP-2) gene delivery using human gingival fibroblasts (HGFs) in rat calvarial defects.

Methods: An 8-mm craniotomy defect was created in Sprague-Dawley rats. The animals were divided into four groups: (1) nongrafted group, the defect was left empty; (2) collagen matrix group, the defect was filled with collagen matrix only; (3) HGF group, the defect was filled with nontransduced HGFs on collagen matrix; (4) BMP-2/HGF group, the defect was filled with BMP-2 gene-transduced HGFs on collagen matrix. Animals were sacrificed at 2 and 4 weeks after surgery, and microcomputed tomographic and histologic observations were performed.

Results: The BMP-2/HGF group showed promoted osseous healing of calvarial defects, as compared with the other groups. At both 2 and 4 weeks, regenerated bone area was significantly greater in the BMP-2/HGF group than the other three groups. Quite a few number of transplanted HGFs were observed within the regenerated bone tissues.

Conclusions and clinical implications: The results of this study suggests that *ex vivo* BMP-2 gene delivery induces prominent bone regeneration *in vivo* and human gingival fibroblasts may be useful as target cells for *ex vivo* gene therapy.

346 | Technical and Biological Complications

Therapy of peri-implant mucositis and peri-implantitis

Presenter: Fourmousis I

Department of Periodontology, School of Dentistry, University of Athens, Athens, Greece

Co-authors: Kotsovilis S^{1,2}, Fourmousis I¹, Karoussis I¹, Trianti M¹, Vrotsos JA¹

¹Department of Periodontology, School of Dentistry, University of Athens, Athens, Greece, ²Biomedical Research Foundation of the Academy of Athens, Athens, Greece

Background: Limited data are available on the efficacy of treatment modalities for peri-implant diseases in humans.

Aim: The aim of the present study was to systematically review randomized and nonrandomized controlled (or comparative) trials and retrospective case-control studies published in the dental literature in English, up to and including February 2011, regarding the efficacy of all modalities used for the treatment of peri-implant diseases (peri-implant mucositis and peri-implantitis).

Methods: *PubMed* and *Cochrane* (CENTRAL) databases were searched electronically and 16 journals were examined manually. At the first phase of selection, the titles and abstracts and at the second phase, full-text papers were examined autonomously and in duplicate by two reviewers (S.K., I.F.). On the basis of the inclusion/exclusion criteria, studies including < 5 patients in at least one study group, prospective or retrospective studies without a control (or second) group, cross-sectional studies, case series/reports, animal studies, *in vitro* studies, reviews, consensus reports, expert opinion articles, practice guidelines, letters and editorials were excluded.

Results: The search yielded 2526 potentially pertinent titles and abstracts. After the first phase of selection, 41 articles were selected for full-text assessment. After the second phase, 25 articles: (1) Seven articles on peri-implant mucositis and (2) 18 articles on peri-implantitis were selected.

Conclusions and clinical implications: *Nonsurgical therapy of peri-implant mucositis and peri-implantitis by means of:* (1) Motivation/instruction in oral hygiene, (2) supra- and submucosal mechanical debridement (using carbon fiber curettes/hand plastic instruments or specially designed ultrasonic devices, followed by rubber cup polishing) or one-stage full-mouth mechanical debridement with or without chlorhexidine, (3) Antiseptic therapy and implant surface detoxification/decontamination (using mouthrinses/irrigants/gels, e.g. chlorhexidine, citric acid, hydrogen peroxide, saline), (4) Chemical cleansing therapy (e.g. 35% phosphoric acid etching gel), (5) Local or systemic antibiotics, (6) Er:YAG laser can significantly improve, (1) Peri-implant clinical "attachment" level and (2) Probing pocket depth. Additional improvement might be accomplished by *surgical therapy of peri-implantitis*, comprising: (1) Soft tissue resective surgery and/or implantoplasty, and (2) Osseous regenerative techniques (osseous grafts and substitutes, alone or in combination with

resorbable or nonresorbable barrier membranes). However, the indications and the relative efficacy of the above-mentioned treatment modalities have not been clearly determined and long-term studies are required.

347	Technical and Biological Complications
-----	--

Alveolar antral artery isolation during the sinus lift procedure with the double window technique.
A case report

Presenter: Gatto A

Department of Surgical Speciality, U.O. Dental Clinic, Fondazione IRCCS Cà Granda, University of Milan, Milan, Italy

Co-authors: Speroni S, Maridati PC, Briguglio F Stoffella E, Gatto A, Maiorana C

Department of Surgical Speciality, U.O. Dental Clinic, Fondazione IRCCS Cà Granda, University of Milan, Milan, Italy

Background: As widely described in the literature, sinus lift procedure with technical side, described by Tatum and modified by Boyne and James, is nowadays widely used for implant and prosthetic rehabilitation of maxillary distal edentulous ridge, where the bone support is not dimensionally adequate for a right implant placement. Vascular anastomosis between the posterior superior alveolar artery and infraorbital artery ramifications, called Alveolar antral artery, present in 40% of cases, can be a serious limitation to this procedure.

Aim: Aim of this work is to illustrate, through a case study, the possibility to perform the sinus lift surgery, even in the presence of alveolar antral artery, as long as that procedure has previously determined on the basis of a right X-ray support.

Methods: The patient, 40-year-old male, arrived to our attention, for the implant and prosthetic rehabilitation of the edentulous upper right jaw. The OPT examination showed the need to perform, before the placement of implants, a sinus lift procedure, due to the atrophy of the residual ridge. The Denta CT scan, performed previously, clearly shown the presence of vascular anastomosis between infraorbital artery ramifications and post. sup. alveolar artery in the surgery site. The size and location of the alveolar antral artery were determined by using a Dicom data processing software (Materialize by Mimics) in order to have the exact position during surgery. The surgery was performed by isolating the artery through a double windows.

Results: Sinus lift procedure was performed without any complications and the alveolar antral artery was isolated avoiding the risk of bleeding.

Conclusions and clinical implications: This case report wants to show how a proper analysis carried out by preoperative CT X-rays, allows the management of complex clinical cases, such as the presence of a vascular bundle on the surgery site. The bleeding caused by the section of the alveolar antral artery is the second surgical complications during sinus lift procedure, after perforation of the sinus membrane. It is evident the

importance of a right and correct preoperative investigation for the management of any surgery.

348	Technical and Biological Complications
-----	--

Early oral implant failures: aetiologic factors
(a retrospective study)

Presenter: Kessarlis P

Athens Medical Center, Athens, Greece

Co-authors: Kessarlis P, Hatjigeorges C, Louskos N

Athens Medical Center, Athens, Greece

Background: The failure of the host tissue to establish or maintain osseointegration around dental implants is due to either impaired healing (surgical trauma, systemic characteristics of the host) or overload, or microbial infection. The long-term failure rate of dental implants is generally 5–10%. Discriminating between causes of implant failure is of importance for instituting a successful implant therapy.

Aim: The objective of this retrospective study was to identify clinical and radiographic characteristics of peri-implant disease sites.

Methods: Two hundred and fifty-five fixtures placed to 78 patients (48 female, 30 male, 22–75 years old), of which 154 Axiom (Sallanches, Anthogyr, France) and 101 Replace (Gotenborg, Nobel Biocare-Sweden), with internal conical/triangle, submerged, of those, 134 were maxillary and 121 were mandibular. Preoperative and postoperative antibiotics were used. The mean follow-up period was 378 days. The clinical symptoms of failure included: mobility, persistent pain, infection.

Results: Data recorded included: patient's sex, age, history, complications, additional procedures, location of implants, perio-testing, radiographs. Six maxillary and four mandibular fixtures failed with an overall success rate of 96%. Five hundred and ten sites (255 fixtures) in 78 patients revealed the following results: 90 sites scored 0 (no bone loss), 248 scored 1 (slight bone loss), 30 sites scored 2 (serious bone loss), 62 sites scored 3 (severe bone loss).

Conclusions and clinical implications: On the basis of the published literature, there appears to be a number of scientific issues which are not yet understood. Therapeutic attempts should have their rationale in the restoration of a biomechanical and/or host bacterial equilibrium. It is suggested that implant practitioners should avoid giving guarantees of success to their patients. The most important factors associated with early implant failures are neither the surgical trauma or lack of surgeon's experience nor the infection or smoking. Immunologic factors are involved in osseointegration (Ab avidity to *B. forsythus* and Ab titer to *S. aureus*).

Oral bisphosphonate-related osteonecrosis of the jaw with dental implant; a single case report

Presenter: Kon K

Department of Oral Implant and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan

Co-authors: Kon K¹, Takahashi E², Ozeki M¹, Shimogisi M¹, Shiota M¹, Kasugai S¹

¹*Department of Oral Implant and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan,* ²*Oral Surgery, Kawasaki Social Insurance Hospital, Kanagawa, Japan*

Background: Nitrogen-containing bisphosphonates have been widely applied to patients with osteoporosis to prevent bone fracture. Recently, bisphosphonates-related osteonecrosis of the jaw (BRONJ) after oral surgery has been reported especially in patients treated with intravenous bisphosphonates. Almost all reported BRONJ were related to intravenous administration; however, the reports of BRONJ with oral administration were little.

Aim: The aim of this case report is to demonstrate the management of an oral bisphosphonate administrated patient with osteonecrosis of the jaw bone including dental implant.

Methods: One patient, who had severe pain around implants, referred to Kawasaki Social Insurance Hospital in 2009. She had been treated with antibiotic administration for 1 week at a private dental clinic. Two dental implants had been placed in the lower left molar area. The radiographic examination showed that radiolucency region was observed around the implants, and the both implants partially contact mandibular canal. She had been diagnosed as osteoporosis, received replacement of the left hip replacement arthroplasty, and had been taking oral bisphosphonates, alendronate, for about three years at a dosage of 5 mg/day. Considering these situation, she was diagnosed as BRONJ. Before surgical treatment, bisphosphonates administration was withdrawn by her orthopedic surgeon. Sequestrum including two implants was resected, and treated with systemic antibiotics and local irrigation.

Results: At present, the patient has no radiographic, no abnormal sensation and no clinical evidence of recurrence 6 months after the surgery.

Conclusions and clinical implications: Osteonecrosis and implantitis in patient treated by oral bisphosphonates seem to be rare, but osteonecrosis around osseointegrated implant will become severe morbidity, not only exposure of bone sequestrum in oral cavity with severe pain, postoperative wound after sequestrotomy, but also difficulty of mastication. Informed consent should be provided related to possible future implant failure and possible osteonecrosis of the jaw bone.

Prevalence and risk indicators of peri-implant diseases in a Belgian population: a cross-sectional study

Presenter: Lasserre J

Catholic University of Louvain, Brussels, Belgium

Co-authors: Lasserre J, Marrone A, Brecx M

Catholic University of Louvain, Brussels, Belgium

Background: Since several years, the apparition of peri-implant diseases has been observed but few large clinical studies provide data on the prevalence and risk indicators of this biological complication.

Aim: The primary outcome of this study is to evaluate in a Belgian population (>100 treated patients) the frequency of mucositis and peri-implantitis in patients with implants of at least 5 years in function. The secondary outcome is to assess some of the patient's characteristics as possible risk indicators for peri-implant diseases.

Methods: One hundred and three patients (38 males/65 females) with a total of 266 implants were examined during the year 2010. Implants had been inserted in university hospitals as well as in private clinics and the mean time of implants in function was 8.5 years (± 3.2). The average patients' age in the population was 62 years (± 13.4). General health informations were recorded as well as habits regarding smoking, maintenance visits and oral hygiene. Full mouth clinical parameters (PPD, BOP, PII) were assessed and radiographs taken to determine the periodontal status and implants diagnosis.

Results: On one hand, the prevalences of mucositis and peri-implantitis at the patient's level were 31% and 37%, respectively. On the other hand, they were 38% and 23% at the implant's level. Patients with a history of periodontitis (OR = 1.3) and with diabete (OR = 1.31) were slightly prone to peri-implantitis. The association was stronger for hepatitis patients (OR = 2.43) and when diabete and history of periodontitis were present at the same time (OR = 1.77). No association was found between smoking, gender and peri-implantitis in this population.

Conclusions and clinical implications: This study shows that after a mean time of 8.5 years of function an important proportion ($\pm 60\%$) of implants present biological complications (mucositis or peri-implantitis). Furthermore, a positive correlation exists between diabete, periodontitis and peri-implantitis. This suggests that patients with such characteristics could be more prone to develop peri-implant diseases. As a consequence they should be informed before implant placement and frequently recalled for maintenance visits. Finally, other general conditions like hepatitis could be associated with peri-implantitis but new larger clinical trial are needed to confirm these findings.

Effect of laser Er:YAG in peri-implantitis treatment

Presenter: Costa AL*Faculdade Medicina Dentária da Universidade do Porto, Porto, Portugal***Co-authors: Costa AL, Correia F, Felino A, Almeida RFE, Pereira MS***Faculdade Medicina Dentária da Universidade do Porto, Porto, Portugal*

Background: Peri-implantitis is an inflammatory process that affects soft and hard tissues around a functioning and osseointegrated implant that can result in loss of supporting bone and consequent implant lost. Peri-implantitis have microbiological colonization and it was assumed that the removal of bacterial plaque biofilms from the implant surface may be a prerequisite in order to stop disease progression. The primary treatment in peri-implantitis lesions is to get access to the implant surface for debridement and decontamination in order to achieve resolution of the inflammatory lesion. No single method of surface decontamination was found to be superior. Using conventional means of therapy, eradication of pathogens by mechanical means on implant surface structures is difficult. It is still dubious which therapeutic strategies are the most efficacious for the treatment of peri-implantitis lesions according to their morphology, extent and severity. Another treatment model that may offer an advantage over traditional mechanical treatment includes the use of laser therapy; data have shown that treatments with Er:YAG laser have bactericidal effect and that can debride the implant surface effectively and safely. Slightly better clinical results have been reported by Er:YAG laser treatment as compared with traditional nonsurgical mechanical debridement.

Aim: To review on literature on what is the effect of Er:YAG laser in peri-implantitis treatment.

Methods: Search in PubMed for the articles published in the last 5 years with the keywords "laser Er:YAG peri-implantitis".

Results: Search provided nine results; one was excluded by applying the zirconia implants.

Conclusions and clinical implications: Degranulation and implant surface debridement its obtained effectively and safely by Er:YAG laser. Er:YAG laser seemed to be more suitable in reduction of bleeding on probing (BOP), probing depth (PD) and clinical attachment level (CAL) gain when compared with other techniques of debridement and in promote reosseointegration. There is a definite need for more well designed studies (preferably longitudinal, randomized controlled clinical trials) to assess the impact of laser treatments and whether there are threshold values beyond which nonsurgical intervention may not be possible.

Is titanium allergy a myth or reality?

Presenter: Macan D*Department of Oral and Maxillofacial Surgery, University Hospital Dubrava, School of Dental Medicine, University of Zagreb, Zagreb, Croatia***Co-authors: Gabric-Panduric D¹, Biocic J², Music S³, Macan D²***¹Department of Oral Surgery, School of Dental Medicine, University of Zagreb, Zagreb, Croatia, ²Department of Oral and Maxillofacial Surgery, University Hospital Dubrava, School of Dental Medicine, University of Zagreb, Zagreb, Croatia, ³Division of Materials Chemistry, Ruder Boskovic Institute, Zagreb, Croatia*

Background: A worldwide use of titanium implants in medicine and dentistry has grown exponentially in the last three decades. Titanium alloys are being widely used for dental implants, endo-prostheses, pacemakers, stents and orthodontic brackets. A good corrosion behaviour and high biocompatibility are primarily gained by an immediately formed oxide film on the surface. However, sporadic cases of titanium incompatibility that deserve attention have been reported. The clinical manifestation included urticaria, eczema, oedema, redness, and pruritus of the skin and mucosa or rarely depression and neurological disturbances. The forementioned symptoms can be grouped into the I and IV type of hypersensitivity. Patients that are affected by metal allergens are generally diagnosed using the epicutaneous (patch) test which has not yet been standardized for titanium and therefore cannot be clinically reliable.

Aim: Aim of the presented case was evaluation of two available diagnostic methods in exclusion or confirmation of suspected titanium allergy.

Methods: After placement of two Astra Tech dental implants in the right mandible, a 44-year-old patient complained of subjective sensations which in the opinion of patient were associated with potential titanium allergy. There was neither clinical sign nor symptom related to allergic etiology. On the patient's request, explantation of the inserted dental implants was done followed by epicutaneous testing and scanning electron microscopy (SEM) (Field Emission Scanning Electron Microscope, JSM-7000F, Jeol Ltd, Japan) of the explanted implant surfaces. Based on the SEM technique, mapping of the tissue chemical elements found on the implant surface using *Cameo* software (CAMEO Chemicals, CAMEO Software Suite, USA) was also performed.

Results: Suspected titanium allergy was not confirmed either by epicutaneous testing or after scanning electron microscopy and consequent chemical elements analysis of the found tissue on the implant surface. On SEM images there were no implant surface irregularities. Chemical analysis of the tissue found on the explanted implant surface has confirmed normal bone tissue between implant threads on low magnification and on higher magnification some organic material which can respond to osteoblast on the titanium implant surface. These results may sustain normal osseointegration process.

Conclusions and clinical implications: Epicutaneous testing and current method of chemical elements mapping based on SEM technology are efficient and reliable diagnostic method in potential exclusion or confirmation of suspected titanium allergy.

Initial results for adjunctive treatment with aPDT on immediate placed implants in periodontal compromised sites

Presenter: Möller F

University Cologne, Cologne, Germany

Co-authors: Neugebauer J^{1,2}, Möller F², Kistler F¹, Kistler S¹, Scheer M², Rothamel D², Bayer G¹, Zöller JE²

¹Private Practice, Landsberg, Germany, ²University of Cologne, Cologne, Germany

Background: The treatment decision for the last remaining and periodontal compromised teeth is difficult to avoid further complication and to fulfill the patient expectations for a stabile prosthetic restoration. The use of tilted implants allows minimizing the number of implants and the corresponding risk of complication. Immediate loading with immediate restoration is a treatment option even with a reduced number of implants with a high success rate. However, with the improved implant surfaces an increased number of retrograde peri-implantitis is observed. The effective management of the chronically infected extraction socket before the implant placement is determining the success rate. The antimicrobial photodynamic therapy (aPDT) is proven to reduce the risk of dry sockets after tooth extraction.

Aim: The aim of this study is to evaluate the effectiveness of aPDT on the success and complication rate of immediate extraction and restored implant sites.

Methods: Between 2005 and 2010 a total number of 102 Patients were treated and received 92 restorations in the mandible and 23 in the maxilla with a total number of 509 implants. One hundred and forty-seven implants (control) were placed in fresh extractions sockets without any adjunctive procedure. Sixty-seven implant (aPDT) sites were prepared after the photodynamic therapy was applied for infection control at the extraction socket.

Results: Two out of 147 implants failed and showed no osseointegration at the time of impression taking. Another 10 implants showed signs of retrograde peri-implantitis or peri-implant sequester resulting in a complication rate of 8.1% in the control group. Two implants with retrograde peri-implantitis could be treated with systemic antibiotic therapy; one additional required a surgical procedure. Seven implants required a surgical revision to remove sequester. In the aPDT-group all implants reached osseointegration at the time of impression taking and only one implant showed peri-implant sequester (1.5% complication rate). No sign for retrograde peri-implantitis were observed in the aPDT-group.

Conclusions and clinical implications: Immediate implant placement in periodontal compromised sites is showing a significant number of sequester formation. This seems a special side effect of immediate loading in the mandible requesting additional surgical procedures. Utilizing aPDT seems to be beneficial to reduce the complication rate for immediate loaded extraction sides. More data needs to be collected to back-up the statistical findings.

Dental implant complication: definition, categorization and ratio of complications to failures

Presenter: Moneim A

*Los Gatos Dental Center, Los Gatos, United States
Alameda County Medical Center, Oakland, USA*

Co-authors: Moneim A^{1,2}, Souza D¹

¹Los Gatos Dental Center, Los Gatos, USA, ²Alameda County Medical Center, Oakland, USA

Background: Patients and practitioners might face complications at any time and place during all the process of implant therapy and maintenance programs. This endless process teaches people that it is primordial to find the best long-term solutions for their problems, which means solutions that prevent recurrences.

Aim: To define and categorize dental implant complication and to understand its implication with failures.

Methods: Dental implant complication is defined and classified into four standardized categories relative to the host, practitioner-technique, material-design and unknown causes. This retrospective study investigates complication rates, failure rates and the ratio of complications to failures in an 8-year private practice experience.

Results: The sample was composed of 179 patients with a total of 349 dental implants (Straumann, Basel, Switzerland). The overall frequency of implant complications was 12.89%, which represents a complication rate 2.5 times higher than the failure rate of 5.15%. A chi-square test was conducted and showed that host and practitioner-technique related-causes had higher rates compared material-design and unknown causes ($P < 0.001$).

Conclusions and clinical implications: A broad definition of dental implant complication is presented with a categorization system that can be applied clinically to any type or phase of implant treatment. The monitoring of the ratio of complications to failures should help with prevention and lead to less loss of dental implants. The current study may though be used to make uniform the monitoring of complications based on the root of the problem and to form a basis for comparison in future studies in dental implant therapy.

Study of microleakage at implant-abutment connection

Presenter: Muñoz M

UPC, Barcelona, Spain

Co-authors: Gil X¹, Muñoz M^{1,1}, Delgado L¹, Ríos V¹, Bullón P¹, Lázaro P¹, Herrero M¹, Lázaro P², Herrero M²

¹UPC, Barcelona, Spain, ²University of Seville, Seville, Spain

Background: Bone crestal loss can be caused by a variety of factors such as, peripheric biological sealing, microleakage at abutment-implant gap, and the bones reaction to biomechanical loads. To minimize the entry of bacterias into the microgap and therefore allow the interior of the implant to be colonized, we need very precise connections with distances inferior to two micras, the average size of a bacteria.

Aim: Determine the microgap fit between abutment and Klockner Essential Implant, and the distance which is established in the connection.

Methods: The fit of 20 abutment-implants was determined. They were placed in polyester resin to avoid micromovements. The implants were cut longitudinally by a high precision diamond disc machine (Aucotomn) and observed with an optical Zeiss 240 microscope and an electronic JEOL 6400 high-resolution microscope. An image analysis system was used to determine the adjustment distances. Masticatory forces can influence the misfit between an abutment-implant connection, therefore, chewing was simulated by a servo hydraulic machine (MTS Bionix) (35 kg load).

Results: Three different types of abutments were used, and these were classified in three groups. The average abutment-implant distance was 1.24 ± 1.33 for group 1, 1.66 ± 0.93 for group 2, and 2.78 ± 1.83 for group 3. In group 1 and 3, the abutment-implant distances were <2 micras in their most external part. In all three groups, a decrease in distance was observed from the most external to the internal part of the implant. A cold welding is produced, whose nanometric distance is smaller than the diameter of the bacterias susceptible to colonize the interior of the implant. The movements associated with chewing can increase the distances in the adjustment, but in this study they did not exceed $1.5 \mu\text{m}$.

Conclusions and clinical implications: The causes for good fit are mainly two: implant design and the quality of mechanization and polish to which the implants and their connections are submitted. The distance established in the abutment-implant of this study is less than the size of a bacteria, causal factor of periimplantitis. Nonetheless, the distances are greater than the size of some endotoxins produced by these bacterias, and as observed in other studies, the possible originators of the degradation of the abutments and implants.

356	Technical and Biological Complications
-----	--

Nonsurgical treatment of peri-implantitis with laser, photosensitization and air-abrasion: a systematic review

Presenter: Papadopoulos C

Department of Periodontology @ Implant Biology, School of Dentistry, Aristotle University, Thessaloniki, Greece

Co-authors: Papadopoulos C, Vouros I, Christos K, Antonios K

Department of Periodontology @ Implant Biology, School of Dentistry, Aristotle University, Thessaloniki, Greece

Background: Air-abrasion, laser application, and photodynamic measures are used for surface decontamination during the surgical treatment of peri-implantitis. However, information on the efficacy of these therapeutic modalities in the nonsurgical treatment of peri-implantitis is limited.

Aim: The aim of the present systematic review was to address the focused question: "What is the efficacy of laser, photodynamic, and air-abrasive techniques in the nonsurgical treatment

of peri-implantitis when compared with each other and/or to other therapeutic approaches?"

Methods: An electronic search of the MEDLINE database was carried out on articles published in the English language up to and including January 2011. The online search was supplemented by manual searching of 15 major peer-reviewed journals. All prospective longitudinal studies were considered, including randomized controlled trials, controlled clinical trials, cohort studies, case-control studies, and case series. A two-stage screening process was performed independently and in duplicate. Regarding clinical studies, publications with a minimum of 10 patients (per group) and a follow-up period of at least 3 months were included. Animal studies reporting on clinical and/or histological findings had to report on a minimum of four animals and a follow up period of 2 months.

Results: The search strategy retrieved a total of 516 articles and five studies that fulfilled the inclusion criteria were finally included in the systematic review. Treatment with Er:YAG laser seems to be equally effective to mechanical debridement and irrigation with chlorhexidine in reducing probing depth after 6 months. Moreover, Er:YAG laser resulted in significantly higher reduction of bleeding on probing. However, the observed clinical improvements were not maintained for a period of 12 months, especially in advanced peri-implantitis cases. Histological observations from human biopsies suggest that a single course of nonsurgical Er:YAG laser application may not be adequate for treatment of peri-implantitis. Er:YAG laser and air-abrasive treatments show similar reductions of probing depth, suppuration, and bleeding, but the overall clinical improvement at 6 months after therapy seems limited for both treatment approaches in severe peri-implantitis lesions. Microbiological data indicate that both photodynamic therapy and conventional surgical treatment reduce periopathogenic bacteria in ligature-induced peri-implantitis in dogs.

Conclusions and clinical implications: Nonsurgical air-abrasive, laser, and photodynamic treatments seem to equally improve clinical parameters in peri-implantitis cases. However, the magnitude of clinical improvement appears to be limited and the available documentation is weak for firm recommendations regarding the application of these techniques as therapeutic measures for advanced peri-implantitis.

357	Technical and Biological Complications
-----	--

Retrieval of a fractured screw in implant dentistry

Presenter: Park S

Bucheon St Mary's Hospital, Bucheon, Republic of Korea

Co-authors: Park S

Bucheon St Mary's Hospital, Bucheon, Republic of Korea

Background: Mechanical complications, such as loosening or damaging of the prosthetic components of an osseointegrated implant, may occur.

Aim: The technique described in this article involves the use of inexpensive instruments commonly found in dental offices.

Methods: Eight fractured prosthetic retaining screws treated with fixed detachable hybrid prostheses were subjected to a failure analysis.

Results: The procedure used for the removal of the fractured abutment screw head is described in detail in this clinical report.

Conclusions and clinical implications: This report describes the management of a loose cement-retained implant supported crown where the thread of the abutment screw had fractured away from the body of the screw and was retained within the implant. The importance of multidisciplinary skills in the treatment of patients with implants is discussed.

Prognostic factor for early and late failures in the restorative moment and 5 years late

Presenter: Sánchez-Pérez A

School of Dentistry, Murcia, Spain

Co-authors: Sánchez-Pérez A, Moya-Villaescusa MJ, Jornet-García A

School of Dentistry, Murcia, Spain

Background: Biological failure of implants can be defined as the inability of tissue to establish or maintain osseointegration. These failures are classified into early (failure to establish osseointegration) and late (failure to maintain osseointegration). As a fact, there does not exist any measure to determine what implant could be a failure in a preventive way.

Aim: The purpose of this study was to evaluate patient factors, and treatment characteristics to identify possible prognostic factors for implant failure, at the moment of prosthetic rehabilitation and after a follow-up period of 5 years.

Methods: A total of 158 consecutive patients (84 females and 74 males) were included in this prospective study. They represent the total patient population treated by means of implants at the Department of Periodontics of the Odontologic University Clinic of Murcia from 07 November of 2005 to 06 October of 2006. Only one implant per patient was selected in order to establish a followed schedule. The inclusion criteria include: at implant insertion, a minimal bone height of 10 mm had to be available, no RTG technique necessary, no present absolute or relative contraindication, at least a manual stability to implant insertion, bone level until implant collar, and having accepted and gave their informed consent previous to their recruitment. The classical surgical protocol with strict sterility measures was used for all surgeries. Bone quality assessment was performed using the Lekholm & Zarb (1985) index. Potential risk factors were evaluated by chi-square tests and post hoc analyses.

Results: For early failures the following variables were statistically significant length of the implant (< 10 mm vs. > 12 mm) bone type (< 2 vs. > 2), mobility 1 at moment of insertion (< 0 vs. > 2) and mobility 2 at the moment of rehabilitation (< 2 vs. > 5). However, for late failures none of these variables was significant.

Conclusions and clinical implications: The EARLY implant success/failure depends on variables such as the bone type, the implant length and the mobility 1 and 2. However, the insertion torque does not affect to end result. On the contrary, LATE success/failure are independent of these variables.

Little effect of chlorhexidine and EDTA-gel on contaminated titanium surfaces

Presenter: Schneider S

University of Oslo, Oslo, Norway

Co-authors: Schneider S, Henderson E, Petersen F, Haugen HJ, Ekstrand K, Ekfeldt A, Wohlfahrt JC

University of Oslo, Oslo, Norway

Background: The formation of a bacterial biofilm on implant surfaces is critical to the development of peri-implantitis. To treat the peri-implant infection it is necessary to eliminate the biofilm. So far the scientific rationale for using a specific chemical decontaminant is though scarce.

Aim: The aim of this *in vitro* experimental study was to compare the efficacy of different chemical solutions when used for chemical debridement of biofilm contaminated polished titanium surfaces.

Methods: Commercially pure titanium disc with a diameter of 6.24 mm and height of 2 mm, mirror-polished with a mean R_a -value of 37.11 were used as test-surfaces. A biofilm was simulated with multilayers of *Staphylococcus epidermidis* covering the entire titanium surface. Several different chemical decontamination agents were tested: 3% H_2O_2 , 0.2% chlorhexidine, 24% EDTA-gel (PrefGelTM, Straumann, Basel, Switzerland), 3% H_2O_2 mixed with 1.6 g/l TiO_2 , and sterile H_2O . Each agent was applied for 2 min on the contaminated surface. The surfaces were thereafter washed with sterile saline. The decontaminated surfaces were evaluated with SEM and bacteria counts were detected with photospectrometry.

Results: SEM image of decontamination with sterile saline showed no significant effects. Similar finding was found for 0.2 vol% Chlorhexidine. SEM image of decontamination with 24% EDTA-gel showed breakage of the biofilm layer but still large amounts of remaining bacteria. Images of decontamination with 3 vol% H_2O_2 and the mixture of 3 vol% H_2O_2 and 1.6 g/l TiO_2 powder showed a marked visible difference as compared with the other tested solutions. Optical density analysis using the Synergy HT Multi Detection microplate reader showed significantly ($P < 0.05$) lower amounts of bacteria left after decontamination with 3 vol% H_2O_2 and 1.6 g/l TiO_2 compared with all other solutions. Chlorhexidine and 24% EDTA-gel were not significantly better than rinsing with sterile saline. Decontamination with 3 vol% H_2O_2 was significantly ($P < 0.05$) better than Chlorhexidine and 24% EDTA-gel.

Conclusions and clinical implications: 3% H_2O_2 and 1.6 g/l TiO_2 decontaminated the titanium surfaces significantly better than all the other tested solutions but further *in vitro* and potentially animal experimental studies will be necessary before clinical testing. 0.2% Chlorhexidine, 24% EDTA-gel and sterile saline had minor and nonsignificant effects on the biofilm.

Effect of crestal module design and implant surface on late implant failure with osteonecrosis of jaw under oral bisphosphonate therapy

Presenter: Seo J-S

College of Dentistry, Yonsei University, Seoul, Korea

Co-authors: Seo J-S, Doh R-M, Kim H-J, Chung W-Y, Tan C-C, Park W

College of Dentistry, Yonsei University, Seoul, Korea

Background: Late implant failure or osteonecrosis of the jaw caused by dental implant under bisphosphonate therapy is emerging issue in implant dentistry. Even the incidence is low compared with the tooth extraction; it results in disastrous bone defect and this makes a very complex and difficult situation.

Aim: In our study, we will try to find correlation between the crestal module designs or implant surfaces and describes case series of osteonecrosis of the jaw associated with late implant failure in patients under oral bisphosphonate.

Methods: Ten consecutive patients suffered late implant failure or osteonecrosis of the jaw by dental implant under bisphosphonate therapy were evaluated. We classified the crestal module design as external butt joint design, internal butt joint design and conical seal design. We also classified the surface characteristics according to the manufacturer and evaluate about attached gingiva.

Results: Most of the patients were over 60 years and the majority of them were female. All patients were prescribed bisphosphonate due to the osteoporosis, not for the treatment of malignant bone diseases. There was no correlation with specific crestal module design or surface characteristics. All implants were osseointegrated but the complications occurred in late period.

Conclusions and clinical implications: Irrespective of the kinds of crestal module design and implant surface characteristics, it could be happened. So close follow-up and oral hygienic care should be focused in all implant patients under bisphosphonate therapy irrespective of the kind of implants.

Study of resistance to antibiotics in periimplantitis

Presenter: Sfarghiu L

S.C. Dentalcom S.R.L., Donit Association, Brasov, Romania

Co-authors: Bodnar DC¹, Tanase G¹, Popovici IA¹, Ispas DC¹, Muntianu L¹, Sfarghiu L², Sandulescu M¹

¹Faculty of Dentistry, University Of Medicine And Pharmacy Carol Davila, Bucharest, Romania, ²S.C. Dentalcom S.R.L., Donit Association, Brasov, Romania

Background: Periimplantitis is a quite common illness in the implantology-prosthodontics rehabilitation. An untreated or improperly treated periimplantitis can lead to compromised dental implant.

Aim: The purpose of this study is the investigation of phenotypic resistance to antibiotics of *Staphylococcus aureus* and *Pseudomonas aeruginosa* monospecific experimental biofilms, isolated from infectious peri-implantary diseases.

Methods: The clinical and microbiological study was conducted on a total of four strains of *Pseudomonas aeruginosa* and *Staphylococcus aureus*, isolated from infectious periimplantary processes, from 23 patients, during 2007–2010. The identification of strains was performed using the automated VITEK system. Determination of sensitivity spectrum to antibiotic of planktonic cells was performed by diffusion method (CLSI/CNCLS). The antibiotics used were: colistin for *P. aeruginosa* and gentamicin for *S. aureus*.

Results: It was noticed that microbial biofilms formed in the presence of various concentrations of antibiotic are similar in number and relatively stable, unlike developed biofilm in the presence of the antibiotic, which has a maximum at 48 h, then cell number drops sharply, which demonstrate a mature biofilm with cells detachment.

Conclusions and clinical implications: This shows that the antibiotic exerts a selective pressure on cells included in the biofilm, preventing the attainment of high cell densities, which would rush ripening and disintegration of the microbial biofilm. However, antibiotics destroy microbial biofilms, but also promote the early presence of microbial biofilms and their persistence over long periods of time in the body.

Retrospective study of conical connection implant (Ankylos dental implant)

Presenter: Shim H

Hallym Sacred Heart Hospital, Hallym University, Anyang, Republic of Korea

Co-authors: Shim H, Yang B, Yoon AY

Hallym Sacred Heart Hospital, Hallym University, Anyang, Republic of Korea

Background: The standardization of connection between fixture and abutment has not been defined. The success of dental implants was no always depends on connection. However, the connection mechanisms is one of the most important things for dental implant success.

Aim: In the present study, we investigate the clinical performance of conical connection implant (Ankylos implant).

Methods: A total of 465 conical connection implants were placed in 180 patients from April 2005 to March 2010. The mean follow-up loading period of implants which was considered successful was 880+ days. We recorded the age, sex, installation site, reason for edentulous region, bone density of installation site, diameter and length of dental implants and periods from installation to uncovering surgery using patient's medical chart.

Results: Twelve ankylos implants were lost during preloaded period. Four hundred and fifty-three implants provided excellent clinical performance during 880+ days on an average. The success rate of this conical connection implant system was 95%.

Conclusions and clinical implications: After a 5-year observation period it can be stated, the 95% ankylos implant are successfully supporting implant prostheses. Further data are needed to evaluate the long-term prognosis of implant-supported restoration.

Photoelastic stress evaluation of 3-unit implant restorations supported with straight and inclined implants

Presenter: Terzioglu H

Department of Prosthodontics, Faculty of Dentistry, Ankara University, Ankara, Turkey

Co-authors: Terzioglu H¹, Ozkir SE²

¹*Department of Prosthodontics, Faculty of Dentistry, Ankara University, Ankara, Turkey, ²Bozuyuk Devlet Hastanesi, Eskisehir, Turkey*

Background: Dental implants are revolutionary improvement in functional and esthetic rehabilitation. Biomechanics is the one of the main factors for achieving long-term success of implant-supported prostheses. It is important to distinguish the effects of macrodesign and straight/inclined implant differences over stress distribution. Macro designs of implants have been introduced to optimize bone and soft tissue loading under conditions of applied axial and oblique direction of compression, tension and torque.

Aim: The aim of this study was to find out whether placement of implants in different macrodesigns, in the posterior region with or without inclination and splinting them, has a biomechanical rationale.

Methods: In this study, the photoelastic response of four different types of implants which were inserted with different angulations and restored with fixed bridges, were comparatively analyzed. The implant types were screw cylinder (ITI, Straumann AG, Basel, Switzerland), stepped cylinder (Frialit2, Friadent GmbH, Mannheim, Germany), root form (Camlog Rootline, Alatec, Wilsheim, Germany), cylindrical implant with micro-threads on implant neck (Astra, AstraTech, Mölndal, Sweden). In the test models, one of the implants was inserted straight while the other one was aligned mesially with 15° angles. Superstructures were prepared as three unit FPD restorations. A 150N loading was applied to the restorations through-out the test.

Results: Stress concentrations around the implants were distributed more balanced when the restoration was loaded on the pontic. Besides, the stress concentrations were mostly observed around the straight placed implants. Inclined implants caused less stress than the straight ones but the stress distribution was not homogenous. The least favorable stress concentration was observed around the root formed implants. The lowest stress was observed around the screw cylinder with microthreads around neck type implant.

Conclusions and clinical implications: As the implants were splinted with fixed restorations, stresses were shared by both implants when the load was applied between the two implants on the pontic. When the load was applied on one of the implants, the remaining implant did not participate in sharing the loads actively. The microthreads around the implant neck is very effective for reducing the stresses. Cylinder type implants are better at stress distribution than the tapering implants.

Customized zirconia abutments: technical complications

Presenter: Vrochari A

Dental School, University of Athens, Athens, Greece

Co-authors: Vrochari A¹, Petropoulou A¹, Pantzari F¹, Chronopoulos V¹, Mattheos N²

¹*Dental School, University of Athens, Athens, Greece, ²School of Dentistry, University of Griffith, Queensland, Australia*

Background: The good long-term clinical results of dental implants are well established, under the scope of osseointegration and function. Esthetics, especially in the anterior maxilla, is another factor gaining importance nowadays. Thus, customized zirconia abutments are replacing the standardized titanium ones at these sites, since they have also very good physical properties and biocompatibility. However, in the clinical practice we are often dealing with failures of such ceramic abutments. These failures could be related to the type of the customized abutment, as well as other factors. High stresses at the abutment–screw–nut interface could be generated as a result of the limited degree of rotational freedom in combination with a slight misfit. This may lead to the loosening of the assembled components and eventually to fracture, at two-material zirconia abutments (e.g. Procera Zr). In the case of two-component abutments (prefabricated titanium post and custom-made zirconia coping cemented on top of that) the weak link is the cement. The failure usually involves separation of the components, without any observed fractures. Other reasons of failure are considered to be defects in the fabrication process, fractures in the green structure, sintering prestresses, or handling errors.

Aim: The purpose of this poster is to present the use and the technical complications of customized zirconia abutments, through a series of clinical cases.

Methods: Three customized zirconia abutments were used in three different patients, in the esthetic zone, to achieve optimal esthetics. In two cases, a two-piece abutment with internal connection (Procera Zirconia) was utilized. In the third patient, a two-component abutment with cement retention was used.

Results: Failure in all three cases of customized zirconia abutments was observed because of technical complications. Consequently, there was a need to modify the treatment plan.

Conclusions and clinical implications: Customized zirconia abutments exhibit good esthetic, biological and technical outcomes, and they are considered to be a widespread and viable treatment option. However, their use in different clinical cases must be carefully selected. Additionally, great attention has to be given in their manufacturing procedure and adjustment in the laboratory.

Posters: Basic Research (Abstracts 365–440)

365 | Basic Research

Bone morphologic evaluation around immediately placed implants covered with PTFE and PTFE + collagen. An experimental study in dogs

Presenter: Marin C

Federal University of Santa Catarina, Florianópolis, Brazil

Co-authors: Marin C¹, Granato R¹, Bonfante E², Suzuki M³, Coelho P⁴

¹*Federal University of Santa Catarina, Florianópolis, Brazil,*

²*Unigranrio University, Duque De Caxias, Brazil,* ³*Tufts University, Boston, USA,* ⁴*New York University, New York, USA*

Background: After extractions efforts are made to preserve alveolar bone for implant placement. The development of new conservative techniques and the use of biomaterials have increase over the time. Here is presented the evaluation of surgical procedure to preserve alveolar bone after extractions and immediate implant placement.

Aim: The objective of this study was to evaluate the bone morphology around implants placed in fresh extraction sockets and subsequently covered with a PTFE or a PTFE + collagen membrane at early implantation time.

Methods: The second, third, and fourth premolars of nine beagle dogs (~1.5 years of age) were bilaterally extracted and implants of 3.8 × 13 mm (Ossean, Intra-Lock International, Boca Raton, FL, USA) were placed in the distal sockets. One of the implants was covered with a PTFE membrane (single layer) (Osteogenics, Lubbock, TX, USA), another with a resorbable collagen membrane followed by a PTFE (dual layer) membrane (Osteogenics, Lubbock, TX, USA), and the remaining implant was left as controls. Soft tissue and suture hygiene was performed twice a day, and the PTFE membranes were removed 10 days after implantation. The left and right hemi-arches provided implants that remained 3 and 6 week *in vivo*, respectively. After sacrifice, the implants in bone were reduced to ~30 µm nondecalcified thin sections, stained with toluidine blue and referred to optical microscopy.

Results: Postoperative evaluation showed that the soft tissue over membrane covered implants for a period of 3–5 days, followed by PTFE membranes exposure until their removal. Uneventful healing occurred throughout the rest of the study. Histology showed the typical ridge resorption in buccal and lingual plates for control implants. Even though vertical ridge resorption was not hindered, horizontal formation and maintenance of bone over both lingual and buccal plates was observed for implants covered with both single and dual layer techniques.

Conclusions and clinical implications: The presence of a membrane over implants placed following extraction resulted in different alveolar ridge morphology at early evaluation times *in vivo*.

366 | Basic Research

The giant cell reparative granuloma: a case report

Presenter: Şenel N

Oral and Maxillofacial Radiology Department, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Şenel N¹, Özcan İ¹, Erdem TL¹, Atalay B²

¹*Oral and Maxillofacial Radiology Department, Faculty of Dentistry, Istanbul University, Istanbul, Turkey,* ²*Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Istanbul University, Istanbul, Turkey*

Background: Giant-cell reparative granuloma (GCRG), which was introduced by Jaffe in 1953, is a rare, benign lesion with a granulomatous appearance. GCRG peculiarly affects maxilla and mandible, but there are few cases that have been reported in condyle, sinuses, temporal bone, ribs, and femur.

Aim: The aim of this study is to present clinical and radiological features and the surgical and prosthetic management of a patient with giant-cell reparative granuloma.

Methods: Our patient is a 52-year-old male, he applied to Istanbul University Faculty of Dentistry, Department of Maxillofacial Radiology with pain and swelling at the left mandibula. We enquired whether he has any systemic disease and he pointed out that he has had rheumatic fever and was operated for mitral valve replacement. We examined the patient intraorally and we noticed that there were no teeth in the mouth and there was a swelling in the left mandible, at premolar area. The panoramic radiography revealed a radioluscent, irregular bordered lesion.

Results: The presence of a malignant tumor was suspected and some biopsy material was obtained for histologic examination, then GCRG diagnosis was reported. The lesion was excised totally and after the recovery, the treatment of the patient was completed with prosthetic restoration over implants.

Conclusions and clinical implications: The etiology of GCRG is not known clearly for the present. Generally, the first treatment option is total curettage of lesion, but in this case there is a risk of recurrence. In maxilla and mandible the probability of recurrence after the surgical intervention is 15%, for the other skull bones this probability is lower. Some authors suggest that after the steroid therapy no surgical intervention is needed. The biopsy material of our patient was examined histologically and the GCRG was reported, then the lesion was removed totally and the prosthetic management was finalised with prosthesis over implants. There was no recurrence in the control radiography taken 6 months after the operation.

Migration of dental implants into the maxillary sinus: a review of proposed risk factors and recommendations for prevention

Presenter: Agarwal R

Washington Hospital Center, Washington, DC, USA

Co-authors: Agarwal R, Shafie H, Obeid G

Washington Hospital Center, Washington, DC, USA

Background: One complication with posterior maxillary dental implant placement is migration into the sinus cavity. Although dental implant migration is not common it is associated with significant consequences. This type of complication can happen immediately during surgery or during the osseointegration phase. Implant migration is reported in the literature in the form of case reports with various techniques on how to manage the migrated implant. There are many consequences due to migration and most of the case reports published address management strategies. Our objective is to discuss the proposed risk factors, recommendations for prevention, and provide a brief overview of management of the migrated implant.

Aim: Many reports describe the management of migrated dental implants but fail to catalogue the associated risk factors. We attempt to identify and classify the risk factors associated with dental implant placement in the posterior maxilla. Furthermore, we provide recommendations to help minimize these risks.

Methods: A search of the literature was performed relating to dental implant migration. The resulting articles and references were evaluated for relevance. A meta-analysis was performed focusing on common factors associated with implant migration based on clinical descriptions, clinical photos, and/or radiographs. Factors reviewed were timing of migration from placement, implant fixture geometry, anatomical location, previous bone grafting, and prosthetic loading. In addition, we review a case of implant migration from our institution.

Results: Our search resulted in 24 articles discussing dental implant migration, 22 in a casereport format and two retrospective reviews. A total of 65 migrated dental implants were reported. Potential risk factors could not be identified in the migration of 25 implants, whereas in the remainder of the cases one or more factors were identified. Of 31 migrated dental implants, 25 were in the molar region compared with six in the premolar region. Implant migration occurred immediately during surgical placement in 15 cases, migration occurred while healing or during second stage surgery in 13 cases. Only seven cases reported migration occurring after prosthetic loading. Analysis of implant fixture geometry revealed a parallel implant in 23 cases and a screw-type implant in 21 cases. Seven cases of migration were seen in sites with previous alveolar bone grafting before implant placement. The most commonly suggested cause of implant migration was poor implant stability in the posterior maxilla.

Conclusions and clinical implications: Based on our analysis, proposed risk factors can be classified as anatomical location,

instrumentation selection, surgical design, implant fixture design, patient selection, and prosthetic design. Recommendations for prevention are provided in order to improve dental implant stability in the posterior maxilla. Further research is needed on the etiology of dental implant migration.

Effect of different abutment–implant connections on the internal stress distribution: a finite element analysis

Presenter: Amid R

Department Periodontics, Shahid Beheshti Dental School, Tehran, Islamic Republic of Iran

Co-authors: Amid R¹, Lafzi A¹, Khademi M², Raoofi S³

¹Department Periodontics, Shahid Beheshti Dental School, Tehran, Islamic Republic of Iran, ²Ahwaz dental school, Ahwaz, Islamic Republic of Iran, ³Shiraz dental school, Shiraz, Islamic Republic of Iran

Background: A thorough understanding of implant biomechanics is necessary to optimize treatment plan and reduce the risk of mechanical complications and failures. There are numbers of publications that studied the effects of implant diameters, platform switching, ridge diameters or inclination of load applied to implant on stress/strain pattern in surrounding bone. However, the data about stress pattern within implant and also effect of different types of connections on load transfer are rare.

Aim: To evaluate the effect of the type of abutment to implant connection on the stress and strain detected in internal surfaces of dental implants.

Methods: Three different types of implant–abutment connections that could be seen in commercially well-known implant systems, were selected for this study. Sample A: 1.5 mm deep internal hex corresponding lead-in bevel, Sample B: tri-channel internal connection, and Sample C: internal Morse taper with degree of tapering 11° and six antirotational grooves. Four types of loading conditions were simulated in a finite element models: 100 and 300 N load applied vertically and at 15 degree to the long axis of the implant body. The maximum Von Mises stress (maximum equivalent stress) at the surface of abutment and implant were set as output variables.

Results: The maximum stress concentration on the inner surfaces of fixtures was higher than stress in bone in all samples. Stress values in sample B were lowest between all models. However, every change in amount and direction of 100 N axial load, made some increase in stress on fixture surfaces. In overall evaluation, the greatest amounts of stress were found at the inner surface of fixture under nonaxial 300 N load in sample C where 112 MPa stress detected.

Conclusions and clinical implications: The stress analysis in abutment–fixture connection clearly showed that stress concentration could be less when the surface area of these components increased. Creating three or six stops in internal surface of fixture resulted in stress reduction.

Effect of micro thread design on stress and strain pattern in dental implants: a three-dimensional finite element analysis

Presenter: Amid R

Department Periodontics, Shahid Beheshti Dental School, Tehran, Islamic Republic of Iran

Co-authors: Amid R¹, Khademi M², Raofi S³, Kadkhodazadeh M¹

¹*Department Periodontics, Shahid Beheshti Dental School, Tehran, Islamic Republic of Iran,* ²*Ahwaz Dental School, Ahwaz, Islamic Republic of Iran,* ³*Shiraz Dental School, Shiraz, Islamic Republic of Iran*

Background: Some investigators studied the influence of the implant design on stress concentration in the bone during loading and indicated that the implant design was a significant factor influencing the stress created in the bone.

Aim: To investigate the influence of microthread design, adding to implant neck, on stress distribution within implant and surrounding bone, using finite element analysis (FEA).

Methods: A commercially available implant with 3.5 mm diameter and 10.5 mm length and its complement abutment was selected to modeling. (Simple model) for design microthread model, we add microthread in computerized model at implant neck. Modeling of bone was done according to one human CBCT (Cone Beam Computerized Tomography) and consisted of cortical bone with 2 mm thickness and cancellous bone. The force of 100 N in vertical direction applied to entire abutment surface.

Results: Results showed that stress concentrated in cortical bone around implant neck in both model. Equivalent stress of simple model in cortical bone next to implant was 4 MPa and for microthread model was 10 MPa. But microthread model showed decreased values in microthread area vs. simple model at the same location. However, the stress concentration increased at the end of coronal and apical end of microthread area. Maximum Strain also seen around the apex of implant.

Conclusions and clinical implications: Adding microthread design in implant neck cause decrease in stress values in adjacent bone, but area of greater stress were seen at apical and coronal area of microthreads. This design also cause higher strain induced in cancellous bone. The results of this study can be used as an explanation for published data showed more crestal bone loss in fixtures with microthreads placed 0.5 mm below the implant neck.

Comparison between occlusal indicators: articular paper and T-scan. Clinical study

Presenter: Cuenca A

University of Seville, Seville, Spain

Co-authors: Cuenca A¹, Herrero M¹, Muñoz M¹, Daemi R¹, Gil J², Bullón P¹, Ríos V¹, Lazaro P¹, Salas C¹

¹*University of Seville, Seville, Spain,* ²*University of Barcelona, Barcelona, Spain*

Background: Articular paper and T-scan system are two methods with different results for evaluate the occlusal contact points between teeth.

Aim: Primary: evaluate the coinciding record with both systems, articular paper and T-scan.

Second: evaluate the intensity of the contacts in the different points, and compare the perception of the intensity of the contacts.

Methods: *Study population:* 20 patients.

- Inclusion criteria: arch integrity, absence of current orthodontic treatment, absence of articulation pathology, collaborating patient.

- Exclusion criteria: periodontal teeth with mobility.

Registration of contact points in articulating paper: individual registration by two clinicians and it looked for three contacts points in maximum intercuspitation. Independent investigators will record the three contact points, which have more intensity according to the T-scan system. *Data Analysis:* In the data collected is compared the contact point register between both examiners (articular paper) and the T-scan system for to analyze the coincidence. Comparison examiner/T-scan and examiner/examiner: Chi-Squared's Test. Analyze the grade of coincidence: Cochran's Q test.

Results: For compared the register data's coincidence between examiners and T-scan system three level degrees of coincidence were established: (1) one of the three contact points, (2) two of the three contact points, (3) three of the three contact points

- The first coincidence between interexaminers was in 95% of the cases, the second coincidence was in 70% of the cases and the third coincidence was in 15% of the cases.

- The coincidence between one examiner and T-scan was for first coincidence in 80% of the cases, the second coincidence was in 50% of the cases and there was 0% for the third coincidence.

- The coincidence between the other examiner and T-scan was 80% for the first coincidence, 45% for the second and 10% for the third coincidence of the cases.

In this study, it can observe that the coincidence between examiners is greater than examiner and T-scan. The T-scan shows similar contact points with respect to the examiners, but with different intensity in these contact points.

Conclusions and clinical implications: T-scan model is an objective system for analyzed the contact point's intensity.

The articular paper is not a valid method to interpreted the contact point's intensity, but it is necessary for a correct interpretation of contact point's position.

Bacterial and *Candida albicans* adhesion on ultraviolet photofunctionalized implant surfaces

Presenter: Att W

Department of Prosthodontics, School of Dentistry, University of Freiburg, Freiburg, Germany

Co-authors: Att W¹, Kohal RJ¹, Koch C¹, Spitzmueller B², Al-Ahmad A²

¹*Department of Prosthodontics, School of Dentistry, University of Freiburg, Freiburg, Germany,* ²*Department of Operative Dentistry and Periodontology, School of Dentistry, University of Freiburg, Freiburg, Germany*

Background: Ultraviolet light treatment of implant surfaces have been introduced as a novel method to enable more rapid and complete establishment of bone-implant integration. In this

discovery, the bioactivity of the implant surface is improved by changing the physicochemical properties as well enhancing the migration and attachment of osteoblasts. However, it is still unknown whether such photofunctionalization enhances the adhesion of pathogenic microorganisms to the implant surface.

Aim: The aim of this study was to examine whether ultraviolet light pretreatment of implant surfaces influences the initial adhesion of bacteria and *Candida albicans*.

Methods: Five Titanium and zirconia-based materials with commercially available machined and microroughened topographies were used for the investigation. Half of the samples of each material were exposed to ultraviolet light with specific wavelengths. Four oral bacterial strains (*Streptococcus mutans*, *Streptococcus sanguis*, *Prevotella nigrescens*, *Enterococcus faecalis*), one Candida strain (*Candida albicans*) and human saliva were allowed to inoculate on nontreated and ultraviolet light-treated samples. The number of colony forming units was determined. Scanning electron microscopy was performed to examine the morphological distribution of the adherent microorganisms on different surfaces. One-way ANOVA and Tukey test were used to detect significant differences for the desorbed colony forming units values from light-treated and nontreated materials, respectively.

Results: Generally, ultraviolet light-treated surfaces showed no significant differences in the strains tested compared with nontreated surfaces ($P > 0.05$). Significantly higher values were observed with *Prevotella nigrescens* on one ultraviolet light-treated zirconia and ultraviolet light-treated titanium than nontreated surfaces ($P < 0.05$), whereas *Streptococcus mutans* were significantly higher on one ultraviolet light-treated zirconia surface. *Candida albicans* adhered significantly higher to most ultraviolet light-treated surfaces than to nontreated surfaces ($P < 0.05$). In contrast, ultraviolet light treatment did not influence the adhesion of microorganisms of human saliva ($P > 0.05$).

Conclusions and clinical implications: Photofunctionalization of zirconia and titanium surfaces seems not to increase the adhesion of prokaryotic microorganisms, whereas the adhesion of eukaryotic strains seems to be enhanced. Further studies are needed to explore the nature and mechanism of ultraviolet light-mediated enhancement of microorganism adhesion to implant surfaces.

372 | Basic Research

In vitro study of osteoblast differentiation on hydroxyapatite sputtered Zirconia

Presenter: Bhargava S

Tokyo Medical and Dental University, Tokyo, Japan
Co-authors: Bhargava S¹, Kuroda S¹, Aoki H², Ohya K¹, Kasugai S¹

¹Tokyo Medical and Dental University, Tokyo, Japan, ²International Apatite Institute, Tokyo, Japan

Background: Hydroxyapatite is the most widely used bioactive material due to its similarity in composition to bone and its high osseointegrative property that is characterized by its high bonding capability to the surrounding tissues. Sputter coating of hydroxyapatite produces a thin coat which is dense, adherent

and crystalline in nature that improves bone strength and initial osseointegration.

Aim: To evaluate and compare the effect of hydroxyapatite sputtered Zirconia on osteoblast cell attachment, proliferation, and differentiation.

Methods: Bone marrow cells from 5-week old male Wistar rat femur were cultured, passaged and then seeded on to preconditioned zirconia discs (density 2×10^5 cells/cm²; $n = 40$; size = 20 mm diameter) whose surfaces were modified first by sandblasting using Zirconia particles and then subjected to further modification by sputter coating hydroxyapatite followed by hydrothermal treatment. The surface roughness, morphology and chemical composition of the discs were evaluated. The osteoblast cell morphology, the actin cytoskeleton and proliferation were analyzed after 3, 6, 24 and 72 h of incubation. The osteoblast differentiation was examined by staining the mineralized nodules after 14 days of culture.

Results: The surface of the discs showed moderately irregular morphology ($R_a = 0.49 \mu\text{M}$), after sandblasting. The thickness of hydroxyapatite coating was $1.7 \mu\text{M}$ and the morphology reflected the underlying blasted surface. The Energy dispersive spectra of the samples pointed out the surface chemistry of the sandblasted surface was mostly based on the Zirconium and oxygen, revealing high peaks on both the surfaces. The presence of Calcium and Phosphate was evident on the sputtered surface. The cell morphology showed globular cells initially with small cytoplasmic extensions. At later time points cells were stellate-shaped with cell communications being established on the entire surface. The actin filaments showed spherical form in the early incubation time periods which extended to long and straight actin stress fibers at later time points. In this study both the surfaces show the expression of actin fibers indicating that surface roughness and composition have similar effect on the bone marrow cells. The sputtered hydroxyapatite surface revealed reduced cell growth at all-time points. Mineralization of the extracellular matrix, as the final stage of osteoblast differentiation, showed no significant difference in nodule deposition on both surfaces.

Conclusions and clinical implications: Surface characteristics and composition contribute to the regulation of osteoblast proliferation and mineralization eventually influencing osseointegration. Excellent osteocompatibility and bioactivity of sputtered hydroxyapatite is beneficial for implant stability and long-term integration.

373 | Basic Research

Age-related properties of human dental pulp stem cells

Presenter: Bressan E

Department of Periodontology, School of Dentistry, University of Padova, Padova, Italy

Co-authors: Bressan E¹, Ricci S¹, Ferrarese N¹, Letizia F², Sivoletta S¹, Zavan B²

¹Department of Periodontology, School of Dentistry, University of Padova, Padova, Italy, ²Department of Histology, Microbiology and Medical Biotechnology, University of Padova, Padova, Italy

Background: In these last years, stem cell biology has emerged as one of the fundamental underpinnings for regenerative

medicine. In this contest, dentistry has taken note on the potential of these cells for clinical applications. In this context the mainly adult stem cells that find large clinical application on odontoiatric field are unquestionably mesenchymal stem cells (MSC) resident in dental pulp.

Aim: Aim of the present work is the study of the biological properties such as proliferation and stemness ability of human adult dental pult stem cells relating its to the age of the donor.

Methods: One hundred and twenty human dental pulp was extracted from teeth (MOLARS) of healthy adult subjects aged 16–over 66 years. Donors have been organized in six groups (20 teeth for each group): 16–25; 26–35; 36–45; 46–55; 56–65; over 66. Adult stem cells have been isolated and coltured in presence of osteogenic, neurogenic, vasculogenic differentiative medium. Proliferation ability by means of time doubli calculation, real time PCR for gene expression and immunohistochemical analises for tissue specific markers have been performed for each group.

Results: Dental Pulp Stem Cells (DPSC) for each group show good proliferative ability at the early passage (p2). DPSC from younger donor (up to 35 years) maintain this ability also in long-term coltures (p8). As regards stemness ability, gene expression and immunoistochemical analises confirm the ability of the cell to be committed into several cell line: bone, endothelial, neuron/glial like cells. In this case too, age related properties are well evident. Stem cells of younger donor maintain the differentiation ability for longer time.

Conclusions and clinical implications: DPSC could be isolated from molar teeth of adult donor up to over 67 years old. In this case cells maintain their proper differentiative ability in short term *in vitro* cultures (p2).

374 | Basic Research

Long Term Evaluation of Thousand Patients Treated with Dental Implant Supported Fixed and Removable Prothesis

Presenter: Cansiz E

Istanbul University Oral and Maxillofacial Surgery Department, Istanbul, Turkey

Co-authors: Gulluk E, Ibrahimoglu D, Cansiz E, Bulent A
Istanbul University Oral and Maxillofacial Surgery Department, Istanbul, Turkey

Background: One hundred patients treated with dental implants in Istanbul University Oral and Maxillofacial Surgery and Prosthodontics Clinics (Istanbul, Turkey) were studied for 10 years.

Aim: The main abjective of this reasearch was to determine the difference between the fixed and the removable implant-retained prothesis in point of patient comfort, oral hygiene and accordingly bone resorbtion.

Methods: Patients were evaluated for the determination of the difference between the fixed and the removable implant-retained prothesis in point of patient comfort, oral hygiene and accordingly bone resorbtion.

Results: The collected data showed some statistically meaningful differences among different kind of treatment modalities. This research showed that, the implant supported fixed prothesis are the most comfortable treatment option for the patient but, oral hygiene maintenance of that kind of prothesis can be complicated. As a result of oral hygiene problems, implant-supported fixed prothesis showed higher bone resorb-tion rates and peri-implantitis than others. Beside this, in terms of oral hygiene maintenance, implant supported removable prothesis were found the most successful treatment modality in spite of some cases with gingival hyperplasia observed. On the other hand, from the point of hygiene, implant and soft tissue supported hybrid prothesis found more successful than fixed prothesis because they provide easy acces to the implant gingiva interface which is important for the cleaning of the surrounding tissues. Also from the point of aesthetic and patient comfort, hybrid prothesis found more successful than implant-supported removable prothesis.

Conclusions and clinical implications: In this research, it is determined that long-term servical bone resorb-tion occurs not only due to peri-implant hygiene problems but also due to improper prosthodontic design.

375 | Basic Research

Comparison of various implant designs in severely atrophic mandible by using 3D finite element analysis

Presenter: Çetin Ü

Department of Prosthodontics, Faculty of Dentistry, Ankara University, Ankara, Turkey

Co-authors: Çetin Ü, Yurdukoru B

Department of Prosthodontics, Faculty of Dentistry, Ankara University, Ankara, Turkey

Background: The severely atrophic completely edentulous mandible is the most difficult to rehabilitate in implant dentistry. Sometimes autogenous grafts may not be intended for improved denture support. Patients are unwilling to undergo or would like to avoid multiple surgical procedures. In such situations short, mini or subperiosteal implants are available offer clinicians alternative options to facilitate prosthetic restoration in the face of anatomic limitations. Implants with a variety of design and dimension approaches have been used for prosthetic reconstructions of atrophic mandible. Decision of choosing short implants, mini implants or subperiosteal implants is a matter of discussion for years.

Aim: The aim of this *in vitro* study is to compare and investigate the stress distribution of standard, mini, short endosteal and conventional subperiosteal implants in athrophic mandible by finite element analysis method.

Methods: Computerized tomography scan images of an atrophic human mandible was used to reconstruct a 3 dimensional model by using computer software. Four different types of implant systems were modeled to form analysis sets. Three endosteal implant systems (11 mm in length – 3.75 mm diameter, 5.5 mm in length – 3.75 mm diameter and 6 mm in length

– 5.75 mm diameter) and a conventional tripod subperiosteal implant system were used as supporting structure. Four endosteal implants were placed in the canine and first premolar regions. Implant-supported overdentures with ball attachments were prepared for each models. Von Misses stresses of the implants and maximum/minimum principal stresses of bone tissues were evaluated.

Results: Biomechanical performance of subperiosteal implants was found to be similar to endosteal implants. No statistically significant difference was found in biomechanical performance of subperiosteal implants and endosteal implants ($P > 0.05$). Biomechanical performance of subperiosteal implants was found to be significantly higher than that of short implants ($P < 0.05$).

Conclusions and clinical implications: Within the limitation of this study, as an alternative option to standart implants, subperiosteal implants are suitable for atrophic mandibles in biomechanical manner. This findings should be supported by further *in vitro* and *in vivo* studies.

Mandibular incisive canal: a 3-dimensional computerized tomographic analysis in taiwanese

Presenter: Chen C-J

Department of Periodontics, Chi Mei Medical Center, Tainan, Taiwan, Tainan, Taiwan

Co-authors: Mau LP^{1,2}, Chen C-J²

¹*Department of Periodontics, University of Texas Health Science Center at San Antonio, San Antonio, USA,* ²*Department of Periodontics, Chi Mei Medical Center, Tainan, Taiwan*

Background: Mandibular incisive nerve is one of the branch of inferior alveolar nerve. It extends anteriorly in the mandible after separating from the mental nerve and forms a plexus to supply canines and incisors.

Aim: The aim of this study was to investigate the existence of incisive nerve and extension from anterior loop of mental nerve using dental CT in Taiwanese population.

Methods: One hundred and thirty-eight mandibular dental CT images were selected from our data bank. There are 69 males and 69 females. The average age is 46.31 ± 12.01 years old. Dental CT images were reformed using Implant MaxOsoftware. Mental foramen and anterior loop were located. The canal extension from medial side of anterior loop of mental foramen was recognized as incisive nerve. The length of incisive nerve was measured.

Results: (1) Around 70% cases did show incisive nerve canal; (2) The length of incisive nerve canal image on the right side is 6.76 ± 6.15 mm and on the left side is 7.21 ± 5.92 mm respectively; (3) The length of incisive nerve canal between right side and left side is not statistically significant (Pair *t* test, $P = 0.194$).

Conclusions and clinical implications: This study demonstrates that incisive nerve does exist in most cases. The length of incisive nerve is around 7 mm and no difference between right and left side.

Influence of implant abutment on detorque value and screw stability

Presenter: Choi Y-S

Dankook University, Choeran, Republic of Korea

Co-authors: Choi Y-S, Bae B-R, Cho I-H, Lee J-S, Kim Y-M

Dankook University, Choeran, Republic of Korea

Background: Frequent implant screw loosening may cause fracture of prosthesis, screw and fixture. Microgap from loosening of screw will be a harbor of microorganism.

Aim: This study was designed to evaluate the influence of implant abutment materials on detorque value and screw joint stability before and after dynamic fatigue test.

Methods: US II $\varnothing 3.75 \times 11.5$ mm (Osstem Co., Seoul, Korea) implant and three different groups of abutment (titanium abutments: group 1, zirconia abutments: group 2, and UCLA abutments: group 3) were used. Each group was made up of seven samples on a customized jig. Abutment screw was tightened by torque wrench (TWMW, Osstem Co., Seoul, Korea). The detorque value before loading and the detorque value after loading (cyclic loading up to 10^5 cycles) of the abutment screw were measured with digital torque gauge. After that loss percentage of removal torque before loading, loss percentage of removal torque after loading and loss percentage of removal torque according to loading were calculated.

Results: (1) Detorque value before loading was 16.42 ± 3.89 Ncm (group 1), 15.55 ± 3.46 Ncm (group 2), 13.83 ± 3.76 Ncm (group 3). There was no significant difference in detorque value before loading among the each group. (2) Detorque value after loading was 16.17 ± 7.12 (group 1), 13.96 ± 3.30 Ncm (group 2), 11.84 ± 1.55 Ncm (group 3). There was no significant difference in detorque value after loading among the each group. (3) Detorque values before and after cyclic loading in each group were not significantly different. (4) Loss percentage of removal torque before loading was $32.42 \pm 16.02\%$ (group 1), $35.99 \pm 14.25\%$ (group 2), $43.08 \pm 15.47\%$ (group 3). There was no significant difference in loss percentage of removal torque before loading among the each group. (5) Loss percentage of removal torque after loading was $33.46 \pm 29.30\%$ (group 1), $42.56 \pm 13.57\%$ (group 2), $51.26 \pm 6.39\%$ (group 3). There was no significant difference in loss percentage of removal torque after loading among the each group. (6) Loss percentage of removal torque according to loading was $-1.88 \pm 44.33\%$ (group 1), $5.11 \pm 37.27\%$ (group 2), $9.23 \pm 24.92\%$ (group 3). There was no significant difference in loss percentage of removal torque according to loading among the each group.

Conclusions and clinical implications: Short-term screw loosening of three types of abutment (titanium, zirconia and UCLA) was not significantly different. When bite force was applied, there was no significant difference in screw loosening between before loading and after loading.

The role of collagen membrane as a phosphoric acid scaffold for bone remodeling

Presenter: Chun JH

Uijeongbu St. Mary's Hospital, Department of Prosthodontics, Seoul, Korea

Co-authors: Chun JH, Shin SW, Lee W

Uijeongbu St. Mary's Hospital, Department of Prosthodontics, Seoul, Korea

Background: After the implantation or any other surgical procedure, Bone remodeling would be occurred, which helps Osseointegration of foreign body. However, this procedure needs a surgery, so there are possible complications.

Aim: The goal of this research is to find role of collagen membrane as a scaffold for possible alternative to the Bone remodeling, which can reduce the physical damage.

Methods: The experiments were carried out on 12 New Zealand white rabbits, approximately 3.5 kg in body weight. We made an incision on the skin of mandibular border and applied 37% phosphoric acid and collagen membrane (Collatape, Zimmer Dental, Carlsbad, CA, USA) to the mandibular bone surface of the first group (Right side, experimental group), and the only phosphoric acid to the second group (left side, control group). After 3 days, 1, 2 weeks, each four rabbits were sacrificed and the specimen was obtained. Each specimen was stained by Hematoxylin & Eosin (H&E) and Tartrate-resistant acid phosphatase (TRAP), and observed histological change by the light microscope.

Results: The demineralization of the experimental group was weak compared with the control group. It also shows the gradual increase of the demineralization (after 3 days, 1, 2 weeks). And the control group showed more extensive demineralization than the experimental group.

Conclusions and clinical implications: This study shows the amount of demineralization as a result of using phosphoric acid. And as time goes by demineralization was increased. But the absorbable collagen membrane was used as a scaffold for the increase of bone demineralization effect and the prevention of adjacent tissue dispersion, rather amount of bone demineralization was decreased. So, the role of collagen membrane as a scaffold for bone remodeling was weak.

SPECT evaluation of peri-implant bone formation with Straumann bone ceramic

Presenter: Ciolino F

Department of Clinical and Dental Sciences, Polytechnic University of Marche, Ancona Torrette, Italy

Co-authors: Aspriello SD¹, Ciolino F¹, Zizzi A³, Rubini C³, Giantomasi F³, Procaccini M¹, Piemontese M¹

¹*Department of Clinical and Dental Sciences, Polytechnic University of Marche, Ancona Torrette, Italy,* ²*University of Aquila, Aquila, Italy,*

³*Department of Neurosciences, Pathologic Anatomy and Hystopathology, Politechnic University of Marche, Ancona Torrette, Italy*

Background: Several recent medical reports have focused attention on the possible application of skeletal scintigraphy imaging in dental researches.

Aim: The aim of this study was to evaluate the osteoblast activity of new peri-implant bone formation (vitality) after guided bone regeneration with Straumann Bone Ceramic on osteoblastic activity through bone scintigraphy.

Methods: Astratech osseospeed implant was placed in 32 years old men in position 2.2 using Straumann Bone Ceramic in vestibular wall after two fixtures loosening by peri-implantitis. A nuclear medicine investigation with single-photon emission-computed tomography (SPECT) was performed. 99m-technetium-MDP scintigrams were performed before, 1 and 6 month after implant placement with grafting. The study was completed with acquisitions of planar images of the skull in an anterior view and the use of regions of interest (ROIs) of the same size in the area around the fixture and in the opposite hemimandible (at the control sites). Count density ratios (counts/pixel) obtained from each ROI were used for a quantitative/relative assessment. Tomographic images were evaluated with a qualitative method. The spatial resolution of the reconstructed tomograms and of the planar images was approximately 7 mm.

Results: Routine planar methodology provided a direct measure of cellular activity of the examined areas. There was a significant increase in tracer uptake 1 month after implant placement during graft healing, which was followed by a significant decrease during implant healing. The difference in count density ratio registered from the same ROI revealed the course of peri-implant osteoblastic activity, which was very high in the first month and then declined during subsequent months.

Conclusions and clinical implications: Nuclear medicine may hold possible advantages in implant dentistry for those who seek to clarify the still unknown aspects of osteoblastic activity and to support the histologic findings. The new bone formation around implant supported by Straumann Bone Ceramic revealed osteoblastic activity.

Biological activity related to different microstructured implant surfaces and chemical compositions

Presenter: Conserva E

Genova University, Genova, Italy

Co-authors: Conserva E

Genova University, Genova, Italy

Background: The interaction between cells and implant is determined by surface microstructure (roughness, pore morphology and dimension) and by its chemical composition. Cells are not influenced by the properties of the bulk material. It is not yet clear which biological cell activity is influenced by these parameters.

Aim: The aim of this study was an *in vitro* comparison of Osteoblast cells adhesion proliferation and gene expression related to two different surface treatments applied to the same implant design in order to assess if and how the interaction between cells and implant was influenced by surface structure (microdesign and roughness) and chemical composition.

Methods: The originality of this investigation was to test fixtures ready to use instead of model systems like disks. A number of 20 fixtures (EZ PLUS INTERNAL 5 × 13 mm) with HA grit sandblasted surface (RBM SURFACE, MEGAGEN, Korea) and of 20 (EZ PLUS INTERNAL 5 × 13 mm) with a Ca²⁺ incorporated in titanium surface (XPEED SURFACE, MEGAGEN, Korea) were investigated. First the implant roughness, macro and microstructures were analyzed by STEREO-SEM and SEM, then the surface chemical composition by XPS analysis. For the biological tests SaOS-2 Osteoblasts coming from human osteosarcoma and Real Time PCR TEST were used.

Results: The Ca²⁺ incorporated in titanium surface showed less contaminants like Si, Cl, Al and C than the HA grit sandblasted surface. The HA grit sandblasted surface morphology was more rough than the Ca²⁺ nanocoated one, showing macropores with a diameter of 3–5 μM and micropores with a diameter of 0.5 μM. The Ca²⁺ nanocoated surface presented more and faster Osteoblast cells spreading, adhesion and proliferation than the sandblasted surface. All data were statistically compared by using the one way ANOVA. No statistically significant differences in ALP activity and PCR test between surfaces were found.

Conclusions and clinical implications: The Ca²⁺ nanocoated surface was very clean with no contaminants. A low percentage of Carbonium (<40%) did not decrease the surface wettability and well promoted a cell to implant contact. The macro-micro pore structured design and the chemical composition of the Ca²⁺ nanocoated surface allowed a better and faster cell adhesion and proliferation but did not play a role into the *in vitro* cellular differentiation.

381 | Basic Research

The effects of hemostatic agents on rat fibroblast cells: a scanning electron microscope study

Presenter: DİNÇER O

Faculty Of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: BİLİR A, EMES Y, ATALAY B, DİNÇER O, ARPINAR Ş, KORKMAZ BÖ, AYBAR B, ERGÜVEN M, YALÇIN S

¹Faculty of Medicine, Istanbul University, Istanbul, Turkey

Background: Hemostatic agents may be used topically in order to control hemorrhage, especially in patients with bleeding disorders. The agent used may have a negative effect on the tissue prolonging the healing time.

Aim: The aim of this study is to compare the effects of three different hemostatic agents on fibroblast cells on a rat primary fibroblast cell culture model. Ankaferd Blood Stopper, fibrin glue and tranexamic acid were the agents to be evaluated for their effects on cell morphology.

Methods: Primary culture fibroblast cells were isolated from the hindfoot extensor tendons of Sprague Dawley rats. The subepidermal tissues of neonatal rats were dissected and the isolated fibroblasts were cultured in DMEM/F-12 media supplemented with 10% fetal calf serum in 75 cm² flasks. First passage

cells were then used in the following experiments. 100% vital cells which have been prepared in a fresh medium were added to the wells with a 5 × 10⁵ cells/well ratio. On the observation of cell adhesion to the well surfaces (at 20th and 60th minutes) insert filters containing the experimental materials have been placed into the wells and the cells were incubated for two time intervals at 24 and 72 h. One milliliter of Ankaferd Blood Stopper[®] (ABS[®]) was added to the medium for the first group. Fibrin glue was diluted 1/1 using sterile saline and 1 ml of this solution was also added to the medium. One milliliter of %10 t-AMCHA was added to the medium of the third group. Cells in the fourth group were not treated with any chemical agent and served as control. All of the groups were analysed by scanning electron microscopy (SEM).

Results: It was found that cell morphologies were similar in all the fibrin glue, tranexamic acid and control groups with healthy cytoplasmic extensions whereas the ABS[®] contained mostly degenerated cells.

Conclusions and clinical implications: Hemostatic agents, when applied to a tissue, may effect the cell morphology.

382 | Basic Research

Retrospective study of 4,353 implants. A 9-year follow-up

Presenter: Daemi R

University of Sevilla, Sevilla, Spain

Co-authors: Daemi R, Salas C, Ríos V, Bullón P, Lázaro P, Herrero M

University of Sevilla, Sevilla, Spain

Background: Retrospective study evaluating the treatment results of 4,353 Straumann implants placed in one centre, in the last 9 years, by two surgeons.

Aim: Evaluate the survival rates, complications and failures. Estimate the incidence of using advanced techniques for the placement of dental implants. Analyse the distribution of the implants with respect to type, diameter, length and implant surface. Assess the incidence of success and failure.

Methods: Variables evaluated for each implant:

- In relation to the patient: age, sex, smoking habit, presence of periodontitis, presence of systemic diseases.
- In relation to the implant: type of surface, type of platform, implant design, length, diameter, type of surgical procedure, bone regeneration, type of prosthesis, complications.

Statistic analysis: A descriptive analysis of the data was performed and then *t*-student and chi-square test. *P* < 0.05.

Results: A total of 4353 implants were analysed in 1204 patients, in a period of 9 years from 2001 to 2010 in a private practice in the southern Spain. Total survival rate was 98.4%. The distribution is as follows: 49% male, 51% women, 81% of patients nonsmokers, 77% had a history of periodontal disease, 43% had implants placed in the posterior maxilla, 19% of implants were SLActive, 60% standard plus, 69% had a diameter of 4.1, 16% diameter of 4.8. Forty-seven percent of the patients had a length of 10 mm, 17% 8 mm and 33% 12 mm.

Seventy-seven percent of the implants were placed conventionally and 7.5% with closed sinus elevation. The failure rate was 1.8% in smokers and 1.6% in nonsmokers, 1.8% in patients with a history of periodontal disease and 1.2% in patients without a history. Neither of these results were significant. The failure rate of implants placed in the posterior maxilla was 2%, compared with 1.1% in the posterior mandible. There was no significant difference found in failure rates between implants with SLA surface (1.9%) and SLActive surface (0.8%), and different implant diameters; 3.3 (2.2%), 4.1 (1.3%) and 4.8 (2.6%). We found significant difference in failure between the type of implant placed: standard plus (1.1%), standard (2.1%), TE (2.8%) and bone level (0%). Implants that needed simultaneous regeneration (including sinus elevation) showed a failure of 2.8%. The majority of failures happened 4 months after the surgical procedures.

Conclusions and clinical implications: The survival results obtained are in accordance with the data published previously by other authors.

Anatomy of the maxillary sinus using cone beam computed tomography

Presenter: Elhamid A

Private Practice, Casablanca, Morocco

Co-authors: Elhamid A, Eddaif M, Larachi D, Mseffer B

Private Practice, Casablanca, Morocco

Background: The sinus lift surgery requires depth knowledge of maxillary sinus anatomy. Several studies interested volume, high and width of maxillary sinus have been done by Ariji Y, Kim HJ, June BC, Uchida Y,...

Aim: The aim of our study is to investigate the anatomy of the maxillary sinus such as the morphology and measurements of sinus floor, the prevalence, location of sinus septum by use of cone beam computed tomography.

Methods: Three hundred and twenty patients undergoing dental treatment in private practice were selected for analysis of maxillary sinus. Cone Beam Computed Tomography (Galileos from Sirona company), 640 sinuses were analyzed. The width of sinus floor, the maximal height and width, the angle between medial and lateral wall of sinus at premolars and molars location was determined. The prevalence of septa was also noted.

Results: We found the prevalence of septa more than 56%, the lateral wall of sinus is the most important location of septa. The width of sinus floor is up to 6 mm in molar area. The angle, between medial and lateral wall of sinus, increase gradually since first premolars to second molars and decrease to third molar.

Conclusions and clinical implications: To avoid complications during sinus augmentation procedures, it is important to identify the anatomic structures inherent to the maxillary sinus. The site of first molar is the most favorable for this surgery. The width of sinus floor at molar region is up to 6 mm letting ask questions about the interest of the harvesting bone graft in this area.

Osteoinduction and bone formation capability of BMP-2 Mimetic Peptide, PEP7

Presenter: Eom T-G

OSSTEM Implant R&D Center, Pusan, Republic of Korea

Co-authors: Kang E-J, Kim S-K, Bae S-Y, Kim Y-S,

Choi K-O, Song J-D, Eom T-G

OSSTEM Implant R&D Center, Pusan, Republic of Korea

Background: Osteoinduction capability of dental implants is important in clinical settings, but most current dental implants lack such bioactive properties. Use of bone morphogenetic protein-2 (BMP-2) has been studied, but stability, safety, and cost of BMP-2 are widely recognized obstacles for dental implant applications. Thus, development of peptides that mimic the functions of BMP-2 can be a good alternative approach. Moreover, the functional mimetic peptide of BMP-2 has an advantage in long-term and *in vivo* stability over the use of BMP-2.

Aim: Herein, we present a study that evaluates osteoinduction and bone formation properties of PEP7, a synthetic peptide inspired by the amino acid sequence participated in BMP-2 and its receptor interactions.

Methods: (1) Osteoinductive capacity of PEP7 in rat subcutaneous ectopic bone formation model To evaluate the osteoinductive capacity of PEP7, CollaCote (Zimmer, 5 mg) with BMP-2 (5 µg) or PEP7 (OSSTEM, 1 or 3 mg) was implanted into subcutaneous tissue of rat. (2) Bone formation capacity of PEP7 in rabbit calvarial bone defect model Cranial defects with 6 mm size were surgically created in 8-week-old-New Zealand white rabbits. Type I rabbit collagen (Sigma, 5 mg) with BMP-2 (Sigma, 5 µg) or PEP7 (100 µg) was implanted into calvarial defect to evaluate bone formation capacity of PEP7. (3) Bone formation capacity of PEP7 in micro-pig mandible bone defect model GSII fixtures (OSSTEM, 3.5 mm × 8.5 mm) coated with BMP-2 (5 µg) or PEP7 (100 or 500 µg) were implanted into micro-pig mandible bone defect and supra-alveolar peri-implant bone formation was evaluated 9 weeks.

Results: Collagen scaffolds loaded with PEP7 were implanted subcutaneously in animal models to evaluate the osteoinduction by PEP7, and we found induction of new bone formation at the implanted sites. Moreover, PEP7 also increased new bone formation in all orthotopic models studied such as calvarial defect model of rabbits and mandible bone defect model of micro pigs. (1) PEP7 induced new bone formation in the rat subcutaneous tissues, which was higher with 3 mg of PEP7 than 1 mg. (2) New bone was formed by PEP7 treatment in the calvarial bone defect, statistically significantly different in BA ratio (%) at 4 weeks ($P < 0.05$). (3) Horizontal alveolar ridge augmentation was observed on the PEP7-coated implant in the peri-implant defect.

Conclusions and clinical implications: Our results showed that the synthetic peptide mimic of BMP-2, PEP7, has osteoinductive and new bone formation properties that can be used for next-generation bio-active dental implants.

The effects of surface roughness and surface morphology on the removal torque of implants. An experimental study in micro-pigs

Presenter: Eom T-G

Implant R&D Center, OSSTEM Implant Co., Ltd., Busan, Republic of Korea

Co-authors: Cho I-H¹, Park J-J¹, Choi H-Y¹, Kim W-J², Cho Y-S³, Eom T-G¹

¹*Implant R&D Center, OSSTEM Implant Co., Ltd., Busan, Republic of Korea,* ²*Institute of Bone Science, OSSTEM Implant Co., Ltd., Seoul, Republic of Korea,* ³*Apsun Dental Clinic, Seoul, Republic of Korea*

Background: Surface features of implant, such as morphology, roughness and composition have been proposed as a potential factor affecting bone integration.

Aim: The aim of the present study was to biomechanically evaluate the influence of surface roughness and surface morphology on osseointegration of implants.

Methods: In 10 micro-pigs, three submerged implants were placed in the tibia. Groups were divided into three groups: Resorbable blasting media surface (RBM; R_a 1.5 μ M), sand blasted with alumina and acid-etched surface (Small SA; R_a 1.5 μ M) and sand-blasted with alumina and acid-etched surface (SA; R_a 2.5 μ M). The micro-pigs were sacrificed following 2 and 4 weeks healing period. After 2 and 4 weeks of healing, the micro-pigs were sacrificed and all implants were evaluated by removal torque testing. For statistical analysis, *t*-tests were performed ($P < 0.05$).

Results: There were no statistically significant difference between the groups, the RBM surface and Small SA relatively had similar removal torque values at both 2 and 4 weeks, but SA surface showed higher removal torque value than Small SA in 4 weeks ($P < 0.05$).

Conclusions and clinical implications: It was found that: (i) surface roughness is more effective in removal torque test than surface morphology; (ii) the SA implant presented the highest removal torque.

Scanning electron microscopy analysis of bone removal using Er:YAG and surgical drill

Presenter: Pandurić DG

Department of Oral Surgery, School of Dental medicine, University of Zagreb, Zagreb, Croatia

Co-authors: Pandurić DG¹, Anić I², Žabkar J³, Katanec D¹, Sušić M¹, Musić S⁴

¹*Department of Oral Surgery, School of Dental medicine, University of Zagreb, Zagreb, Croatia,* ²*Department of Endodontics and Restorative Dentistry, School of Dental medicine, University of Zagreb, Zagreb, Croatia,* ³*Fotona d.d., Ljubljana, Slovenia,* ⁴*Ručer Bošković Institute, Zagreb, Croatia*

Background: Intraoral bone grafting procedures are mainly performed using conventional instruments like drills, burs or saws. Major drawbacks of these techniques are mechanical pressure and vibrations on the bone, limited cut geometry caused by

shape of the device, remnants of osseous debris in adjacent soft tissue possibly leading to infections, the risk of accidental trauma to soft tissue. In recent years, high-energy lasers have been introduced in bone surgery. Haemostatic and aseptic effects, absence of mechanical stress and intricate cut geometry are potential beneficial aspects of noncontact osteotomy with infrared lasers.

Aim: Aim of the presented study was to examine the morphological features and thermal-induced surface changes after Er:YAG ablation and drilling bone treatment.

Methods: The experimental study was performed on 30 bone blocks prepared from pig ribs, simulating the height and the width of intraoral autologous bone blocks commonly used in dental implantology. The main idea was to simulate hole-like preparations for the fixation screw site. For the osteotomies, the Er:YAG laser (AT Fidelis, Fotona, Slovenia) and surgical pilot drill (Screw System, Hager&Meisinger GmbH, Germany) were used. Laser was applied with the 0.9 mm spot size in noncontact max mode (1000 mJ, 20 Hz) and the handpiece was kept at a distance of 10 mm from the bone surface to make bone site within the full thickness of the plate. Drill osteotomy was performed with the 1.0 mm wide pilot drill, commonly used for the fixation screws preparations, at 15,000 rpm, with simultaneous saline irrigation. Analysis of both hole's surfaces using scanning electron microscopy (Field Emission Scanning Electron Microscope, JSM-7000F, Japan) were performed.

Results: Er:YAG laser ablation produced a groove with similar dimensions to that produced by bur drilling. SEM observations revealed that the groove produced by the Er:YAG laser had well-defined edges and a smear layer-free surface with a characteristically rough and tearing appearance, with entrapped fibrin-like tissue and spherical formations. The melting and carbonisation were not observed on sited irradiated with Er:YAG laser. At the border of ablation groove, thermal changes were not found. In the case of drill osteotomy, the smooth surface covered with the smear layer with microfractures embedded was observed. At the border of ablation groove, irregular edges with hairy-like appearance were found. No thermal changes on drilling sited were found.

Conclusions and clinical implications: Er:YAG laser may be considered an possible tool and effective method in clinical dental implantology and at the specified parameters may become applicable as an alternative method for bone surgery.

Cytoskeletal forces control topography-mediated activation of Wnt canonical signaling on titanium surfaces

Presenter: Galli C

University of Parma, Parma, Italy

Co-authors: Galli C, Piemontese M, Passeri G, Macaluso G, Macaluso G, Macaluso G

University of Parma, Parma, Italy

Background: Wnt canonical signaling is a pivotal pathway to determine cell fate and osteoblast differentiation. We previously

showed that rough implant topography enhances the activation of Wnt canonical signaling *in vitro*, and that this mediates surface effects on cell differentiation. The molecular mechanisms underlying topography-dependent control of Wnt signaling remain however elusive.

Aim: The aim of the present study is to investigate whether cytoskeletal forces are required to mediate the effects of surface topography on the activation of Wnt canonical signaling.

Methods: The murine mesenchymal cell line C2C12 was plated on smooth or acid-etched/sand-blasted (SLA) titanium discs. Myosin II and actin microfilaments were stained with a polyclonal anti-myosin II antibody and rhodamine—phalloidin, respectively. Cell viability was measured through a bioluminescence-based ATP quantitation. Activation of Wnt canonical signaling was measured by transfecting cells with a reporter vector system carrying the Firey Luciferase gene under the control of a regulatory promoter sequence binding the TCF/beta-catenin and a control plasmid constitutively expressing Renilla Luciferase and by stimulating cells with soluble recombinant Wnt3a protein. Cells were then treated with myosin II inhibitor Blebbistatin, microtubule inhibitor Nocodazole or were transfected with a constitutively active RhoA isoform.

Results: Immunocytochemistry showed a marked Myosin II labeling along the cytoplasm of cells growing on SLA but not on Polished titanium and myosin II inhibition by blebbistatin reversed topography effects on cell proliferation. As previously reported, activation of Wnt canonical signaling was significantly higher on rough surfaces, but addition of blebbistatin decreased TCF-Luc activity on SLA and no difference was detectable between the groups. Treatment with nocodazole, which has been shown to increase cell contractility, enhanced activation of Wnt canonical signaling on both Polished and SLA surfaces. We then overexpressed a constitutively active isoform of RhoA, a small GTPase that exerts broad effects on cytoskeletal organization and that controls Myosin II activation. This maneuver increased TCF-Luc activity on both surface groups.

Conclusions and clinical implications: This study shows that topography induces localization of the contractile protein Myosin II along the cell edges, which affects cell growth kinetics and is required for the activation of Wnt canonical signaling on SLA surfaces. Increasing cell contractility by nocodazole or by expressing a constitutively active form of RhoA increases the activation of Wnt pathway on both smooth and rough surfaces.

388 | Basic Research

Inhibition of actin stability reverses topography-dependent effects on cell differentiation

Presenter: Galli C

University of Parma, Parma, Italy

Co-authors: Piemontese M, Galli C, Ravanetti F, Passeri G, Macaluso G

University of Parma, Parma, Italy

Background: Cells can discriminate surface profiles, and rearrange their cytoskeleton, to adapt to the substrate. This in turn can affect their behavior and differentiation. Although important evidence

in vitro and *in vivo* shows that rough surfaces promote osteoblast differentiation, many topography-activated molecular pathways underlying this phenomenon have still to be investigated.

Aim: The goal of the present study is to investigate whether it is possible to control the effects of surface topography on cell differentiation by acting on Rho-associated Protein Kinase, a key promoter of actin stability or on microfilament organization.

Methods: Rho-associated protein kinase (ROCK) was inhibited with 0.2 μ M Y-27632, and actin polymerization was inhibited with 2 μ M cytochalasin in murine mesenchymal C2C12 cells or calvaria MC3T3 osteoblastic cells on Polished or acid-etched/sand-blasted (SLA) titanium discs. Actin microfilaments were stained with rhodamine-phalloidin for immunofluorescent observation. Activation of Wnt canonical signaling was measured through a reporter assay by transfecting cells with a reporter vector system expressing Firey Luciferase controlled by a promoter binding TCF/beta-catenin and a Renilla Luciferase expressing control plasmid and stimulating cells with recombinant Wnt3a. Alternatively, total RNA was extracted and gene expression was quantified by Real Time PCR.

Results: Cells on Polished surfaces display parallel bundles of actin filaments and stress fibers, spanning the whole length of the cytoplasm, whereas cells growing on SLA possess shorter filaments without visible stress fibers. We partially disrupted actin polymerization with low dose Cytochalasin. This maneuver increased Wnt canonical signaling on both surfaces, by reporter assay and Real Time PCR. We then inhibited Rho-associated Protein Kinase (ROCK), an important cytoskeletal regulator of actin stability, using a specific inhibitor Y-27632. Y-27632 affected cell shape inducing the formation of cytoplasmic extroflexions and significantly increased TCF-Luc in C2C12 cells on Polished but not on SLA. Consistently with these results, Y-27632 increased the expression of osteoblast-specific genes Alkaline Phosphatase and Osteocalcin only on Polished surfaces in MC3T3 cells.

Conclusions and clinical implications: The present study shows that the integrity of actin microfilaments is required for the observed effects of surface topography on cell differentiation and that it possible to affect surface-induced osteoblastic differentiation by acting on cytoskeletal and microfilament organization.

389 | Basic Research

Effects of the implant-abutment-design on the initial crestal bone resorption

Presenter: Gläser R

Private dental group practice, Senden, Germany

Co-authors: Gläser R

Private Dental Group Practice, Senden, Germany

Background: Despite the high success rates of modern implant systems there are a lot of discussions about certain construction details of the implant-abutment-design influencing the peri-implant bone level.

Aim: The aim was to analyse if the design of the implant-abutment complex is influencing the peri-implant bone reaction by comparing three different implant systems.

Methods: X-rays of Camlog Screw Line implants (Camlog Biotechnologies AG, Wimsheim, Germany) with the Promote[®]-surface (CSLP), AstraTech implants (AstraTech Dental, Mölndal, Sweden) with OsseoSpeedTM-surface (ATOS) and blue-SKY implants with osseocconnect-surface (bredent medical, Senden, Germany) in combination with the platform switched SKY esthetic line abutments (BSEA) have been analysed. In total 54 implants (22 CSLP, 19 ATOS, 13 BSEA) have been inserted and after a subgingival healing period of 3–6 months they have been restored with cemented metal ceramic single crowns. The patient selection has been independent from sex and age. Exclusion criteria have been nicotine abuse, bruxism, lack of compliance, general disease and continuous medication. All patients had minimum 1–1.5 mm bone around the implant during surgical procedure. The X-rays for the study were made on the day of the implant insertion (I), the insertion of the prosthetics (P) and the first recall after 6–12 months (R). Additionally to the use of bite wing holder an precise calibration of each measurement has been done using the technical data of the implant manufacturer like, implant length, length of the polished area, distance of the threads to correct amplifications caused by the X-ray technique. The reference points for all measurements have been the edge of the implant shoulder and the first radiologic visible bone implant contact point.

Results: The analysis of the marginal bone loss of the different implant systems showed an average resorption of 0.85 mm of the CSLP implants, of 0.16 mm of the ATOS implants and 0.22 mm with the BSEA implants in the time from implant insertion to the recall. In the time range from the prosthetic restoration to the recall the following bone loss has been observed: CSLP implants 0.32 mm; ATOS implants 0.09 mm and BSEA implants 0.09 mm. From these observed values results an average bone resorption in the time from implant insertion to prosthetic restoration: CSLP implants 0.53 mm; ATOS implants 0.07 mm and BSEA implants 0.13 mm.

Conclusions and clinical implications: This study shows that the design of the implant–abutment-complex has an effect on the periimplant bone reaction. The influence of the microtextured design of the implant collar and the platform switching seems to be more important than only a conical implant–abutment-connection.

During the whole time of the study for all implant systems no complications have been observed.

390 | Basic Research

Comparison of alterations in resonance frequency assessment in both jaws

Presenter: Gozlu M

Dentestetik Dental Center, Konya, Turkey

Co-authors: Sencimen M¹, Gulses A¹, Altug HA¹, Bayar GR¹, Gozlu M²

¹Department of Oral & Maxillofacial Surgery, Gulhane Military Medical Academy, Ankara, Turkey, ²Dentestetik Dental Center, Konya, Turkey

Background: Achieving and maintaining implant stability are essential for successful clinical outcome with dental implants.

The stability of the implant depends on the factors such as the contact between the implant surface, placement technique and surrounding bone quality. It has been reported that the implants in the mandible could be loaded earlier compared with the maxilla.

Aim: The aim of this clinical study is to compare the alterations of the implant stability quotient values measured during the initial phase of healing in the maxilla and mandible.

Methods: Nineteen patients treated with 53 implants (26 in the maxilla and 27 in the mandible) were included in the current study. The mean bone density of the implant recipient area was measured using *Simplant*TM 11 software incorporated in the CT machine. The mean bone density measurements were recorded in Hounsfield units. Only the implant recipient sites in the maxilla and mandible belonging to D2 bone type were included. Standard two stages surgical technique was utilized to prepare the surgical sites. The ISQ value at implant placement was recorded and did not influence the treatment procedure. The ISQ was measured by an *Osstell* instrument. The ISQ was further registered on 21 and 60 days. *SPSS* statistical software was used for the statistical analysis.

Results: In comparison with the time of insertion, the mean values of the ISQ were decreasing for the first 21 days and on the following days, the ISQ values have increased and reached the values at the time of insertion on the 60 days in both jaws. Analysis of the relation between the changes of the stability in the maxilla and the mandible does not reveal statistically significance.

Conclusions and clinical implications: With the knowledge of the current clinical study, it can be concluded that the implant stabilities at the early stages of the osseointegration process do not change in the maxilla and mandible.

391 | Basic Research

Patterns of muscle activity during chewing cycles in people with implant-supported bridges

Presenter: Grigoriadis A

Karolinska Institutet, Stockholm, Sweden

Co-authors: Grigoriadis A¹, Johansson RS², Trulsson M¹

¹Karolinska Institutet, Stockholm, Sweden, ²Umeå University, Umeå, Sweden

Background: The periodontal mechanoreceptors located around the roots of the teeth signal detailed information about tooth loads to the central nervous system and are involved in the adaptation of the muscle activity to the mechanical properties of the food during mastication. Edentulous people rehabilitated with implant-supported bridges in both jaws lack periodontal mechanoreceptors.

Aim: We asked if the time-varying pattern of muscle activity during chewing cycles and its changes during the masticatory sequence might differ between people with natural dentitions and implant-supported bridges in both jaws.

Methods: Thirteen participants with implant-supported bridges and thirteen with natural dentition chewed and swallowed gelatin-based model food. Electromyographic (EMG) activity of the masseter and temporal muscles was recorded bilaterally

together with the 3-D position of the mandible. We analyzed the time-varying activation of the muscles and the kinematics of the jaw movements during individual chewing cycles in the beginning, middle, and end of the masticatory sequences and compared the observed behavior between the two groups of participants.

Results: For the dentate participants, the peak of the EMG activity occurred around the start of the occlusal phase for cycles in the beginning of the masticatory sequence. The time of the peak was gradually delayed with the progression of the masticatory sequence and occurred ~ 35 to ~ 50 ms after the start of the occlusal phase for cycles in the middle and the end. Moreover, the peak amplitude of the EMG declined markedly during the sequence. For the implant group, in contrast, the peak occurred always after the start of the occlusal phase throughout the masticatory sequence, by ~ 30 ms in the beginning and ~ 40 ms in the middle and end. Furthermore, the peak amplitude of the EMG did not appreciably decline during the masticatory cycle.

Conclusions and clinical implications: In contrast to people with natural dentition, people with implant-supported bridges in both jaws do not adapt the timing and amplitude of the peak muscle activity throughout the masticatory sequence. We suggest that a lack of sensory signals from periodontal mechanoreceptors in the implant group contributes to this difference.

392 Basic Research

Impaired motor control during the first chewing cycle in subjects with implant-supported fixed prostheses

Presenter: Grigoriadis J

Karolinska Institutet, Huddinge, Sweden

Co-authors: Grigoriadis J, Svensson KG, Trulsson M

Karolinska Institutet, Huddinge, Sweden

Background: Sensory information from periodontal mechanoreceptors surrounding the roots of natural teeth is used by the nervous system to optimize positioning of food, force levels and force vectors during biting. Edentulous individuals rehabilitated with implant-supported fixed prostheses in both jaws lack these receptors.

Aim: The aim of this study was to describe the motor behavior during the first cycle of a natural chewing task in subjects with a natural dentition and in subjects with implant-supported fixed prostheses in both jaws.

Methods: Nine subjects with natural dentition (62–73 years of age) and nine with bimaxillary implant-supported fixed prostheses (67–77 years of age) chewed and swallowed a hazelnut. The vertical and lateral jaw movements, electromyographic activity from the masseter and temporal muscles and sound from the auditory meatus (to verify food cracking) were recorded. The task was performed five times and data during the first chewing cycle of each trial were analyzed.

Results: The amplitude of the vertical mandibular movement and the duration of the jaw opening phase of the first chewing cycle did not differ between the groups. However, the total time used from start of jaw opening until split of the hazelnut was

approximately 20% longer for the implant group. In addition, 2/3 of the subjects in the implant group failed to split the hazelnut during the first attempt in at least one of the five trials, which was twice as many as in those with natural dentition. The peak amplitude of the lateral jaw movement was observed during jaw closure in approximately 3/4 of the subjects in the natural dentition group, while it occurred during jaw opening in approximately 2/3 of the subjects in the implant group.

Conclusions and clinical implications: Edentulous subjects with implant-supported fixed prostheses in both jaws show an impaired motor control during fracture of food during the first chewing cycle. We suggest that the different motor behavior observed between the two groups can be explained by the lack of sensory signals from periodontal mechanoreceptors in the implant group.

393 Basic Research

Osseointegration in two colitis rat models

Presenter: Gruber R

Medical University of Vienna, Vienna, Austria

Co-authors: Kuchler U¹, Luvizuto ER², Munoz F³, Watzek G¹, Gruber R¹

¹*Medical University of Vienna, Vienna, Austria*, ²*University Estadual Paulista, São Paulo, Brazil*, ³*University of Santiago de Compostela, Lugo, Spain*

Background: Crohn's disease is a chronic inflammatory process of the gastrointestinal system that has recently been associated with a higher risk of early implant failures. However, we currently lack information on the impact of colitis on the process of osseointegration.

Aim: To provide this information based on preclinical models of a chemically induced inflammatory gastrointestinal system.

Methods: In the first model, colitis was induced by intrarectal instillation of 2,4,6-trinitro benzene sulfonic acid (TNBS). In the second model, colitis was induced by feeding rats with dextran sodium sulfate (DSS) polymers in the drinking water. One week after disease induction, miniscrews were inserted into the tibia. Four weeks after implantation, peri-implant bone volume per tissue volume (BV/TV) and bone-to-implant contacts (BIC) were determined by histomorphometric analysis.

Results: Cortical histomorphometric parameters were similar in the control, DSS and TNBS groups. Median cortical BV/TV was $92.2 \pm 3.7\%$, $92.0 \pm 3.0\%$ and $92.6 \pm 2.7\%$ – and BIC was $81.3 \pm 8.8\%$, $83.2 \pm 8.4\%$ and $84.0 \pm 7.0\%$, respectively. Also no significant differences were observed when comparing the medullary BV/TV and BIC ($19.5 \pm 6.4\%$, $16.2 \pm 5.6\%$ and $15.4 \pm 9.0\%$) and ($48.8 \pm 12.9\%$, 49.2 ± 6.2 and $41.9 \pm 11.7\%$), respectively. Successful induction of colitis was confirmed by loss of body weight and morphology of the gut.

Conclusions and clinical implications: These data show that osseointegration is not impaired in chemically induced colitis models. As these models not fully reflect the situation in a patient, the clinical implications of these findings remain vague.

Esthetic smile analysis at maximum lipdynamic in Chinese

Presenter: Hu X

School & Hospital of Stomatology, Peking University, Beijing, China

Co-authors: Hu X¹, Lin Y¹, Heberer S², Nelson K³

¹*School & Hospital of Stomatology, Peking University, Beijing, China,*

²*Implantology and Special Prosthodontics, Clinic and Polyclinic for Oral & Maxillofacial Surgery, Charité Campus Virchow Clinic, Berlin, Germany,* ³*Department of Oral and Maxillofacial Surgery, Albert-Ludwigs Universität Freiburg, Freiburg, Germany*

Background: Owing to global migration clinicians are increasingly seeing patients with different ethnic backgrounds. The perception of esthetics is influenced by culture, ethics, or races and may vary from the standards established according to the Caucasian population. Planning esthetic prosthodontic treatment of patients from different ethnicities can be a challenge.

Aim: The aim of this study is to analyze smile features in maximum lip-dynamic in Chinese.

Methods: Sixty-two Han-Chinese with a mean age of 28.5 years were enrolled and photographed. Standardized digital photos were made to measure the height of displayed gingiva and papilla in the maxilla during enjoyment smile. The data was then compared with the data acquired in Part I (Caucasians). Statistical analysis was performed using Mann-Whitney *U* test and nonparametric analysis.

Results: The mean displayed gingival height in the total subjects ($n = 62$) was 1.3 mm (0–8 mm). There was no significant difference between the genders ($P > 0.05$), but a significantly lower display of gingiva at the molars compared with Caucasians (Part I) ($P < 0.001$). 16.1% ($n = 10$) of the total subjects displayed gingiva from the central incisor to the first molar with a mean gingival height of 2.8 mm. The total subjects ($n = 62$) showed a mean papilla height of 3.4 mm (0–11.6 mm) with no significant difference between the genders ($P > 0.05$), and again a significantly lower display of papilla at the molars ($P < 0.001$) was found in Chinese. 43.5% ($n = 27$) of the total subjects showed papilla from the central incisor to the first molar. The mean papilla height of these subjects was 3.9 mm. Hundred percent of the subjects displayed papillae.

Conclusions and clinical implications: The results indicate that red esthetics is a paramount factor both for Chinese men and women in the esthetic restoration from the central incisor to the premolars.

Osseointegration enhanced by nano-structured CaP coated implants: a molecular, biomechanical and CT analysis

Presenter: Jimbo R

Department of Prosthodontics, Faculty of Odontology, Malmö University, Malmö, Sweden

Co-authors: Jimbo R^{1,2}, Coelho P^{4,5}, Schwartz-Filho HO^{1,7}, Xue Y⁶, Mustafa K⁶, Andersson M³, Wennerberg A^{1,2}

¹*Department of Prosthodontics, Faculty of Odontology, Malmö University, Malmö, Sweden,* ²*Department of Biomaterials, Sahlgrenska Academy, Gothenburg University, Gothenburg, Sweden,* ³*Department of Biomaterials and Biomimetics, New York University College of Dentistry, NY, USA,* ⁴*Department of Periodontology and Implant Dentistry, New York University College of Dentistry, NY, USA,* ⁵*Division of Periodontology, Department of Oral Diagnosis and Surgery, School of Dentistry, UNESP, São Paulo State University, Araraquara, Brazil,* ⁶*Department of Clinical Dentistry, Center for Clinical Dental Research, University of Bergen, Bergen, Norway,* ⁷*Department of Chemical and Biological Engineering, Applied Surface Chemistry, Chalmers University of Technology, Gothenburg, Sweden*

Background: Reportedly, the nano-structured calcium phosphates (CaP) applied to implant surfaces have some impact on osseointegration. Histological and biomechanical investigations suggest that the combined effect of topography and chemistry may enhance osseointegration. However, these evaluation techniques may be too coarse to detect biological effects in the nano-order, at times difficult to detect minor differences, which could significantly influence osseointegration. For comprehensive clarification of the effect of nano-structures, it may be worthwhile to combine the traditional evaluation approaches to further detailed evaluations such as gene expression and/or 3D observation using μ CT.

Aim: The aim of this study was to evaluate with various techniques, the biological effect of nano-structured CaP-coated implants placed in rabbits in order to obtain detailed information during the osseointegration process.

Methods: Seventy-six turned, commercially pure titanium (Grade 4) implants were used in the study. Half of the implants (test) were coated with nano-CaP particles and thereafter, heat-treated. Only heat-treatment was applied to the control implants. Surface characterization was conducted using SEM, XPS, and the interferometer. The test and control implants were inserted each in the right and left legs of both the femur and tibia of 18 adult lop-eared rabbits. The animals were sacrificed at 2, and 4 weeks ($n = 9$ for each). The implants placed in the femur were subjected to μ CT analysis to observe the 3D bone formation. The samples were thereafter processed for histological observations. The implants placed in the tibia were removal torqued and tissue surrounding the implant was retrieved for real-time PCR analysis. Wilcoxon signed rank test was used to analyze the differences between the two groups.

Results: The nano-CaP coated test surface presented significantly higher removal torque values (approximately 134%) than control surfaces at 2 weeks, however at 4 weeks, no significant

differences were detected. The gene expression analysis showed that osteocalcin, alkaline phosphatase, and collagen-1 presented significantly higher expression for both 2 and 4 weeks. The 3D μ CT observation showed that both implants were surrounded by trabecular structures and bone formation was seen for both groups. The histological observation showed that newly formed bone was evident at the implant interface.

Conclusions and clinical implications: The results indicated that nano-CaP coating significantly enhanced the gene expression of osteogenic genes, which was in accordance to the biomechanical analysis. The μ CT and histological observation provided further information about the osseointegration process around the implant. The combination of various evaluation techniques may further clarify the biological reaction to different nano-structures.

396 | Basic Research

"Frontonasal dysplasia. Dental implications and rehabilitation including implants". A case study

Presenter: Kaloumenos K

Dental School, Athens, Greece

Co-authors: Kaloumenos K, Papavasiliou G, Silvestros S, Kamposiora P

Dental School, Athens, Greece

Background: Frontonasal dysplasia, in general, is a very rare midline anomaly characterized by malformations of the central portion of the face, accompanied with others, like: bifid nose tip, Cleft nose, Encephalocele, Exencephaly, Flared nostrils, Widely spaced eyes, Meningocele and extra big toes.

Aim: The aim of this study was to investigate whether implants can be used as a solution to the congenital anodontia present on patients with "frontonasal dysplasia".

Methods: One patient diagnosed with Frontonasal Dysplasia had to be rehabilitated in the Graduate Prosthodontics Clinic of the University of Athens, Greece. The main problem, concerning the patient's dental condition was the congenital anodontia. This led to difficulty in mastication and speech and of course aesthetic problems. The number and positioning of the existing teeth led to a treatment plan including the placement of two implants to be connected to natural teeth abutments, thus providing the patient with two short span fixed partial dentures. There was no literature available for the proposed treatment as it was explained in depth to the patient. Nevertheless the patient's consent was obtained and two implants (Xive, Friadent GmbH P. O. Box 71 01 11 68221 Mannheim/Germany) implants were placed following a two stage surgery technique.

Results: Following a 6 month osseointegration period the final restoration was placed in May 2010. The patient was placed in a 3 month recall program and has been very positive about the treatment, being able to speak and eat easier. At 3 and 6 month recalls, X-ray as well as clinical evaluation showed no signs of bone loss, implant mobility or periimplantitis. The patient's oral hygiene was good and no problems from the prosthesis were observed.

Conclusions and clinical implications: The positive outcome of this case study showed that patients with Frontonasal Dysplasia can be treated with osseointegrated implants. Although difficult to obtain, a larger patient population could lead to sound conclusions on the treatment of such patients.

397 | Basic Research

Comparative assessment of ultrasound transmission velocity to evaluate different bone types for dental implantology *ex vivo*

Presenter: Kämmerer P

Oral and Maxillofacial Surgery, University Medical Centre Mainz, Mainz, Germany

Co-authors: Kämmerer P¹, Kumar V¹, Brüllmann D², Al-Nawas B¹, Klein M¹

¹Oral and Maxillofacial Surgery, University Medical Centre Mainz, Mainz, Germany, ²Policlinic of Oral Surgery, University Medical Centre Mainz, Mainz, Germany

Background: Ultrasound transmission velocity (UTV) may be used as a feasible method for noninvasive assessment of mechanical quality of different bone types before the insertion of endosseous dental implants.

Aim: Therefore, the purpose of this study *ex vivo* study was a comparison of UTV with radiological examinations [qualitative cone-beam computerized tomography scan (qCBCT), computed microtomography (μ CT)] as well as with histomorphometry.

Methods: Six samples each of cortical, cancellous and mixed bone were harvested from a fresh pig cadaver with a trephine bur. UTV measurements (m/s) revealed information on the mechanical bone quality of the samples. The fractions of mineralized tissue of the material ("bone density") were determined via, qCBCT and μ CT. For qCBCT, white pixel/black pixel ratio (WP/BP), for μ CT, bone volume/total volume (BV/TV) were calculated. Conventional histomorphometry was performed for visualization of the different samples. It was tested if the different methods were able to discriminate different bone types correctly. The correlation between UTV and radiological measurements was tested descriptively via scatter plot.

Results: For the cortical, cancellous and mixed bone samples; UTV values showed a mean of 1945.17, 1266.9 and 1472.2 m/s, respectively; WP/BP quotients were 0.96, 0.15 and 0.33, respectively; BV/TV quotients were 0.94, 0.2 and 0.47, respectively. Each method was able to discriminate between the different bone types ($P < 0.0001$). A strong correlation between UTV and radiological values was seen.

Conclusions and clinical implications: The results of our study underline the correlation of UTV with the radiologically obtained parameters. The advantages of UTV over other methods in terms of noninvasiveness, simplicity of use, nonionizing nature and cost effectiveness could make this modality useful before obtain valuable information on bone quality before dental implantation.

Effect of simvastatin administration on rat calvarial bone defect healing

Presenter: Karanikola T

Department of Alveolar surgery, Implantology & Radiology, Dental School, Aristotle University, Thessaloniki, Greece

Co-authors: Karanikola T¹, Tsartsalis S³, Veis A¹, Kalekou H², Mironidou-Tzouveleki M³, Tsirlis A¹

¹Department of Alveolar surgery, Implantology & Radiology, Dental School, Aristotle University, Thessaloniki, Greece, ²Department of Stomatology, Dental School, Aristotle University, Thessaloniki, Greece, ³A Laboratory of Pharmacology, Medical School, Aristotle University, Thessaloniki, Greece

Background: Unsufficient bone volume consists one of the major problem in the field of Implantology. Several pharmacological agents interfere with the process of new bone regeneration either promoting or blocking it. Simvastatin is a widely prescribed molecule with potential pleiotropic effects. Bone regeneration-related effect is one of them while its actual role in this process is a matter of debate.

Aim: The aim of this study is the evaluation of the bone regeneration potential after systemic simvastatin administration on artificial bony defects in the rat calvaria.

Methods: Thirty-two male adult Wistar rats were used. Each animal underwent a surgical procedure during which one circular bone defect (6-mm in diameter) was created on each of the parietal bones. Animals were divided in two groups: group (ST, $n = 16$) received daily intraperitoneal simvastatin injections (10 mg/kg/day), while the other group (CN, $n = 16$) served as control. Bone healing was assessed in both groups in 2 and 4 weeks. Calvarial bone samples including the defect area were retrieved and decalcified in EDTA acid buffer and embedded in paraffin. The two most central fronto-occipital sections of each sample were taken, stained with Hematoxylin and Eosin, and subjected to histological and histomorphometric analysis.

Results: Partial bone regeneration in the defect area was observed in all groups. Histomorphometrical data were subjected to *t*-test analysis and revealed significantly higher percentage of new bone in ST group in 2 weeks (39.26 ± 18.90 vs. 23.53 ± 13.19 , $P < 0.05$) while no significant difference was observed in 4 weeks healing period (31.62 ± 12.91 vs. 29.34 ± 13.47 , $P > 0.05$).

Conclusions and clinical implications: The results showed that systemically administered simvastatin had a significant bone regeneration-promoting effect in the first 2 weeks of administration. However, it was observed that in longer administration period (4 weeks), the new bone regeneration was not promoted and resulted in nonsignificant differences as compared with the control group.

Comparison of the effects of different implant apical design on stress and strain values in surrounding bone: a finite element analysis study

Presenter: Khademi M

Ahwaz Dental Faculty-Department of Periodontics, Ahwaz, Islamic Republic of Iran

Co-authors: Khademi M¹, Amid R², Raoofi S³

¹Ahwaz Dental Faculty-Department of Periodontics, Ahwaz, Islamic Republic of Iran, ²Shahid Beheshti Dental Faculty-Department of Periodontology, Tehran, Islamic Republic of Iran, ³Shiraz Dental Faculty-Department of Periodontics, Shiraz, Islamic Republic of Iran

Background: Failure of implant fixtures or restorations was attributed to either biological or mechanical factors. But, most implant complications have a biomechanical origin especially stress overload. So, a through understanding of implant biomechanics, the behavior of implant systems and its surrounding vital tissue in response to external loading makes it possible to optimize treatment plans for each patient and reduce the risk of functional complications and failures.

Aim: The aim of this study was to investigate the effects of implant design in apex area on stress and strain patterns within surrounding bone.

Methods: Three commercially available implant with similar diameter (3.5 mm) and almost similar length (10–11 mm) and complement abutment was selected to modeling, including: sample A: flat apical design with light tapering degree, sample B: dome shape apical design with light tapering degree, sample C: flat apical design with intense tapering degree in one-third apical. Modeling of bone was done according to one human CBCT and consisted of cortical bone with 2 mm thickness and cancellous bone. The force of 100 and 300 N in vertical and 15° axially direction applied to entire abutment surface. Equivalent stress and strain were calculated using FEA methods.

Results: Result showed that stress concentrated in cortical bone around implant neck in all models. In nonaxial load stress concentrated in buccal side. The most strain value detected was around the apex of fixture in sample C (7200 Micro strain). This is in concomitant with the highest level of stress detected in cancellous bone among all samples (4.4 MPa). We observed the pathologic overload, according to Frost, in apical area of sample B, which had dome-shaped apex. However, its strain value was less than sample C.

Conclusions and clinical implications: Great sudden changes in diameter along the fixture had some disadvantages in stress concentration and the amount of strain. Uniform tapering can be considered as a standard feature for the most clinical situations. The flat apical design causes better stress and strain distribution than dome-shaped apex in surrounding bone.

The effect of different bone graft materials on exophytic bone formation in rabbit calvaria

Presenter: Kim S-G

Department of Periodontology, Kyung Hee University School of Dentistry, Seoul, Republic of Korea

Co-authors: Kim S-G¹, Kim J-C¹, Herr Y^{1,2}, Chung J-H^{1,2}, Shin S-I¹, Lee D-Y¹, Kwon Y-H^{1,2}

¹Department of Periodontology, Kyung Hee University School of Dentistry, Seoul, Republic of Korea, ²Institute of Oral Biology, Kyung Hee University School of Dentistry, Seoul, Republic of Korea

Background: Guide bone regeneration has been performed on resorbed alveolar ridges to regenerate bone for implant placement. During the surgery bone graft material firmly maintains the space under the membrane enhancing bone regeneration process.

Aim: The purpose of the present study was to evaluate osteoconductive effect of Micro-macroporous biphasic calcium phosphate (MBCPTM, MBCP) and deproteinized bovine bone mineral (Bio-Oss[®], DBB) on exophytic vertical bone formation in guided bone regeneration using titanium reinforced e-PTFE membrane (TR).

Methods: Membrane was contoured in rectangular parallelepiped shape (8 mm length, 5 mm width and 4 mm inner height). MBCP and DBB were used as fillers in the space under the membrane. In addition, graft material was incorporated in 8% inorganic polyphosphate (polyP). Twenty adult male New Zealand white rabbits were used in this study and four rabbits were allotted to each group randomly. The test groups were divided as following: Test I (TR + MBCP), Test II (TR + MBCP + polyP), Test III (TR + DBB), Test IV (TR + DBB + polyP), and TR without any filler served as a control. The experimental animals were sacrificed at 8 and 16 weeks after the surgery as scheduled. Nondecalified preparation were processed in common. Histologic and histomorphometric analysis was carried out on exophytic space as a whole and on four equally divided vertical sections of the exophytic space for all groups.

Results: Control group and test group III showed the highest new bone formation at 16 weeks. There was no significant difference in the new bone formation between test group I and II at 16 weeks. All groups showed more amount of new bone formation at 16 weeks compared with 8 weeks and only test group II showed statistically significant difference. Extent of new bone formation in test group III was greater than any other groups at 8 and 16 weeks, but there was no statistically significant difference. New bone formation in Test group III was prominent in upper half of exophytic space at 8 and 16 weeks.

Conclusions and clinical implications: Within the limitations of our experiment, it could be concluded that even though both MBP and DBB seem to have osteoconductive effect, DBB resulted in more favorable new exophytic bone formation than MBCP. PolyP incorporation in both MBCP and DBB showed no significant influence in new bone formation.

The effect of platelet-derived growth factor on bone regeneration with bone morphogenetic protein-2

Presenter: Kim K-H

School of Dentistry, Seoul National University, Seoul, Republic of Korea

Co-authors: Kim K-H, Park S-Y, Kim H-J, Koo KT, Lee Y-M, Ku Y, Rhyu I-C, Seol Y-J

School of Dentistry, Seoul National University, Seoul, Republic of Korea

Background: Platelet-derived growth factor (PDGF) modulates cell migration, proliferation and angiogenesis. Bone morphogenetic protein-2 (BMP-2) induces differentiation of wide range of cells into bone. These two proteins have demonstrated effectiveness on bone regeneration in direct or indirect way.

Aim: This study is aimed to evaluate whether PDGF-BB can enhance the bone regeneration with BMP-2.

Methods: Rat bone marrow stromal cell (BMSC) obtained from rat tibia and transduced with adenovirus containing BMP-2. Negative control group, BMP-2 alone group, BMP-2 and rhPDGF-BB combined group was planned. For *in vitro* studies, BMP-2 expression and ALPase activity were measured. For *in vivo* studies, collagen gel with protein and/or cells transduced with BMP-2 gene were applied into the rat calvarial defects according to the groups. After 2 weeks, animals were sacrificed. Histomorphometric analysis was performed.

Results: *In vitro* study, combination of BMP-2 and PDGF-BB reduced BMP-2 expression from BMP-2 transduced cells and ALPase activity. *In vivo* study, combination of BMP-2 and PDGF-BB showed smaller volume of bone formation comparing with BMP-2 alone application. However, more mature bone was showed at combination of BMP-2 and PDGF-BB than BMP-2 alone.

Conclusions and clinical implications: PDGF-BB inhibited BMP-2 action on osteoblastic differentiation *in vitro*. However, maturation of bone was enhanced by combination of two proteins *in vivo*. The combination therapy of two proteins may be promising therapy for healing craniofacial bones.

Acknowledgement: This study was supported by grant no 03-2009-0018 from the SNU DH Research Fund. This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (20100021519).

Effect of the implant contact amount and the stiffness of surrounding material on the resonance frequency analysis values

Presenter: Kim S-G

The Catholic University of Korea, Seoul, Korea, Republic of

Co-authors: Kwak M-S, Kim S-G

The Catholic University of Korea, Seoul, Korea, Republic of

Background: It has been currently suspected of the clinical efficacy for the resonance frequency analysis device. It has been found that there was some debate about the correlation

between the amount of bone-implant contact area and the resonance frequency analysis (RFA) value.

Aim: The purpose of the present study was to evaluate the effect of the amount of contact between implant and its surrounding material on the RFA values, and examine the effect of stiffness of material around implant on the RFA values.

Methods: Sixty resin blocks that had the different amounts of contact area (100%, 50%/cervical 1 mm, 50%/cervical 3 mm, 30%/cervical 1 mm, 30%/cervical 3 mm, 15%/cervical 2 mm) with implants were fabricated. Ten resin blocks with 100% contact, 50% more monomer, and 10 silicone putty blocks with 100% contact were also made. The implants with $\varnothing 5.0\text{ mm} \times 13.0\text{ mm}$ were placed on eighty specimen blocks. The resonance frequency analysis value was measured by Osstell Mentor.

Results: The control resin group with 100% contact had the highest RFA value of 83.9, which was significantly different only from the resin group with 15% contact among the resin groups. The putty group had the lowest RFA value of 36.6 and showed statistically significant differences from other resin groups.

Conclusions and clinical implications: Within the limitation of an *in vitro* study, there was no correlation between the amount of contact around implant and the RFA values except the resin group with 15% contact. A significant increase in the RFA value was observed related to the increase in stiffness of material around implant. Clinical implications: The RFA values may show the degree of maturation in bone growth around implant, not the amount of bone contact around implant.

Evaluation of collagen-based membranes on guided tissue regeneration in furcation defects. An experimental study in dogs

Presenter: Kim V

New York University, NY, USA

Co-authors: Kim V⁴, Bonfante E², Marin C¹, Granato R¹, Janal M⁴, Suzuki M³, Coelho P⁴

¹Federal University of Santa Catarina, Florianópolis, Brazil,

²Unigranrio University, Duque De Caxias, Brazil, ³Tufts University, Boston, United States of America, ⁴New York University, NY, USA

Background: Tissue engineering is an important field of reconstructive surgery. The use of new materials can improve surgical approaches and outcomes. The materials as resorbable membranes can guide the regeneration and after resorption avoid additional surgeries to remove membranes. Some features as biocompatibility, slow resorption and levels bone regeneration must be evaluated before clinical use in animal model.

Aim: The objective of the present study was to evaluate the effectiveness of a collagen-based membrane on guided tissue regeneration of furcation defects in a dog model.

Methods: This study included eight beagle dogs of ~ 1.5 years of age. All surgical procedures were carried out under general anesthesia. The surgical procedure was performed in the posterior maxilla, where an intrasulcular incision from the distal aspect of the premolar to the mesial aspect of the molar was

made followed by total flap reflection. Then, a 4 mm in length by 2 mm diameter cylindrical bur was utilized to create standardized defects at the region between the mesial and distal premolar roots of the second and third premolars. Before suture, a collagen-based membrane was placed in one of the defects (membrane group), and the other defect was left uncovered (no membrane group). The left and right sides provided samples that healed for 2 and 16 weeks *in vivo*, respectively. Following euthanasia, the three-dimensional bone architecture was acquired by microcomputer tomography, and each defect was assigned to one of the following categories: fully regenerated (F, bone height and width were regenerated), nonregenerated (N). Statistical analysis was performed by chi-squared tests.

Results: No signs of inflammation were detected during soft tissue healing and throughout the course of the study. Statistical analysis showed that tooth did not have an effect on outcome ($P=0.5$), whereas significant differences were observed as a function of time *in vivo* ($P=0.008$), and between treatment groups ($P=0.08$).

Conclusions and clinical implications: Conclusion: The collagen-based membrane placement significantly improved tissue regeneration in induced furcation defects.

The effect of abutment and dynamic loading on implant microgap

Presenter: Lee J-H

Dankook University, Choeran, Republic of Korea

Co-authors: Lee J-H, Oh B-D, Shin S-Y, Hong J-T

Dankook University, Choeran, Republic of Korea

Background: Complications caused by microgaps between implant fixture and abutment were frequently reported. On the other hand, titanium abutments and gold-alloy abutments have been widely used for a long-time in the clinical situations, but the use of zirconia abutments also increased due to the increased esthetic demands.

Aim: This study was designed to compare and evaluate the microgap differences according to types of abutment and the microgap changes caused by dynamic loading.

Methods: Samples were classified into three groups according to the type of the abutments and seven samples were tested in each group. Titanium abutment (Cement abutment), zirconia abutment (ZioCera abutment) and casting gold-alloy abutment (UCLA plastic abutment) were connected into titanium implants of external hexagonal structure US II $\varnothing 3.75 \times 11.5$ mm (Osstem Co., Seoul, Korea) by torque wrench with the tightening torque of 30 Ncm. Using the fatigue loading testing machine, a sine type dynamic loading of 25–250 N was applied for 10^5 times with the frequency of 14 Hz. Using the SEM both before and after the loadings, implant fixture-abutment interfaces were analyzed on the labial, palatal, mesial and distal surface to measure the microgaps between implant fixture and abutment.

Results: The microgaps on each surfaces before and after the loading were compared, no statistically significant difference

was observed in the microgaps caused by the dynamic loading on the labial, palatal, mesial or distal surface. Comparing the microgaps according to type of abutments, statistically significant difference was observed between the UCLA and the titanium group and between the UCLA and the zirconia group on both before and after the loading ($P < 0.05$). No statistically significant difference was found between the titanium and the zirconia group.

Conclusions and clinical implications: Repeated loadings for 10^5 times did not show any significant effect to the microgaps between implant fixtures and abutments and to the interfaces of zirconia abutments used with esthetic purpose as well as those of conventional metal abutments.

405 | Basic Research

Effect of microgroove-depth on osteoblast differentiation

Presenter: Leesungbok R

Department of Biomaterials & Prosthodontics, Kyung Hee University School of Dentistry, Seoul, Republic of Korea

Co-authors: Leesungbok R, Lee S-W

Department of Biomaterials & Prosthodontics, Kyung Hee University School of Dentistry, Seoul, Republic of Korea

Background: In our previous studies, $60\text{-}\mu\text{M}$ -wide etched microgrooves among various widths on titanium substrata were verified to enhance various human primary cell behaviors. However, the effect of microgroove-depth remains to be investigated.

Aim: The purpose of this study was twofold; to test the efficacy of using periodontal ligament cells (PLCs) alternative to MG63 osteoblast-like cells or human mesenchymal stem cells (MSCs) for determining the osteoblast differentiation on titanium surfaces and to investigate the effect of microgroove-depth on the osteoblast differentiation of PLCs.

Methods: Using photolithography, microgrooves were fabricated to have $60\text{-}\mu\text{M}$ width and $10\text{-}\mu\text{M}$ depth on titanium substrata followed by subsequent acid etching (E60/10). Smooth titanium surface was used as a control (NE0). Difference of the degrees of alkaline phosphatase (ALP) activity and osteoblast differentiation between MSCs and PLCs on NE0 and E60/10 after various time periods of osteogenic culture were investigated using the ALP activity test and extracellular calcium deposition assay, respectively. Microgrooves were subsequently fabricated to have monotonous width of 60 and $10\text{-}\mu\text{M}$ and $20\text{-}\mu\text{M}$ depth (NE60/10 and NE60/20) along with their respective etched microgrooves (E60/10 and E60/20). Both NE0 and acid-etched titanium (E0) were used as controls. Cell adhesion, cell proliferation and osteoblast differentiation of PLCs were analyzed and the expressions of genes involved in osteoblast differentiation were analyzed using the RT-PCR and quantitative real-time PCR. One-way ANOVA and Pearson's correlation analysis were used for statistics.

Results: Compared with NE0, E60/10 significantly enhanced the ALP activity and osteoblast differentiation of both MSCs

and PLCs, with highest enhancement after 11 days of MSCs' osteogenic culture for ALP activity test and 21 days for extracellular calcium deposition assay whereas PLCs showed highest enhancement after 17 and 24 days. Among NE0, E0, NE60/10, NE60/20, E60/10 and E60/20, E60/10 significantly promoted cell adhesion, cell proliferation and osteoblast differentiation of PLCs. Genes responsible for encoding ALP, runt-related transcription factor 2 and osteocalcin were significantly up-regulated on E60/10 compared with other surfaces. Significant correlations were found between the results of cell adhesion, cell proliferation, osteoblast differentiation and gene expressions.

Conclusions and clinical implications: This study indicates that $60\text{-}\mu\text{M}$ -wide and $10\text{-}\mu\text{M}$ -deep etched microgrooves on titanium are more capable of enhancing various cell behaviors of PLCs than the $60\text{-}\mu\text{M}$ -wide and $20\text{-}\mu\text{M}$ -deep microgrooves, suggesting that the application of such surface on oral or orthopedic titanium implants would yield promising clinical results.

406 | Basic Research

Modal damping factor: a mandibular bone quality assessment technique, for preoperative evaluation of implant placement

Presenter: Lianos K

Dental School, University of Athens, Athens, Greece

Co-authors: Lianos K^{1,2}, Panteliou S²

¹*Dental School, University of Athens, Athens, Greece*, ²*Department of Mechanical Engineering And Aeronautics, University Of Patras, Patra, Greece*

Background: Modal Damping Factor (MDF) is a material and system property. Its measurement is based on vibration excitation through acoustic frequencies. The method is nondestructive, nonirradiating that has been successfully applied on metallic structures and composites. It is supported by an analytical-arithmetic tool based on model's theory and a dedicated device [1–5] is used for the assessment of bone structural integrity and for monitoring metabolic bone diseases (i.e. osteoporosis) [6–10]. It was shown that MDF is sensitive to fatigue and structural changes, especially porosity. Raman spectroscopy, is a bone chemical quality assessment tool. A bone Raman spectrum contains information on collagen-apatite vibrations, informing about its major chemical constituents. Raman spectra are recorded using a FRA-106/S FT-Raman (Bruker, Karlsruhe, Germany). Contemporary methods for human mandible quality assessment include, for research purposes, Bone Mineral Density (BMD) measurements through Dual-Energy X-Ray Absorptiometry (DEXA). BMD is measured using a Norland XR-26 MARK-II bone densitometer and was used as the control method.

Aim: Development of a noninvasive tool, based on MDF, for objective assessment of dentofacial bone quality to facilitate presurgical implant planning.

Methods: We applied structural integrity monitoring through Modal Analysis and Raman Spectroscopy, to obtain objective assessment of mandible bone quality. MDF, BMD and Raman

measurements were performed on 10 human cadaveric mandibles [11,12]. Specifically, for MDF measurement, vibration triggering is produced by controlled sound electronics and applied through a metallic stem to the mandible mid-point, while output is acquired through an accelerometer placed consecutively on five points on each side of the middle one. MDF is measured with designed-constructed dedicated device.

Results: Average MDF-BMD measurements and their inverse correlation for all mandibles are presented. High BMD values, expressing high bone density, correspond to low MDF values, which in turn express improvement of bone structure. Anterior mandibular points present higher BMD and lower MDF measurements than the posterior ones. Raman spectroscopy shows a similar qualitative pattern with surface mineral/collagen ratio remaining constant throughout the mandible.

Conclusions and clinical implications: From data acquired a very promising correlation between MDF-BMD-RAMAN clearly arises, reinforcing the belief (from our previous research findings) that MDF method can be advanced to an *in vivo* bone quality assessment tool. With the advantages of accurate and repeatable measurements and being noninvasive, nonirradiating, painless, portable, of low cost, short duration and easy in use, the MDF method encourages further research investigation.

The effect of fibrin-binding oligopeptide derived from fibronectin on migration of periodontal ligament cells *in vitro* wound healing model

Presenter: Lim J-H

Department of Periodontology and Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Republic of Korea

Co-authors: Lim J-H, Rho Y-H, Koo K-T, Kim T-I, Seol Y-J, Lee Y-M, Ryu I-C, Chung C-P, Ku Y

Department of Periodontology and Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Republic of Korea

Background: Fibronectin (FN) has an effect on cell attachment, migration, and differentiation by interaction with cells and plays a role in tissue regeneration and wound healing. The biologic function of Type III 9–10 domains of FN has examined in many studies and interest has recently increased in fibrin, collagen/gelatin, and heparin-binding domains other than major cell binding sites.

Aim: The aim of this study was to evaluate the effect of synthetic FN fragments containing an N-terminal fibrin-binding domain on migration of human PDL fibroblast cells in an *in vitro* wound-healing model.

Methods: Three types of synthetic oligopeptides, which included fibrin-binding domain of FN (FF1, 3 and 5), were allocated to the experimental groups. Recombinant oligopeptide (F20) including Type III 9–10 domains of FN was used as a positive control and a group treated with nothing was the negative control. Cell migration capacity was evaluated using a Cell Migration Assembly kit.

Results: The migration rates and number of migrated cells increased in the test group and both control groups at each

point in time. F20, which was used as a positive control in this study, showed a significantly increased cell migration rate as compared with the control group at 6 and 12 h, but not at 18 or 24 h. There were no significant differences among test groups or between the test and positive control (F20) ($P < 0.05$). In examination of the number of migrated cells, there was no observable significance between the test and either control aside from the FF1 100 μM, and FF5 100 μM groups at 6 h and the FF1 50 μM, and FF3 100 μM groups at 12 h. There was no significant difference among the test groups ($P < 0.05$).

Conclusions and clinical implications: Within the limits of this study, N-terminal fibrin-binding domain of FN promoted cell migration of PDL fibroblast cells.

Bone healing process, in corticotomy using Er,Cr:YSGG laser, Fissure bur, microsaw in white rabbit

Presenter: Lim J-S

Yeouido St. Mary's Hospital, The Catholic University of Korea, Seoul, Republic of Korea

Co-authors: Lim J-S¹, Yoon H-J¹, Lee S-H¹, Yew S-H²

¹Yeouido St. Mary's Hospital, The Catholic University of Korea, Seoul, Republic of Korea, ²Practice in private clinic, Seoul, Republic of Korea

Background: Corticotomies are well-known procedures in implant dentistry. Its applications on guided bone regeneration, ridge splinting technique and distraction osteogenesis were published previously. Different bone cutting instruments are currently available with the saw, rotating bur and lasers. However, comparison of these instruments on healing process is insufficient.

Aim: The aim of this study was to compare the healing response in osteogenesis using Er,Cr:YSGG laser, microsaw, fissure bur in white rabbits.

Methods: With the range of 2.75–3.0 kg, 13 New Zealand white rabbits were used. They were divided into three groups, which one group has five and the other two groups have four rabbits each. Osteotomy was done on three groups using Er,Cr:YSGG laser, microsaw and fissure bur and sacrificed at 1, 5 days, and 2 weeks. Corticotomy was done in the surrounding of the both mandibular 1st molars with 1 mm of width and depth. Osteotomy with Er,Cr:YSGG, microsaw, fissure bur were experimental groups, and contralateral side with periosteotomy only were used as a control. The specimen were assessed for angiogenesis and osteogenesis using hematoxylin and eosin staining method and vascular endothelial growth factor (VEGF) immunohistochemical staining method. Focal hemorrhage, new bone formation, and periosteal reaction were observed in hematoxylin and eosin staining method. Intensity of vascular endothelial growth factor expression and percent of vascular endothelial growth factor.

Results: Sacrificing group at day 1 and 5 using laser, microsaw, and fissure bur showed only focal hemorrhage and no sign of periosteal reaction and new bone formation. However, hematoxylin and eosin stain analysis showed significantly

increased periosteal reaction, trabecular pattern and new bone formation at 2 weeks groups using laser, microsaw, and fissure bur. Bone regeneration was not occurred at day 1 groups while bone formation of each instrument was observed at day 5 and the 2 weeks group. There was no significant difference in amount of new bone formation and periosteal reaction among three instruments.

Conclusions and clinical implications: Using different instruments such as Er,Cr:YSGG laser, microsaw, and fissure bur in osteotomy showed no significant healing response in osteogenesis. Therefore, it is totally up to a surgeon which instrument he or she will choose in corticotomy.

Modifying osteogenic differentiation of human periodontal cells *in vitro*

Presenter: Lorincz A

Semmelweis University, Budapest, Hungary

Co-authors: Lorincz A, Barabas J

Semmelweis University, Budapest, Hungary

Background: Background. Cells of human periodontal ligament origin (PDL) are known to have the capacity to differentiate into osteogenic cells, that can be induced by simple means in an *in vitro* monolayer culture.

Aim: The aim of the present study was to investigate whether this capacity could be increased by the addition of certain simple materials (small molecules in the nomenclature of another classification).

Methods: Primary cultures of human PDL cells were prepared. The cells were obtained from the PDL of surgically removed impacted third molars. After 2–3 passages a subconfluent culture was obtained and was used for the present study. In the study group Strontium ranelate was added to the culture medium designed for osteogenic differentiation. Alizarine red staining, immunocytochemistry and rtPCR were used to follow the changes taking place in the cultured cells.

Results: Our results showed that changes suggestive of osteogenic (osteoblastic) differentiation took place in both the study and the control group. There was a significant difference in Alizarine Red staining between the two groups. The same changes in the expression of important proteins in osteogenic differentiation took place at different times in the two groups.

Conclusions and clinical implications: Based on the present study strontium ranelate may be a feasible candidate for enhancing the osteoinductive properties of bone grafting materials as well as a possible agent in inducing osteogenesis in tissue engineering environments.

Topographic approach to determine discrepancy between clinical and software-guided casts for implant placement

Presenter: Lumetti S

University of Parma, Parma, Italy

Co-authors: Lumetti S, Forlani G, Manfredi E, Galli C, Rivara F, Macaluso G

University of Parma, Parma, Italy

Background: Software-guided implant planning and positioning is a potent tool for implant rehabilitation, making flapless implant surgery a clinically viable option. The precision of this procedure, however, has scarce support from the available literature.

Aim: The aim of the present study was to develop a method to quantitate the position discrepancy between a cast obtained from a surgical template (STC: Surgical Template Cast) generated using Nobelguide System[®] (Nobelbiocare, Göteborg, Sweden) and a cast obtained from an impression taken immediately after implant placement (CC: Clinical Cast). The measuring system is based on a photogrammetric method.

Methods: Seven consecutive edentulous patients were analyzed for a total of 43 implants (Nobel Replace, Nobelbiocare, Göteborg, Sweden). Each cast was placed on a steel plate marked with 16 points created by a computer controlled drilling machine (accuracy < 10 μM) along the edge. A series of 16 convergent images was taken by positioning a high-resolution camera on each mark around the cast. Four points were measured for each implant. Every measured point was therefore photographed from 16 different positions. Images were then imported into a specific software (Photomodeler, Vancouver, Canada) to calculate the implants spatial coordinates. The position of each implant was obtained by computing the gravity centre of the four points, whereas the orientation of the implant axis was computed from the normal vector to the plane fitting the four reference points. The computational method used to determine the differences in relative distances and angle of the implants was based on roto-translation, that is the spatial transfer from a cartesian system to another through a seven-parameters Helmert transformation (MatLab, MathWorks, Natick, MA, USA). Coordinates were also exported to a graphic viewer (Surfer8, Golden Software Inc, Golden, CO, USA) to obtain a graphical representation of the results.

Results: The table summarizes the mean of the differences between the implant position and the orientation as determined in STC and in CC.

Position (mm)			Angle (degrees)		
Mean	SD	Min/max	Mean	SD	Min/max
0.35	0.13	0.13/0.87	3.64	0.9	1.01/8.09

Conclusions and clinical implications: This is the first report of a photogrammetry-based measuring system applied to determine the STC vs. CC discrepancy. The only other system with similar precision (12 μM) is based on a contact scanner and yielded comparable results.

Treatment planning based on biomechanical requirements

Presenter: Flach M

University of Applied Sciences, Virtual Prototyping, Koblenz, Germany

Co-authors: Flach M¹, Streckbein P², Streckbein R³, Howaldt H-P²

¹Virtual Prototyping, University of Applied Sciences, Koblenz, Germany, ²Department of Cranio-Maxillo-Facial Surgery, Justus Liebig University, Gießen, Germany, ³IZI FW – Institute for Postgraduate Education in Dental Implantology, Limburg, Germany

Background: Biomechanical aspects play a major role in the success of implant treatment. The general principles of bone remodelling are commonly known. Even if the individual bone architecture around dental implants is given by 3D planning/navigation tools, the biomechanical requirements are not considered in the implant positioning process. The position of the implant is still defined by general rules and the experience of the surgeons.

Aim: The aim of this study is to show the biomechanical impact of different implant positions in a 3D patient individual bone environment and to suggest a procedure considering biomechanical requirements during implant treatment planning.

Methods: The bone geometry from a CT-scan before implant placement is transferred to a segmentation tool. In the segmentation tool the implants were placed in accordance to the implant positions given from the surgery. This is achieved by another CT-scan containing the implants. The geometry of the implants in the segmentation is taken from a CAD system to make sure that the exact geometry of the implant is used. A finite element model is created out of the bone segmentation and the placed implants. The occlusion forces are applied to the finite element model and the bone stresses and strains are calculated. To show the influence of the implant position to the bone reaction the coordinates of the implant are varied and subsequent finite element calculations are carried out. A comparison of all varied positions is done and the optimal implant position is determined.

Results: The 3D geometry of the patient individual bone given from CT-scans differs from the idealised geometry usually used for finite element calculations. As a result of that the position of the implants has a significant influence to the bone strains. With the variation of the implant position an optimal placement of the implant can be carried out and used in the treatment planning process.

Conclusions and clinical implications: The implant position has a major impact to the biomechanical response of the bone. The described procedure for implant placement considering the biomechanical requirements of the bone tissue can be used during the implant treatment planning process to achieve an optimal clinical result of the bone remodelling process.

Modification of culture into osteogenic or keratogenic differentiation from subcutaneous adipose-derived stem cells *in vitro*

Presenter: Nakata H

Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan

Co-authors: Nakata H, Noritake K, Hao J, Takafuji K, Kasugai S, Kuroda S

Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan

Background: Provision of autologous graft is often required for tissue regeneration of severely defected or compromised sites of the maxillofacial region. However, harvesting tissues from oral parts or iliac bone for example may occasionally cause patients to agonize over excessive intervention and issue limitation of the donor sites. To overcome the shortcomings, MSCs are considered as a matter of current interest for generating tissues, reducing physical stress. Among the various sources currently available for extracting MSCs, adipose tissue has emerged as a promising candidate.

Aim: Adipose-derived stem cells (ADSC) are an abundant population of adult stem cells with the ability to differentiate into several specialized cell types including epithelial and mesenchymal cells. The purpose of the study was to examine the possibility of ADSC growing into several matured cell types in various culture conditions.

Methods: Dedifferentiated fat cells (DFAT) and ADSC were isolated from 10 female ICR mice. Approximately 4 g of abdominal subcutaneous fat tissue was minced and digested in 0.1% (w/v) collagenase solution. After filtration and centrifugation, the floating top layer containing mature adipocytes was collected to obtain DFAT. After wash with PBS, cells were transferred to adhere to the ceiling of a 25 cm² culture flask completely filled with DMEM supplemented with 20% FBS and antibiotics. After 7 days, the medium was removed and the flask was inverted upside down for the normal culture style in the fresh medium. To obtain ADSC, the precipitate of the centrifuge was resuspended and cultured in DMEM as well as DFAT. Both cells were cultured at 37°C and 5% CO₂ for 1 month.

Results: ADSC propagation was accelerated by addition of 6-bromoindirubin-3'-oxime (BIO) to the culture medium. After 3 weeks, it was noted that several specialized phenotypes of cells were observed and gathered each other to form colonies. Subsequently, isolated each colony was separated by a magnet-activated cell sorting system to identify immunophenotypes of the cells. Culture of ADSC in a fibrin gel or with β -TCP revealed differentiation of keratocyte-like cells and osteoblast-like cells, suggesting high potential of ADSC for differentiation. On the other hand, DFAT was less viable for proliferation and differentiation in the designed condition.

Conclusions and clinical implications: In this study, we ascertained the possibility of ADSC differentiation into several specialized cell types by modification of culture condition. Therefore, subcutaneous ADSC appears to be one of the most useful candidates for stem cell therapy of tissue regeneration to defected sites in oral region.

Early peri-implant endosseous healing of two different implant surfaces

Presenter: Novaes Jr. A

School of Dentistry of Ribeirao Preto of the University. of Sao Paulo, Ribeirao Preto, SP, Brazil

Co-authors: Novaes Jr. A, Barros R, Queiroz A, Almeida A
School of Dentistry of Ribeirao Preto of the University of Sao Paulo, Ribeirao Preto, SP, Brazil

Background: Several implant surfaces are being developed, some in the nanoscale level. One way of evaluating the quality of these surfaces is to evaluate how they can create bone within gaps created between the implant and the bone surface.

Aim: To compare the early healing properties of two implant surfaces in face of circumferencial defects through histomorphometry.

Methods: Six mongrel dogs had the lower bicuspid extracted from both sides of the mandible. After 8 weeks, four implants (3.25 × 10 mm) were placed in each side, on one side with a Nanotite surface and the other with an Osseotite surface. One implant in each side was placed equicrestally on the healed ridge and acted as a control, in the other sites three different circumferencial gap defects were created, 1, 1.5 and 2 mm wide and 5 mm in length from the bone crest. Following 8 weeks of healing, the following histomorphometric parameters were evaluated: Distance from the bone crest to the first bone implant contact (VBR); in order to evaluate the bone remodeling (BR) within the gaps, three horizontal measurements were made in the length of the gap, A-from the shoulder of the implant to the bone, B-from the midpoint of the defect to the bone and C-from the most apical point of the defect to the bone.

Results: In the Nanotite group, the VBR was lower for the control group (0.84 mm) and increased as the gaps became wider, mean 1.52 mm for the 1 mm defect, 1.63 for the 1.5 and 1.87 for the 2 mm defects; differences were NS. Similarly, in the Osseotite group the VBR was 0.65 mm for the control, 1.48 mm for the 1 mm defect, 1.62 for the 1.5 and 1.87 mm for the 2 mm defect. Differences were significant only between the control and the 2 mm defects. The intergroup analysis was statistically NS. Owing to crestal remodeling, the measurement for BR-A was sometimes inexistent, in the Nanotite group it occurred in two control implants, in two for the 1 mm gap, three for 1.5 and four implants for the 2 mm gap. In the Osseotite group, it was found in one control implant, two for the 1 mm gap, three for the 1.5 mm and four implants in the 2 mm gaps. Considering the other two linear measurements (B and C) the mean values increased from the control to the 2 mm gap defect, but the differences were statistically NS.

Conclusions and clinical implications: In conclusion, both surfaces may lead to complete fill of the circumferencial defect varying from 1 to 2 mm wide and 5 mm in length. However, as the gap increased so did the VBR and the potential for gap resolution decreased. In part two of the study, through fluorescence analysis differences between the surfaces at different periods of healing will be analyzed.

The multidisciplinary approach to the patients with burning mouth syndrome

Presenter: Özcan İ

Oral and Maxillofacial Department, Faculty Of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Özcan İ¹, Erdem TL¹, Özkan M²

¹Oral and Maxillofacial Department, Faculty of Dentistry, Istanbul University, Istanbul, Turkey, ²Department of Consultation Liaison Psychiatry, Istanbul Faculty of Medicine, Istanbul University, Istanbul, Turkey

Background: Cooperation between dentist and psychologist has special importance because of the important role which oral cavity plays in psychological progress and also the form and function oral cavity which affects a person's psychological situation.

Aim: The aim of this research is to define the extent and dispersion of the spritual symptoms of people complaining of facial, tongue and jaw pain, burning mouth, glossodynia, disorder in tasting, parestesia in face, gingival pain, xerostomia, bruxism, pain in TMJ region; and to emphasize the multi-disciplinary approach of dentists to these patients.

Methods: In this research, 151 (114 female, 37 male) patients appealed to our clinic with facial, tongue and jaw pain, burning mouth, glossodynia, disorder in tasting, parestesia in face, gingival pain, xerostomia, bruxism, pain in TMJ region complaints. SCL-90 R (Symptom Check List-90-Revised), Back Depression and Trait Scales were evaluated in 151 patients.

Results: The results of this study has been revealed that depression increased with the increasing of mean age of patients, somatization increased correlated with depression, with psychosis, with psychosis and paranoid ideas. In 72% of the patients anxiety was found as increased.

Conclusions and clinical implications: As a conclusion of this study, the cooperation between dentists and psychiatrists in the patients with oral manifestations those cannot be related with any subjective findings may be offered.

Cherubism affected both maxilla and mandible – a case report

Presenter: Özcan İ

Oral and Maxillofacial Radiology Department, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Özcan İ, Demirtaş N, Barut O, Erdem TL

Oral and Maxillofacial Radiology Department, Faculty Of Dentistry, Istanbul University, Istanbul, Turkey

Background: Cherubism is a rare disease that usually affects the jaws in children mostly below 5 years old. Some cases were reported that frequently associated with dental malformations. Nevertheless, the reason for this remission is unknown.

Aim: Aim of the study is to present a female patient with Cherubism in which both maxilla and mandible were affected as a rare situation in the disease. In addition to this, clinical

features of the disease and planning of both aesthetic and functional reconstruction in conjunction with handicap of dental implant planning; some dental conditions – as a ghost teeth – in the case were presented.

Methods: A 21-year-old female patient, presented with painless progressive swelling of bilateral cheeks. Clinical investigation revealed deformed alveolar bone crest with missing teeth. Panoramic radiograph of the patient revealed variably bilaterally, expansive, radioluscent, lytic lesions with ground glass appearance involving both mandible and maxilla of the patient. Additionally, with 11 missing teeth, all of 17 teeth were malformed, two of them were dilacerated, one was impacted and seven were ghost teeth. However, the lesions in maxilla and mandible were operated five times before her appeal to our clinic, resided after all operations. The young patient was desiring to have fixed prosthesis because of aesthetic worries.

Results: Because of the high incidence of residives of the lesions, the radiological and clinical follow-up of the patient was approved. The functional and aesthetic rehabilitation had to be planned in opposition to the patient's wish.

Conclusions and clinical implications: As a conclusion of this report, in patients with Cherubism because of lack of osseointegration dental implants may cause complications. For this reason, the functional and aesthetic rehabilitation can be managed with noninvasive prosthetic approach.

416 | Basic Research

Dimensional Accuracy of Implant Master Cast Made with Type IV and Mounting Stone

Presenter: Pantzari F

Eastman Dental Center @ School of Engineering and Applied Sciences, Rochester, NY, USA

Co-authors: Pantzari F^{1,2}, Ercoli C¹, Funkenbusch P¹, Feng C¹

¹*Eastman Dental Center @ School of Engineering and Applied Sciences, Rochester, NY, USA, ²Department of Prosthodontics, Dental School of Athens, National @ Kapodistrian University of Athens, Athens, Greece*

Background: Type IV stone has generally been used to fabricate cast for implant prosthesis. Limited comparative data exists on the dimensional accuracy of other types of stone for the fabrication of implant prosthesis.

Aim: The purpose of this study was to evaluate the dimensional accuracy of mounting stone vs. type IV stone on the accuracy of implant master cast.

Methods: Three externally hexed, Nobel Biocare (Steri-Oss) implants were screwed in a machined aluminum base at 15 mm distance from each other. A framework (Master framework) was cast on the aluminum base and then used to fabricate a master stone base. Twenty-five vinylpolysiloxane impressions were taken with the open tray technique. Each impression was poured twice, once with type IV stone and once with mounting stone. The dimensional accuracy of these 50 bases was tri-dimensionally measured by attaching the master framework to the center implant and using the framework as measuring

reference. The X and Y coordinates of the geometric implant center was calculated averaging the coordinates of the six corners of the hexagon with a traveling microscope and the relative distances among the three implants were calculated with the use of the Pythagorean theorem. The vertical measurements were obtained with a digital caliper at the locations of the left (L) and right[®] implant.

Results: The data analysis by the Shapiros test showed normal distribution in the two groups of different stone. The two-sample *t*-test showed no significant difference between type IV stone and mounting stone at a significance level of $\alpha = 0.05$.

Conclusions and clinical implications: Implant master casts fabricated with mounting stone have the same dimensional accuracy of casts fabricated with Type IV stone.

417 | Basic Research

Effect of inorganic polyphosphate on exophytic bone formation in rabbit calvaria

Presenter: Park S-Y

Department of Periodontology, Kyung Hee University School of Dentistry, Seoul, Republic of Korea

Co-authors: Park S-Y¹, Jeong J-W¹, Herr Y^{1,2}, Chung J-H^{1,2}, Shin S-I¹, Lee D-Y¹, Kwon Y-H^{1,2}

¹*Department of Periodontology, Kyung Hee University School of Dentistry, Seoul, Republic of Korea, ²Institute of Oral Biology, Kyung Hee University School of Dentistry, Seoul, Republic of Korea*

Background: Guided bone regeneration has become a predictable procedure in implant dentistry. In this procedure, preventing membrane from falling down and maintaining stable space are critical. Various bone graft materials are used to avoid membrane from collapsing and facilitate bone regeneration.

Aim: The purpose of present study was to evaluate the osteoconductive effect of the combined use of inorganic polyphosphate with human bone allograft on exophytic vertical bone formation in guided bone regeneration with titanium reinforced e-PTFE membrane (TR).

Methods: Freeze-dried cortical bone (Oragraft[®]; FD) and solvent-dehydrated bone allograft (Puros[®]; SD) were used as filler materials in the space created by titanium reinforced e-PTFE membrane. In addition, graft materials were incorporated in 8% inorganic polyphosphate (P). Membrane was contoured in rectangular parallelepiped shape (8 mm length, 5 mm width and 4 mm inner height) and sterilized with ethylene oxide before the surgery. Twenty New Zealand adult white male rabbits (mean weight 3 kg) were used in this study and four rabbits were allotted to each group randomly. The test animals were divided into five groups as following: Group 1 (TR + FD), Group 2 (TR + FD + P), Group 3 (TR + SD), Group 4 (TR + SD + P), Control Group (TR; without any filler). The experimental animals were sacrificed at 8 and 16 weeks after a surgery as scheduled. Nondecalcified preparation was processed for histologic and histomorphometric analysis. The exophytic space covered by membrane was divided into four sections. For histo-morphometric analysis, a PC-based image analysis system was used to assess new bone formation and residual graft materials.

Results: New bone formation was increased in test group at 16 than 8 weeks, but there was no statistically significant difference. Graft materials were remarkably decreased in all test groups at 16 than 8 weeks. Group 1 and 2 showed significantly greater new bone formation at 16 than 8 weeks. Group 2 showed significantly greater new bone formation than other groups at 8 and 16 weeks. In the top area of membrane space, Group 2 and Group 4 showed significantly more new bone formation than other groups.

Conclusions and clinical implications: Within the limitations of our experiment, it can be concluded that more favorable new exophytic bone formation could be obtained by composite grafts of freeze-dried cortical bone and 8% polyphosphate.

Bone response to demineralization by etchant in the rabbits

Presenter: Park YH

E-Da Hospital, Kaohsiung, Taiwan

Co-authors: Park YH, Kim TG, Lee W

E-Da Hospital, Kaohsiung, Taiwan

Background: A range of methods have been used to achieve rapid new bone formation in contemporary dentistry, but acid etching of the alveolar bone has never been reported.

Aim: This study compared the histological changes in demineralized cortical bone with those in the control sites.

Methods: The experiments were carried out on twelve New Zealand white rabbits, approximately 3.5 kg in body weight. After exposing both buccal surface of the mandible, 37% phosphoric acid was applied to the left buccal side and 10% phosphoric acid was applied to the right side of the same area. The experimental groups were divided into four sites depending on the application time (5 and 10 min), and phosphoric acid concentration (10% and 37%). The control site was set up on the adjacent area of the experimental site. Two weeks later, the rabbits were sacrificed. After fixation and decalcification, the tissue sample was fabricated. The tissue slide was stained with H&E and TRAP (Tartrate-resistant acid phosphatase), and the histomorphologic changes were observed by optical microscopy.

Results: A part of the cortical bone was partially resorbed in the demineralized area. Immature bone was formed on the surface of the cortex, from the demineralized site to the control one. There was no difference in tissue healing in the areas where 37% and 10% phosphoric acid was applied. Larger amounts of tissue healing were observed in the group that had been exposed to the etchant for 10 min. TRAP staining revealed osteoclasts in all sites that were more highly distributed in the experimental sites than the other group.

Conclusions and clinical implications: Etching by phosphoric acid on the alveolar bone helps new bone formation and the activation of osteoclasts.

Accuracy of template-based dental implant placement

Presenter: Patellis E

Private Practice, Willisau, Switzerland

Co-authors: Patellis E¹, Eggers G²

¹*Private Practice, Willisau, Switzerland*, ²*Private Practice, Weinheim, Germany*

Background: Accurate positions of implants is of paramount importance. Based on Computer Tomography data, dedicated software for implant planning allows virtual placement of the dental implants to help the clinician find an optimum solution. Technical systems are available that support the transfer of this virtual planning into the clinical setting of the oral cavity. In the present study, a system was investigated that creates individual oral drilling templates based on the planning from imaging data. **Aim:** The accuracy of a system for image-guided dental implant planning and placement based on individually fabricated oral templates was investigated in a phantom study.

Methods: The study was performed on identical phantoms of a partially edentulous mandible. In one phantom mandible (the master model), pilot boreholes for dental implants were placed. Computerized tomography image data were then acquired. Using a system for template-based dental implant placement, identical boreholes were planned on the image data and then reproduced in the 10 remaining phantom mandibles (the "slave" models) from two different surgeons. The resulting positions were compared with the positions in the master model using a three-dimensional digitizer arm. To assess the influence of the surgeon, all drilling results were compared in a two-sided paired *t* test. The holes in the five slave models that were created by the first surgeon using the drilling templates were compared with the holes in the other five slave models that were created by the other surgeon using the same templates. To assess the reproducibility of the creation of the templates, the drilling results of the two models that were drilled with each of the five templates were compared in a two-sided paired analysis of variance (ANOVA).

Results: The mean deviation of borehole apex positions in the slave phantoms, as compared with the master phantom, was 0.50 ± 0.04 mm and was below 1 mm in 29 of 30 boreholes. The accuracy was highly reproducible, irrespective of the template used and the surgeon involved.

Conclusions and clinical implications: The use of templates for image-guided insertion of dental implants is a method with high and reproducible accuracy.

Competitive protein adsorption study on grit-blasted c.p. Ti surfaces

Presenter: Pegueroles M

Biomaterials, Biomechanics and Tissue Engineering Group (BIBITE), Universitat Politècnica de Catalunya (UPC), Barcelona, Spain

Co-authors: Pegueroles M¹, Tondo C¹, Planell JA², Gil FJ¹, Aparicio C³

¹*Biomaterials, Biomechanics and Tissue Engineering group (BIBITE), Universitat Politècnica de Catalunya (UPC), Barcelona, Spain,*

²*Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain,*

³*Minnesota Dental Research Center for Biomaterials and Biomechanics (MDRCBB), University of Minnesota, Minneapolis, MN, USA*

Background: The biological events that lead to the appropriate response of already successfully proved biomaterial surfaces, such as blasted-roughen titanium for dental implants, are mainly influenced by the interactions at the bio/non-bio interface. We aimed to increase the knowledge and eventually controlling the protein adsorption on the biomaterial surface.

Aim: A thorough characterization of protein adsorption processes (amount, kinetics, conformation and competition) on polished and grit-blasted titanium surfaces with the combined use of quartz crystal microbalance with monitoring of dissipation (QCM-D) and fluorescent FITC-labelling techniques.

Methods: Kinetics of the *in situ* protein-adsorption was carried out with a QCM-D (Q-Sense, Sweden). Changes in both resonance frequency (Δf) and energy dissipation (ΔD) of smooth TiO₂-coated sensors along the time (*t*) were determined by exposition at 37°C to 40, 80 and 100 mg/ml of Fn-, Fbg- and BSA-solutions, respectively. Two-step competitive adsorption studies were also performed by reproducing the protein-concentration ratios of the human blood plasma. FITC-Fn, FITC-Fbg and FITC-BSA concentrated solutions were immersed on 8 mm grit-blasted c.p. Tidisks (particles type: Al₂O₃ and SiC; particles sizes: 300 and 600 nm). Polished c.p. Ti discs were also studied. Finally, fluorescence intensity of the desorbed labelled proteins was measured.

Results: Fluorescent protein adsorption studies on rough Ti surfaces indicate that the main influencing factor on FITC-Fn and FITC-BSA protein adsorption is the chemical composition of the shot-blasting particles, which in turn, modifies the surface energy parameter. Grit-blasting the c.p. Ti surfaces with SiC- or Al₂O₃-particles leads to an increase or decrease of FITC-Fn and FITC-BSA protein adsorption, respectively. No correlation between the adsorbed Fbg and surface parameters was found. Fn did not change its structure once adsorbed on smooth TiO₂-sensor surfaces; whereas Fbg and BSA presented two and three different structures/conformations, respectively, during the time of analysis and characterized by a significant increase in the adlayer rigidity compared with the previous adsorption step. When proteins were in competition during adsorption, and BSA was introduced the second in the system, BSA displaced larger proteins, such as Fn and Fb. On the contrary, when BSA was introduced before other

proteins, bigger Fn or Fbg proteins adsorbed forming a layer on the top of the BSA layer.

Conclusions and clinical implications: The QCM-D and FITC-labeling study shows that chemical composition (nature of the blasting particles) is an important factor affecting protein adsorption behavior of the blasted-rough c.p. Ti surfaces. Moreover, conformational changes of the adlayers and kinetics of the competitive protein adsorption on TiO₂-crystals were determined.

Platelet-rich fibrin evaluation for osteogenesis

Presenter: Pluemsakunthai W

Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan

Co-authors: Pluemsakunthai W^{1,2}, Kuroda S¹, Shimokawa H³, Noritake K^{1,2}, Hao J^{1,2}, Miyahara T^{1,2}, Lin Z¹, Kasugai S^{1,2}

¹*Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan,* ²*Global Center of Excellence (G-COE) Program, Tokyo Medical and Dental University, Tokyo, Japan,* ³*Developmental Oral Health Science, Tokyo Medical and Dental University, Tokyo, Japan*

Background: Platelet-rich fibrin (PRF) is generally used as a natural scaffold in various clinical treatments because it has been known as a reservoir of a vast number of biologically active molecules, which are associated to tissue regeneration. However, PRF membrane resorption has not been identified yet and nor has osteogenic potential of PRF been well evaluated.

Aim: The objective of this study was (1) to examine dissolution and protein synthesis of a PRF membrane in a culture media and to measure the total amount of platelet-derived growth factor (PDGF) *in vitro*. (2) To evaluate the osteogenic potential of PRF *in vivo*.

Methods: *In vitro* Human Venous blood (3 ml) was drawn and centrifuged. After centrifugation, the PRF clot was separated into the upper phase and the lower phase, and then all samples were subjected for the examinations. A half of the samples were compressed to fabricate PRF membrane sheets and incubated with cycloheximide in DMEM. The medium was collected at 20 min and 1, 4, 24 and 72 h. The other samples were digested with guanidine-HCL (GndHCl), homogenized and centrifuged, and then the supernatants were dialyzed. Release of PDGF was quantified by ELISA. *In vivo* 1 ml blood was drawn from the femoral vein of Wistar male rat and centrifuged to separate into the upper phase for PRF and the lower phase for the cellular components. A full-thickness bone defect of 5 mm in diameter was prepared at the rat calvaria. The defects received the autologous PRF. After 2 and 4 weeks the parietal bones hosting the defects together with the covering periosteum were excised and subsequently scanned by μ CT for the new bone volume. And the specimens were consequently sectioned for histology.

Results: The lower part of PRF contained double the amount of PDGF compared with the upper phase. The membranes from the lower part dissolved more and faster than those from the upper. Furthermore, no *de novo* PDGF synthesis was detected within PRF since the protein amount did not differ

by cycloheximide. The total amount of the PDGF was more determined by the GndHCl, suggesting its preferable strategy for protein measurement. The animal study demonstrated no prominent new bone in the PRF filled defects (paired Student's *t*-test, $P < 0.05$), which is hypothesized that the PRF was quickly resorbed in the rat calvariae.

Conclusions and clinical implications: Therefore, an appropriate scaffold harboring PRF would give an idea for assisting tissues engineering.

Immunohistochemical study of bone response to the immediate implantation in the rat maxilla

Presenter: Pyo SW

Bucheon St. Mary's Hospital, Bucheon, Republic of Korea
Co-authors: Pyo SW¹, Cho CJ², Park S¹

¹*Bucheon St. Mary's Hospital, Bucheon, Republic of Korea*, ²*Graduate School of Clinical Dental Science, Seoul, Republic of Korea*

Background: Dental implants are used successfully for restoration of dental function. However, in patients with diabetes mellitu, the use of dental implants is controversial. The impact of diabetes on the healing of bone associated with immediately placed dental implants is not completely understood. And little is known about the expression of biological molecules involved in bone healing around implants.

Aim: The purpose of this study is to investigate the bone healing response around immediately placed titanium implants in the rats with controlled and uncontrolled diabetes by immunohistochemical study.

Methods: Twenty rats were divided into the control, insulin-treated and diabetic groups. Rats received streptozotocin (60 mg/kg) to induce diabetes; animals in the insulin-treated group also received 3 units of subcutaneous slow-release insulin. Two titanium implants (1.2 × 3 mm) were placed in the extraction socket of maxillary first molars of animals and were sacrificed at 3 days, 1, 2 and 4 weeks. The expression levels of bone morphogenetic protein (BMP)-4, transforming growth factor (TGF)-β and osteonectin (ON) were measured with immunohistochemical staining method.

Results: The BMP-4 expression increased immediately all groups at day 3, week 1 and week 2. However, staining intensity of diabetic group was weaker than the control and the insulin-treated group but not significant. At week 4, in all groups, the amount of BMP-4 expression decreased. The TGF-β expression instantly showed at day 3 in control group only. At week 1 and 2, TGF-β staining gradually increased in all group. But in the all group staining intensity decreased at 4 week. And we found the expression of ON in the control and the insulin-treated group were higher than that of the diabetic group at 1 and 4 weeks, indicated that bone formation be active in those groups.

Conclusions and clinical implications: In this study, the immediate placement of titanium implants in the maxilla of diabetic rat led to unreasonable bone healing response. It is expected that the reduced predictability of success of immediate implantation with the uncontrolled diabetes patients.

Analysis of osteoblastic gene dynamics in the early human mesenchymal cell response to an implant support: an *in vitro* study

Presenter: Ricci M

Istituto Stomatologico Tirreno, Camaiore, Italy

Co-authors: Ricci M, Funel N, Orazio V, Bobbio A, Barone A, Covani U

Istituto Stomatologico Tirreno, Camaiore, Italy

Background: Understanding the molecular dynamics of bone repair and osteointegration may aid in the development of therapeutics to improve implants outcome. It has been advanced that the expression patterns of genes responsible for osteogenesis might be dependent on the characteristics of the surface of the implant support.

Aim: On this basis, the aim of this *in vitro* research is evaluating the genes involved in the differentiation of mesenchymal stem cells in osteoblast when placed in contact with an implant support.

Methods: *In vitro* studies were performed in Primary Cell Cultures of Human Mesenchymal Stem Cells (hMSC) obtained from health bone biopsy. Cells were cultivated in contact with an implant support for 10 days into appropriate medium condition. The total RNA extraction was performed with Trizol protocol. Four gene (RUNX, Beta-catenin, Osterix and DLX5) were carried out with normalization of gene expression against the glyceraldehyde 3-phosphate dehydrogenase (GAPDH) house-keeping control gene and the quantitation of gene expression was performed using the direct ratio, the standard curve method and the DDCT calculation. No treated cells and osteocyte cells were used as controls.

Results: The osteogenic support positively modulates the expression of osterix gene in hMSC cells respect to untreated and osteocyte cells after 10 days of co-cultivation. The direct ratio analyses revealed a mean increase of 2.8-fold with respect to RUNX and Beta-Catenin gene expression in osteocyte control cells.

Conclusions and clinical implications: Our preliminary data showed us the efficacy of the implant support to modulate the genes involved in the osteogenic pathway in hMSC cells. More experiment are warranted to establish the effect of time culture in gene modulation.

Baseline loading criteria of biomimetic implants. Biomechanical and histomorphometric study

Presenter: Alonso CR

Private Practice, Girona, Spain

Co-authors: Alonso CR¹, De Zarate FGO³, Prat JS³, Lobato PC², Cespedes MCM²

¹*Private Practice, Girona, Spain*, ²*Human Anatomy and Embryology Unit, DPiTE, Health University of Barcelona Campus, Barcelona, Spain*,

³*Private Practice, Barcelona, Spain*, ⁴*Human Anatomy and Embryology Unit, DPiTE, Health University of Barcelona Campus, Barcelona, Spain*

Background: Removal torque strength has been used as a standard biomechanical measure of bone to implant contact,

where greater forces required to remove the implants can be interpreted as a measurement of the increased osseointegration. Resonance frequency analysis is applied to evaluate implant stability. Surface quality is one of the main factors that influences the biological response to implants, histomorphometric analysis being a useful method to evaluate it. To date, a comparative *in vivo* analysis between these methods has not been reported.

Aim: To apply removal torque, radiofrequency and histomorphometry as consecutive methods to evaluate the progression of osseointegration. To assess the bone ingrowth potential of a new biomimetic surface as well as to obtain baseline data for setting the loading criteria for this type of implants.

Methods: Six young beagle dogs were used. To simulate a human clinical situation, all the studied implants were standard size (4 mm diameter and 8 and 10 mm length). All the tests and analysis were carried out *in vivo*. After 12 weeks of healing period of the lower premolar extractions, 48 biomimetic surface implants were placed, leaving them uncovered with healing abutments. The implants were tested 4, 8 and 12 weeks postinstallation according with the following protocol: the implant integration was biomechanically evaluated in surgical conditions by resonance frequency test, and peak removal torque test for half of the implants. The specimens obtained, which included the remaining implant-healing abutment complex with 1.5 mm surrounding bone and queratinized soft tissues around the abutment, were processed for microanatomic, histomorphometric and microCT analysis.

Results: Data analysis revealed mean removal torque values of 31 Ncm at 4 weeks, 71 Ncm at 8 weeks, and 94 Ncm at 12 weeks of healing. Mean radio frequency values were 68 ISQL, 71 ISQL and 76 ISQL at 4, 8 and 12 weeks, respectively. The removal torque and radio frequency values increased between the time of surgery and recall, but significant statistic differences were found for removal torque only. On the other hand, histomorphometric (bone-to-implant contact) and removal torque data revealed a significant correlation despite the absence of correlation observed with the radio frequency tests.

Conclusions and clinical implications: This study demonstrates that removal torque test followed with histomorphometrical analysis is a reliable method for assessing the osseointegration progress of implants. In addition, the data obtained suggest that biomimetic implants can be safely loaded after 8–12 weeks.

Evaluation of cytotoxicity of cements used for fixation of implant restorations

Presenter: Rutkunas V

Faculty of Medicine, Institute of Odontology, Vilnius University, Vilnius, Lithuania

Co-authors: Rutkunas V¹, Sabaliauskas V², Bukelskiene V³, Baltriukiene D⁴, Liutkevicius E⁵

¹*Faculty of Medicine, Institute of Odontology, Vilnius University, Vilnius, Lithuania,* ²*Faculty of Medicine, Institute of Odontology, Vilnius University, Vilnius, Lithuania,* ³*Institute of Biochemistry, Vilnius University, Vilnius, Lithuania,* ⁴*Institute of Biochemistry, Vilnius University, Vilnius, Lithuania,* ⁵*Department of Chemistry and Bioengineering, Vilnius Gediminas Technical University, Vilnius, Lithuania,* ⁶*Institute of Biochemistry, Vilnius University, Vilnius, Lithuania,* ⁷*Department of Chemistry and Bioengineering, Vilnius Gediminas Technical University, Vilnius, Lithuania*

Background: In order to achieve good integration implant restorations have to be cemented with biocompatible cements.

Aim: The aim of the study was to evaluate the cytotoxicity of permanent and provisional dental cements using *in vitro* model.

Methods: Human gingival tissues were collected from patients undergoing periodontal surgical procedures and fibroblasts were cultured *in vitro*. Cell type was determined by performing proteomic analysis. Selected temporary and permanent cement materials including Harvard, Fuji Plus, Temp-Bond, Temp-Bond clear, Maxcem Elite and Premier Implant Cement specimens (5 × 2 mm) were fabricated. The toxicity of prepared specimens was tested by exposing them to cell culture medium up to 5 days at 37°C under sterile conditions. Cell viability was estimated using MTT (3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium bromide) assay. The data concerning cell viability were statistically analyzed using one-way ANOVA test and Tukey multiple comparison test.

Results: Results obtained after 48 h showed moderate toxic effect of adhesive cement compared with control group. Cytotoxic effect was observed in specimen groups of Fuji Plus, Harvard and temporary cements: significantly reduced cell viability compared with control group ($P \leq 0.001$) was detected. After 120 h of incubation the tested materials caused an increase in cellular activity except adhesive cement material which resulted in prolonged decrease.

Conclusions and clinical implications: Moderate cytotoxic effects of investigated cements were detected. Adhesive cement had highest cytotoxic effect on fibroblast cells. Decrease in cellular activity was time dependent.

Fibroblast adhesion evaluation on laser-modified titanium abutment materials

Presenter: Sabaliauskas V

Institute of Odontology, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

Co-authors: Sabaliauskas V¹, Rutkunas V¹, Bukelskiene V¹, Baltriukiene D^{2,4}, Liutkevicius E^{2,5}, Melninkaitis A³

¹*Institute of Odontology, Faculty of Medicine, Vilnius University, Vilnius, Lithuania*, ²*Department of Chemistry and Bioengineering, Vilnius Gediminas Technical University, Vilnius, Lithuania*, ³*Institute of Biochemistry, Vilnius University, Vilnius, Lithuania*, ⁴*Laser research center, Vilnius University, Vilnius, Lithuania*, ⁵*Department of Chemistry and Bioengineering, Vilnius Gediminas Technical University, Vilnius, Lithuania*

Background: Enhancement of the soft tissue integration of titanium by means of surface modifications would have significant advantages including more predictable esthetic outcome, improved soft tissue stability and seal against bacteria leakage.

Aim: Four different surface modifications were developed to test human gingival fibroblast adhesion to titanium abutment material by determining focal adhesion contact (FAC) formation in fibroblast cultures.

Methods: Commercially pure (CP2) titanium discs were ablated with impulse (Expla NL640) laser in four different manners: group 1 consisted of overlapping laser-ablated holey structures, group 2 – separated holey structures, group 3 – grid like holey structures, group 4 – parallel lined structures. All holey structures were the same in size, about 15 µm in depth. Fibroblast cultures were prepared for transmission electron microscopy (TEM) at day 3 after seeding, and the number of FACs as well as the ratio FAC / cellular cross-sections was determined at a length of 400 µm in ultrathin sections. Immunogold labeling was applied to visualize the extracellular fibronectin and vitronectin molecules including the intracellular vinculin and actin in FAC zones. In addition, the attachment of fibroblasts to the holey structures was analyzed with scanning electron microscope (SEM).

Results: The results suggested that the cells preferentially attached to the holey structure by forming bridges inside and covering the hole created by laser. Higher number of FACs and the majority of intra- and extracellular matrix molecules were counted on surfaces with highest number of holey structures (group 1).

Conclusions and clinical implications: In conclusion, these surfaces seem to favor human gingival fibroblast adhesion. Thereby, an improved soft tissue barrier may be developed in the region of the implant neck.

Chemical debridement of contaminated titanium surface shows little effect of chlorhexidine and PrefGel™

Presenter: Schneider S

University of Oslo, Oslo, Norway

Co-authors: Schneider S, Henderson E

University of Oslo, Oslo, Norway

Background: The formation of a bacterial biofilm on implants seems to be critical to the development of peri-implantitis. In order to treat the peri-implant infection its necessary to surgically expose the implant surface and eliminate the biofilm. So far there is not reported a superior method or solution for this decontamination. In this study, we tested *in vitro* different solutions that are suitable in a clinical situation.

Aim: The aim of this *in vitro* study was to compare different chemical solutions and their effect on cleaning biofilm contaminated polished titanium surfaces.

Methods: Commercially pure titanium disc, diameter of 6.24 mm and height of 2 mm, mirrorpolished with a mean R_a -value of 37.11 were used as surface. A biofilm was simulated with multilayer of *Staphylococcus epidermidis* which covering the entire titanium surface. Several different chemical decontamination agents were tested; 3% H₂O₂, 0.2% Chlorhexidine, PrefGel™ (EDTA), 3% H₂O₂ mixed with 1.6 g/l TiO₂, and sterile H₂O. Each agent were applied for 2 min on the contaminated surface. The surfaces were there after washed with sterile saline water. The outcome was valuated with SEM and bacteria count was found with photospectrometry. Significance differences between each groups ($P < 0.05$) was found using the Dunn's test (SigmaStat 3.5, Systat Inc., St. Louis, CA, USA).

Results: SEM image of decontamination with sterile saline water showed no effect on the surface. Similar finding was found for 0.2 vol% chlorhexidine. SEM image of decontamination with PrefGel™ showed breakage of the biofilm layer but still large amount of remaining bacteria. Images of decontamination with 3 vol% H₂O₂ and the mixture of 3 vol% H₂O₂ and 1.6 g/l TiO₂ powder showed a marked visible difference compared with the other solutions. Optical density analyze in the Synergy HT Multi Detection microplate Reader showed significant ($P > 0.05$) lower amount of bacteria left after decontamination with 3 vol% H₂O₂ and 1.6 g/l TiO₂ compared with all other solutions. Chlorhexidine and PrefGel™ were not better than rinsing with saline H₂O. Decontamination with 3 vol% H₂O₂ was significant ($P > 0.05$) better than Chlorhexidine and PrefGel™.

Conclusions and clinical implications: Significant ($P > 0.05$) lower amount of bacteria left after decontamination with 3 vol% H₂O₂ and 1.6 g/l TiO₂ compared with all other solutions. Chlorhexidine and PrefGel™ were not better than rinsing with saline H₂O. Decontamination with 3 vol% H₂O₂ was significant ($P > 0.05$) better than Chlorhexidine and PrefGel™.

Influence of nanostructured surface of medical titanium alloys on the osteoblast behavior

Presenter: Shi B

School and Hospital of Stomatology, Wuhan University, Wuhan, China

Co-authors: Xia H¹, Wang M¹, Shi B¹, Wang A²

¹School and Hospital of Stomatology, Wuhan University, Wuhan, China, ²Huazhong University of Science and Technology, Wuhan, China

Background: Nanophase metals possess a biologically inspired nanostructured surface that mimics the dimensions of constituent components in bone, including collagen and hydroxyapatite. There has been a growing interest in how the presence of nanometer structures on a bone integrated implant surface influences the healing process. However, to date, interactions of osteoblasts on nanostructured titanium surface compared with conventional titanium surface need to be elucidated.

Aim: The purpose of this study was to investigate the effect of nanostructured surface on adhesion, proliferation and differentiation of osteoblasts grown on the medical Ti₆Al₄V surface made by supersonic fine particles bombarding technique.

Methods: The nanostructured surface of medical Ti₆Al₄V disks was prepared by supersonic fine particles bombarding (SFPB) technique. The control group of medical Ti₆Al₄V disks was treated with sulfuric acid and hydrochloric acid. Osteoblast-like MG-63 cells were cultured and seeded on the disks. Cell adhesion was observed with SEM at 8 h, 24 h later. MTT assay were carried out to observe the cell proliferation on the different substrates at 1 d, 2 d, 3 d. Cell differentiation was tested by alkaline phosphatase (ALP) activity at 7 d, 14 d.

Results: SEM showed the concave pits with sub-micro diameters, rough and complicated microtextures on the titanium surface using SFPB, and the spreading of adhesion cells on the nanostructured surfaces were better than those of control group. The proliferation rate of osteoblasts on the nanostructured surfaces was a little higher than that of the control group. Cells grown on nanostructured surfaces exhibited significantly more ALP activity as compared with the control surfaces.

Conclusions and clinical implications: The nanostructured titanium surface can enhance the osteoblast response than the conventional acid etched surface, which may be promising to improve orthopedic implant efficacy.

Acknowledgements: This study was supported by funds from the Fundamental Research Funds for the Central Universities of China (No. 3081019) and the National Natural Science Foundation of China (No. 30300392).

Influence of clinically relevant factors on the immediate biomechanical surrounding for a series of dental implant designs

Presenter: Shunmugasamy V

Polyhtecnic Institute of New York University, New York, NY, USA

Co-authors: Shunmugasamy V³, Gupta N³, Pessoa R², Janal M¹, Coelho P¹

¹New York University, New York, NY, USA, ²Federal University at Uberlândia, Uberlândia, Brazil, ³Polyhtecnic Institute of New York University, New York, NY, USA

Background: The combination of macrodesign, surface of implant play an important role in the osseointegration process. The bone configuration is another important factor for implant success rates. Use of computadorized simulations with these three factors can lead to development of new materials.

Aim: The objective of the present study was to assess the influence of various clinically relevant scenarios on the strain distribution in the biomechanical surrounding of five different dental implant macrogeometries.

Methods: The biomechanical environment surrounding an implant i.e., the cortical and the trabecular bone was modeled along with the implant. These models included two different values of the study parameters including loading conditions, trabecular bone elastic modulus, cortical/trabecular bone thickness ratio, and bone loss for five implant designs. Finite element analysis was conducted on the models and strain in the bones surrounding the implant was calculated. Bone volumes having strains in four different windows of 0–200, 200–1000, 1000–3000 and >3000 µε were measured and the effect of each biomechanical variable and their two-way interactions were statistically analyzed using the analysis of variance method.

Results: The study showed that all the parameters included in the study had effect on the volume of bones in all strain windows, except the implant design, which affected only the 0–200 and >3000 µε windows. The two-way interaction results showed that interactions existed between implant design and bone loss, and loading condition and bone loss in the 200–1000 µε window and between implant design and loading condition in the 0–200 µε window.

Conclusions and clinical implications: Within the limitations of the present methodology, it can be concluded that although some unfavorable clinical scenarios demonstrated a higher volume of bone in deleterious strain levels, a tendency toward the biomechanical equilibrium was evidenced regardless of the implant design.

The effects of state and trait anxiety levels in temporomandibular joint dysfunction and myofascial pain syndrome

Presenter: Ürk ES

Oral and Maxillofacial Radiology Department, Faculty Of Dentistry, Istanbul University, Istanbul, Turkey

Co-authors: Ürk ES, Özcan İ

Oral and Maxillofacial Radiology Department, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

Background: Temporomandibular joint (TMJ) dysfunction is mostly related to bruxism. Bruxism is defined as a diurnal or nocturnal parafunctional activity that includes clenching, gnashing, and grinding of teeth. Anxiety and psychological problems can cause to bruxism, in consequence TMJ dysfunction.

Aim: The aim of this study is to evaluate the relationship between TMJ dysfunction and myofascial pain and state or trait anxiety using STAI method.

Methods: The study included 150 patients (90 females, 60 males, age mean: 38.2) suffering from TMJ dysfunction (noise and pain on TMJ) and myofascial pain that invoke Istanbul University Dentistry Faculty, and 150 individuals (82 females, 68 males, age mean: 37.1) without TMJ problems and any myofascial pain as the healthy control group. The state and trait anxiety levels of the patients and controls are measured using the STAI survey. Individual pain experience was recorded by means of a visual analogue scale (VAS).

Results: The statistical significance level is accepted as $P < 0.05$. STAI-S levels of the study group are 37.3 and its STAI-T levels are 62.51, STAI-S levels of control group are 42.02 and its STAI-T levels are 43.22. STAI-S levels of the study group are significantly low when compared the controls ($P < 0.05$). However, STAI-T levels of study group are significantly high when compared the controls ($P < 0.001$). Statistically significant differences were recorded for both, STAI and VAS.

Conclusions and clinical implications: As a result of our findings the patients having TMJ dysfunction and myofascial pain have high levels of state and trait anxiety. Thus, it can be estimated that TMJ disorders and pain is closely related to anxiety and in addition to the conventional treatment methods, the patients should also be treated psychologically.

Influence of Bony Defect Type and Depth on Implant Stability

Presenter: Song Y-N

Department of Peridontics, The Institute of Oral Health Science, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Co-authors: Song Y-N, Yang S-M, Kye S-B, Shin S-Y

Department of Peridontics, The Institute of Oral Health Science, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Background: The resonance frequency analysis (RFA) is widely used for measuring implant stability. A linear relationship

between the exposed implant height and the corresponding RFA value was demonstrated. Osstell measurements are sensitive in the identification of marginal bone loss.

Aim: The purpose of this study was to evaluate the effects of defect type and defect depth on the implant stability in bovine rib bone.

Methods: (1) Defect preparation: Fourteen frozen cow rib bone blocks were used in this study. Seven implant beds were prepared in each rib block and each hole for implants was 15 mm apart. Circular defect, one wall defect, and three-wall defect were prepared with two different kinds of depth (2.5 mm, 5 mm) for each defect model. (2) Implant placement and ISQ measurement: The external type implants (4 × 10 mm) were placed. Insertion torque was measured during placement. RFA was measured using Osstell instrument at the four directions according to L bar. Measurements were taken repeatedly three times at each direction. (3) Statistical analysis: Data was analyzed using Mixed model considering random effect between subjects with Tukey method. P -value was corrected using Bonferroni's method to prevent inflated type I error. The significance level of both tests was $P < 0.05$.

Results: Insertion torque in implants with no defect was higher than in any other defects and showed statistically significant difference with all other defects. Insertion torque in 2.5 mm depth was higher than in 5 mm depth. As the defect size increased in the same defect depth, ISQ was reduced. ISQ was highest in implants with no defect and then in three wall defect, one wall defect and lastly in circular defect ($P < 0.001$). Except in cases of three wall defect, ISQ in implants with 2.5 mm defect was higher than in implants with 5 mm defect ($P < 0.0001$). In implants with three wall defect, ISQ in implants with 5 mm defect was higher than in implants with 2.5 mm defect but the difference was not statistically significant ($P = 0.055$) Table 1. The thickness of cortical bone (mm), insertion torque (N) and ISQ for each seven defect type were measured.

Conclusions and clinical implications: ISQ values varied with depth and size of peri-implant defect. As the bone wall around implants decrease, ISQ value was decrease (no defect > 3 wall defect > 1 wall defect > circular defect). When defect depths were increased, the mean insertion torque and ISQ values decreased significantly.

Table 1

Defect type	Insertion torque (N)	ISQ
No defect	17.93 ± 11.64	84.70 ± 5.52
3 wall 2.5 mm	7.64 ± 3.34	80.93 ± 4.88
3 wall 5 mm	5.86 ± 2.14	81.74 ± 3.32
1 wall 2.5 mm	8.00 ± 7.98	73.36 ± 7.49
1 wall 5 mm	6.71 ± 4.84	69.77 ± 8.93
Circular 2.5 mm	3.79 ± 2.86	65.07 ± 7.31
Circular 5 mm	1.71 ± 1.20	56.07 ± 8.51

Osteoconductive potential evaluation of bone substitutes using schneiderian membrane and maxillary bone marrow osteoprogenitor cells

Presenter: Srouji S

Carmel Medical Center, Haifa, Israel

Faculty of Medicine, Technion, Haifa, Israel

Co-authors: Srouji S^{1,2}, Mouger G¹

¹*Carmel Medical Center, Haifa, Israel*, ²*Faculty of Medicine, Technion, Haifa, Israel*

Background: In a well-established clinical procedure, bone substitutes (or osteoconductive materials) of various origins (e.g. autograft, allograft, xenograft or alloplast) are placed surgically underneath the lifted membrane of the sinus in order to induce bone formation on maxillary osseous floor. The various bone substitutes available on the market as well as the many relevant clinical studies, have made the clinician's choice very difficult, and brought the need for an accurate screening methodology as an essential step required for their broad application.

Aim: In this study, we demonstrate a new approach by which *in vitro* and *in vivo* assays are used to screen bone substitutes for their osteoconductivity. The screening is done using local osteoprogenitors (bone-producing cells) isolated from schneiderian membrane and maxillary tuberosity bone marrow.

Methods: In the present study, the osteoconductive potential of the different bone graft materials or substitutes available in the market, e.g. Bio-Oss, Bi-Ostetic, OraGraft (allograft), and Pro-Osteon, was examined. The AlamarBlueTM Metabolic Activity Assay (Serotec, USA) was used to determine the adhesion of cells seeded on the different bone substitutes and to determine how these materials affect the proliferation abilities of the cells seeded on them. Samples of the different bone substitutes seeded with MSSM or Maxillary derived osteoprogenitors and co-cultured for 14 days were taken for SEM ($n=3$) assessment. Eight-week-old athymic nude mice were used for *in vivo* ectopic transplantation, all mice were euthanized 8 weeks after transplantation. The harvested transplants were prepared for histology and were used for histomorphometry measurements using Image Pro plus 6 computerized analysis system. The results of the experiments were expressed as mean vs. the control values \pm SEM.

Results: The adherence of these cells to bone substitutes and their proliferation, tested *in vitro*, has been shown to be most optimal in bone graft materials, first in OraGraft (allograft) and then in Pro Osteon. *In vivo* bone formation, within the bone graft, was also observed to be best using OraGraft and Pro-Osteon.

Conclusions and clinical implications: Testing the osteoconductivity of these bone graft substitutes *in vitro* and *in vivo* has shown that the method is simple and informative for the purpose of screening biomaterials currently in use for sinus augmentation procedures. Ectopic osteoconductivity of the biomaterials seeded with the cells chosen for bone formation proved to be a technique useful for screening and thus to optimally select osteoconductive biomaterial for sinus augmentation.

Evaluation of marginal bone level and root development of autotransplanted teeth

Presenter: Strbac GD

Bernhard Gottlieb University Clinic of Dentistry, Department of Oral Surgery, Medical University of Vienna, Vienna, Austria

Co-authors: Strbac GD, Hof M, Vasak C, Watzek G, Bernhart T, Zechner W

Bernhard Gottlieb University Clinic of Dentistry, Department of Oral Surgery, Medical University of Vienna, Vienna, Austria

Background: Autogenous transplantation, or autotransplantation of teeth, is a predictable treatment option for the replacement of missing or unresorable teeth. Autotransplantation is mainly recommended in children and adolescents where implants and other prosthodontic replacements are contraindicated due to further expected growth of the patient.

Aim: To investigate marginal bone level and root development of autotransplanted teeth 5 and 10 years after surgical treatment. In addition to confirm the osseoinductive effect of autotransplanted teeth concerning the prevention of alveolar bone resorption, known from dental implants, the alveolar bone increase was evaluated.

Methods: Seventy-one (92.21%) molars, four (5.19%) premolars and two (2.6%) canines were investigated at least 5 and 10 years after surgical treatment. For clinical and radiological investigation the contralateral tooth of the same jaw was evaluated as control in each patient. The autotransplanted teeth (TX) and their contralateral control teeth (TC) were examined concerning marginal bone level and root development pre-, 5 and 10 years post-treatment clinically and with radiographs.

Results: In 94.92% no alveolar bone resorption could be investigated. Marginal alveolar bone growth was 1.23 ± 1.52 mm in TX and 0.55 ± 0.97 mm in TC. Further root development was investigated in 81.35% of TX. After surgical intervention root development was 1.98 ± 1.68 mm in TX and in 0.03 ± 0.15 mm of TC.

Conclusions and clinical implications: The most common autotransplanted teeth are immature molars, premolars and canines with incomplete root formation. Although the surgical techniques for autotransplantation of teeth have been slightly modified in the last decades, an atraumatic surgical approach is evident to a successful clinical outcome. A preservation of the periodontal ligament and Hertwig's root sheath will prevent inflammation and ankylosis and will ensure a physiological marginal bone level and further root development. This present investigation confirms autotransplantation as a successful treatment option for the replacement of teeth to achieve natural teeth with healthy parameters.

Influence of implant length and insertion depth on stress analysis: a finite element study

Presenter: Suh S-W

Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, Republic of Korea

Co-authors: Suh S-W¹, Eom T-G¹, Kim Y-K², Kim S-G³, Kim M-D¹

¹*Implant R&D Center, OSSTEM Implant Co. Ltd., Busan, Republic of Korea*, ²*Department of Oral and Maxillofacial Surgery, Section of Dentistry, Seoul National University Bundang Hospital, Seongnam, Republic of Korea*, ³*Department of Prosthodontics, Graduate School of Clinical Dental Science, The Catholic University of Korea, Seoul, Republic of Korea*

Background: In clinical practice, location of implant when the implant fracture, it is the same location that crestal bone level caused by bone loss. Thus, the bone level around the implant is an important factor in the stability, it requires a clinical guide. **Aim:** This study is to determine the clinical evidence, for determining the depth of the initial placement by implant and surrounding bone stress analysis.

Methods: Analysis model was constructed same implant insertion depth. A total of five implant-bone models with two different length and different marginal bone shape were created which had insertion depth variation. A 300 N Buccolingual load was applied at the implant-abutment.

Results: In alveolar bone, the stress of bone resorption case was higher than the subcrestal insertion case. Implant strength of subcrestal insertion case was higher than the bone resorption case.

Conclusions and clinical implications: When the diameter of the implant procedure, such as deep as possible to implant in the bone and the implant will help the long-term stability.

In vitro biochemical evaluations on the implant surface

Presenter: Takagi T

GC Corporation, Tokyo, Japan

Co-authors: Takagi T, Noguchi T, Yamanaka K, Sakai Y

GC Corporation, Tokyo, Japan

Background: It is well-known that various biochemical reactions occur on the implant surface through the osseointegration mechanism. Especially in the early stage of the osseointegration, the platelets attachment to the implant surface is considered beneficial. On the other hand, Prof. Thomas Albrektsson suggested that clinically reliable range of implant surface roughness was $S_a: 1.0-2.0 \mu\text{m}$ (named moderately rough surface) and this was approved as a consensus report by EAO in 2009. This leads us to believe that the surface topography including surface roughness was one of the important factors of successful implant clinical cases. However, the relationship between the surface topography and the biochemical behavior remains to be fully elucidated.

Aim: The aim of this study is to evaluate the biochemical behavior on the implants which had several surface topographies.

Methods: One of the biochemical behaviors was estimated by Platelet Rich Plasma (PRP) trapping test on Ti-disks all made of pure-Ti (Grade-4). Polished, turned, and moderately rough surface, and moderately rough with micro-pored surface were used. PRP was obtained from the centrifuged blood of Sprague-Dawley rats. PRP was dropped on to Ti-disks ($n = 3$) and these Ti-disks were incubated at 37°C. The extra PRP were washed out and then the Ti-disks were freeze-dried. Afterward, trapped platelets were observed by the Scanning Electron Microscopy and counted.

Results: The amounts (with Standard Deviations) of the platelets on the polished, turned, only moderately rough, and moderately rough with micro-pored surface were 10 (3), 16 (10), 42 (11), 77 (25), respectively. The moderately rough with micro-pored surface showed the highest amounts of the attached platelets and it was observed many platelets trapped into micro pores, effectively.

Conclusions and clinical implications: It was suggested that the moderately rough surface with micro topography had a great advantage in the early stage of the osseointegration. These results indicated that the implant with blood compatibility surface leads preferable healing process for the clinical cases such as immediate loading or early loading techniques.

Plasma rich in growth factors activated implants: what do lymphocytes and osteoblasts see

Presenter: Tejero R

1 Eduardo Anitua Foundation, Jacinto Quincoces

39,01007, Vitoria, Spain

Co-authors: Trouche E^{1,2}, Tejero R^{1,2}, Anitua E³, Reviakine I^{2,4}

¹*Eduardo Anitua Foundation, Jacinto Quincoces, Vitoria, Spain*,

²*CIC biomaGUNE, Paseo Miramón, San Sebastián, Spain*, ³*Private Practice in Implantology and Oral Rehabilitation, José M^a Cagigal, Vitoria, Spain*, ⁴*Department of Biochemistry and Molecular Biology, University of the Basque Country, Leioa, Spain*

Background: Nowadays, prosthetic devices and regenerative therapies are commonly used to improve the efficiency of classical therapies. A combination of these two strategies is based on the activation of implant surfaces with an autologous plasma fraction rich in growth factors (PRGF). This activation entails the formation on the surface of an implant of a platelet-rich fibrin matrix. Encouraging results for the osseointegration of titanium prostheses have been obtained with this method, but the mechanism is not well understood, limiting further development of this therapeutic approach.

Aim: The aim of our study is to understand how PRGF-activated implants interact with the two key players in the implant integration process: the immune response evoked by the implant on one hand, and osteoblast behavior on the other.

Methods: Lymphocyte activation: Human PBMCs were isolated by Ficoll-Hypaque density gradient. Isolated PBMC were plated with Staphylococcal enterotoxin B (SEB, 50 ng/ml) on

TCPS and TiO₂ with or without calcium-activated or nonactivated PRGF. After 4 days, lymphocytes were stained with CD4 and CD25 and analyzed by flow cytometer. Osteoblast behavior: The conditionally immortalized human fetal osteoblastic cell line hFOB1.19 was obtained from the American Type Culture Collection. For quantification of hFOB1.19 proliferation, cells were plated on implants with activated or nonactivated PRGF. After 1, 4 or 8 days, the cell proliferation is evaluated by the MTS based assay.

Results: Our results show that lymphocytes plated on TCPS as well as on Ti exhibit a significant population of activated lymphocytes positive for CD4 and CD25 (47%). This population is reduced by nonactivated PRGF (35%) and more significantly by calcium-activated PRGF (33%). Consequently, PRGF and more particularly calcium-activated PRGF diminish the lymphocyte activation induced by SEB. Examining osteoblast proliferation, we found that nonactivated PRGF can efficiently replace fetal calf serum in the osteoblast proliferation experiments, but calcium-activated PRGF do not perform better. This may indicate an intricate interplay between the soluble- and platelet-derived growth factors that are present in PRGF and that influence osteoblast behavior.

Conclusions and clinical implications: Immunomodulating effect of PRGF is interesting in the context of the idea that excessive inflammatory response contributes to implant rejection. The nontrivial effect of PRGF on osteoblast proliferation deserves further examination and may open further therapeutic possibilities once properly understood.

extracted. After 30 days of socket healing, the animals received two implants in two different sites: a transmucosal implant in the maxilla and an implant at the tibiae. After 60 days, the sample was randomly divided into control group (SHAM) and a test group (OVX). The animals allocated at the test group ($n = 8$) were then, subjected to ovariectomy in order to induce the estrogen deficiency while the remaining animals were submitted to sham surgery (SHAM). All animals were sacrificed after 120 days of the beginning of the experiment. It was performed the densitometric analysis of the femur and lumbar vertebrae and the histometry of the bone tissue around implants. D'Agostino and Mann-Whitney tests were used for the comparisons among the groups for all the analyzed parameters. Level of significance was set at 5%.

Results: The results revealed a significant difference between groups related to the bone mineral density with OVX group presenting the lowest values. Regarding the tibiae, the OVX group presented a decrease in the bone to implant contact and bone area between the threads of the implants, with a statistically significant difference between the groups. On the other hand, implants placed in the maxilla showed no difference between the groups.

Conclusions and clinical implications: Therefore, within the limitations of this study, our findings suggest that mechanical load due to mastication would have a protective effect against estrogen deficiency induced bone loss around implants in animals.

The effect of estrogen deficiency on bone tissue around implants in two different sites

Presenter: Verzola M

Department of Diagnosis and Surgery, Araraquara Dental School, Unesp – Universidade Estadual Paulista, Araraquara, Brazil

Co-authors: Verzola M¹, Giro G¹, Coelho P², Pessoa R³, Kawai T⁴, Orrico S¹

¹*Department of Diagnosis and Surgery, Araraquara Dental School, Unesp – Universidade Estadual Paulista, Araraquara, Brazil,*

²*Department of Biomaterials and Biomimetics, New York University, New York, NY, USA,* ³*Particular Praticice, Uberlândia, Brazil,*

⁴*Department of Immunology, The Forsyth Institute, Boston, MA, USA*

Background: Postmenopausal osteoporosis is a common bone-weakening systemic disease. This condition is characterized by a gradual loss of bone mass through bone microarchitectural deterioration induced by the lack of ovarian function. Although it has been suggested that estrogen deficiency could be considered a potential risk factor for dental implant therapy success the literature is still contradictory.

Aim: The aim of this study was to evaluate the response of the bone tissue around implants with estrogen deficiency in two different sites.

Methods: For this purpose 16 rats aged approximately 30 days were included in the study. Initially, the left first molar was

The experimental study of the influence of the lacto bacterial symbiotic on the osteoregeneration and inflammatory processes

Presenter: Vinogradov S

St Petersburg State I.P. Pavlov Medical University, Saint-petersburg, Russian Federation

Co-authors: Vinogradov S, Yaremenko A

St Petersburg State I.P. Pavlov Medical University, Saint-petersburg, Russian Federation

Background: It is known, that microorganisms render the differently directed influence on the production of cytokines and also influence osteoregenerating processes.

Aim: The aim of the study was to compare the inflammatory process of the mandible destruction and deformations prevalence in white rats after filling the bone wound with the composition, containing the lacto bacterial symbiotic.

Methods: The experiment was carried out on 30 white pubescent rats of the line "Wistar". Under the intravenous narcosis the animals were fixed on an operational table. With a scalpel No. 15C was made the cut of the mucous membrane in the area of the molar teeth, and exfoliated the mucoperiosteal flap. After that with the help of the carbide bur No. 1 (diameter of 4 mm) we created the osteotomical canal, filled the wound with the medicamental composition, and sutured it (with the vicryl 6-0). All the animals have been divided into three groups (10 rats in each group). The animals of group I had been injected with the

medicamental composition, consisting of a collagen sponge containing a hydroxyapatite and chlorhexidine gluconate, impregnated with the lacto bacterial symbiotic solution. The animals of group II had been injected with the only collagen sponge containing a hydroxyapatite and chlorhexidine gluconate. The animals of group III had not been injected with anything into the osteotomical canal. After 4 and 8 weeks, we visually estimated the expressiveness of the local inflammation signs in the mandible and the surrounding soft tissues. Otherwise we made a computer planimetry of the mandible destruction zone.

Results: Estimating the data of all the experiment, we noticed the inflammatory complications in all the groups of animals (in the group I – 3 rats (30%) from 10 animals, in the group II – 9 rats (90%) from 10 animals, in the group III – 10 rats (100%) from 10 animals). According to the computer planimetry, the greatest mandible destruction area was in the group III ($6.59 \pm 0.14 \text{ mm}^2$ on the average). The mandible destruction area in the group II was $2.59 \pm 0.03 \text{ mm}^2$ on the average and in the group I this parameter was the least – $1.05 \pm 0.03 \text{ mm}^2$ on the average. The distinctions between all the groups are statistically authentic ($P < 0.05$).

Conclusions and clinical implications: Estimating experimental data, it is possible to assume, that such an application of the bacterial therapy can optimise the processes of the osteoregeneration and promote the decreasing of inflammatory complications at the patients with dental implants and a bone augmentation. Besides, it is possible to apply probiotic's metabolites on the implant's surface.

439 | Basic Research

Dimensional study on the anatomic structures around maxillary sinus using Cone-Beam Computed Tomography

Presenter: Yang H-S

Chonnam National University, Gwangju, Korea, Republic of

Co-authors: Kim D-S, Chung H-J, Yang H-S, Lee S-W, Kang B-C, Kim Y-J

Chonnam National University, Gwangju, Republic of Korea

Background: When performing an implant surgery on the posterior maxilla, excessive bleeding or maxillary sinus perforation could occur as complications. Therefore, implant surgeons need to be well-informed of adjacent anatomical structures on the posterior region of maxilla, before the surgery. With the knowledge of anatomical structure such as blood vessels and nerve in the posterior maxilla and membrane thickness on maxillary sinus, unnecessary bleeding or complications after the surgery could be prevented. In addition, the cortical bone thickness of sinus floor and lateral wall are also important factors in the preoperative diagnosis for sinus elevation surgery. Recent report has shown that Cone-Beam Computed Tomography (CBCT) measurements were as an accurate representation of the clinical thickness of labial gingiva and bone (Fu et al. 2010).

Aim: This study was aimed to evaluate the dimensions of anatomic structures around maxillary sinus on the posterior maxilla using CBCT for reducing complications in relation to dental implant placement and maxillary sinus floor elevation.

Methods: From CBCT images of 68 patients (mean age 57.4 ± 11.8 years) who were planned for implant treatment in Chonnam National University Dental Hospital, we measured on the vertical and horizontal distances for dimension and position of anatomical structures around maxillary posterior region. The height and bucco-lingual width of available alveolar bone and cortical bone thickness of posterior maxilla, the thickness of cortical bone and mucosal membrane of sinus, and the position and dimension of posterior (or middle) superior alveolar nerve and vessel were measured and compared in posterior tooth regions. Statistical analysis was performed with ANOVA using PASW Statistics (18.0 SPSS Inc., Chicago, IL, USA).

Results: Vertical heights of alveolar bone of maxilla decreased posteriorly from the premolar region to the molar region, but bucco-lingual widths increased posteriorly. The mean cortical bone thickness on the sinus floor was 0.7 mm. The cortical thickness of lateral sinus wall was thicker on the premolar region than the molar region (1.2 vs. 0.8 mm), but the thickness at the medial wall was relatively consistent (0.8 mm). The mean thickness of sinus membrane was 1.8 mm on the floor, and in the range of 1.0–1.5 mm at the level, 3 and 10 mm above the sinus floor on lateral and medial aspect. The *n* vertical distance from sinus floor to posterior superior alveolar vessel was 7.8 ± 2.9 mm and its diameter was 1.3 ± 0.3 mm.

Conclusions and clinical implications: These results will provide useful informations about anatomical structures surrounding maxillary sinus to reduce several complications in cases of sinus floor elevation procedure and implant placement surgery.

440 | Basic Research

The influence of intramarrow penetration on the angiogenesis in GBR using synthetic bone substitutes

Presenter: Yoon H-J

Yeouido St. Mary's Hospital, Catholic University of Korea, Seoul, Republic of Korea

Co-authors: Yoon H-J¹, Lee S-H¹, Lim P²

¹Yeouido St. Mary's Hospital, Catholic University of Korea, Seoul, Republic of Korea, ²Practice in private clinic, Seoul, Republic of Korea

Background: The concept of intramarrow penetration or decorication before a GBR procedure is controversial because there are no human clinical trials to support its effectiveness, and there are opposing points of view derived from animal studies regarding its usefulness. Studies have been designed to evaluate the effects of cortical bone perforation histologically and histomorphometrically on GBR without bone graft.

Aim: The purpose of this study was to investigate the influence of intramarrow penetration on the angiogenesis and osteogenesis of GBR using synthetic bone substitutes in rabbit cranial defects, by assessing the histology and immunohistochemistry.

Methods: The right and left sections of the calvarium of 11 rabbits were exposed. In each rabbit, two custom-made titanium domes, one on each side of the midline, were placed. The cortical surface inside the boundary of one of the circular slits was then mechanically perforated five times using a 0.8-mm-diameter round bur (experimental site), while the bone surface within the perimeter of the other slit (control site) was left intact. Each experimental and control sites received β -TCP. The animals were sacrificed at 2, 4 and 8 weeks. The longest vertical distance of the newly generated tissue, the percent area of newly formed bone and the amount of marrow cell formation in the grafted area were examined histomorphometrically using light microscopy. The expression of vascular endothelial growth factor (VEGF) was determined as the percentage of positively stained cells and the immunostaining intensity by immunohistochemical staining.

Results: The percentage of the height of newly formed bone and the percent area of newly formed bone for experimental group were consistently greater than for control group at all sacrifice intervals. The amount of marrow cell for experimental groups became similar more rapidly with the normal rabbit calvarial bone than control groups. The immunostaining intensity and the percentage of positively stained cells for VEGF in experimental group were greater than control group at week 2 post-surgery.

Conclusions and clinical implications: Based upon this study that used a rabbit model with β -TCP placed in the parietal regions, intramarrow penetrations of the receptor bone improve repair and angiogenesis in bone grafts and increase the amount of newly formed bone in the grafted area, especially in the early bony healing phase.

Posters: Material Research (Abstracts 441–493)

441 | Material Research

Biomechanics and micro gap: comparison of seven different dental implants

Presenter: Howaldt H-P

University of Applied Sciences, Department of Engineering, Koblenz, Germany

Co-authors: Howaldt H-P

University of Applied Sciences, Department of Engineering, Koblenz, Germany

Background: In dental implant design it is very important to reduce the marginal bone resorption. A frequently discussed reason for bone resorption can be found in the bacterial contamination around the implant caused by micro gaps. Micro gaps occur in the implant abutment interfaces under functional loading. Another reason for bone resorption can be found in bone overloading at the marginal crest which can be measured by the bone strains. The physiological value of bone strains is in a range of 2000–3000 $\mu\text{M}/\text{m}$ in all human and animal bones. An implant should be designed to meet the requirements of minimal micro gaps and low bone strains.

Aim: The aim of this study is to investigate the micro gaps and the bone strains caused by the seven different dental implants Ankylos, Astra, Bego, Branemark, Camlog, Straumann and Xive.

Methods: The geometries of seven different implants are transferred into three dimensional finite element models. In a non-linear analysis, considering pretension of occlusion screw and friction/contact between implant and abutment, the influence of the cone angle to the bone strains and the appearance of micro gaps are determined. As a loading sequence a time function is used simulating three chewing cycles with increased loading.

Results: The flat connection group (Branemark, Camlog, Xive) shows significantly higher levels of micro gaps compared with the conical connection group (Ankylos, Astra, Bego, Straumann). It is found that there is no correlation between the defined groups and the respective bone strains. The highest (Astra) and lowest (Ankylos) bone strains are found in the conical connection group. Considering both parameters the implants Ankylos and Bego shows the best results.

Conclusions and clinical implications: Flat implant abutment connections (Branemark, Camlog, Xive) are not able to avoid micro gaps. Conical implant abutment connections can efficiently avoid micro gaps but has a negative effect to peri-implant bone strains (Astra, Straumann). In using conical connections the design of the implant is very sensitive concerning wall thickness and cone angle. The increase of bone strains of conical connections can be reduced by enlarging the implants wall thickness (Ankylos) or by decreasing the cone angle (Bego). Considering these design principles low bone strains can be achieved while no micro gaps will occur.

442 | Material Research

Clinical effect of toothpaste fluoride on osteointegrated titanium implants. Electric potential and bone loss

Presenter: Jet-Garcia A

Department of Periodontology, Faculty of Medicine and Dentistry, Murcia University, Murcia, Spain

Co-authors: Jet-Garcia A, Sanchez-Perez A, Moya-Villaescusa MJ

Department of Periodontology, Faculty of Medicine and Dentistry, Murcia University, Murcia, Spain

Background: Titanium and titanium-based alloys are chosen for dental implant treatment due to their resistance to corrosion and their biocompatibility. Several *in vitro* studies had reported that fluoride can decrease titanium corrosion resistance.

Fluoride toothpastes have been used since 50 years ago to prevent dental caries, and are used at present by millions of people every day.

While numerous studies have been carried out on the corrosion resistance of titanium in fluoridated mediums, the clinical effects of toothpaste fluorides on titanium osteointegrated implants has never been investigated.

Aim: The aim of our study was report how local fluoride can modify the electric potential on the surface of titanium osteointegrated implants in humans. And to determine whether there was any association between fluoride exposure, implant electric potential and bone loss.

Methods: Seventy-two titanium implants (Microdent System, Barcelona, Spain) were evaluated in 26 patients. All patients were asked for their oral hygiene habits and which toothpaste used.

Implants were in function for a mean of 25 months (range, 12–60 months). All implants were connected to cobalt–chromium prostheses. Potential measurements were taken twice on each implant: first time connected with the superstructure and second time on the surfaces of implants without prostheses. The measurement device is composed by one electronic redox-potential meter, one periodontal probe as counter electrode and one referential electrode (Ag/AgCl, KCL).

Marginal bone loss was evaluated in standardized radiographs at the moment of prosthetic connection and at the moment of electric measures (minimum 12 months).

Results: We follow up 72 implants, five of them were not exposed to fluoride, 46 (63%) were exposed to toothpastes containing up to 1500 ppm F, and 21 (29%) were exposed to concentrations > 1500 ppm F.

Significant differences ($P > 0.05$) were found in electric potential between implants exposed or not to local fluoride. We also found significant differences ($P > 0.05$) in electric potential, between the couples implant–abutment not-exposed to fluoride and those exposed to concentrations > 1500 ppm F.

No significant differences in marginal bone loss were found between implants exposed to different fluoride concentrations.

Conclusions and clinical implications: Daily used of dentifrices containing fluoride can modify the electric potential on the

surface of osteointegrated titanium implants. However, this effect on the electric potential does not lead to further bone resorption within the limits of our study.

443 | Material Research

Effect of porous composite uncalcined hydroxyapatite/poly-DL-lactide for vertical ridge augmentation

Presenter: Akino N

Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan
Co-authors: Akino N¹, Tachikawa N², Takaya K¹, Kasugai S¹

¹*Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan,* ²*Implant Dentistry, Dental Hospital, Tokyo Medical and Dental University, Tokyo, Japan*

Background: The use of dental implants has been one of restorations to replace missing teeth. Some cases might be required additional bone graft at the site of insufficient bone volume in order to attain a predictable long-term function and an esthetic treatment outcome. Autogenous bone grafts have been considered the gold standard for bone grafting applications in implant treatment. However, the benefits of autografts are restricted because of limited donor sources and associated morbidity. As a result, it would be desirable to use a readily available, safe, and effective substitute for autografts.

Aim: The purpose of this study was to assess the effect of vertical ridge augmentation using novel bone substitute.

Methods: This bone substitute consisted of porous composite uncalcined hydroxyapatite (HA, 70wt%) and scaffold of poly-DL-lactide (PDLLA, 30wt%). The HA/PDLLA blocks were implanted onto cranial bone of 18 rabbits. Animals were sacrificed 1 or 3 months after implantation. The samples were measured weight – average molecular weights (Mw). Specimens were decalcified and embedded in palafin. Histological and histomorphometrical analysis were performed to evaluate a quantitative analysis of the newly formed bone (%).

Results: Mw of 3 months group (56.5%) and 1 month group (64.1%) were significantly lower than that of day 0. We observed new bone formation in the sections of both groups. The HA/PDLLA blocks directly contacted with the original bone and the newly formed bone tended to increase over months. The degradation of the material was showed from the periphery of the samples at 1 month after implantation. Bone formation was significantly higher in 3 months group (26.2 ± 5.1%) compare with 1 month group (18.7 ± 4.4%).

Conclusions and clinical implications: The measurement of Mw revealed that the HA/PDLLA blocks were biodegraded even at 1 month after implantation. And the histological and histomorphometrical observations indicated that new bones were formed into the material. These results suggested that the HA/PDLLA block was biocompatible, biodegradable and osteogenesis. Therefore, the HA/PDLLA block was considered a useful material for vertical ridge augmentation.

444 | Material Research

Biomechanical and histologic evaluation of nonwashed resorbable blasting media and alumina-blasted/acid-etched surfaces

Presenter: Bonfante E

Unigranrio University, Duque De Caxias, Brazil
Co-authors: Bonfante E², Marin C¹, Granato R¹, Giro G⁵, Suzuki M³, Coelho P⁴

¹*Federal University of Santa Catarina, Florianópolis, Brazil,*

²*Unigranrio University, Duque De Caxias, Brazil,* ³*Tufts University, Boston, MA, USA,* ⁴*New York University, New York, NY, USA,*

⁵*Universidade Estadual Paulista Julio de Mesquita, Araraquara, Brazil*

Background: In the past machined surfaces were used as a gold standard for dental implants. Over the years the improvement of industrial processing and biomaterials produced moderate rough implant surfaces with high biocompatibility and decrease of osseointegration period. The use of bioceramics in association with implant surfaces is a promising field and this feature probably a faster osseointegration process is reached. The animal evaluation of this new surface treatment determine its benefits for osseointegration before clinical use.

Aim: The objective of this study was to compare the biomechanical fixation and histomorphometric parameters between two implant surfaces: nonwashed resorbable blasting media (NWRBM) and alumina-blasted/acid-etched (AB/AE), in a dog model.

Methods: Six beagle dogs of ~ 1.5 years of age were utilized and each animal received one implant of each surface per limb (distal radii sites). After a healing period of 3 weeks, the animals were sacrificed and half of the implants were biomechanically tested (torque to interface fracture) and the other half referred to non-decalcified histology processing. Histomorphometric analysis considered bone-to-implant contact (BIC) and bone area fraction occupancy (BAFO). Statistical analysis was performed by paired *t* tests at 95% level of significance.

Results: While no significant differences were observed for both BIC and BAFO parameters ($P > 0.35$ and $P > 0.11$, respectively), a significantly higher level of torque was observed for the NWRBM group ($P = 0.01$). Bone morphology was similar between groups, which presented newly formed woven bone in proximity with the implant surfaces.

Conclusions and clinical implications: A significant increase in early biomechanical fixation was observed for implants presenting the NWRBM surface

445 | Material Research

Cell growth on titanium disks treated by plasma of Argon: experimental study

Presenter: Canull L

University of Bonn, Bonn, Germany

Co-authors: Canull L, Gotz W

University of Bonn, Bonn, Germany

Background: The initial interactions between cellular components and materials play an important role in the stages of the healing process around fixture and implant abutment. These

interactions are critically mediated by the state of the surface. Plasma treatment has been used for several decades to increase cellular adherence to polymeric and metallic materials. Recently it was suggested to enhance cell adherence to titanium implant surface.

Aim: The present experimental study was aimed to analyze wheatear cleaning treatment using plasma of argon could interfere with cellular growth of fibroblasts on titanium turned disks at different time-points.

Methods: Sixty titanium disks were dived in two groups: 30 were left untreated (control) and 30 were cleaned using plasma of argon (test). They were immersed in culture of fibroblasts (L-929) and, after preparation, stained using DIPA, staining nuclei, and fluorescent phalloidin, labeling cellular body. Count nuclei and analysis of cellular body was performed using fluorescent microscopy and imaging analysis software. Analysis was performed at different time-points: 2, 8 and 48 h.

Results: At the end of this study, the control group presented fibroblast adhesion mean values of 135 (± 26), 184 (± 64), 372 (± 67) cells/field respectively at 2, 8 and 48 h. The test group presented fibroblast adhesion mean values of 181 (± 37), 233 (± 51), 369 (± 84) cells/field respectively at 2, 8 and 48 h. Test group data demonstrated statistical significantly higher values compared with control group at 2 ($P < 0.0039$) and 8 h ($P < 0.0488$). Data at 48 h did not presented any statistical significant difference. Analyzing cellular body, at 2 h the cellular body is flatter and more spread, i.e. the process of cellular adherence is in a more advanced stage in the treated sample.

Conclusions and clinical implications: Removal of organic and inorganic contamination on the surface of titanium disks using plasma of argon seems to accelerate fibroblast adhesion in the early stage (2–8 h). This effect disappears in the long run due to the space saturation. According to the presented data, plasma cleaning could be applied in prosthetic treatment of implant-supported rehabilitation, enhancing soft tissue response to the abutment insertion.

micromechanical interlocking of the bone–implant interface. New evidence suggests that implants with a regular pattern of roughness may warrant superior clinical results.

Aim: Our aims were two-fold, first to develop a novel method for manufacturing laser induced regular surface topography on grade 2 commercial pure titanium specimen surfaces and second to characterise the newly developed surface.

Methods: We have performed a series of three-dimensional finite element method (FEM) models in order to calculate interfacial tissue stress and maximum effective strains of bone–implant surfaces with different micro-pit dimensions. Thus the retention degrees of the designed micro-pits and the mechanical response of the interfacial area were evaluated. Following FEM analysis, we planned to produce novel micro-pits with diameters ranging from 60 to 75 μm on ASTM B265 grade 2 commercial pure titanium specimen surfaces. The irradiations in the range of 200–230 ns pulse durations were performed with a 20 Watt Telesis Zenith (Ohio, USA) ytterbium fiber laser. Topographical evaluation was performed with a scanning electron microscope (JSM-6060 JEOL). The new morphologies were characterized by micropits most of which had a diameter within the targeted range (60–70 μm).

Results: Interfacial shear strength decreases with increasing diameter of micropits. A threshold region was detected that the interfacial strength became almost constant. According to the results of our FEM analysis, a minimum threshold value of 70 μm for a pit's diameter was calculated. Accordingly, when pits' diameter is higher than this threshold value, bone is expected to retain its maintenance.

Conclusions and clinical implications: Ytterbium fiber laser is a promising tool for manufacturing dental implants with a desired surface topography. We are now planning to undertake a series of *in vivo* studies in order to investigate the effects of this novel laser-induced micropit patterned surfaces on micro mechanical interlocking of the implant materials and bone.

446 | Material Research

Q-switched laser-induced micro-pits: as bone stabilizers

Presenter: Celen S

Ege University, Izmir, Turkey

Co-authors: Celen S, Efeoglu C, Özden H, Akay C

Ege University, Izmir, Turkey

Background: Lasers are increasingly used in the rapid production of micromedical implants and devices; meeting the most important requirements such as contamination-free, isotropic, distinct and regular surface textures. Commercial pure titanium and its alloys are the metals of choice due to their bioinert characteristics such as tissue compatibility and osseointegration. Surface microstructuring is imperative in order to increase bone–implant contact and implant stability. It is well known that the degree of mechanical interlocking increases with the roughness of the implant. The pattern of roughness, size and distribution of regular patterns have crucial effects on

447 | Material Research

The implant-stability-measurement-instrument Osstell™ mentor: an adequate diagnostic tool for ankylosed teeth?

Presenter: Crismani A

Department of Orthodontics, Medical University of Innsbruck, Innsbruck, Austria

Co-authors: Crismani A¹, Weinberger T², Schwarz K², Bertl M²

¹Department of Orthodontics, Medical University of Innsbruck, Innsbruck, Austria, ²Department of Orthodontics, Medical University of Vienna, Vienna, Austria,

Background: The currently available diagnostic methods for tooth ankylosis – X-ray and percussion-test – are highly subjective and CT scans not justifiable in most cases.

Aim: The implant-stability-measurement-instrument Osstell™ mentor was tested as an adequate diagnostic tool for ankylosed teeth. Further objectives were to (1) assess significant differences of the

measuring values between ankylosed and nonankylosed teeth and to (2) assess an initial reference ISQ value for ankylosed teeth.

Methods: Forty-five lower deciduous molars were tested for ankylosis with clinical analysis and a panoramic X-ray. Fifteen assumed ankylosed deciduous molars and 30 normal deciduous molars were measured with Osstell™ *mentor*. For each tooth two measuring values were documented (mesiodistal and buccolingual). An ankylosed tooth was expected to show higher Implant-stability-quotient (ISQ)-values because of its rigid tooth–bone-connection in contrast to a normal tooth with a periodontal membrane and therefore higher mobility. Additionally, age, sex, weight, height, cross bite, deep bite, Angle Class and patient-satisfaction were documented.

Results: Significant differences of the average values in mesiodistal and buccolingual direction between ankylosed and non-ankylosed deciduous molars could be found. No association between ankylosis and cross bite, deep bite, Angle Class and sex could be detected. Second deciduous molars were more often affected than first. An initial reference ISQ value of 43 for ankylosed deciduous molars could be defined with a sensitivity of 53.3% in mesiodistal and 20% in buccolingual direction. In both directions the specificity was 100%.

Conclusions and clinical implications: The present study revealed that the resonance frequency analyzer Osstell™ *mentor* can be used as an additional diagnostic tool for dental ankylosis.

448 | Material Research

Effects of rotating titanium debridement brushes on the surface structure of dental implants

Presenter: Duddeck DU

Interdisciplinary Outpatient Department for Oral Surgery and Implantology, Department for Craniomaxillofacial and Plastic Surgery, University to Cologne, Cologne, Germany

Co-authors: Duddeck DU, Karapetian VE, Rothamel D, Zöller JE

Interdisciplinary Outpatient Department for Oral Surgery and Implantology, Department for Craniomaxillofacial and Plastic Surgery, University to Cologne, Cologne, Germany

Background: The surface of dental implants determines the biological response to the implant and effects its ability to integrate into the surrounding tissue. After bone loss caused by peri-implantitis the implant surface becomes exposed to microbes, inflammatory cells and organic contaminants. For a sufficient implant debridement i.e. cleaning and conditioning of exposed implant surfaces, concrements and tissue remnants have to be removed. In order to avoid recontamination after mechanical cleaning, additional dissolving of the biofilm and disinfection is necessary. Mechanical debridement is typically performed with a curette or burr causing damages on the rough implant surface. Rotating brushes seem to fit to the architecture of dental implant surfaces.

Aim: The aim of this poster is to present topographic effects of different rotating titanium debridement brushes on the titanium surface of dental implants.

Methods: Dental implants with machined, oxidized, sandblasted, acid-etched, sandblasted-acid-etched and sintered

titanium surfaces have been investigated by scanning electron microscopy (SEM) before and after treatment with two different rotating single use titanium debridement brushes. The SEM images allowed to draw conclusions on the topographical effects of the rotating brushes. Results were compared with implant surfaces treated with titanium and carbon curettes.

Results: Stiff titanium bristles on rotating brushes allow a surface cleaning with only minor impact on all tested implant structures. Both analyzed titanium brushes were more gentle to the implant surface than other mechanical methods.

Conclusions and clinical implications: Rotating titanium brushes have a minor impact on the implant structure when used for mechanical debridement in peri-implantitis therapy. The use of rotating titanium brushes may shorten the treatment time.

449 | Material Research

Biodegradation pattern of native and cross-linked porcine collagen matrices – an experimental study in the rat

Presenter: Fienitz T

Department of Oral Surgery, Heinrich-Heine University, Duesseldorf, Germany

Co-authors: Rothamel D¹, Fienitz T², Benner M¹, Kreppel M¹, Scheer M¹, Zöller J¹

¹Department of Oral and Maxillofacial Plastic Surgery, University of Cologne, Cologne, Germany, ²Department of Oral Surgery, Heinrich-Heine University, Duesseldorf, Germany

Background: Within the last decade, collagen has been established as sufficient membrane material for GTR and GBR procedures. Moreover, it might be also an adequate matrix for soft tissue augmentation procedures to avoid the donor site morbidity of soft tissue grafts from the palate. However, different collagen matrices differ significantly regarding resorption time, biodegradation pattern and the invasion of inflammatory cells.

Aim: The aim of the present study was to compare the biodegradation and tissue integration of native collagen membranes and native and differently cross-linked collagen matrices in rats.

Methods: Two commercially available GTR/GBR membranes of 0.3–0.6 mm thickness [Jason® pericardium membrane (JM) and CollProtect® membrane (CM), noncross-linked porcine type I collagen, Botiss Biomaterials, Berlin, Germany] and four experimental porcine collagen matrices of 1.5 mm thickness developed for soft tissue augmentation procedures [native (ND), dehydrothermally cross-linked (DHCL), ethylenedioxy cross-linked (CCL) and specifically defatted (DND) dermis collagen, AAP Biomaterials, Dieburg, Germany] were included in the study. Specimens of 1 × 1 cm were randomly allocated in unconnected subcutaneous pouches separated surgically on the back of 40 wistar rats. Rats were divided into five groups (1, 2, 4, 8 and 12 weeks), including eight animals each. After 1, 2, 4, 8, and 12 weeks of healing, animals were sacrificed and explanted specimens were prepared for histologic and histometric analysis. The following parameters were evaluated: biodegradation over time, volume stability, vascularization, tissue integration and foreign body reaction.

Results: Regarding membranes materials, fastest vascularization and tissue integration was noted for CM, whereas JM showed a significantly longer biodegradation time of up to 2 months. Biodegradation pattern of dermis collagen scaffolds differed significantly in terms of invasion of inflammatory cells and resorption time, depend on the cross-linking technique.

Conclusions and clinical implications: Within the limits of the present study, it was concluded that (i) collagen matrices harvested from porcine pericardium provide longer barrier function than dermis collagen (ii) cross-linking of collagen matrices may increase the foreign body reaction which in turn influences the tissue integration and resorption time.

450 | Material Research

Treatment planning of zirconia implants:
a microscopic fracture analysis

Presenter: Gahlert M

Private Dental Clinic, Munich, Germany

Co-authors: Gahlert M¹, Burtcher M², Grunert I²,
Kniha H¹, Steinhauser E³

¹Private Dental Clinic, Munich, Germany, ²Clinical Department of Prosthetic Dentistry, Innsbruck Medical University, Innsbruck, Austria, ³Department of Precision- and Micro-Engineering/Engineering Physics, Munich University of Applied Sciences, Munich, Germany

Background: Zirconia as implant material has become an alternative to titanium because of its tooth like colour and its biocompatibility. In a recent study we could demonstrate that after an average in-situ period of 36.8 months out of 170 inserted zirconia implants 13 implants fractured.

Aim: The purpose of the present study was to investigate the incidence and the microscopic failure methodology of fractured zirconia implants with regard to treatment planning.

Methods: Thirteen fractured zirconia implants (Z-Look3, Z-Systems AG, Konstanz, Germany) were prepared for macroscopic and microscopic assessment. Microscopic examination was based on light microscopy and scanning electron microscopy (SEM). Implant position and implant design were investigated with regard to fracture incidences to identify reasons for failures.

Results: All fractures occurred due to singular bending overload (forced rupture). Material failures due to the production process or preparation marks could be excluded. SEM analysis showed that the direction of crack propagation was always from oral to vestibular. Twelve fractured implants had a diameter of 3.25 mm and one implant had a diameter of 4 mm. The patient with the fracture of the 4 mm diameter implant was adversely affected by strong bruxism. Twelve implants were positioned in region of the anterior teeth of the maxilla and mandibula. All cracks started at the lowest part of the grooves of the thread. Statistical evaluation showed a highly significant correlation between implant position and fracture incidence.

Conclusions and clinical implications: Taken together the data clearly suggest that fracture of zirconia dental implants is

mainly dependent on overloading bending strength, implant design and implant position. Treatment planning should consider that diameter reduced zirconia implants (3.25 mm) cannot be suggested for clinical use. Mechanical preparation of zirconia implants does not seem to influence fracture incidence or crack propagation.

451 | Material Research

Removal torque of prosthetic screw after fatigue tests
in cone-morse and internal hexagonal implants

Presenter: Gehrke SA

Biotechos, Santa Maria, Brazil

Co-authors: Gehrke SA¹, Fonseca Fernandes TRO²

¹Biotechos, Santa Maria, Brazil, ²Universidade Paulista, São Paulo, Brazil

Background: One of the most commonly observed mechanical failure are relacioned to an insufficient induced tension to the screw. This fact can lead to loosening of the screw joint, due to reduced precharge, responsible for maintaining the stability of the screw joint interface and the resistance to the forces that tend to separate the components.

Aim: The objective of this study aimed to evaluate and compare the torque of loosening of straight solid pillars connected to implants morse cone and two-piece straight abutments connected to implant connection with internal hexagon, after mechanical cycling test.

Methods: Two groups were formed ($n = 10$), such as: group 1 (Universal Implant Tapered Hexagon II Internal attached to the straight two pieces abutment), group 2 (Universal II Implants Cone Morse attached to the straight solid pillars). To make the mechanical cycling tests, the straight solid pillars for Morse connection were tightened with a 25 Ncm torque, and the straight abutment of two piece for connection of internal hexagon were tightened with a 32 Ncm torque, with analogical torque mechanical driver Tohnichi, which are the recommended torques by the manufacturer. All abutments were retightened after 10 min, to minimize the effects of relaxation of the joint. The samples were submitted to fatigue tests in a testing machine of mechanical cycling to 360,000 cycles with applied axial load of 80N and frequency of 4 Hz. After the end of the cycles, the torque required for loosening of prosthetic components of each group was measured through an analogical torque mechanical driver Tohnichi.

Results: Results showed that the experimental conditions before this study there were significant differences in values removal torque between groups 1 and 2, and the average removal torque group 1 was 61.98% and Group 2 was 102.87% being possible to say that removal torque morse taper implant after cycling is greater than in internal hexagon implants.

Conclusions and clinical implications: The results for samples from group 2 showed that there was a significant increase in the values removal torque compared with baseline torque tightness, showing a significant improvement in performance after mechanical cycling.

Comparative study of level in peri-implant bone resorption of the according to three different types of antagonists

Presenter: Gehrke SA

Biotecnos, Santa Maria, Brazil

Catholic University of Uruguay, Montevideo, Uruguay

Co-authors: Gehrke SA^{1,3}, Machado VA², De Botoli Jr N²

¹*Biotecnos, Santa Maria, Brazil*, ²*Universidade Paulista, São Paulo, Brazil*, ³*Catholic University of Uruguay, Montevideo, Uruguay*

Background: The use of dental implants as a treatment option for patients and partially or completely edentulous patients is becoming increasingly common in clinical dentistry. However, the peri-implant bone resorption remains a major concern for implantodontists. Many studies have been used to demonstrate the relationship of occlusal overload and peri-implant bone resorption. Natural teeth, implants and dentures have different characteristics in the transmission of masticatory forces.

Aim: The objective was to compare the level of peri-implant bone resorption, according to three different types of antagonists.

Methods: We selected nine patients who had a total of 29 implants in posterior mandible rehabilitated with crowns made of porcelain, which had as antagonists natural teeth, dentures or implant-supported dentures. The bone loss occurred after prosthetic rehabilitation were measured and compared through the digitization of radiographs taken in reopening before prosthetic loading and after 2 years in function.

Results: Results showed that all implants showed bone loss, regardless of the type of antagonist, with no statistically significant difference between groups. It was not the object of this study, a comparison between implants with external and internal hexagon, but the different types of antagonists.

Conclusions and clinical implications: We can conclude that regardless of the type of antagonist there was bone loss in the all studied implants.

Microestructural characterization of titanium dental implants by electron microscopy and mechanical tests

Presenter: Gehrke SA

Biotecnos, Santa Maria, Brazil

Catholic University of Uruguay, Montevideo, Uruguay

Co-authors: Gehrke SA^{1,3}, Helfenstein B⁴, De David BA⁴

¹*Biotecnos, Santa Maria, Brazil*, ²*Universidade Paulista, São Paulo, Brazil*, ³*Catholic University of Uruguay, Montevideo, Uruguay*, ⁴*Pontificia Universidade Católica, Porto Alegre, Brazil*

Background: Mini screw types for titanium implants, with differentiated design, were tested for traction and torsion for behavior analysis of the shape relative to the requirements of ASTM F136.

Aim: The objective was to study the behavior of an implant different format, mini screw, made of unalloyed titanium when

subjected to traction and torsion. Relate themicrostructure and phases present before and after heat treatment.

Methods: In this study, we analyzed eight mini titanium screws (ASTM Gade 2). Three samples were tested by torsion and three by traction with the normalization ASTM F136 (7) and ISO 6475:1997. Broken samples were observed by electron microscopy, and in turn, were cut longitudinally, prepared by conventional grinding and polishing and etched with a solution for metallographic tests by optical and electron microscopy scanning for the characterization of the phases present. Two implants were thermally treated in a horizontal furnace under protective atmosphere of argon. The hardness of each phase observed before and after heat treatment was obtained with a Vickers indenter. The X-ray diffraction was used to confirm the phases present in samples with and without heat treatment.

Results: Results showed that all implants showed mechanical tensile strength above by the standard requirement, being that 83.3% of them broke above the doughnut, in support of the prosthesis. Distinct morphologies in ruptured by mechanical tests, were obtained. Metallographic tests, X-ray diffraction (XRD) and microhardness were used for microstructural characterization of material, before and after heat treatment. The presences of β phase in screw surface after quenching treatment prove that the thermal treatment can contribute for mechanical resistance in surface implants.

Conclusions and clinical implications: The heat treatments altered the percentage of α and β phases and consequently the hardness of the material. There was an augmenting the β phase at the edge of the bolt subjected to quenching and an increase in screw a phase annealed.

Effectiveness of a new, self tapping implant: 5–6 years results

Presenter: Gholami H

Dental School, Bern University, Bern, Switzerland

Co-authors: Gholami H, Katsoulis J, Avrampou M, Merisque-Stern R

Dental school, Bern University, Bern, Switzerland

Background: Nowadays a broad range of implant systems is on the market. Few of them exhibit good scientific evidence of their efficacy and effectiveness, while other systems have poor documentation or lack completely any scientific background.

Aim: To evaluate the 5–6 years clinical and radiologic outcomes of a new dental implant system, which was released on the market in 2003 (Thommen Medical, Switzerland) and to determine crestal bone level changes.

Methods: Eighteen service patients (nine males and nine females) with a mean age of 62.8 ± 14.2 received 61 implants in different location of both jaws. They were followed for 5–6 years and included in the present evaluation. The self-tapping, screw-shaped implant, has a slightly rough, acid-etched and sand-blasted surface. Radiographs had been taken immediately after surgery, at the time of implant loading, 1 and 5 year after loading. Crestal bone changes over time were measured form

as a distance from the implant shoulder to the first bone contact (DIB). For statistical analysis the SPSS 17 statistical package was used. The Person correlation was applied to assess the association between PD, BoP and DIB. To assess the influence of gender, implant size, jaw site and prosthetic indication on crestal bone a regression model was calculated.

Results: At the end of the study period 58 implants were available. One implant had failed and one patient with two implants had died. The mean PD 2.6 ± 0.7 mm. 36.4% of the implants showed at least at one site with positive BOP. Age was the only factor, which significantly affected the mean PD ($P < 0.01$). Patients' gender ($P = 0.009$) had a significant effect on BoP. The average crestal bone loss after 5–6-years follow-up was small with 1.5 mm. Most changes of DIB occurred between surgery and loading and the first year after loading. Thereafter, the mean annual bone loss was < 0.2 mm, namely 0.12 mm. Any effect of various variables on crestal bone loss was not identified.

Conclusions and clinical implications: From this first report on a new implant system it can be concluded, that it can be successfully applied for various prosthetic indications in both jaws. Crestal bone around the implant remains stable during a 5-year period and fulfills criteria of success.

Histomorphologic/histomorphometric evaluation of four different implant design at early implantation times. An experimental study in dogs

Presenter: Suzuki M

Tufts University, Boston, MA, USA

Co-authors: Giro G⁵, Granato R¹, Marin C¹, Suzuki M³, Bonfante E², Coelho P⁴

¹Federal University of Santa Catarina, Florianópolis, Brazil,

²Unigranrio University, Duque De Caxias, Brazil, ³Tufts University, Boston, MA, USA, ⁴New York University, New York, NY, USA,

⁵Universidade Estadual Paulista Julio de Mesquita, Araraquara, Brazil

Background: Understand the socket healing after immediate implant placement is an important issue for correct implant placement. Beyond this several implant systems are present commercially with different designs which can improve the osseointegration process. Understand the interplay between implant and osseointegration after immediate placement of each design is important to choose the correct design for this clinical situation. An experimental study in dogs can evaluate the different systems.

Aim: The objective of this study was to histomorphometrically evaluate bone around immediately placed implants with four different bulk and surface design

Methods: The first, second, third and fourth premolars of eight beagle dogs (~1.5 years of age) were bilaterally extracted and implants of approximately 4 mm in diameter and 10 mm in length (Unitite, SIN, Sao Paulo, Brazil; Replace Select, Nobel Biocare, Sweden; Straumann, Basel, Switzerland; and Nanotite, Biomet 3i, FL, USA) were placed at the buccal plate crest level (implant surface was interpolated between sockets). The left and

right hemi-arches provided implants that remained 2 and 4 week *in vivo*, respectively. After sacrifice, the implants in bone were reduced to ~30 μm nondecalcified thin sections, stained with toluidine blue and referred to histomorphometric evaluation under optical microscopy. The bone-to-implant contact (BIC), and buccal bone loss (BBL) were evaluated. Statistical analyses were performed by Kruskal–Wallis test at 95% level of significance. The Dunn's test was used for multiple comparisons.

Results: Histomorphometric analysis showed no differences between implant surface × time *in vivo* for BIC ($P > 0.39$). While larger degrees of BBL were observed for all groups at 4 weeks compared with 2 weeks, differences between groups were not significant ($P > 0.48$). At 2 weeks, woven bone was observed in proximity with all implant surfaces. At 4 weeks, initial replacement of woven bone by lamellar bone was observed for all implants.

Conclusions and clinical implications: No significant differences in measurable parameters were observed between immediately placed implant systems.

Histomorphometric evaluation of AB/AE and PSCaP plateau root form implants at early implantation times. An experimental study in dogs

Presenter: Granato R

Federal University of Santa Catarina, Florianópolis, Brazil

Co-authors: Granato R¹, Marin C¹, Suzuki M³, Bonfante E², Gil J¹, Giro G⁵, Coelho P⁴

¹Federal University of Santa Catarina, Florianópolis, Brazil,

²Unigranrio University, Duque De Caxias, Brazil, ³Tufts University, Boston, MA, USA, ⁴New York University, New York, NY, USA,

⁵Universidade Estadual Paulista Julio de Mesquita, Araraquara, Brazil

Background: The macrodesign play an important role in the osseointegration process. A combination of surface treatment and macrodesign can be an excellent combination to maintain the bone levels after extraction. A preclinical study is necessary to confirm this hypothesis.

Aim: The objective of this study was to histomorphometrically evaluate bone around immediately placed plateau root form implants presenting two different surface treatments.

Methods: The third and fourth premolars of eight beagle dogs (~1.5 years of age) were bilaterally extracted and implants of 3.5×11 mm with either an alumina-blasted/acid-etched (AB/AE) or plasma sprayed calcium-phosphate (PSCaP) (Bicon LLC, Boston, MA, USA) were placed in the distal sockets at the buccal plate crest level (implant surface was interpolated between sockets). The left and right hemi-arches provided implants that remained 3 and 5 week *in vivo*, respectively. After sacrifice, the implants in bone were reduced to ~30 μm nondecalcified thin sections, stained with toluidine blue and referred to histomorphometric evaluation under optical microscopy. The bone-to-implant contact (BIC), bone area fraction

occupancy (BAFO), and buccal bone loss (BBL) were evaluated. Statistical analyses were performed by Kruskal–Wallis test at 95% level of significance. The Dunn's test was used for multiple comparisons.

Results: Histomorphometric analysis showed no differences between implant surface \times time *in vivo* for BIC and BBL at $P > 0.39$, and $P > 0.57$, respectively. A marginal nonsignificance was observed between the 3 weeks AB/AE vs. the 3 weeks PSCaP at $P = 0.0057$. At 3 weeks, woven bone was observed filling the plateaus for both implant surfaces. However, at 5 weeks, replacement of woven bone by lamellar bone was only observed for the PSCaP surface.

Conclusions and clinical implications: No significant differences in measurable parameters were observed between immediately placed plateau root form implants of AB/AE and PSCaP surfaces. Morphologic evaluation showed that PSCaP-coated implants presented lamellar bone at an earlier implantation time compared with the AB/AE surface.

Bone healing capacity of the new fluoridated hydroxyapatite in the rabbit cranium defect

Presenter: Han S-J

Dankook University, Cheonan, Republic of Korea

Co-authors: Han S-J

Dankook University, Cheonan, Republic of Korea

Background: The bone graft materials are grossly divided into autogenous bone, allogenic bone, xenogenic bone, and alloplastic material. Among the various allogenic graft materials, hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$, HA), the main inorganic phase of human hard tissue, is widely used as a repair material for bones. When HA applied to bony defect, however, it may be encapsulated with fibrous tissue and floated in the implanted area by the lack of consolidation. Fluoridated hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$, FHA), where F- partially replaces the OH- in the hydroxyapatite, is considered as an alternative material for bone repair due to its solubility and biocompatibility.

Aim: This study was designed to find out the bone healing capacity of FHA newly produced as a nanoscale fiber in the laboratory.

Methods: We implanted HA and FHA in the rabbit cranium defect and histologically analysed the specimen.

Results: The results were as follows. (1) In the 4 weeks, fibrous connective tissue and little bone formation around materials of the experimental group I implanted HA were observed. In the experimental group II implanted FHA, newly formed bone around materials were observed. (2) In the 8 weeks, the amount of newly formed and matured bone of the experimental group II was more than the experimental group I and control group.

Conclusions and clinical implications: From the results obtained, we suggest that FHA, newly synthesized, is relatively favorable bone substitute with biocompatibility and has better bone healing capacity than pure HA.

Bone regeneration by bioactive hybrid membrane within rat calvarium

Presenter: Hong K-S

Dankook University, Cheonan, Republic of Korea

Co-authors: Hong K-S¹, Yim S-B¹, Jung J-H¹, Han K-A², Kim K-R¹, Heo B-C¹, Shim J-Y¹, Yang K-H¹, Lee S-J¹

¹*Dankook University, Cheonan, Republic of Korea*, ²*Ajou University, Suwon, Republic of Korea*

Background: Absorbable membranes are becoming favored over nonabsorbable ones due to their better cell compatibility, biological reactions, and no surgical removal process. Together with the conventional passive role as a barrier, the next-generation GBR membrane should also stimulate the bone regeneration process.

Compared with a pure polymeric composition, bioactive inorganics are believed to enhance bone formation, such as bone matrix synthesis and calcification

Aim: The aim of this study was to examine the bone regeneration potential of a novel hybrid membrane consisting of collagen and nano-bioactive glass (nBG) for use in guided bone regeneration.

Methods: nBG was added to a reconstitution of collagen at a concentration of 30%, and the hybrid was formulated into a thin membrane. Two membrane groups, including pure collagen, collagen-nBG hybrid were implanted within a rat calvarium defect (Φ 5 mm) for a period of 3 weeks.

Histomorphometric analysis was carried out to evaluate the bone regeneration within the defect.

Results: The defect in the collagen-nBG membrane was recovered nearly. However, there was little defect recovery in the blank control. The new bone formation was as high as ~ 44 , $\sim 30\%$ of the defect treated with the collagen-BG, and collagen, respectively, while only 3% of new bone was observed in the blank control.

Conclusions and clinical implications: The nBG was shown to stimulate bone formation of the collagen membrane within a rat calvarium defect.

Effects of periosteum and membrane on the resorption of grafted iliac bone in calvarium of rabbit

Presenter: Hur J

Department of Dental Science, Gwangju, Republic of Korea

Co-authors: Kook M, Hur J

Department of Dental Science, Gwangju, Republic of Korea

Background: Guide tissue regeneration with absorbable membrane on resorption of iliac bone graft is very usual and important technique.

Aim: This research was performed to evaluate the effect of periosteum and absorbable membrane on resorption of iliac bone graft in rabbit calvarium.

Methods: Eighteen rabbits were used. Iliac bone was harvested with a size of 10 mm \times 8 mm \times 4 mm with or without periosteum.

Grafted bone was divided into three groups; iliac block bone without periosteum (control group), iliac block bone with periosteum (periosteum group), iliac block bone covered with absorbable membrane without periosteum (membrane group). The grafted bone was transplanted and fixed on frontal bone.

Results: (1) In gross examination, the grafted site showed no sign of inflammation, wound dehiscence, displacement and exposure of the bone. The grafted iliac bone was well located on calvarial bone. (2) In radiographic evaluation, not only radiolucency had been increased but also bone volume had been decreased in time-dependent manner. At the initiatory stage, the grafted bone was observed as being attached to the periosteum of recipient site and cranial bone in all groups without any inflammation. (3) In histological evaluation of the control group, osteoclasts were not observed in the area of grafted bone after 2 weeks. Osteoclasts and resorption of the grafted bone were observed in the area of the periosteum of recipient site and adjacent site after 4 weeks. Osteoclasts and the severe resorption of the grafted bone was observed after 8 weeks. The grafted bone was resorbed with a transformation of the shape. (4) In histological evaluation of the periosteum group, the periosteum attached to the grafted bone was observed after 2 and 4 weeks and the close attachment was observed between the periosteums of recipient site and the grafted bone. The vascularization of the periosteum attached to the grafted bone was observed at 4 weeks after the graft. A few of osteoclasts was observed after 2 and 8 weeks. The size of the grafted bone was reduced while maintaining the shape of the bone after 8 weeks. (5) In histological evaluation of the membrane group, the continuity of the membrane was observed at 2–4 weeks, but the partial resorption of the membrane was observed after 8 weeks. Also the border between the periosteums of the recipient site and the grafted bone was distinct and a few of osteoclasts was observed in the area of the periosteums of the recipient site.

Conclusions and clinical implications: Periosteum and absorbable membrane in the bone graft surgery can reduce the resorption of the grafted bone.

460 | Material Research

Biocompatibility: evaluation of titanium alloys in oral implantology

Presenter: Iliescu AA

University of Medicine and Pharmacy, Bucharest, Romania

Co-authors: Iliescu AA¹, Burlibasa M¹, Ionescu I¹, Burlibasa L², Tanase G¹, Sfeatcu R¹, Sandulescu M¹

¹University of Medicine and Pharmacy, Bucharest, Romania, ²Faculty of Biology, Bucharest, Romania

Background: Biocompatibility is the property of a biological product which in contact with living materials (tissues or organs), manages to establish mutual relationship of biotolerance or rejection.

Aim: Biocompatibility of titanium and its alloys has been demonstrated in this study, by coming into contact with living

materials (tissues or organs), managing to establish mutual relationship of biotolerance or rejection.

Methods: The studied material was a titanium alloy (Ti6Al4V). It is a lot of 10 rectangular pieces with 6 × 3 × 2 mm dimensions, sandblasted, cleaned and covered with a protective layer of titanium oxide. It was observed the behavior of living tissues (subcutaneous and intramuscular) to this alloy. For implants it was used the classic ISO 10993 and ISO/Tc.194 standards and the provisions of Law 205/2004 in Romania, with regard to the welfare of laboratory animals. Biocompatibility was method, with strict compliance of followed by the reaction occurring at the site of implantation (subcutaneous and intramuscular) to Wistar race rats and guinea pigs. Term observation of the subjects in question was 21 days (according to ISO). During the experiment have been pursued two goals: behavior and clinical status of subjects throughout the study development, as well as local reaction (subcutaneous and intramuscular).

Results: Presenting the results of the biocompatibility of Ti6Al4V product was made by means of daily observation (21 days). After euthanasia of subjects, were performed gross examination and histopathology of pieces taken from the above mentioned subjects. Subsequently, the slides were studied under the optical microscope.

Conclusions and clinical implications: Intramuscular implantation of Ti6Al4V sample showed that there were no changes, showing that these samples are not toxic and do not contain inflammatory, neoplastic or other type of substances which could testify the incompatibility. All relationships established between these samples and host tissues, demonstrates that within 21 days were established bioinertness connections.

461 | Material Research

Nanostructured titanium-bioceramic composite scaffolds for biomedical applications

Presenter: Jurczyk K

Department of Conservative Dentistry and Periodontology, Poznan University of Medical Sciences, Poznan, Poland

Co-authors: Jurczyk K¹, Niespodziana K², Jurczyk M²

¹Department of Conservative Dentistry and Periodontology, Poznan University of Medical Sciences, Poznan, Poland, ²Institute of Materials Science and Engineering, Poznan University of Technology, Poznan, Poland

Background: In the last decade great interest has been observed in the field of nanoscale biomaterials. The architecture of porous implant has been suggested to have a great effect on implant integration with newly grown bone. The present research aims in fabricating Ti-based composite porous scaffolds to promote bone or tissue ingrowth into pores and provide biological anchorage.

Aim: Aim of our studies is to develop nanostructured titanium-bioceramic scaffolds by producing the porous structures with a strictly specified chemical and phase compositions, porosity and surface morphology and such that will well adhere to the substrate, show high hardness, high resistance to

biological corrosion and good biocompatibility. In this work, the structure and biological properties of titanium-10 wt% bioceramic (45S5 Bioglass and hydroxyapatite) scaffolds were studied.

Methods: Mechanical alloying for the fabrication of titanium-bioceramic nanopowders is developed. Porous scaffolds (typical dimensions of the pellets were: 10 mm in diameter and 3 mm in height) are successfully fabricated with porosities ranging from 50% to 70% using NH_4HCO_3 and powder sintering technique.

Results: Nanograined materials due to very high number of atoms on the surface possess large surface energy. Thus they exhibit entirely different behavior compared with the micron-sized grains. The bone forming cells generally attach themselves to the surface which roughness is of nanometer range. In this study, *in vitro* biocompatibility test was performed. All discs showed good cell growth. No difference was observed on cell growth between Ti-10 wt% bioceramic and microcrystalline titanium discs. This fact suggests that chemical composition of Ti-based nanocomposites has no effect on cytocompatibility. On the other hand, a strong adhesion to the surface is noticed after 1 day on electrochemically etched Ti-bioceramic nanocomposite sample. The cells do not produce filopodia or produce them in a smaller number compared with the cell culture on smooth surface. Therefore, it seems that the cell adhesion depends on the material porosity. Analysing the surface of the Ti-bioceramic nanocomposite after 5 days of cell culture, the cells covered smaller part of the observed area compared with analogical but not electrochemically etched sample.

Conclusions and clinical implications: New type of bulk 3-dimensional porous Ti-based bionanocomposites with desired size of porous are developed. Nanostructured biomaterials possess unique mechanical and surface properties similar to the bone and hence are considered to be the future generation biomaterials. With regard to microcrystalline Ti, it could help to obtain better dental implants with better biocompatibility.

Marginal adaptation of three different casting waxes on stone, titanium and zirconia dies

Presenter: Kapsampeli V

Aristotle University, Thessaloniki, Greece

Co-authors: Kapsampeli V¹, Michalakos K^{1,2}, Pissiotis A¹, Hirayama H², Oishi Y²

¹*Aristotle University, Thessaloniki, Greece*, ²*Tufts University, Boston, USA*

Background: Fabrication of implant-supported restorations requires the use of wax on either stone dies, metal or zirconia abutments. The affinity of the wax for the stone, metal or zirconia seems to be critical in order to produce accurately fitting castings with close margin adaptation.

Aim: The purpose of this research was to investigate the marginal adaptation of three different types of wax on stone dies, and metal and zirconia abutments.

Methods: An externally hexed implant (Biomet 3i) (3.75 × 13 mm) was embedded in autopolymerizing PMMA resin (Orthoplast, Vertex). A castable UCLA cylinder (Attach-

ments International) was fastened on the implant and modified with autopolymerizing PMMA resin (Pattern Resin, GC Corp.) in order to resemble a prepared maxillary central incisor. Custom trays were fabricated and 30 definitive impressions with addition silicone were obtained and poured with type V dental stone (Hard Rock, WhipMix). A titanium and a zirconium abutment were then fabricated after scanning the acrylic pattern with a mechanical scanner (Procera Forte, Nobel Biocare). Die spacer (Tecno Skin, Smile Line), as well as a separating fluid (Microfilm, Kerr) were applied on the stone dies, the titanium and the zirconia abutments. Ten wax patterns were fabricated from each one of the three different types of wax (1. Starwax/Dentaurum, 2. SU Esthetic wax/Schuler Dental, 3. Unterziehwachs/Bredent) on stone, titanium and zirconium dies, giving a total of 90 specimens. All wax patterns were fabricated by the same experienced dental technician. The specimens were examined under a stereomicroscope (Olympus, Japan). Four digital pictures (labial, mesial, distal, palatal) were obtained from each specimen and the evaluation of the marginal adaptation was performed on three predetermined points on each one of the four sides. The mean marginal opening of each side was calculated and used for the statistical analysis.

Results: Descriptive statistics, 2-way ANOVA and Tukey's HSD tests were used to reveal statistically significant differences among the three different waxes when used on stone, titanium and zirconia dies. A statistical significant difference was found ($P < 0.005$). Tukey's HSD test revealed that all waxes were significantly different ($P < 0.005$) from one another.

Conclusions and clinical implications: Use of proper wax is critical for a good marginal adaptation on stone, titanium and zirconia dies.

Different volumes of implant-abutment connections

Presenter: Karbach J

Department of Oral and Maxillofacial Surgery, University of Mainz, Mainz, Germany

Co-authors: Karbach J¹, Linck A¹, Stender E², Wagner W¹, Al-Nawas B¹

¹*Department of Oral and Maxillofacial Surgery, University of Mainz, Mainz, Germany*, ²*Department of Dental Material Science and Technology, University of Mainz, Mainz, Germany*

Background: There is a discussion about a possible microbiological reservoir in the implant-abutment gap.

Aim: As a first step the volume of the implant-abutment connection of different implants was measured.

Methods: The volume was analyzed by filling difference amounts of toluidine blue into the inner implant before the abutment was connected. A contamination probe was taken from the implant-abutment connection to detect overfill. The implant was placed in 1.5 ml of sodium chloride. The concentration of toluidine blue was measured spectroscopically in the sodium chloride.

Results: The space between the implant-abutment connections showed different inner volumes (Table 1).

Table 1

Implant type	Diameter (mm)	Length (mm)	Abutment	Volume (μ l)
Astra (Osseo Speed S)	3.5	11	Uni Abutment 20°; 3.5; 4.0	0.6
Ankylos C/X	3.5	11	Regular/X GH.3; A15	1.0
ICX-templant	4.1	12.5	Asthetic Line Titan 3.0 mm	1.8
Straumann bone-level	3.3	10	WC Titanium-Abutment	2.2
Nobel Biocare (Nobel Active NP)	3.5	10	Esthetic Abutment 3.0 mm	3
Xive S plus	3.8	11	Esthetic Base straight/A: 0; GH: 3	3.5
ICX-templant	4.1	12.5	Voll-Abutment, Standard, lang 5 mm; H 1 mm	4.3
ICX-templant plus	3.45	12.5	ICX plus Titanabutment 5 mm, H 0 mm	4.4
Camlog (Screw line)	3.8	11	Universal-Abutment 4.3 mm	4.9

Conclusions and clinical implications: The different inner volumes of the implant–abutment connection does not implicate that there is a bigger microgap in the implants with the highest inner volume but perhaps a bigger reservoir for bacteria.

464 | Material Research

Permanent loading behaviour of a novel implant attachment system

Presenter: Keilig L

Endowed Chair of Oral Technology, Bonn, Germany

Co-authors: Keilig L^{1,2}, Saternus A², Bayer S², Grüner M², Hültenschmidt R², Bourauel C¹, Stark H²

¹Endowed Chair of Oral Technology, Bonn, Germany, ²Department of Prosthetic Dentistry, Preclinical Education and Materials Science, Bonn, Germany

Background: A novel retentive attachment system for endosseous dental implants (SFI-Anchor, Cendres + Métaux SA, Switzerland) is aimed as an alternative anchorage system for removable partial dentures. The two-component male part of the SFI-Anchor is mounted on the implant(s), adjusted in the mouth of the patient to counter a possible implant divergence of up to $\pm 20^\circ$ and then fixed with resin cement. Intraoral functional loading of the denture, for example during chewing, is transferred to the anchor.

Aim: It was the aim of this study to investigate the permanent loading behaviour of the resin cement fixation for this anchorage system with and without thermo cycling close to the requirements of the EN ISO 14801.

Methods: Dynamic fatigue testing of the fixation was performed for three different resin cements, AGC Cem (Wieland, Germany), Multilink Automix (Ivoclar Vivadent AG, Liechtenstein) and RelyXTM Unicem (3M ESPE, USA). For each cement two groups were created. A first group of test specimens was directly loaded in a materials testing machine, a second group was placed in a thermo cycling set-up for 90 days with temperatures of 5°, 37° and 50° before materials testing. Permanent loading was performed with forces between 100 and 250 N for 1,000,000 loading cycles. A pure lateral load direction was chosen in order to maximise loading of the fixation. A lateral deflection of more than 0.2 mm, measured at the top of the male part, was considered as failure of the specimen. A number of five specimens were tested for each force level.

Results: For the two cements AGC Cem and Multilink Automix thermo cycling showed to have only a minor influence in the survival rate of the specimens tested. For RelyX Unicem, the thermo cycling slightly improved the survival rate of the specimen. When failing, two different kinds of failures could be observed, either a permanent deflection as stated in the above failure criteria, or a fracture of the upper part of the anchor. A significant higher number of fractures could be observed with AGC Cem than with RelyX Unicem and Multilink Automix.

Conclusions and clinical implications: It has been shown that the material aging as simulated by thermo cycling has only a minor influence on the long-time stability of the SFI-Anchor. Nonetheless the cement used for the fixation has to be chosen carefully as for example AGC Cem seems to have an unfavourable influence to permanent loading behaviour.

465 | Material Research

Poly-ether-ether-ketone (PEEK) polymer for dental implants

Presenter: Kim M-J

School of Dentistry, Seoull National Universtity, Seoul, Republic of Korea

Co-authors: Kim M-J, Kim S-Y, Heo S-J, Kaok J-Y, Lim Y-J, Kim S-K, Kim S-H, Kim M-J, Yeo I-S

School of Dentistry, Seoull National Universtity, Seoul, Republic of Korea

Background: Bone resorptions between the titanium or zirconia implants and the surrounding bone may be predominantly affected by differences in the elastic moduli. To overcome these limitations, researchers have explored alternative materials to rigid titanium and zirconia for use in medical devices. The elastic modulus poly-ether-ether-ketone (PEEK), a high performance linear thermoplastic polymer, can be tailored to match cortical bone. Other advantages of PEEK as a biomaterial are its biocompatibility, cytocompatibility, greater strength on a per mass basis than many metals, its natural beige color, and the bony fusion that has been observed around implants made of this material in a clinical setting. The PEEK polymer was of great interest as an alternative to titanium in orthopedics, because the PEEK had low elastic modulus which can reduce the loss of the surrounding bone due to stress shielding effect. However, dental implants made of PEEK have not been widely explored.

Aim: The purpose of this study was to evaluate the fatigue properties of PEEK for dental implants and the stress shielding effect of PEEK-, titanium-, zirconia-implant fixtures and coated existing dental implant fixtures with PEEK.

Methods: The static compressive strengths of glass fiber-reinforced PEEK (GFR-PEEK), CFR-PEEK (Victrex[®] PEEK for medical grades 450GL30 and 450CA30, Thornton-Cleveleys, UK), and titanium rods (Grade 4 cp-titanium, OSSTEM Implant, Seoul, Korea) were evaluated. Among these specimens, the weakest GFR-PEEK was selected to estimate the fatigue limits of PEEK dental implants according to ISO 14801. Furthermore, the shielding effects of coating PEEK onto existing titanium and zirconia fixtures were investigated using finite element

analysis. The nonparametric Wilcoxon's test and the Kruskal–Wallis test was used statistically.

Results: The mean compressive strength of the GFR-PEEK, CFR-PEEK and titanium rod (4 mm) were 256.37, 462.76 and 1,395.42 N. The fatigue limit of 4 mm GFR-PEEK was 310 N. Through FEA, the bone next to the PEEK-coated Ti and zirconia implants showed higher levels of SED than the bone in direct contact with the Ti and zirconia implants.

Conclusions and clinical implications: The mean compressive strength of the GFR-PEEK and CFR-PEEK implant ranged within the limits of clinical acceptance for the anterior and posterior dentition, respectively. PEEK implants showed the excellent fatigue resistance. The dental implant with PEEK coating might reduce the stress shielding effects and bone resorption between existing dental implant and surrounding bone.

Histomorphometric analysis and resonance frequency in titanium implants with shot-blasted surface

Presenter: Lazaro-Calvo P

Master Perio/implants (Dentistry Faculty), Seville, Spain

Co-authors: Rios-Carrasco B¹, Rios-Santos V¹, Herrero-Climent M¹, Mur JG², Fernandez-Palacin A¹, Lazaro-Calvo P¹, Fernandez PB¹

¹*Master Perio/implants (Dentistry Faculty), Seville, Spain,*

²*BarcelonaTech (UPC), Barcelone, Spain*

Background: Implant systems development provides direct apposition bone–implant. Osseointegration must be compared between new surfaces and standardized protocols sufficiently investigated.

Aim: Evaluate bone–implant contact and Resonance Frequency Analysis in titanium implants with shot-blasted surface inserted in the rabbits tibia.

Methods: Sample aize: with nQuery Advisor 6.0, two sample *T*-test significance level $\alpha = 0.05$, difference in means (16) and common standard deviation (13), *N* per group = 12 (80% Power). This study was carried out on six New Zealand rabbits (4 kg). Twelve tibias, two implants for tibia, *N* = 12. One Strauman SP 4.1 × 8 implant and one Klockner Essential 4.0 × 8 implant were inserted in each proximal tibia, and resonance frequency analysis was determined by Ostell Mentor. Six weeks later, RFA was determined and the rabbits were sacrificed for histomorphometric analysis. The statistical analysis was performed using SPSS statistic program. Descriptive statistics and inferential test were performed (*T*-student).

Results: Bone implant contact, fibrous presence and new bone was similar in both groups (N.S.D.).

Conclusions and clinical implications: The osseointegration of Klockner Essential implants with shot-blasted surface is similar to implants with SLA surface in the rabbits tibia.

Osteoblast behavior on magnesium and calcium phosphate coatings on Titanium

Presenter: Lee B-A

Chonnam National University Dental Hospital, Gwangju, Republic of Korea

Co-authors: Lee B-A, Lee Y-J, Wee K-H, Jung Y-S, Hong S-I, Lee J-H, Kim K, Lee H-S, Kim O-S, Chung H-J, Kim Y-J

Chonnam National University Dental Hospital, Gwangju, Republic of Korea

Background: Surface modification of implant materials should be necessary to enhance osseointegration. Magnesium (Mg) is expected to be a new class of implant materials because of its ability in bone formation. However, there were few studies with regard to interaction of osteoblasts on the titanium substrate with Mg and Hydroxyapatite (HA)-Mg coatings.

Aim: The aim of this study is to evaluate osteoblast behavior on Mg and HA coatings on titanium.

Methods: HA, Mg, and HA-Mg multicoatings were produced as thin films on titanium substrate (15 mm diameter, 5 mm thickness) by RF magnetron sputtering. The samples were then divided into three groups. Group I was HA-coated titanium surface (HA group). Group II was magnesium-coated titanium surfaces (Mg group). Group III was HA-Mg multi-coated titanium surfaces (HA-Mg group). The control was machined titanium surface. The obtained coatings were identified by X-ray diffraction (XRD), scanning electron microscopy (SEM) and EDX. The biological responses of MC3T3-E1 cells on the coated titanium surface were evaluated by MTT assay, alkaline phosphatase (ALP) activity. The Student *t*-test was used to analyze the data regarding cell viability assay and ALP activity ($P < 0.01$).

Results: XRD, SEM, and EDX results showed that HA, Mg, and HA-Mg depositions on titanium substrates were successfully performed. In SEM images, cells adhered and grew well on the surface of all titanium specimens. In MTT assay, the cells on all samples proliferated actively within culture period, showing good cell viability. HA group, Mg group, and HA-Mg group showed 91%, 103%, and 108% cell viability, respectively, when normalized to control. However, there was no significant difference among groups. ALP activity of HA group, Mg group, and HA-Mg groups significantly increased to 140%, 170%, and 190%, respectively, when compared with control. There was also significant difference between HA and HA-Mg group.

Conclusions and clinical implications: These results suggest that Mg and/or HA-Mg coatings on titanium substrate could increase osteogenic responses.

Biomimetic calcium phosphate bone filler with multiple drug-delivery modalities

Presenter: Liu T

Department of Oral Implantology and Prosthetic Dentistry, Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam, The Netherlands

Co-authors: Liu T^{1,3}, Wu G^{1,3}, Wismeijer D^{1,3}, Everts V^{2,3}, Liu Y^{1,3}

¹Department of Oral Implantology and Prosthetic Dentistry, Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam, The Netherlands, ²Department of Oral Cell Biology, Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam, The Netherlands,

³Research Institute MOVE, University of Amsterdam and VU University Amsterdam, Amsterdam, The Netherlands

Background: Treatment of critical-sized bone defect remains a challenge in oral implantology and orthopedics. Apart from osteogenic agents, defects that resulted from infection need antibiotics and defects that resulted from a tumor need antineoplastic drugs. An ideal bone filler should be accommodative to retain and deliver the different agents "on demand". However, no current products meet this requirement.

Aim: The aim of this study is to develop a novel bone filling material that is not only biocompatible, biodegradable and osteoinductive, but also has the capacity to deliver different drugs for different purposes in the treatment of critical-sized bone defect.

Methods: Biomimetic Calcium Phosphate (BioCP), a recently developed bone-filling material, is made from a supersaturated calcium phosphate solution (CPS) at 37°C and a pH of 7.4 using biomimetic principles. Three drug-delivery modalities were designed using Fluorescein-isothiocyanate labeled bovine serum albumin (FITC-BSA) as a model: Type I, BSA was incorporated into the whole volume of BioCP; Type II, BSA was incorporated into outer layer of the biomimetic calcium phosphate coating of BioCP; and Type III, BSA was adsorbed on BioCP. Osteoclasts were generated on the different types of BioCP, after 6 and 10 days their number was counted and the release of calcium was assessed by using atomic adsorption spectrometry. The release kinetics of the BSA of the three drug-delivery types of BioCP was monitored. Finally, the attachment and morphology of the osteoclasts was analyzed using scanning electron microscopy.

Results: The Ca²⁺ release of all types of BioCP was significantly increased by the resorbing activity of osteoclasts both after 6 and 10 days. The osteoclast-mediated degradation rates of Type I and Type II BioCP correlated with the protein release, and showed slow release kinetics. The protein release of Type I and Type II BioCP was significantly increased at the presence of osteoclasts both after 6 and 10 days compared with those without osteoclasts. Type III BioCP gave a burst release which osteoclasts did not affect significantly. SEM micrographs showed an extensive attachment of osteoclasts to the different types of BioCP and absorption lacunae were frequently noted.

Conclusions and clinical implications: Biodegradable and osteoinductive BioCP bone filler can act as a drug delivery system; the two basic delivery modalities of Type I and Type II provide

alternative methods for the deliverance of different drugs for different purposes. All the properties conferred BioCP a promising application potential in healing critical-sized bone defects with different etiologies.

Implant surface treatment using sol-gel derived hydroxyapatite-coating on TiO₂ nanotube

Presenter: Ma J

Chonnam National University Dental Hospital, Gwang-ju, Republic of Korea

Co-authors: Ma J¹, Vang M-S¹, Yang H-S¹, Lim H-P¹, Yun K-D¹, Kim J-H¹, Park J-H¹, Kim H-J², Kim MJ², Kim JU², Park S-W¹

¹Chonnam National University Dental Hospital, Gwang-ju, Republic of Korea, ²Chosun University Dental Hospital, Gwang-ju, Republic of Korea

Background: TiO₂ nanotube enhances invitro bone cell behavior, and may provide greater *in vivo* osseointegration than rough (gritblasted) implant surfaces.

Aim: The aim of this study is to gain improved implant surface by sol-gel derived hydroxyapatite-coating on the TiO₂ nanotube surface.

Methods: The disks of commercially pure titanium with 15 mm diameter and 3 mm thickness were hydroxyapatite (HA)-blasted. Titanium oxide nanotubes were fabricated using the anodization technique. And the disks were coated with hydroxyapatite by sol-gel method in a vacuum for 30 and 60 s, and then heat treated at 500°C. The structure, morphology and chemical composition of the surfaces were characterized using field emission scanning electron microscope (FE-SEM) with energy dispersive spectra (EDS). The compositions of the porous layer and HA deposition surface were also investigated by Electron Spectroscopy for Chemical Analyzer (ESCA). High Resolution X-Ray Diffractometer (XRD) was used to characterize the structure of sample surfaces. Then cell culture was done using human osteosarcoma cell. For determining cell proliferation and viability, the XTT assay was used. The XTT assay was performed on first, third, fifth and seventh days. The cell morphology was observed using FE-SEM at 6, 24 and 48 h.

Results: (1) At 30 s coating, calcium phosphate particles filled the nanotubes and covered them slightly, and at 60 s coating, calcium phosphate particles covered nanotubes completely. (2) The sol-gel derived hydroxyapatite layer, heat-treated for 30 min at 500°C, was identified as well-crystallized. And the morphology and characteristics of nanotubes were maintained after 500°C heat treatment. (3) The sol-gel coated surface showed significantly higher cell viability than anodized surface in 1, 3 days.

Conclusions and clinical implications: In this study, the sol-gel method was used to coat calcium phosphate on TiO₂ nanotube surface. We could obtain calcium phosphate coated surface and at the same time the nanotube structure was maintained. This surface is expected to improve biologic response of dental implant for its nanoscale morphology and biocompatibility of calcium phosphate.

Attachment and spreading of osteoblasts on two differing titanium microsurfaces

Presenter: Maik K

University of Birmingham, Birmingham, UK

Co-authors: Maik K, Sammons R

University of Birmingham, Birmingham, UK

Background: In the early stages of implant placement initial interactions between implant surfaces, proteins and cells are believed to play an important role in the process of osseointegration. Understanding the influence the surface may have on cells and their subsequent behaviour is therefore desirable. Previous studies have shown that primary rat osteoblasts spread more rapidly within a 30 min attachment period on the Dentsply Friadent Plus[®] surface when compared with the DPS[®] surface.

Aim: The aim of this study was to compare human osteoblast-like (SAOS-2) cell attachment and spreading on DPS[®] and Plus[®] surfaces.

Methods: Three discs of each surface were incubated in cell culture medium containing $1-5 \times 10^4$ of cells per ml at 37°C 5% CO₂ for 30 and 45 min. The samples were fixed and prepared for scanning electron microscopy (JOEL JSM5300LV). Cells were counted and classified according to the stage of cell spreading in separate randomised areas and cell density was determined over a randomised area of 1.0855 mm². Statistical analysis was carried out between samples using the Mann-Whitney *U*-test with Bonferroni correction.

Results: There was no difference observed in the number of cells attached per unit area at either time interval on the two surfaces. Cell spreading assays revealed no significant difference in the proportion of cells proceeding to the final fully spread stage, after 30 min but there was a significantly higher number of cells on the Plus[®] surface (43.3 ± 6.87) in comparison with DPS[®] (28.5 ± 6.06) after 45 min ($n=9$) ($P < 0.0001$).

Conclusions and clinical implications: These results indicate that the difference in cell spreading previously observed with rat osteoblasts is also seen with human osteoblast like cells although the difference was observed slightly later. Faster cell spreading is correlated with enhanced cell differentiation on the Plus surface in comparison with DPS as described by other workers.

A novel biphasic ceramic: adjuvant to accelerate the mechanical recovery of bone defect

Presenter: Manchón A

Universidad Rey Juan Carlos, Madrid, Spain

Co-authors: Manchón A¹, Alkhraisat M², Rueda C²,

Torres J¹, Ewald A³, Gbureck U³, Rodriguez A¹, Prados-Frutos JC¹, Cabarcos EL²

¹Universidad Rey Juan Carlos, Madrid, Spain, ²Universidad Complutense, Madrid, Spain, ³University of Würzburg, Würzburg, Germany

Background: The use of bone regeneration procedures is becoming a daily practice in dentistry motivated in part by the wide

acceptance of dental implants as an option for oral rehabilitation. The clinicians and the patients demand higher efficiency and the reduction of time necessary to complete bone regeneration and thus oral rehabilitation. Therefore, the development of highly efficient material for bone augmentation will enhance treatment outcome and optimally shorten the time necessary for bone to regenerate. Our approach to achieve the above-mentioned targets is the combination of biodegradable calcium phosphate with the calcium silicate phase.

Aim: Accelerate the mechanical recovery of the bone defects by inducing a rapid formation and remodeling of new bone tissue allowing for the sooner allocation of dental implants and shorten the time necessary to complete the oral rehabilitation.

Methods: Biphasic calcium silicate ceramic composed of β -tricalcium phosphate and calcium silicophosphate (Ca₅(PO₄)₂-SiO₄) was prepared by sintering a mixture of brushite, silicon dioxide and calcium carbonate at 1100°C for 12 h. The potential use of the new biphasic ceramic as template for the growth of osteoblasts was verified using human osteoblast like cell line MG 63 (ATCC no. CRL-1427, Rockville, MD, USA). The bone regeneration efficacy of the new biomaterials will be realized by creating critical defects of 10 mm in diameter in the calvaria of adult male New Zealand rabbits and were filled with three different β -tricalcium phosphate ceramics. The percentage of newly formed bone (NB%) and remnant biomaterial were evaluated at 8 and 12 weeks after implantation.

Results: The novel biphasic ceramic was efficient to improve significantly the osteoblast proliferation and activity when compared with β -tricalcium phosphate. Critical sized defects were filled with the new material and the animals were sacrificed after 8 and 12 weeks. The results are highly encouraging as the defects regenerated with the novel biomaterial show an almost complete resorption of the bone substitute and the bridging of the defect by hard tissue of similar appearance to the surrounding healthy bone.

Conclusions and clinical implications: The novel biphasic ceramic successfully promote the almost complete regeneration of critical defect and was superior to β -tricalcium phosphate. This strongly indicates the promise use of the novel biomaterial to accelerate the mechanical recovery and shorten the time necessary for clinical rehabilitation.

The effect of different implant/abutment connection on screw joint stability: a biomechanical study

Presenter: Michalakis K

Aristotle University, Thessaloniki, Greece

Tufts University, Boston, MA, USA

Co-authors: Michalakis K^{1,2}, Calvani P(lino)², Muftu S³, Pissiotis A¹, Hirayama H²

¹Aristotle University, Thessaloniki, Greece, ²Tufts University, Boston, MA, USA, ³Northeastern University, Boston, MA, USA

Background: Dental implants with an internal connection have been designed in order to establish a better stress distribution

when lateral external forces act on the prosthesis. It was speculated that with this design the fastening screw, connecting the prosthetic abutment with the implant, would not take a substantial part of the system's stress and as a result the common complication of screw loosening or fracture, observed in externally hexed implants, would be eliminated.

Aim: The purpose of this *in vitro* study was to examine the mechanical strength of the implant–prosthesis interface in two different implant designs, one with an external and one with an internal connection.

Methods: Two different companies producing externally and internally hexed implants were randomly chosen from a pool of 15 brands widely used today. The selection was performed by a personal computer in order to eliminate any bias. Ten externally hexed and 10 internally hexed implants were placed in blocks of autopolymerizing PMMA acrylic resin. The length of each implant was 13 mm, while its diameter was 3.75 mm. The long axes of the implants formed a 130° angle with the loading axis. Base metal alloy crowns were fabricated and connected to the implants. The length of the crowns was 10 mm, while their width at the incisal edge was 8 mm. Torque values suggested by the manufacturers were applied to the fastening screws. The crowns were subjected to a compressive force by an Instron Universal test machine. The force was exerted on the cingulum of the crown, which was 5 mm above the abutment/implant interface. Four cycles of loading–unloading were applied to each specimen, in order to achieve displacements of 0.5, 1, 2 and 2.5 mm.

Results: The mean loads for the first cycle were 256.7 N for the external connection and 256 N for the internal connection implants. For the first cycle the independent *t* test did not reveal any significant differences among the two tested groups ($P = 0.780$). For the second (818.19 and 780.2 N), third (1394.1 and 1225 N) and fourth (1488 and 1029 N) cycles, the independent *t* test revealed significant differences among the two tested groups ($P < .001$).

Conclusions and clinical implications: The outcome suggested that the internal hexagon implant system could not provide adequate structural integrity between its components. It was noticed that the fastening screw of the internally hexed implants bent. No implant or prosthesis failure was noticed in either group.

473 | Material Research

Bioactivity of Ti-6Al-4 V Alloy Implant Treated with Ibendronate

Presenter: Moon S-H

Chonbuk National University Dental Hospital, Jeonju City, Republic of Korea

Co-authors: Moon S-H, Ryu S-H, Chung S-Y, Bae T-S, Kim H-S
Chonbuk National University Dental Hospital, Jeonju City, Republic of Korea

Background: Implant surface modification have been needed to promote an osseointegration and to decrease the treatment duration.

Aim: This study was designed to investigate the drug loading capacity of anodized nanotubular Ti-6Al-4V alloy surfaces and to evaluate the bone response to surface immobilized bisphosphates (BPs) on anodized nanotubular Ti-6Al-4V alloy surface.

Methods: We investigated two groups of titanium implants (1) nontreated Ti-6Al-4V alloy group; (2) anodized and bisphosphonate treated Ti-6Al-4V alloy group. FE-SEM, removal torque, drug-releasing test, EDM analysis of each group were performed.

Results: (1) During the electrochemical oxidation process, the well-arranged and self-organized nanotubular TiO₂ layer was densely formed on the Ti-6Al-4V alloy surface. (2) The drug loading capacity of Ti-6Al-4V alloy surfaces was enhanced by anodizing surface modification. (3) The removal torque was increased in bisphosphonate-coated group, and it was statistically significant ($P < 0.05$). (4) According to EDS analysis of surface, relatively high bone formation and Ca, P peak was observed at the anodized and bisphosphonate treated Ti-6Al-4V alloy group.

Conclusions and clinical implications: These results demonstrated that bisphosphonate-immobilized Ti-6Al-4V alloy implants with nano-tubular surfaces have positive effect in early bone-to-implant contact.

474 | Material Research

Histologic evaluation after application of lactoferrin combined with anorganic bovine bone in rabbit calvaria

Presenter: Moslemi N

Dental Research Center, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran

Co-authors: Paknejad M¹, Rohn AR¹, Yaraghi SYS², Elhami F⁴, Mehrfard A³, Moslemi N⁵

¹*Dental Research Center, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran,* ²*Department of Nutrition and Biochemistry, School of Public Health, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran,* ³*Dental Faculty, Azad Islamic University, Tehran, Islamic Republic of Iran,* ⁴*Private Practice, Tehran, Islamic Republic of Iran,* ⁵*Dental Research Center, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran*

Background: Recent studies have shown that lactoferrin promotes the proliferation and differentiation of osteoblasts and inhibits osteoclast-mediated bone resorption. It has potent antimicrobial and immunomodulatory activities, as well. Bovine-derived bone graft (Bio-Oss) has been extensively used as an osteoconductive material in bone reconstructive surgeries.

Aim: The purpose of this study was to examine whether the combination of lactoferrin with Bio-Oss would improve ossification in experimentally induced bone defects in rabbit calvaria.

Methods: A total of 40 bone defects with the diameter of 6 mm were created on the calvaria of 10 male New Zealand rabbits (four defects in each animal). Two of these sites were filled with Bio-Oss mixed with two different doses of lactoferrin (50 and 500 µg/ml). Third defect was filled with Bio-Oss alone and the fourth one was left empty as control group. After 4 weeks, histologic sections were prepared. The type, percentage and

vitality of newly formed bone, inflammation, percentage of residual material, and foreign body reaction were assessed for each specimen. Data were analyzed by Cochran Q and Friedman tests.

Results: There was no sign of obvious inflammation and foreign body reaction in any group. All groups were similar in terms of vitality, type and percentage of new bone formation. The percentage of new bone formation in control group was slightly lower ($13.4\% \pm 2.3\%$) compared with the other three groups (Bio-Oss alone: $14.9\% \pm 1.4\%$; Bio-Oss + 50 µg/ml lactoferrin: $15.6\% \pm 1.9\%$; Bio-Oss + 500 µg/ml lactoferrin: $16.3\% \pm 1.8\%$). Although the amount of residual biomaterial was lower in lactoferrin containing groups compared with Bio-Oss alone group, the differences were not statistically significant (Bio-Oss + 50 µg/ml lactoferrin: $11.9\% \pm 1.3\%$; Bio-Oss + 500 µg/ml lactoferrin: $12.5\% \pm 1.6\%$; Bio-Oss alone: $14.8\% \pm 1.5\%$) ($P=0.392$).

Conclusions and clinical implications: Based on results of this study, the combination of lactoferrin and Bio-Oss did not show any significant improvement in bone regeneration compared with Bio-Oss alone in surgically induced bony defects in rabbit calvaria.

475 | Material Research

Strain gauge analysis of the effect of axial loads on implant-supported partial fixed prostheses

Presenter: Nishioka R

Sao Paulo State University, Sao Jose Dos Campos, Brazil

Co-authors: Nishioka R, Souza F, Luis V, Osvaldo A, Alberto K, Gabriela N

Sao Paulo State University, Sao Jose Dos Campos, Brazil

Background: The use of oral implants of partial edentulism is now well-accepted treatment modality.

Aim: The present study used strain gauge analysis to perform an *in vitro* evaluation of the effect of axial loading on three elements of implant-supported partial fixed prostheses, varying the type of prosthetic cylinder and the loading points.

Methods: Three internal hexagon implants were linearly embedded in a polyurethane block. Microunit abutments were connected to the implants applying a torque of 20 Ncm, and prefabricated Co-Cr cylinders and plastic prosthetic cylinders were screwed onto the abutments, which received standard patterns cast in Co-Cr alloy ($n=5$). Four strain gauges (SG) were bonded onto the surface of the block tangentially to the implants, SG 01 mesially to implant 1, SG 02 and SG 03 mesially and distally to implant 2, respectively, and SG 04 distally to implant 3. Each metallic structure was screwed onto the abutments with a 10 Ncm torque and an axial load of 30 kg was applied at five predetermined points (A, B, C, D, E). The data obtained from the strain gauge analyses were analyzed statistically by repeated measures ANOVA and Tukey's test, with a conventional level of significance of $P < 0.05$.

Results: The results showed a statistically significant difference for the loading point ($P=0.0001$), with point B generating

the smallest microstrain (239.49 µε) and point D the highest (442.77 µε). No statistically significant difference was found for the cylinder type ($P=0.748$).

Conclusions and clinical implications: It was concluded that the type of cylinder did not interfere in the magnitude of microstrain, but the axial loading location influenced this magnitude.

Keywords: strain gauge analysis, dental implants, dental prosthesis, implant-supported dental prosthesis, cylinders.

476 | Material Research

Strain gauge analysis: evaluation of axial loading in external hexagon implants in linear and offset placement

Presenter: Nishioka R

UNESP, Sao Jose Dos Campos, Brazil

Co-authors: Nishioka R¹, Nishioka G², Vasconcellos LG¹, Souza F¹

¹UNESP, Sao Jose Dos Campos, Brazil, ²UNESP, Araraquara, Brazil

Background: The state philosophy is to place three implants to support 3-unit restorations, and the straighter the implant placement alignment, the greater potential for bending of the implants. Rangert have claimed the efficiency of offset implant placement, which brings out considerable stress reduction by converting the bending situation at more favorable axial loading situation, compared with stright-line placement of implants.

Aim: The present study used strain gauge analysis to perform an *in vitro* evaluation of the effect of axial loading on three elements of implant-supported partial fixed prostheses, varying the type of implant placement and the loading points.

Methods: Three external hexagon implants were straight and offset embedded in a polyurethane block. Microunit abutments were connected to the implants applying a torque of 20 Ncm. Prefabricated Co-Cr copings were screwed onto the abutments, which received standard patterns cast in Co-Cr alloy ($n=5$). Four strain gauges (SG) were bonded onto the surface of the block tangentially to the implants, SG 01 mesially to implant 1, SG 02 and SG 03 mesially and distally to implant 2, respectively, and SG 04 distally to implant 3. Each metallic structure was screwed onto the abutments with a 10 Ncm torque and an axial load of 30 kg was applied at five predetermined points (A, B, C, D, E). The data obtained from the strain gauge analyses were analyzed statistically by repeated measures ANOVA and Tukey's test, with a conventional level of significance of $P < 0.05$.

Results: The results showed a statistically significant difference for the loading point ($P=0.0001$), with point A generating the smallest (131.74 µε) and point D the highest microdeformation (222.41 µε). No statistically significant difference was found for the implant placement ($P=0.294$).

Conclusions and clinical implications: It was concluded that the implant placement did not interfere in the magnitude of microdeformation, but the axial loading location influenced this magnitude. The offset implant placement did not always compensate for the axial loading at prosthetic screw.

Comparison of thermal and mechanical properties of 2-, 3-, and 4-fluted implant drills in osteotomy sites

Presenter: Oh HJ

Seoul National University, Seoul, Republic of Korea

Co-authors: Oh HJ¹, Yoon J-H², Kang H-S², Lim D², Koo K-T¹

¹*Seoul National University, Seoul, Republic of Korea*, ²*Osstem Implant Inc., Busan, Republic of Korea*

Background: Avoiding excessive trauma during implant site preparation is considered a critical element of implant success because thermal and mechanical factors contribute to the formation of necrotic tissue. However, study on the thermal and mechanical effects by implant drill design is insufficient. Advantage of having an extra flute in the drill design may be enhanced cutting efficiency reducing drilling time which in turn reduces heat generation. On the other hand, more flutes may narrow channels of the flutes that function as a path for bone chip removal resulting in impaired cutting efficiency and elevated frictional heat. However, there is no evidence in the literature to support this.

Aim: The purpose of the present study was to investigate heat generation and cutting efficiency associated with 2-, 3-, and 4-fluted implant drills that were specially designed for comparison concerning optimal number of flutes.

Methods: Two-, 3-, and 4-fluted implant drills were designed with point-angle, relief-angle, rake angle, and manufacturing process controlled. Real-time temperature changes during drilling were measured in artificial bone with irrigation using an infrared thermal imager. Cutting efficiencies were assessed as drilling time to the 15 mm depth under constant load with a specially fabricated instrument. Each drilling procedure for each drill was performed up to 20 times. A one-way ANOVA was used for statistical analysis.

Results: Mean temperature changes were 8.3, 10.76, and 15.13°C by 2-, 3-, and 4-fluted drill, respectively. As the number of the flute increased, mean temperature change also increased ($P < 0.05$). Mean drilling times for cutting efficiency were 2.58, 2.46, and 2.53 second by 2-, 3-, and 4-fluted drill, respectively. A tendency for the cutting efficiency to increase or decrease by the number of the flute was not observed. The cutting efficiency differences among three kinds of drills were statistically insignificant. However, the cutting efficiency of 3-fluted drill was better than that of the 2-fluted (twist) drill ($P < 0.05$).

Conclusions and clinical implications: The observations herein suggest that increase in contact area between the drill and bone increases heat induction. As the number of the flute increased, frontal and lateral contact area of the drills increased. As the effective elimination of the bone chips were hampered in the narrowed path of the drills with more flutes, bone chips accumulated in the channels eventually resulting in elevated frictional heat. Meanwhile, the cutting efficiency would be more related to cutting edge that was affected by the point angle, rake angle and relief angle that were controlled in this study. However, the optimal number of the flute affecting the cutting efficiency may exist because 3-fluted drill had better cutting efficiency than 2-fluted drill.

A simplified approach to bone height measurement

Presenter: Pande N

Healthy Smiles Pvt. Ltd., Kathmandu, Nepal

Co-authors: Pande N

Healthy Smiles Pvt. Ltd., Kathmandu, Nepal

Background: There has been numerous development over imaging techniques for implantology in the past. But yet, a general dental practitioner with limited resources need to depend upon the radiographic image alone. This paper tries to describe one of the simplest method of assessing bone height in an Intra-oral Peri-apical radiograph.

Aim: To describe a method of radiographic bone height measurement using an IOPA in a simple and cost effective manner in a general dental practice.

Methods: One hundred intraoral periapical digital radiographs with a radiopaque markings of 13 mm Gutta Percha points taken with the help of Rinn beam aiming device and evaluated on a Vixwin Pro software by Gendex. A 13 mm Gutta Percha point was pasted with a cello tape in the Sensor of a Gendex Visualix eHD and the radiograph of the proposed implant site was taken using the Rinn Beam Aiming device (Dentsply) and Gendex Oralix AC X-ray machine. The gutta percha image thus captured in the Vixwin software was remeasured and the distortion calculated and correction required for 1:1 image assessed. Bone was measured from the crest to the vital anatomical structure and the proposed osteotomy height is planned.

Results: The result showed that there was a very high level of reliability in this technique for bone height measurement (calculation pending).

Conclusions and clinical implications: This simple methodology of bone height measurement can be adapted in any dental practice with no extra armamentarium or investment. It is the most cost effective and easy way of planning for simple cases of implantology where access to expensive cone beam scanning is unavailable.

Bio-mimetic approach on implant surface treatment: literature review on peptides.

Presenter: Perini A

Department of Oral Surgery, Dental School, University of Padova, Padova, Italy

Co-authors: Perini A¹, Menegazzo P¹, Derton N³, Bagno A², Bacci C¹, Sivoletta S¹, Stellini E¹, Berengo M¹

¹*Department of Oral Surgery, Dental School, University of padova, Padova, Italy*, ²*Department of Chemical Processes of Engineering, University of Padova, Padova, Italy*, ³*Scuola di Specializzazione in Ortognatodonzia, University of Ferrara, Ferrara, Italy*

Background: Many researchers are studying treatments capable of giving osteoconductive characteristics to implant surface. Osteoconductive treatments can promote chemiotaxis, mitosis, osteoblastic differentiation and activity. Many proteins of the extracellular matrix have been demonstrated to be biological promoters for early osteointegration. The use of the whole

protein is difficult due to antigenicity, denaturation during sterilization, high cost of production.

Aim: The aim of this study is to review literature regarding the use of peptides for implant surface treatment.

Methods: We considered publications present on The National Library of Medicine searched on PubMed up to december 2010 with the following key-words: "osteointegration", "biomimetic", "adhesion", "extracellular matrix", "collagen", "vitronectin", "fibronectin", "peptides", "RGD", "HVP", "YIGSR", "IKVAV", "REDRV", "P-15", "LDV", "DGEA" "growth factor". Have been considered data on bone-to-implant contact (BIC), torque-removal-test (TRT), histomorphometric and histologic analysis (mainly bone density, newly formed bone, bone aspect) as inclusion criteria. Seventy-five articles have been found using the previously reported keywords and 30 have been selected as following the enlisted inclusion criteria.

Results: Literature review shows as the use of parts of these proteins can achieve good results without previous reported problems. Many peptides have been identified as the sequence RGD responsible of cellular adhesion in many extracellular matrix proteins, the sequences YIGSR and IKVAV present in laminin proteins, REDRV and LDV in fibronectin, DGEA and P-15 in type I collagen and KRSR and HVP *in vitro* nectin.

Attaching peptides on implant surface, cellular receptors can bind to implant surface and promote cellular adhesion, proliferation, morphology, gene expression. With the use of single peptides it is possible to obtain a defined cellular response, avoiding undesirable reactions caused by the whole protein. Furthermore, an entire protein tends to be randomly folded upon adsorption to the biomaterial surface, resulting in a less effective availability of the receptor-binding domains as compared with short peptides. By linking peptide sequences to implant materials, an artificial ECM can be generated onto the titanium surface providing suitable biological cues to guide new tissue formation.

Peptide sequences can also be easily synthesized with low costs, and are more resistant to denaturation, pH and temperature changes.

Conclusions and clinical implications: The use of peptides to treat implant surface in order to enhance cellular adhesion and promote quicker bone formation seems to give good results. Further studies are needed to evaluate the best peptides to use for this purpose.

Synthetic porous calcium phosphate granules for bone substitutes

Presenter: Piccinini M

Department of Materials Engineering and Industrial Technologies-University of Trento, Trento, Italy

Co-authors: Piccinini M¹, Sglavo VM¹, Buccioti F²

¹Department of Materials Engineering and Industrial Technologies-University of Trento, Trento, Italy, ²Eurocoating SpA, Cirè-pergine Valsugana(tn), Italy

Background: Synthetic bone substitutes are often manufactured by calcium phosphates (CaP) due to their biocompatible, bioactive and osteoconductive characteristics. Porous granules

are used in maxillofacial surgery and orthopedics applications. Hydroxyapatite (HA), beta-tricalcium phosphate (β TCP) and their combinations (HA/ β TCP) are the most used composition for bone substitutes. Tetracalcium phosphate (TTCP) is a bio-ceramic with *in vivo* solubility similar to β TCP, but possesses higher mechanical strength associated with higher density; for this reason an innovative composite material HA/TTCP was also considered in present work for the production of porous granules. The spherical morphology allows easy injectability into bone voids; macroporosity created by granules agglomeration is fundamental for tissue and vascular ingrowth thus determining fast implants osteointegration.

Aim: The aim of the present work is the production of different synthetic and porous calcium phosphate granules and the evaluation of their geometry and structure, microporosity, composition and solubility behaviour.

Methods: Porous calcium phosphate granules were manufactured by using powders with different Ca/P ratio and polysaccharide polymer as porogen, thus modulating the composition and microporosity. Chemical and physical characterization of granules was performed using XRD, FT-IR, ICP-OES and EDXS. Scanning Electron Microscope (SEM) was used to analyze the shape, surface roughness and microporosity of the granules. The solubility in MES (pH 5.5) and TRIS (pH 7.3) solutions was evaluated by dissolution rate and dissolution behavior test and K_{sp} was then calculated.

Results: Spherically shape granules with uniform size in the range 300–1200 μ M were obtained. Macroporosity (among the granules) was obtained by opportune granules agglomeration. Interconnected microporosity (within the granules) was varied in the range 0.1–10 μ M and it was found that this feature plays a key role in solubility process by increasing the active surface area at the same level of granule composition. HA granules resulted less soluble than β TCP granules while an intermediate behaviour was observed for biphasic components.

Conclusions and clinical implications: Results suggest that the porous granules manufactured in the present work could find applicability in the field of bone regeneration as bone-fillers material due to their variable and controlled morphology, interstitial fluid circulation through macro- and micro-interconnected porosity, composition and different solubility behavior. These features should facilitate bone tissue in-growth and bone void filling as shown by preliminary *in vivo* experiments.

Treatment effects of grade 4 and 5 titanium for orthodontic mini-screws on MC3T3 osteoblastic cells

Presenter: Piemontese M

University of Parma, Parma, Italy

Co-authors: Piemontese M, Galli C, Ravanetti F, Passeri G, Lumetti S, Macaluso G

University of Parma, Parma, Italy

Background: Endosseous mini-screws are novel devices used to improve anchorage for orthodontic treatments. Although it has been shown that topography of titanium surfaces modulates cell

growth and differentiation and affects implant osseointegration, optimal composition and surface characteristics for mini-screws have still to be determined.

Aim: In the present study, we investigated the behaviour of osteoblastic-like cells cultured on grade 4, commercially pure titanium (cpTi) or grade 5, Ti-4Al-6V titanium alloy discs with different surface treatment designed for orthodontic mini-screws.

Methods: MC3T3 osteoblast-like cells were plated on polished, acid-etched or acid-etched cpTi enriched with calcium phosphate (CaP) or polished, electrochemical-treated or electrochemical-treated and CaP-enriched titanium alloy discs. Topographic investigations of samples and cell morphological analysis were carried out with SEM. Cell viability on titanium discs was assessed through a chemiluminescence assay at 24, 48 and 72 h. Stress fibres and focal adhesions were investigated by immunofluorescence labelling for actin and vinculin, respectively. qRT-PCR for osteoblast-specific genes was performed after 3 days of culture to measure cell differentiation.

Results: Flattened shape and vinculin co-localization at the end of stress fibres oriented along the main cellular axis was observed on polished surfaces; cells on rough surfaces had spindle and bipolar shape, but the cytoskeleton appeared less organized than on polished surfaces. Cell adhesion and proliferation was highest on smooth surfaces. Cells grew more slowly on rough cpTi and quickly reached a plateau. Cells on rough grade 5 titanium, however, proliferated more rapidly and no difference was observed after 72 h between smooth and rough grade 5 surfaces. CaP enrichment on grade 4 titanium significantly increased mRNA levels for alkaline phosphatase and osteocalcin when compared with nontreated surfaces, however osteoblast-specific gene expression on grade 5 titanium was lower on rough surfaces as compared with smooth surfaces.

Conclusions and clinical implications: Rough grade 4 surfaces promote cell adhesion, and CaP enrichment on grade 4 titanium seems to improve *in vitro* osteoblast differentiation. Electrochemical treatment, in the absence or presence of CaP does not appear to support expression of differentiation markers in this cellular model. These results suggest that acid-etching plus CaP enrichment of cpTi may be considered a suitable surface modification to achieve a cell favourable response to implant material.

482 | Material Research

Can Cone Beam Computer Tomography predict the bone density expected at the implant surgical site? Exploratory study

Presenter: Rodrigues R

Maloclinics, Lisbon, Portugal

Co-authors: Rodrigues R, Lopes A, Rocha M, Nobre M

Maloclinics, Lisbon, Portugal

Background: High success rate of implant rehabilitation depends on different characteristics related either to the implants, to the surgical protocol as well as to the bone conditions. The type of bone should be considered for a correct rehabilitation planning. Development of new imagiologic exams brought more information about the bone volume and density.

Aim: To evaluate the Hounsfield Unit (HU) expected at implant site through the readings of the dental scan, and to compare them with the operator clinical findings at the moment of surgery.

Methods: A comprehensive review of the literature was completed to define the actual bone classification and the impact of this information on the clinical outcomes in implant rehabilitations. The bone density placement site of 90 Nobel Speedy Groovy Implants (NobelBiocare®, Sweden) were evaluated, by the reading of the H.U using the Cone Beam Computer Tomography (CBCT) (Kodak 9500, New York, USA) dental scan. The bone density values were then converted into a scale of "soft, medium, and dense", according to the numerical values found in the literature, and then compared with the clinician's observation at the surgery moment during the insertion torque (clinical classification: CC).

Results: The correlations between "C.B.C.T" and "C.C", "axial implants" and "tilted implants" and between "residual bone" and "postextraction" were analyzed using the gamma test. The correlation coefficient between "CBCT" and "C.C" was strong and statistically significant ($R=0.570$; $P=0.000$). Analyzing according to the axis of the implants, the correlation coefficient, for axial implants, was $R=0.567$ ($P=0.000$) and for tilted implants $R=0.615$ ($P=0.049$). When comparing the results according to postextraction or residual bone implants, the correlation coefficient was $R=0.401$ ($P=0.101$) and $R=0.653$ ($P=0.000$), respectively.

Conclusions and clinical implications: Within the limits of this exploratory study, it is possible to predict the bone density, using the HU evaluation of CBCT. Highest correlations were found in implants placed in residual bone either for axial or tilted implant placement. Correlations between the expected values of bone density when placing postextraction implants were found to be not significant. More studies are needed in this area of research, with higher samples and different operators, so that bone density may be predictable and therefore use as information when planning implant rehabilitations.

483 | Material Research

Marginal peri-implant bone loss using two different type of fixture: a prospective split-mouth clinical study

Presenter: Rossi A

Unit of Oral Surgery, University of Milan, Milan, Italy

Co-authors: Rossi A¹, Diego L², Anello T¹, Tagliatesta L¹

¹Unit of Oral Surgery, University of Milan, Milan, Italy, ²Unit of Prosthodontic, University of Milan, Milan, Italy

Background: The use of large diameter implants represents a reliable indication for the rehabilitation of the posterior area in order to obtain more functional and prosthetic support. Despite a relevant number of publications concerning posterior dental rehabilitation using large diameter implants, few data are present about the difference in marginal bone loss using fixture with different macrostructure design.

Aim: The purposes of this prospective split-mouth study on humans is to evaluate (a) marginal peri-implant bone loss using two different macrostructure implant design of the same

diameter (Astra ST 5mm[®] Astratech, Astra 5mm Straight[®] Astratech) (b) success and survival rate of implants inserted in posterior area for single tooth prosthetic rehabilitation.

Methods: A prospective split-mouth study focus on single-tooth rehabilitation with 5 mm-implant with same surface but different macrostructure. From 2006 10 patients with bilateral and posterior symmetric single-tooth loss were included in the study. The inclusion criteria were very selective: vertical bone height minimum 12 mm, horizontal bone width minimum 7 mm in order to insert implant of 5 mm diameter with no GBR technique associated, normal occlusion, normal intermaxillary distance and implant-supported prostheses in occlusion with fixed dentition. Routine documentation of the treated patients was obtained with: diagnostic wax-up, surgical templates, panoramic and intraoral radiographs; CT scans were performed only when the other radiographic exams should not be sufficient to evaluate the treated area. The following parameters were evaluated: (1) peri-implant bone resorption, (2) peri-implant clinical parameters, (3) survival and success of implants according to the criteria proposed by Albrektsson.

Results: From loading time, all the patients reached 24 months follow-up. No implants were removed during the follow-up period. Implant bone resorption values were from 0 to 0.5 mm in the 80% of cases and from 0.5 to 1 mm in the 10%; one patient presented 1.3 mm bone implant resorption. MPI was 0 in the 90% of cases, 1 in the 10%. The 95% of patients present any bleeding after probing. One patient reported a probing depth higher than the physiological value (4 mm). Survival rate was 100%, success rate was 95%. No statistical significant difference were observed between the two types of implants.

Conclusions and clinical implications: Despite of the limited follow-up, the present study suggested that implant with same diameter but different macrostructure seems to be equally predictable and safe for implant-prosthetic rehabilitation of single unit lateral-posterior edentulous areas.

484 | Material Research

TGF- β inhibitor peptide coatings on dental implants for improving osseointegration

Presenter: Sevilla P

Center for Research in Nanoengineering, Technical University of Catalonia, Barcelona, Spain

Co-authors: Sevilla P^{1,2}, Holmberg K³, Rodriguez D^{1,2}, Gil J², Aparicio C³

¹Center for Research in Nanoengineering, Technical University of Catalonia, Barcelona, Spain, ²Biomaterials, Biomechanics and Tissue Engineering group, Technical University of Catalonia, Barcelona, Spain,

³Minnesota Research Center for biomechanics and Biomaterials, School of Dentistry, University of Minnesota, Minneapolis, MN USA

Background: When titanium is implanted in bone a cascade of reactions is provoked entailing the generation of an undesired fibrous tissue layer around the surface of the implant, retarding and sometimes compromising osseointegration. TGF- β 1 stimulates production of collagen type I, the main protein in the fibrous tissue layer, as well as inhibits osteoblastic differentia-

tion. Two peptides, P17 and P144, developed by Borrás-Cuesta et al., are inhibitors of TGF- β 1 activity, reducing fibrogenesis on different cell types and tissues.

Aim: Our aim is to biofunctionalize titanium with a covalently anchored coating of TGF- β inhibitor peptides. We expect to improve and accelerate osseointegration by inhibiting TGF- β activity around implants and thus, avoiding the aforementioned undesired consequences. This represents a change in the paradigm of strategies for improving osseointegration around metallic implants. We report on (a) the effective covalent immobilization of the peptides on the metallic surface using silane chemistry and malonic acid as cross-linker, and (b) the inhibitory effect of the coatings on the TGF- β activity.

Methods: A novel four steps process was used to produce the covalently anchored peptide coatings. (1) Ti surfaces were etched in NaOH at 60°C; (2) activated surfaces were silanized with 3-aminopropyltriethoxysilane; (3) malonic acid was coupled as a crosslinker; and (4) TGF- β inhibitor peptides were linked to the surfaces. Characterization of the coatings was performed using techniques such X-ray photoelectron spectroscopy, contact angle and fluorescence microscopy, between others. *In vitro* tests are currently being carried out to evaluate the effect of the coatings on osteoblasts and fibroblasts. The inhibitory capacity of the coatings was assessed by Western Blot.

Results: Results demonstrate the existence of a covalent anchorage between the TGF- β inhibitor peptides and the surface, accomplishing also high amount and homogeneous distribution of peptide on the surface. The mechanical and thermochemical stability results followed the same trend and showed that the coatings are stable for long periods of time. The peptide coatings did not negatively affect osteoblast adhesion and proliferation and the peptides effectively inhibit TGF- β 1 signaling pathway.

Conclusions and clinical implications: We have obtained TGF- β inhibitor coatings by covalently anchoring peptides following a new chemical route. The proved mechanical and chemical stability of the coatings will hinder their detachment during surgical placement and will localize on the surface of the implant long-term biological activity after implantation. These surfaces constitute a promising candidate for dental implants that will be further tested *in vivo*.

485 | Material Research

Assessment of antibacterial potential for impression materials in implantology-prosthetic rehabilitation

Presenter: Sfarghiu LG

S.C. Dentalmed Com Srl, Donit Association, Brasov, Romania

Co-authors: Sfarghiu LG¹, Dobrovolschi O¹, Dobrovolschi T¹, Cristache CM², Muntianu L³, Sandulescu M³, Ionescu I³, Iliescu AA³, Burlibasa M³

¹S.C. Dentalmed Com Srl, Donit Association, Brasov, Romania, ²S.C.

Concordia Dent S.R.L., Bucharest, Romania, ³Faculty of Dentistry, University of Medicine And Pharmacy Carol Davila, Bucharest, Romania

Background: Decontamination of dental impression by immersion in disinfectants is a very timely topic in implants-

prosthodontics rehabilitation. In order to avoid dimensional changes of the impressions and the subsequent contamination with toxic residues from decontamination process, were incorporated a series of disinfectant substances in the structure of impression materials.

Aim: The purpose of this study is to evaluate through microbiological methods and techniques, the antibacterial potential of some impression materials frequently used in implantology–prosthodontics rehabilitation.

Methods: Impression materials were selected from the following categories: condensation and addition silicones (light and putty); irreversible hydrocolloids, polyethers and zinc oxide eugenol pastes. Testing the antibacterial potential of these materials was carried out for these microorganisms: *Staphylococcus aureus*, *Escherichia coli*, *Streptococcus faecalis* (2 strains), *Haemophilus influenzae*, *Pneumococcus*. Culture media used were: Mueller–Hinton, Muller–Hinton medium with blood and Mueller–Hinton medium supplemented with nutrient HEM. The density of bacterial suspensions was determined by the McFarland method and the incubation was performed at a temperature of 37°C, for 20h.

Results: The antibacterial potential of impression materials was determined by antibiogram similar methods. Most pronounced antibacterial potential for all tested microorganisms was recorded for zinc oxide-eugenol pastes, followed by irreversible hydrocolloids. The lowest antibacterial potential was recorded for polyethers.

Conclusions and clinical implications: By means of incorporation the antimicrobial substances in the structure of impression materials and by assessment of natural antibacterial potential of these materials used in dentistry, are avoided the dimensional changes and also the toxic residues subsequent to decontamination by immersion of dental impressions.

486 | Material Research

Radiographic identification of dental implants

Presenter: Skondra E

University of Athens, Athens, Greece

Co-authors: Skondra E, Sykaras N

University of Athens, Athens, Greece

Background: Nowadays implant therapy is a significant option in replacing the form and function of lost natural dentition. Many manufacturers have developed implants with different diameters, lengths, surfaces, platforms and body design. The identification of implants when the type is unknown is a common problem in contemporary dentistry.

Aim: The purpose of this study was the radiographic identification of dental implants.

Methods: In this study, 32 different implants were used with their corresponding healing and straight abutments for cemented restorations. Radiographic images, produced with the parallel cone technique, were captured using a device which permitted a standard and repeatable way of implant positioning in relation to the bone. The implants were stabilized against the bone generating an image that simulated the endosseous

placement. The implants were radiographically evaluated at 0°, 30°, 60° and 90° and X-rays were taken with A: the implant alone, B: the implant and its healing abutment and C: the implant and its straight permanent abutment. A total of 12 images for each type of implant were analyzed. Emphasis was placed on determining those morphological features that had enough diagnostic power to gradually produce implant groups of smaller size and eventually allow their identification. In addition to that, 60 observers (dentists) divided in two groups of implant specialists and nonspecialists, were provided with radiographic images of implants and the level of identification along with missed features were recorded. This helped to evaluate the clinical methodology suggested by the initial analysis and confirm the diagnostic accuracy and power of implant features.

Results: The aforementioned analysis allowed a classification of the implant morphological characteristics starting from the most generic and concluding with the most specific ones. With this classification all implants were identified. Difficulty in the identification of some features was noticed. The more experienced dentists showed a greater percentage of successful identification of the implants.

Conclusions and clinical implications: This study contributed to the formation of a possible methodology which will help the clinician to radiographically identify the different types of implants and give the opportunity for prosthetic rehabilitation when the type of implant is unknown.

487 | Material Research

Bond strength of repair to zirconia and its veneering porcelain

Presenter: Hong Cheong JS

Prosthodontic Unit, Restorative Department, National Dental Centre of Singapore, Singapore, Singapore

Co-authors: Hong Cheong JS¹, Hean TK², Kiam CE³, Beng Choon KT⁴, Lin CC⁵

¹*Prosthodontic Unit, Restorative Department, National Dental Centre of Singapore, Singapore, Singapore,* ²*Restorative Department, National Dental Centre of Singapore, Singapore, Singapore,* ³*Restorative Department, National Dental Centre of Singapore, Singapore,* ⁴*Graduate Prosthodontics Residency Programme, Faculty of Dentistry, National University of Singapore, Singapore, Singapore,* ⁵*Restorative Department, Faculty of Dentistry, National University of Singapore, Singapore, Singapore*

Background: Zirconia is gaining popularity in dentistry with several applications such as crown copings, fixed prosthesis frameworks and even as implant abutments. However, failure of these all-ceramic zirconia restorations could still happen. Failure occurs when the veneering ceramic fractures, exposing the coping material. The fracturing of veneering ceramics was the primary cause of failure of all-ceramic restorations.

Aim: The repair of zirconia coping material has not been well documented in the literature. Zirconia is a very hard material and is difficult to trim and disassemble when the restoration fails. In the clinical situation when only a small fragment of the veneering porcelain fractures or chips off, repairing the

restoration becomes a feasible option considering the cost of redoing the prosthesis and the possible trauma to the underlying tooth during the prosthesis removal. Thus, there is a need to find out acceptable ways of repairing fractured veneering porcelain instead of disassembling and redoing the restoration. The purpose of this study was to test the shear bond strength of repairing an all-ceramic zirconia system using two difference repair techniques with and without thermocycling conditions.

Methods: An *in vitro* study was investigated to test the repair shear bond strength of Noritake Katana[®] ($n = 20$) and Noritake Cerabien ZR[®] ($n = 20$) to composite resin using the CoJet[®] system and Clearfil Ceramic Primer[®] with and without thermocycling conditions (1000 cycles between 5° and 55° with dwell time of 30 s). Olympia[®] alloy with Vita[®] Omega 900 opaquer ($n = 20$) act as the PFM control. Three-way ANOVA and one-way ANOVA followed by Post-hoc Tukey's HSD test were used to test the significance of each factor.

Results: CoJet[®] system repair yielded significantly stronger shear bond strength ($P < 0.05$) than Clearfil Ceramic Primer[®] in all test specimens within the same condition. Under similar conditions, the repair bond strength to Noritake Cerabien ZR[®] was higher than the repair bond strength to Noritake Katana[®] than the repair to Vita[®] Omega 900 Opaquer on Olympia alloy, and thermocycling lowered the shear bond strength of repair.

Conclusions and clinical implications: Both repair techniques gave acceptable bond strength in their repair to the Noritake[®] Katana zirconia and its veneering porcelain Noritake[®] Cerabien ZR and their repair strength was comparable to that of the enamel-composite resin bond in other studies. Between the two repair techniques however, the CoJet[®] system, when compared with the Clearfil Ceramic Primer, gave a better repair strength when used to repair Noritake[®] Katana and Noritake[®] Cerabien ZR.

Surface roughness changes caused by the galvanic corrosion between a titanium abutment and base metal alloy

Presenter: Song K-Y

Department of Prosthodontics, Collage of Dentistry, Chonbuk national university, Jeonju, Republic of Korea
Co-authors: Lee Jungjin J-J, Song K-Y, Ahn S-K, Park J-M
Department of Prosthodontics, Collage of dentistry, Chonbuk national university, Jeonju, Republic of Korea

Background: The most commonly used for dental implants is titanium and its alloys because of its excellent mechanical properties, physical biocompatibility and corrosion resistance. Pure titanium metal has high reactivity with oxygen and poor castability. So alternative materials such as Co-Cr, Ni-Cr alloys have been introduced and used for fabricating suprastructure. These alloys have good mechanical properties, but their biocompatibility and corrosion resistance are of concern. Galvanic corrosion occurs when dissimilar alloy are placed in direct contact within the oral cavity or within the tissues. Resistance of corrosion is critically important because corrosion can lead to

roughening of the surface, weakening of the restoration, liberation of elements from the metal or alloy, and toxic reactions.

Aim: The purpose of this study was to evaluate the level of electro-chemical corrosion and surface roughness change for the cases of Ti abutment connected to restoration made of base metal alloys.

Methods: It was hypothesized that Ni-Cr alloys in different compositions possess different corrosion resistances, and thus the specimens ($13 \times 13 \times 1.5$ mm) in this study were fabricated with three different types of metal alloys, commonly used for metal ceramic restorations. The electrochemical characteristics were evaluated with potentiostat (Parstat 2273A) and the level of surface roughness change was observed with surface roughness tester. Paired *t*-test was used to compare mean average surface roughness (R_a) changes of each specimen group.

Results: All specimens made of nickel-chromium-based alloys, average surface roughness was increased significantly ($P < 0.05$). Among them, the Ni-Cr-Be alloy ($0.016 \pm 0.007 \mu\text{m}$) had the largest change of roughness followed by Ni-Cr ($0.012 \pm 0.003 \mu\text{m}$) and Ni-Cr-Ti ($0.012 \pm 0.002 \mu\text{m}$) alloy. There was no significant changes in surface roughness between each metal alloys after corrosion.

Conclusions and clinical implications: In the case of galvanic couples of Ti in contact with all specimens made of nickel-chromium-based alloys, average surface roughness was increased.

In vivo study of low temperature macro and nano porous carbonated hydroxyapatite

Presenter: Strnadova M

Lasak Ltd., Prague, Czech Republic

Co-authors: Strnadova M¹, Strnad J¹, Sponer P², Urban K², Strnad Z¹

¹*Lasak Ltd., Prague, Czech Republic, ²Department of Orthopaedic Surgery, Faculty of Medicine and University Hospital in Hradec Kralove, Charles University in Prague, Hradec Kralove, Czech Republic*

Background: HA bone regeneration materials are typically prepared from human or animal bone tissue or by *in vitro* preparation methods. Allogenic/xenogenic materials may represent the risk of disease transmission caused by the residual organic components of the donor's tissue. Synthetic material on the other hand rarely offers the structure suitable for new bone formation.

Aim: The aim of this study was to evaluate the osteoconductive properties of a synthetic porous hydroxyapatite and to compare it with the biological apatite (DBB).

Methods: The synthetic nanostructured carbonated HA powder was prepared by the reaction of calcium hydroxide and phosphoric acid. The powders were foamed and heat treated at temperatures ranging from 150°C (BC1) to 700°C (BC2). The third implanted biomaterial was DBB Bio-Oss[®]. X-ray diffraction, chemical analysis, DTA, SE-microscopy, gas adsorption and mercury porosimetry, were used to characterize the materials. Carbonate substitution in the structure of the samples was

distinguished by infrared spectroscopy. *In vivo* performance of the materials was determined by implantation into the tibiae of beagle dogs.

Results: The newly formed bone tissue in the cortical sites of the BC₁ implants had reached 36.07% (± 8.04) of the total cortical defect after 3 months *in vivo*; in BC₂ and DBB the newly formed bone was 39.99% (± 8.7) and 40.08% (± 7.35) of the total cortical defect, respectively. The bone formation in the spaces between implanted granules of BC₁ within the cortical region (BAI% -Bone Area Ingrowth) had reached 73.2% (± 11.6); in BC₂ and DBB the newly formed bone filled 79.2% (± 15.8) and 79.9% (± 7.3), respectively. In the cancellous bone sites, the bone implant contact (BIC%) was determined using histomorphometry after 3 and 6 months, postoperatively. The BIC of the tested materials (BC₁, BC₂ a DBB) was >70% after 3 months and increased to >80% after 6 months independently of the granule size. These histomorphometric findings indicate that the *in vivo* osteoconductivity of BC₁ material was greater than for BC₂ and DBB at both at 3 and 6 months.

Conclusions and clinical implications: The carbonated HA prepared by low-temperature synthesis resembles the structure and chemical composition of the biological bone HA and can substitute successfully bovine apatite with advantage of the absolute elimination of risk caused by residual antigenic proteins of xenogeneic bone.

Evaluation of the bone stress and strain around implants with various thread design

Presenter: Takeshita T

GC Corporation, Tokyo, Japan

Co-authors: Takeshita T

GC Corporation, Tokyo, Japan

Background: For the dental implant, the most important factor which should be considered is the long-term osseointegration with the bone in the oral region. Osseointegration of the dental implant is a well-confirmed phenomenon, however the long-term stability of the bone around the implant is still under discussion. The bone around implants was known to repeat the modeling and remodeling. One of the well-confirmed reasons is the occlusal force. The concentrated loading distribution to the bone must be avoided for the long-term stability of the bone.

Aim: The aim of this study was to evaluate the bone stress and strain around implants with various thread design.

Methods: We applied to the Design of Experiments, extracted six factors (thread pitch, thread height, thread width, two thread angles, single thread or double thread) and these were distributed the orthogonal table L₁₈. The bone stress and strain around implants were estimated by the finite element method (FEM) and the pull-out test. FEM: 18 models of implants were analyzed using the SolidWorks (3D CAD)/COSMOSWorks (FEM system). The alveolar bone was considered to be an idealized segment with a cortical bone thickness 1 mm, with an enclosed a cancellous bone. The implants were loaded with forces 200 N from 45° tilted direction. For evaluation, the maximum stress of

the cancellous bone was extracted and analyzed. The pull-out test: 18 models of implants were pulled out from the Biomechanical Test Blocks SAWBONES (GP20, Division of Pacific Research laboratories Inc.). The integrated values ($n = 3$) of each force-strain curves were calculated and analyzed.

Results: FEM: "the thread height" is the most effective factor compared with another factors. The result shows that the thread height 0.35 mm is the best height between 0.35 and 0.55 mm to reduce the bone stress under the condition of 45° tilted direction. The pull-out test: "the thread width" and "the thread height" are the two most effective factor compared with another factors. The result shows that the thread width 0.3 mm is the best width between 0.3 and 0.7 mm and that the thread height 0.55 mm is the best height between 0.35 and 0.55 mm to reduce the bone strain.

Conclusions and clinical implications: It was suggested the optimized design of implant is that the upper part of implant which has the low thread height, and the lower part of implant which has the thin thread width and high thread height. There is a possibility that the optimized design of implant reduces bone stress and strain caused by the occlusal force and has an advantage of the long-term osseointegration with the bone in the oral region.

Effect of excimer UV lamp radiation on titanium

Presenter: Takiguchi Y

Showa University, Tokyo, Japan

Co-authors: Takiguchi Y, Kataoka Y, Ikeda S, Miyazaki T

Showa University, Tokyo, Japan

Background: There have been a number of reports of surface treatment of titanium to acquire osseointegration earlier. Ultraviolet (UV) lamps have attracted much attention in recent years because of promoting cellular attachment and proliferation by their radiation effect to titanium.

Aim: The purpose of this study has been to compared the ability of these types UV lamp, excimer UV lamp (EX-UV) and the low-pressure Hg-UV lamp (LP-UV).

Methods: The wave length of the excimer UV lamp (EX-UV) and the low-pressure Hg-UV lamp (LP-UV) were analyzed by spectral distribution measuring assembly. For measuring contact angle of water on titanium plates, Ti plates (10 × 10 × 1.0 mm) was prepared from JIS grade 2 Ti block. Ti plates were wet-abraded with #800 to #1200 grit SiC abrasive paper. The samples were cleaned in acetone, ethanol and sterile water using an ultrasonic washing machine. After radiation of UV, EX-UV and LP-UV, the angle were analyzed at various radiation time, ranging from 0 to 120 min. Furthermore, *in vitro*, mRNA expression levels of oxidative stress genes (GP1, SOD3, GAPDH) in osteoblastic cell cultured on titanium, EX-UV irradiated, were analyzed by real-time PCR as compared with cells cultured on LP-UV.

Results: The peak of spectral distribution properties of EX-UV was observed at 175 nm. Whereas, the main peak of LP-UV was at 250 nm, and some small peaks were at other wavelength.

The Contact angle of EX-UV after 1 min radiation was significantly lower than LP-UV. The expression of oxidative stress genes were not significant differences between EX-UV and LP-UV in 3- and 5-days later.

Conclusions and clinical implications: It has been felt that the excimer UV lamp offers shortening radiation time to get the same effect of LP-UV. In addition, we will attempt analysis of surface chemical constitution change before and after the UV radiation, and cellular responses *in vitro* and *in vivo*.

Biomechanical evaluation of a thin-film ceramic in three different implant bulk configurations. An experimental study in dogs

Presenter: Teixeira H

Universidade Estadual Paulista Julio de Mesquita, Araraquara, Brazil

Co-authors: Teixeira H⁵, Marin C¹, Granato R¹, Suzuki M³, Bonfante E², Coelho P⁴, Lillin T⁶

¹Federal University of Santa Catarina, Florianópolis, Brazil,

²Unigranrio University, Duque De Caxias, Brazil, ³Tufts University, Boston, United States of America, ⁴New York University, New York, United States of America, ⁵Universidade Estadual Paulista Julio de Mesquita, Araraquara, Brazil, ⁶School Of Veterinary D'alffort, Paris, France

Background: The implant surface is a great field of reserch in implant dentistry and great improvement was obtained over the last years. The macrodesign play an important role in the osseointegration process. A combination of surface treatmente and macrodesign can be an excellent combination to accelerate the osseointegration. A preclinical study is necessary to confirm this hiphotesis.

Aim: The objective of this study was to biomechanically evaluate the effect of a thin bioactive ceramic electrodeposition in three different implant bulk configurations at early implantation times.

Methods: This study utilized 18 beagle dogs (~ 1.5 years of age). Three implant surfaces, namely bioactive ceramic electrodeposition (BCE), alumina-blasted/acid-etched (SLA), and resorbable blasting media (RBM) were fabricated in three implant macrogeometries (smooth cylindrical, buttress, and reverse buttress). All combinations between surface and bulk configurations were placed in each dog (left and right radii). The dogs were sacrificed for each evaluation time (10 days and 6 weeks after surgery, $n=9$), and the implants were subjected to torque to interface fracture. Effects of time, surface, and bulk design on torque were evaluated by a GLM at 95% level of significance.

Results: Statistical analyses showed a significant increase in torque as time elapsed *in vivo* ($P<0.001$), and that the BED surface presented significantly higher values compared with SLA and RBM ($P<0.001$). In addition, the reverse buttress bulk design presented a significantly higher performance compared with the smooth cylindrical ($P<0.03$), whereas the buttress design showed intermediate values.

Conclusions and clinical implications: Biomechanical fixation at early implantation times was affected by both implant surface treatment and implant bulk design.

Early osseointegration of plasma rich in growth factors activated implants

Presenter: Tejero R

Eduardo Anitua Foundation, Vitoria, Spain

CiC BiomaGUNE, San Sebastián, Spain

Co-authors: Tejero R^{1,3}, Anitua E²

¹Eduardo Anitua Foundation, Vitoria, Spain, ²Private Practice in Implantology and Oral Rehabilitation, Vitoria, Spain, ³CiC BiomaGUNE, San Sebastián, Spain

Background: Recent results, as well as some classical early studies indicate that the outcome of an implantation is to a large extent a matter of kinetics: the integration process is reduced to a competition between wound healing and inflammatory responses, and the outcome depends on which of the two processes is faster. It can therefore be hypothesized that Plasma Rich in Growth Factors (PRGF) implant surface bioactivation shortens the time required for the healing process to begin by diminishing the inflammatory response on one hand, and stimulating the healing mechanisms with platelet-derived growth factors on the other.

Aim: The aim of our study is to evaluate the early osseointegration of PRGF-activated implants in a rabbit model.

Methods: In total 48 screw type titanium implants were used (Manufacturer: BTI Biotechnology Institute, $S_q=0.94\ \mu\text{M}$, $S_{dr}=35.33\%$). The implants were grouped according to their surface state before implantation: noncoated (NC); PRGF-bioactivated (PRGF); collagen-coated (Col) and Collagen-coated PRGF-bioactivated (Col-PRGF) ($n=6$). The ultrathin rabbit collagen type I coatings were prepared before implant sterilization and properly physicochemically characterized. The implants were press-fit in the implant sites of the femur condyles of New Zealand white rabbits. If PRGF was used, it was drawn from the rabbit and used to wet the implants and fill the implant sites during the surgery. The animals were sacrificed 2 and 8 weeks after implant placement. Implants were then prepared for histological study. Osseointegration was evaluated qualitatively and quantitatively by means of Bone to Implant Contact (BIC) and Bone Volume Density (BVD). For statistical analysis independent samples *T*-test ($P<0.05$) was used.

Results: At 2 weeks, the histologies show already abundant periimplant immature bone with high-osteoblastic activity. Both PRGF and Col-PRGF yield increased levels of osseointegration but differences are not statistically significant. At 8 weeks after implantation, we find long mature bone trabeculae extending from the subchondral bone to the implant surfaces. At this healing period there are significant differences of PRGF, Col and Col-PRGF with respect to NC implant surfaces. The PRGF group in particular shows the highest levels of osseointegration.

Conclusions and clinical implications: Although PRGF technology is widely accepted as beneficial for soft tissue healing, its application for bone regeneration is not yet popular. The results here presented show that the endogenous regenerative technology PRGF applied on the surface of implants can increase early periimplant bone formation and thus improve implant osseointegration.