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Hard and soft tissue augmentation for implant placement in the aesthetic zone

Daniel Alves, Ana Pais, Fernando Almeida
Centro de Formação FA, Carvalhos – Vila Nova de Gaia, Portugal

Background: Surgical techniques for implant placement have evolved greatly over the past years. However, there are still some difficulties when we need bone regeneration prior to implant placement. There is strong scientific evidence for horizontal bone regeneration but not for vertical augmentation.

Aim/Hypothesis: To show hard and soft tissue augmentation with autogenous bone combined with biomaterials.

Material and methods: Male patient aged 41 with infection and presence of fistula in two abutment teeth of a fixed partial denture in the esthetic zone. The patient doesn't have systemic disease. A computed tomography (CT) scan was done to observe the affected areas with accuracy. The extraction of abutment teeth (1.2 and 2.1) was made after 8 days of antibiotic treatment with amoxicillin 1 g. After 8 weeks of soft tissue healing a new approach for guided bone regeneration (GBR) was done. Two autologous bone blocks were removed from the mandible with the help of a piezoelectric device to be used has onlays for GBR. After the bone blocks were screwed, the gaps were filled with bone substitute material (xenograft – bovine bone) covered with non-resorbable collagen membrane. After 6 months, a new CT scan was performed and 2 bone level implants were placed in the 1.1 and 2.1 areas. 3 months after the implant placement a new surgical approach was done and screwed provisional crowns were placed. All-ceramic crowns were screwed after 8 weeks of complete soft tissue healing.

Results: In the case presented, the horizontal and vertical GBR allowed bone support for implant placement and an aesthetic soft tissue emergence profile. Without GBR it would have been impossible.

Conclusions and clinical implications: Patients undergoing implant-supported fixed rehabilitation are increasingly demanding. When it comes to the aesthetic zone, the demand is even greater. Replacement of teeth can only obey the principles of aesthetics if the support tissue is also recovered. Autogenous bone graft combined with xenograft allows a more predictable rehabilitation of hard and soft tissues.

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Horizontal ridge augmentation using a new particulate synthetic graft: human case report with microtomographic and histological analyses

Leandro Alves Da Costa, Rafael Mantovani, José Gabarra Jr, Tulio Pignaton, Valdir Muglia, Sergio Scombatti De Souza
USP, Ribeirão Preto, Brazil

Background: Anatomic limitations of the residual alveolar bone may impede implant placement. Alveolar ridge augmentation procedures are required in such cases to provide alveolar bone width and/or depth for the placement of dental implants. ReproBone® is a new synthetic biomaterial composed by hydroxyapatite and β-tricalcium phosphate that can be used as a bone graft substitute in augmentation procedures.

Aim/Hypothesis: This pilot human case report presents a guided bone regeneration procedure for horizontal ridge augmentation using a new particulate synthetic graft substitute associated to a collagen membrane, aiming to provide bone volume for implant placement, with microtomographic and histological analyses of the newly formed bone.

Material and methods: The patient was a male, 58 years old, non-smoker, with no systemic health conditions that could affect the surgical procedure, had a missing tooth (first superior right pre-molar) and decided to place an implant. However, the computerized tomography analysis revealed that residual alveolar bone width was too narrow for implant insertion, and therefore a bone augmentation procedure was necessary. An autogenous bone block graft was initially planned, but due to the patient's resistance to this procedure, an alternative surgical protocol was proposed, using a synthetic biomaterial. The patient signed an informed consent form authorizing all procedures and scientific documentation. Guided bone regeneration was performed using ReproBone® granules and a collagen membrane (BioMend®) to increase the buccal-palatal bone width. The following medications were used: Amoxicylin 500 mg + Clavulanic acid 125 mg 3×/day (8/8 h) for 11 days, starting 24 h before surgery; Ibuprofen (Advil) 200 mg 6/6 h for 5 days; PerioGard® rinse twice a day (12/12 h) for 15 days. Healing was uneventful with no membrane exposure or other complications. After 6 months the area was reopened and before placing an implant a bone biopsy was collected for microtomographic and histological analyses.

Results: The bone augmentation procedure provided bone volume for implant placement. Microtomographic results showed 40% of cortical bone volume and 17% of residual biomaterial. Histological analysis showed residual biomaterial particles in different stages of absorption and surrounded by newly formed bone.

Conclusions and clinical implications: The results suggest that this biomaterial may be used for horizontal ridge augmentation as an alternative to autogenous bone blocks, reducing patient morbidity.

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A randomized clinical trial evaluating plasma rich in growth factors (Endoret) in the treatment of post-extraction mandibular molars

Eduardo Anitua,[1] Mohammad Alkhraist,[2] Gorka Orive,[2] Alia Murias[2]

[1]Private practice in oral implantology, Vitoria, Spain, [2]Fundacion Eduardo Anitua, Vitoria, Spain

Background: Several studies have reported controversial results about the use of platelet rich plasma products in the treatment of post-extraction defects. Plasma rich in growth factors (Endoret) is the pioneering autologous therapy for tissue repair and regeneration. Different previous studies have suggested that the use of Endoret may exert potential benefits in the soft and hard tissue healing dynamics of a post-extraction socket.

Aim/Hypothesis: The aim of the present randomized clinical trial is to evaluate the safety and efficacy of plasma rich in growth factors in the treatment of post-extraction molars in the lower maxilla. The influence of Endoret in pain, swelling, soft tissue healing and bone regeneration will be carefully evaluated. This will be by far the largest clinical trial in the literature evaluating a platelet rich plasma product in this topic.

Material and methods: Randomized Clinical Trial, controlled with conventional treatment. Sixty patients that require a single extraction in mandibular molars were initially selected in the study. At the first visit patients received either Endoret or conventional treatment (closure of the lesion) depending on the randomization made previously. The percentage of totally regenerated post-extraction sockets. As secondary outcomes: regenerated bone volume (measured by CT-Scanner), post-operative pain (VAS), soft tissue healing index and inflammation. Any adverse event or complication will be recorded.

Results: Results show that both primary and secondary outcomes were improved by the use of plasma rich in growth factors (Endoret). Apart for increasing the number of sockets healed and the percentage of bone regenerated, the use of Endoret significantly reduced the post-operative pain and inflammation whereas it significantly improved the soft tissue healing index. No significant adverse events were reported.

Conclusions and clinical implications: The present clinical trial has demonstrated that plasma rich in growth factors (Endoret) is safe and effective in the treatment of post-extraction molars in the mandible. This is to our knowledge the largest and most important clinical trial in the literature on this field. Data reported herein show that Endoret is the best treatment for the post-extraction defects as it increases the number of sockets healed and the percentage of bone regenerated and reduces post-operative pain and inflammation.

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Evaluation of alveolar ridge preservation 3 months after tooth extraction with a mix of particulate DFDBA and platelet concentrates

Behrang Baniasadi, Eddy Ayachi, Anass Azmani, Laurence Evrard

Hopital ERASME, Bruxelles, Belgium

Background: Vertical alveolar ridge loss has been shown to reach up to 22% in the first 3 months after tooth extraction, if no filling of the socket is performed. Previously described best alveolar preservation techniques have shown vertical facial loss reduced up to 12.5%.

Aim/Hypothesis: The present study evaluated the percentage of vertical loss of mid-buccal bone wall in case of post-extractional alveolar filling with DFDBA and platelet concentrates (PRF) gel and membrane, 3 months after teeth extraction, in order to compare with results gained with other techniques.

Material and methods: Ninety-five teeth were removed in 56 patient. No exclusion criterias were defined. Seventeen patients had tobacco habits, and 16 received provisional removable prosthesis. Teeth were removed for periodontic, endodontic, caries or root fracture reasons. Among teeth removed, 72 were monoradicular and 23 pluriradicular. Atraumatic extraction was performed with a minimal flap technique. Sockets were filled with a mixture of particulate DFDBA 300–500 μm and platelet concentrates and covered with a platelet-rich-fibrin membrane. After suturing, primary closure was achieved in most time. Measurements of bone height were performed by two independent operators, in the middle of the buccal aspect of the alveolar sockets, on Panoramic X-Ray before extractions, and on CT-Scan 3 months after. Calibration between panoramic X-Ray and CT-Scan measurements were made for each patient, using specific anatomical landmarks.. We applied t test to compare the mean bone loss between different groups, we calculated Spearman correlation coefficient r to find out if tabacco use or provisional removable prosthesis had any effect on bone loss.

Results: In our series, 3 months after teeth extraction and alveolar ridge preservation using DFDBA and platelet concentrates, the mean percentage of vertical loss of mid-buccal bone wall is 5.53%. there is no statistical difference beetwen bone loss of monoradicular teeh and pluricular teeth $P = 0.982$ (NS). There is no statistical correlation beetwen tabac habits and bone loss $P = 0.2$ (NS), and no statistical correlation beetwen immediate prothesis and bone loss $P = 0.786$ (NS).

Conclusions and clinical implications: In this study, vertical mean bone loss after 3 months is 5.53%, which seems to reach a good result in socket preservation. Tabaco and

provisional removable prosthesis does not seem to be negative factors in bone resorption. Further RCT should be designed, in order to confirm these results.

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Histological evaluation of PRGF as adjunct to DBB in maxillary sinus floor augmentation: preliminary results of a split-mouth study

Leonidas Batas

Department of Preventive Dentistry, Periodontology and Implant Biology, School of Dentistry, Aristotel University of Thessaloniki, Thessaloniki, Greece

Background: Autologous growth factors are currently evaluated for their potential to enhance bone formation in association with maxillary sinus floor augmentation (MSFA).

Aim/Hypothesis: To evaluate histologically whether chair-side prepared autologous platelet rich growth factor (PRGF) in combination with deproteinized bovine bone (DBB) enhances bone formation when compared with DBB alone as graft material in MSFA.

Material and methods: Six partially edentulous patients with ≤3 mm residual bone height bilaterally in the posterior maxilla were subjected to MSFA with DBB in combination with PRGF in one side or DBB alone in the contralateral side. PRGF was prepared by collecting 20 ml of peripheral blood from each patient into tubes containing 3.8% (wt/vol) sodium citrate as anticoagulant and centrifugation at 1400 rpm for 8 min at room temperature (PRGF System1, Vitoria, Spain). From the separated blood, the 0.5 ml plasma fraction located just above the red cell fraction, but not including the buffy coat, was then collected and deposited in an eppendorf tube, and activated with the addition of PRGF activator (50 μl calcium chloride solution 10%w/v). The resulting PRGF was then mixed with deproteinized bovine bone (DBB) in a glass dish. After 5–8 min, the material attained a viscous consistency and was ready for application. MSFA was performed with the lateral window technique. Trephine biopsies were obtained during oral implant site preparation approximately 6 months after MSFA and processed for decalcified or non-decalcified histological and histomorphometrical evaluation. Non-parametric statistics, with P set at 0.05, were performed.

Results: The collected biopsies varied in length (range: 3.5–9.9 mm); consequently, the portion of the biopsy representing augmented tissues also varied (range 2.3–14.6 mm^2). New bone formation with a trabecular appearance and numerous DBB particles in contact with the new bone or with loose connective tissue were observed. No differences in the relative volumes of bone formation were found in sinuses augmented with DBB+PRGF or DBB alone 6 months after MSFA (35.6 ± 8.26 mm and 37.8 ± 3.15 mm, respectively).

Conclusions and clinical implications: Based on these preliminary results, PRGF as an adjunct to DBB does not enhance bone formation inside the human sinus when implant installation is planned several months after MSFA.

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Histological evaluation of PRGF as adjunct to DBB in maxillary sinus floor augmentation: preliminary results of a split-mouth study

Leonidas Batas,[1] Andreas Stavropoulos,[2] Sokrates Koumpias,[1] Antonios Kostantinidis[1]

[1]*Department of Preventive dentistry, Periodontology and implant biology, School of Dentistry, Aristotel University of Thessaloniki, Thessaloniki, Greece,* [2]*Department of Periodontology and Community Dentistry, Faculty of Odontology, Malmö University, Malmö, Sweden*

Background: Autologous growth factors are currently evaluated for their potential to enhance bone formation in association with maxillary sinus floor augmentation (MSFA).

Aim/Hypothesis: To evaluate histologically whether chair-side prepared autologous platelet rich growth factor (PRGF) in combination with deproteinized bovine bone (DBB) enhances bone formation when compared with DBB alone as graft material in MSFA.

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Conclusions and clinical implications: Based on these preliminary results, PRGF as an adjunct to DBB does not enhance bone formation inside the human sinus when implant installation is planned several months after MSFA.

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Maxillary sinus augmentation with PRF+graft vs. collagen membrane+graft: a clinical, radiological and histological study

Nilufer Bolukbasi
Istanbul University Faculty of Dentistry, Istanbul, Turkey

Background: Maxillary sinus augmentation is a well-documented technique; however there is no consensus on the ideal grafting material for sinus augmentation surgery. PRF is classified as a leukocyte and fibrin concentrate. PRF can be used successfully solely or in combination with graft materials. There is not enough evidence on the effect of PRF in sinus lifting surgery.

Aim/Hypothesis: The objective of this study was to compare the efficacy between the use of bovine bone graft material and PRF mixture and bovine bone graft material and collagen membrane combination in sinus augmentation surgery. Results were obtained by means of clinical, radiographical and histological examination.

Material and methods: Patients treated between 2008 and 2012 were selected for the study. Radiological measurements were obtained by panoramic radiographs at six time-points for approximately 36 months. To evaluate the relationship between sinus-graft height and each implant, the bone level (BL) was divided by implant length (IL). To evaluate the change in the height of grafted sinus, the grafted sinus floor above the lowest part of the original sinus height (GSH) was divided by the original sinus height (OSH). Bone characteristics were evaluated through the samples taken after 6-month healing period by using histologic and histomorphometric analyses.

Results: Twenty-five patients, 32 augmentation surgeries and 66 one-staged implants were included to the study. No implant loss or complication was observed in both groups. There were no statistical differences according to new bone formation ($P = 0.61$) and biomaterial remnant ($P = 0.87$). During the evaluation period test group showed statistically less change in the BL/IL ratio ($P = 0.022$). The difference of GSH/OSH ratio was found to be insignificant between groups ($P = 0.093$). It was observed that grafted sinus covered the implant apex and sinus floor was above the original sinus height in all cases.

Conclusions and clinical implications: It may be concluded from this study that both combinations can be successfully used for sinus augmentation. Further studies evaluating different graft materials and PRF combinations in the early phases of healing are beneficial.

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Mg-doped brushite cement for bone regeneration

Jatsue Cabrejos-Azama,[1] Mohammad Alkhraisat,[2] Julia Lucas-Aparicio,[1] Carmen Rueda,[2] Jesús Torres,[3] Luis Blanco,[1] Enrique López-Cabarcos[2]
[1]Estomatología III – Facultad de Odontología y Física-Química II – Facultad de Farmacia. Universidad Complutense de Madrd, Madrid, Spain, [2]Física-Química II – Facultad de Farmacia. Universidad Complutense de Madrid, Madrid, Spain, [3]Ciencias de la Salud – Universidad Rey Juan Carlos, Alcorcón, Spain

Background: The development of synthetic materials used for substituting autologous bone graft requires large investments that are dedicated to improve the properties of the new materials, and also their efficiency in bone engineering. One way to improve the biological performance of the materials is by incorporating magnesium ions since they are involved in processes like cellular proliferation and differentiation. Thus, we consider the incorporation of Mg2+ presents a biological approach toward increasing the bioactivity of calcium phosphate scaffolds.

Aim/Hypothesis: The main focus of this work was to incorporate magnesium ions in brushite cements.

Material and methods: Monocalcium phosphate (MCP) and β-tricalcium phosphate (β-TCP) containing different concentrations of Mg were synthesized and subsequently used as reagents in the preparation of cements. Table 1 shows the composition of the cements obtained. The cements were then crushed and sieved to grain size between 0.5 and 0.8 mm. Afterwards, the cement particles were 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 A. 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.

Table 1. Cement compositions

	Powder				Liquid
Samples	Reagents without magnesium		Reagents with magnesium		Water (PLR)
CPC	β-TCP	MCPM			3.0 $g.ml^{-1}$
Mg-CPC1			67%Mg-TCP	7%Mg-MCPM	3.0 $g.ml^{-1}$
Mg-CPC2			67%Mg-TCP	27%Mg-MCPM	3.0 $g.ml^{-1}$
Mg-CPC3			67%Mg-TCP	67%Mg-MCPM	3.0 $g.ml^{-1}$

B. Histological evaluation: Magnesium ions indeed improve the bone formation provoked by calcium phosphate implants and maintain the osteotransductive property of calcium phosphates. Furthermore, Mg-doped cements improve the degradability of the scaffold.

Conclusions and clinical implications: Magnesium-incorporate in brushite cement may be adequate bone graft to the clinical application and thus increase the predictability of bone regeneration procedures.

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Aesthetic outcomes in a case of GBR of fresh socket site with rehabilitation implant prosthodontic using Zirconia Abutments: 1 year of follow-up

Ernesto Caselli
Private Practice, Ancona, Italy

Background: As the number of patients seeking implants increases, so do the aesthetic challenges. Adequate bone is necessary to place an implant with an aesthetically pleasing outcome. Failing teeth that require implant replacement often have bone deficiencies, and several surgical techniques have been advocated for maintaining bone volume at the time of extraction. 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/Hypothesis: In this case report can show how an implant-prosthetic rehabilitation in the frontal area could be performed when adequate bone support is absent, using regenerative surgical procedures, in order to obtain a good final aesthetic outcome.

Material and methods: A 25 year old female patient presented 11 and 21 teeth with fracture and inflammation. After extractions a vertical and horizontal regeneration procedure using a resorbable membrane (Bioguide – Geistlich) and de-proteinized bovine bone material (Bio-oss Geistlich) was performed. After 6 months two titanium implants Astra Tech Osseospeed Tx (4 × 11 mm) were inserted and two healing abutments, with a removable prothesis were installed The prosthetic rehabilitation was performed after 2 months with zirconia abutments (Atlantis Abutment) and ceramic crown (LAVA).

Results: One year after crown placement a good aesthetic and prosthetic profile was achieved.

Conclusions and clinical implications: The use of zirconia abutments and prosthodontic crowns with ceramic zirconia and bone regeneration techniques allowed us to obtain good, functional and aesthetic immediate results that in 1 year.

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Immediate loading of single-tooth restorations after re generation bone in aesthetic area: one-year of follow-up (case report)

Ernesto Caselli
Private Practice, Ancona, Italy

Background: As the number of patients seeking implants increases, so do the aesthetic challenges. Adequate bone is necessary to place an implant with an aesthetically pleasing outcome. Failing teeth that require implant replacement often have bony deficiencies, and several surgical techniques have been advocated for maintaining bone volume at the time of extraction.

Aim/Hypothesis: 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.

Material and methods: A 40-year old male patient presented a big lesion against to the tooth 15. After tooth extraction we used Bio-oss (Geistlich) to fill the defect and used a Bio-guide (Geistlich) and Mucograft (Geistlich) to seal the extraction site. After 6 months we installed an Astra Tech Osseospeed Tx (4 × 11 mm) titanium implant with immediately temporary crown for a non functional loading. After 3 months from the implant insertion we have taken the final impression and finalized the case with the use of an Atlantis abutment and a ceramic crown.

Results: At the time of prosthetic loading we eventually got a major aesthetic and functional result with an excellent soft tissue integration.

Conclusions and clinical implications: After 1 year of both radiographic and clinical follow up we have observed the excellent integration of the soft tissues and admirable maintenance of peri-implant bone.

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Two-stage maxillary sinus augmentation using autogenous bone and β-tricalcium phosphate: clinical and histomorphometric evaluation in humans

Miguel David Cevallos Lecaro,[1] Jakub Strnad,[2] Radek Mounajjed[1]
[1]*D.C.M. Klinika s.r.o., Hradec Králové, Czech Republic,* [2]*Lasak s.r.o., Prague, Czech Republic*

Background: Maxillary sinus grafting procedures are predictably used to increase the bone height in the posterior maxilla. The autologous bone is considered the gold standard for sinus floor elevation. Due to the potential morbidity of the donor

site, various bone substitutes have been developed. The use of β-tricalcium phosphates has been documented in oral and maxillofacial surgery. The composite grafts reduce the amount of the bone harvesting.

Aim/Hypothesis: To asses the clinical and histomorphometric data of the new bone tissue from a mixture of autologous bone and β-tricalcium phosphate.

Material and methods: A total of 72 two-stage sinus lift were performed in 54 patients during 2007 to 2010. The autologous bone was harvested from the mandibular ramus and mixed with the β-tricalcium phosphate (Poresorb® TCP sized 1–2 mm, Lasak, Prague, Czech Republic) The materials were used in a proportion ranged between 1 : 1 and 1 : 3. After the healing period a total of 119 implants were placed and 10 samples of the regenerated bone were collected for the histomorphometric analysis. CBCT or panoramic X-rays were performed pre-surgically, before the implant placement, 6 months after implant placement and then yearly to evaluate the bone formation and marginal bone loss. The success rate was determined using the Albrektsson et al. criteria.

Results: The mean of the residual bone was 4.07 mm ± 1.87 mm. The bone gain in the sinus was 11.91 mm ± 2.80 mm. The implant success rate was 94.95%. The histomorphometric measurements on the biopsies showed a bone area mean of 39.7 ± 9.71%. The residual allograft area was 16.21 ± 8.78%. The connective tissue was 44.16 ± 5.85%.

Conclusions and clinical implications: Within the limit of this study, the osteoconductive β-tricalcium phosphate associated with autologous bone is a viable grafting material for sinus lift procedures. The use of composite grafts can help to reduce the morbidity and aggressivity of the bone harvesting.

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A comparative study of the regenerative effect of sinus bone grafting with platelet-rich fibrin-mixed Bio-Oss and commercial fibrin-mixed Bio-Oss

Byung-Ho Choi, Seung-Mi Jeong, Jeong-Seog Son, Dae-Sik Kim, Sae-Ha Kang

Department of Dentistry, Yonsei University Wonju College of Medicine, Wonju, South Korea

Background: Anorganic bovine bone (Bio-Oss®) particles are one of the most popular grafting materials. The particles are often mixed with platelet-rich fibrin (PRF) or a commercial fibrin (Tisseel®) to form a mouldable graft material.

Aim/Hypothesis: The objective of this study was to compare the potentials of PRF-mixed Bio-Oss® and Tisseel®-mixed Bio-Oss® to enhance bone regeneration in a canine sinus model.

Material and methods: Six mongrel dogs were used in this study. After elevating the sinus membrane in both maxillary sinus cavities, an implant was placed into the sinus cavity. In one of the sinus cavities, the PRF/Bio-Oss® composite was grafted, whereas the Tisseel®/BioOss® composite was grafted in the other sinus cavity. After a 6 month healing period, bone formation in the graft sites and bone implant contact were evaluated.

Results: The mean osseointegration rate was 43.5 ± 12.4% and new bone formation rate 41.8 ± 5.9% in the PRF/Bio-Oss® composite sites. In the Tisseel®/Bio-Oss® composite sites they were 30.7 ± 7.9% and 31.3 ± 6.4%. There were statistically significant differences between the groups.

Conclusions and clinical implications: The findings from this study suggest that when platelet-rich fibrin is used as an adjunct to Bio-Oss® particles for bone augmentation in the maxillary sinus, bone formation in the graft sites is significantly greater than when Tisseel® is used.

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Alveolar ridge preservation techniques: a systematic review and metanalysis of histological and histomorphometrical data

Marco Clementini,[1] Valeria De Risi,[2] Gianluca Vittorini,[2] Alice Mannocci,[3] Massimo De Sanctis[4]

[1]University Tor Vergata, Rome, Italy, [2]Catholic University Sacred Heart, Rome, Italy, [3]University La sapienza, Rome, Italy, [4]University of Siena, Siena, Italy

Background: After a tooth extraction a consequent loss in height and width of the alveolar process always takes place, impairing the execution of both traditional and implant supported dentures. Various surgical procedures have been introduced aiming both to maintain an ideal ridge profile and to prevent alveolar ridge collapse, preserving adequate dimensions of bone in order to facilitate correct implant placement, especially in the anterior sites. However, a systematic assessment of the nature and quality of the newly formed tissue, with proper evaluation of histomorphometric data, has not been carried out.

Aim/Hypothesis: The aim of this paper is to systematically review histological and histomorphometrical data from literature that provide information regarding the effect of alveolar ridge preservation procedures on healing after tooth extraction in humans.

Material and methods: The MEDLINE-PubMed and the Cochrane CENTRAL databases were searched up to September 2012; 38 papers were selected from 646 founded. A meta-analysis was performed regarding the variations in the mean percentage of bone, connective tissue and residual graft material between three different type of alveolar ridge preservation procedures.

Results: The best value regarding bone percentages is produced at 3 months by allografts (54.4%) while the worst is obtained at 5 months by xenografts (23.6%). Whilst with regard to connective tissue, the highest and lowest values are shown at 7 months, respectively with allografts (67%) and alloplasts (27.1%). Last, referring to residual graft material, the

lowest rates are displayed by allografts (12.4% to 21.11%) while using xenografts and alloplasts, at 7 months, the highest are showed (37.14% and 37.23%). In any cases no statistical difference was found.

Conclusions and clinical implications: With the limits due to the features of the selected papers, no major histological and histomorphometrical differences arouse among different alveolar ridge preservation procedures and when compared to spontaneous healing. Thus it might be argued that in preserved sites it is unnecessary to wait further than 3–4 months prior to implant insertion.

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Abstract withdrawn

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Graft shrinkage and survival rate of implants after sinus floor elevation using NanoBone®: 1-year prospective study

Marc El Hage,[1] Semaan Abi Najm,[2] Mark Bischof,[1] Rabah Nedir,[1] Jean-Pierre Carrel,[2] Jean-Pierre Bernard[2]
[1]University of Geneva – Ardentis Dental Clinic, Geneva, Switzerland, [2]University of Geneva, Geneva, Switzerland

Background: In the posterior maxilla, insufficient bone volume is frequently encountered due to the pneumatization of the maxillary sinus together with crestal bone resorption after tooth loss. Autogenous bone has long been considered the gold standard grafting material because of its osteoinductive and osteoconductive properties. Extra-oral donor sites increase surgical complexity and are associated with significant (and underreported) morbidity and scarring. Therefore alternative grafting materials have been developed such as nano-crystalline hydroxyapatite embedded in silica gel matrix (NanoBone®; Artoss, Rostock, Germany). Clinical and radiographic outcomes of sinus grafts have been studied. Of particular interest is whether graft height and volume are maintained over the long term.

Aim/Hypothesis: The aims of this study were (1) to evaluate the vertical shrinkage percentage of nanocrystalline hydroxyapatite embedded in silica gel used for maxillary sinus floor elevation (SFE) and (2) to determine the survival rate of the implants 1 year after placement in the healed grafted sinuses.

Material and methods: Eleven maxillary sinuses were augmented in eight patients with NanoBone. After a healing period averaging 14.42 months, 19 implants were placed and followed up with clinical and radiographic evaluation. Panoramic radiographs were taken immediately after SFE and at 12 months after grafting. Measurements of changes in height were made by a computerized measuring technique using an image editing software.

Results: The mean graft height shrinkage percentage at 12 months after surgery was 8.84% (±5.32). One implant was lost before loading. All the 18 remaining osseointegrated implants received the prosthetic rehabilitation and were controlled after 3 months of functional loading. The implant survival rate at the 1-year interval was 94.74%.

Conclusions and clinical implications: A 100% NanoBone alloplastic graft used in lateral SFE procedures presented limited height shrinkage. Implants placed in these grafted sinuses showed survival rates similar to those found in published data. These results should be interpreted cautiously considering the study's reduced sample size.

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Comparative investigation of the effects of titanium prepared platelet-rich fibrin (T-PRF) and platelet-rich fibrin (PRF) on new bone formation

Erhan Firatli,[1] Mustafa Tunali,[2] Hakan Özdemir,[3] Zafer Kucukodaci,[4] Seref Ezirganli,[5] Emre Barış,[6] Serhan Akman[7]
[1]Faculty of Dentistry, Istanbul University, Istanbul, Turkey, [2]Department of Periodontology, Gulhane Military Medical Academy, Haidarpasa Hospital, Istanbul, Turkey, [3]Department of Periodontology, Faculty of Dentistry, Cumhuriyet University, Sivas, Turkey, [4]Department of Medical Pathology, Gulhane Military Medical Academy Haidarpasa Hospital, Istanbul, Turkey, [5]Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Bezmialem Vakif University, Istanbul, Turkey, [6]Department of Oral Pathology, Faculty of Dentistry, Gazi University, Ankara, Turkey, [7]Department of Prosthodontics, School of Dentistry, Selcuk University Konya Turkey

Background: Thrombocytes have an important role in coagulation, and prevent excessive blood loss in venous injuries. They contain numerous cytokines and growth factors that influence bony regeneration and maturation of soft tissue. Platelet-derived growth factor AB (PDGF-AB), transforming growth factor-1 (TGF-1), and vascular endothelial growth factor (VEGF) are key growth factors that are present in thrombocytes. Platelet-rich fibrin (PRF) was first developed in France by Choukroun et al. in 2001 as an autologous biomaterial that contains leucocytes and platelet-rich fibrin. We have developed a new, titanium-prepared platelet-rich fibrin (T-PRF) together with the protocol for forming it in rabbits, which is based on the hypothesis that titanium tubes may be more effective at activating platelets than the glass tubes used by Choukroun in his platelet-rich fibrin (PRF) method.

Aim/Hypothesis: In this study, we aimed to study the effects on new bone formation of titanium prepared platelet-rich fibrin (T-PRF), and platelet-rich fibrin (PRF) graft materials placed under titanium barriers in rabbits.

Material and methods: Eighteen adult male New Zealand white rabbits were used in this study. Two titanium barriers were fixed on each rabbit's calvarium. The study included three groups, one of which was a control group. The experiment groups, T-PRF, and PRF were placed under titanium barriers; in the control group, no materials were used. Half of the animals were sacrificed after 1 month, and the rest were sacrificed after 3 months. After this, light microscopy images were taken, and a histomorphometric evaluation was carried out.

Results: More new bone area was noted in the T-PRF group than in PRF group, also more new bone area was noted in the PRF group than in the control group after 1 month, and 3 months. The amounts of new bone formation in experiment groups, and control group were found to be higher at the third month than at the first month.

Conclusions and clinical implications: In the limitation of our study, T-PRF, and PRF with titanium barriers in guided bone regeneration are successful graft materials. T-PRF use seems to be more effective than PRF in guided bone regeneration (GBR), but more research regarding the clinical parameters of T-PRF are required.

405 Posters – Tissue Augmentation and Engineering

Bone formation 6 and 12-months after sinus elevation surgeries with a bovine derived biomaterial: microtomographic and histological analyses

José Gabarra Jr, Sergio Scombatti De Souza, Rafael Mantovani, Leandro Alves Da Costa, Tulio Pignaton, Valdir Muglia, Arthur Novaes Jr
USP, Ribeirao Preto, Brazil

Background: Rehabilitation of the posterior edentulous maxillae is a challenge when bone volume is limited. The presence of the maxillary sinus together with loss of alveolar bone height may not indicate implant placement. Sinus lift procedures are well documented in the literature to increase bone volume by filling the sinus cavity with autogenous bone and/or bone graft substitutes.

Aim/Hypothesis: This case report presents a microtomographic and histological analysis of bone biopsies taken 6 and 12-months after sinus lift procedures using a bovine derived bone graft substitute.

Material and methods: A 55 years old non-smoker female, presenting limited bone volume on both sides of the posterior edentulous maxilla wanted to rehabilitate those sites. The patient had no systemic health conditions that could affect the surgical procedures. In both side of the maxillae sinus lift procedures were conducted using the lateral surgical approach and the maxillary sinues were filled with a bovine bone graft substitute (BioOss®). A collagen membrane (BioGide®) was placed over the graft and the surgical flap was sutured to entirely cover the membrane. Proper post-operatory medications were prescribed (Amoxicylin 500 mg + Clavulanic acid 125 mg, Ibuprofen 200 mg and PerioGard® rinse). Healing was uneventful with no membrane exposure or other complications. After 6-months the left side was reopened and before placing an implant a bone biopsy was collected for microtomographic and histological analyses. For personal reasons, the patient decided to postpone the second surgery, and the right side was reopened only 12-months after the sinus lift procedure; again a bone biopsy was collected prior to implant placement for microtomographic and histological analyses.

Results: Clinically, new mineralized tissue can be seen in the surgical sites, as well as some remaining particles of biomaterial. The newly formed bone allowed implant insertion in both sides. The micro tomographic biopsy analysis presented the following volumes: for the 6-months healing period, 27% of bone and 39% of residual biomaterial; for the 12-months healing period, 52% of bone and 16% of biomaterial. Histological analysis showed, for both periods, newly formed woven bone and remaining particles of biomaterial – noticeably fewer particles in the 12-months biopsy.

Conclusions and clinical implications: This split-mouth case report showed that the bovine derived graft continues to be absorbed between 6 and 12 months post-operative healing period, and that bone formation considerably increases in the same period.

406 Posters – Tissue Augmentation and Engineering

Comparison of Algipore and Bio-oss in maxillary sinus floor augmentation: histological and histomorphometric evaluation

Giuliano Garlini,[1] Marco Redemagni,[2] Claudio Dellavia[3]
[1]Studio Odontoiatrico Associato, Milan, Italy, [2]Studio redemagni, Lomazzo (Co), Italy, [3]University of Milan, Milan, Italy

Background: In case of posterior maxillary atrophy, sinus floor augmentation surgery has become a routine procedure to allow implants insertion. Even if autogenous bone is considered the gold standard, not all patients are suitable for more complex surgeries. Many bone substitutes have been tried to find an alternative to autografts.

Aim/Hypothesis: The aim of this study was to compare histological and histomorphometric a vegetable originated hydroxyapatite (Algipore) with DBB (Bioss) utilised as bone substitutes alone in sinus floor elevation.

Material and methods: Five healthy patients undervent a bilateral maxillary sinus floor elevation. The original bone was augmented with 100% Algipore on the test side and 100% Bioss on the control site. Bioptical specimens were obtained from each surgical site by a 3-mm inner diameter trephine bur, with the consensus of the patients, 6 months after the surgery. Undercalcified sections were prepared for light microscopy. Histological interest were focused on new bone formation, bone

remodelling, and biomaterial replacement. Histomorphometric measurements of the tissue fractions in the augmented area were performed For all measurements mean and standard deviation were computed in the two groups of samples and they were then compared using a Wilcoxon signed-rank test for paired samples (level of significance, $P < 0.05$).

Results: For both the materials inflammatory infiltrate was not present. At microscopical level numerous blocks of Bio-oss resulted well osseointegrated, the border between the two tissue was indistinguishable. At microscopical level some Algipore's block were joined by bone connections. A close contact between the two block was observed without the presence of slits. Histomorphometric analisys showed that, the medullary space average was higher for the Bioss compared with Algipore (38% SD 8.90% vs. 29% SD 7.88%) while we find the opposite situation regarding the average of residual material (Algipore 44% SD 20.36% vs. 22% SD 6.40% Bioss). Considering the bone formation in the grafted sinuses after 6 months, all the materials performed well, with a 39% SD 10.42% for Bioss and 26% SD 15.07% for Algipore respectively. At statistical analysis, no significant differences in terms of new bone formation and residual biomaterial between the two groups were found (P value > 0.05).

Conclusions and clinical implications: In conclusion, within the limitation of the present study, the data confirmed that sinus lift carried out with Algipore perfomed in a similar way of that carried out with Bioss and that this material is safe, predictable and without invasiveness.

407 Posters – Tissue Augmentation and Engineering

Er,Cr:YSGG-laser assisted sinus floor augmentation – an experimental pilot study

Markus Hof,[1] Adnan Redzic,[1] Ewald Unger,[2] Christian Ulm,[1] Andreas Moritz,[1] Bernhard Pommer[1]

[1]Bernhard-Gottlieb School of Dentistry, Medical University of Vienna, Vienna, Austria, [2]Center for Biomedical Engineering and Physics, Medical University of Vienna, Vienna, Austria

Background: Perforation of the maxillary sinus membrane in the course of sinus floor augmentation represents the most frequent intraoperative complication regardless of the surgical technique used. Laser-assisted osteotomy of the lateral sinus wall may offer an alternative treatment approach, however, reports addressing this surgical technique are still scarce.

Aim/Hypothesis: The aim of this study was to investigate potential differences on various laser settings using Er,Cr:YSGG-laser focusing on treatment duration as well as membrane perforation rate.

Material and methods: In this experimental study design Erbium, chromium:yttrium-scandium-gallium-garnet (Er,Cr:YSGG) laser-assisted surgery was performed on fifteen edentulous maxillae of human cadavers using forty-four settings. In a pre-selection different power, water and air settings were tested for best clinical performance. Treatment duration as well as membrane perforation rate were recorded using different clinical laser-settings (power: 2.75/3.00 Watt; water: 50/60%; air: 50/60%) and used for statistical analysis.

Results: While higher power settings significantly decreased the time required for laser osteotomy (10.2 vs. 16.0 s, $P = 0.006$) a higher sinus membrane perforation rate was observed using the 3.00 watt setting (30.4%) compared to the 2.75 watt setting (15.2%). Water settings of 50% did not result in different treatment time compared to 60% settings (12.8 vs. 13.4 s, $P = 0.119$), yet were associated with a higher perforation rate (23.3% vs. 15.3%, $P = 0.078$). No difference in treatment duration (13.0 vs. 13.2 s, $P = 0.644$) as well as sinus membrane perforation rate (20.5% vs. 18.1%, $P = 0.686$) could be substantiated between air settings of 50% vs. 60%. The lowest membrane perforation rate of 6.8% ($P = 0.024$) was achieved using following laser setting: 2.75 watt, 60% water and 50% air.

Conclusions and clinical implications: Er,Cr:YSGG laser-assisted osteotomy may be considered as promising alternative treatment approach to conventional lateral sinus floor augmentation, however, further studies are needed to confirm these results.

408 Posters – Tissue Augmentation and Engineering

The effect of adipose-derived stem cells on bone formation and osseointegration in diabetic rabbits

Wang Hongliang, **Song Yingliang**

School of Stomatology Fourth Millitary Medical University, Xi'an, China

Background: Diabetes has become a global public health problem. The failure rate is higher in patients with diabetes. Consequently, diabetes is considered as a relative contradiction for dental implant treatments. In recent years, interest has rapidly grown in the developmental plasticity and therapeutic potential of stromal cells isolated from adipose tissue, called adipose-derived stem cells (ASCs). In this experiment, we investigate the effect of ASCs on bone formation and osseointegration in diabetic rabbits.

Aim/Hypothesis: To investigate the effect of Adipose-derived Stem Cells on bone formation and osseointegration in diabetic rabbits.

Material and methods: Adipose-derived Stem Cells were obtained from New Zealand rabbits and identified by multilineage differentiation. Diabetic rabbit models were established by intravenous injection of Alloxan. ASCs were composite with Bio-Oss and implanted around implants in the tibia of diabetic rabbits. Bone formation was studied by general observation, histological and Micro-CT analysis at 4.8 and 12 weeks after operation respectively.

Results: ASCs possess the ability of self-renewal, proliferation and multi-differentiation. More bone formation and better osseointegration obtained when ASCs applied ($P < 0.05$).

Conclusions and clinical implications: ASCs could be applied to improve bone formation and osseointegration in diabetic rabbits. And it may provides a new treament option for diabetic patients with missing teeth.

409 Posters – Tissue Augmentation and Engineering

Spontaneous sinus bone formation at the sinus floor after sinus elevation without bone grafts or implants placement–cases report

Kuo-Ching Huang, Chih-Yang Wang
Periodontal Division, Department of Dentistry, ChiMei Medical Center, Tainan, Taiwan

Background: It is a common method to lift the sinus with lateral window technique to gain the bone height in atrophic maxilla ridge. Generally, in this technique, bone substitutes alone or with implants is/are placed into the ridge and space between the sinus membrane and floor after elevation the Schneiderian membrane to gain the sufficient bone height for implant placement. In some article, implant was simultaneously installed to keep the space for the bone formation following sinus elevation without graft material. According to the study of Schenk, et al., the formation of Blood clots can contribute to generate new bone. Thus, whether the bone formation can be achieved after sinus membrane detached without using any bone substitutes or implant placement?

Aim/Hypothesis: To present two cases about the spontaneous bone formation in the sinus floor after sinus elevation without any bone substitutes graft and implant placement for space maintenance, and the results of the histological examination.

Material and methods: Both of cases with upper right posterior edentulous area. They wanted to have reconstruction with implant on the maxillary edentulous area. The sinus augmentation is necessary for the two cases, that due to the bone height is insufficient. Within the surgery, the membrane perforation was noted when detaching the Schneiderian membrane with lateral window method. It was too large to repair with collagen membrane. After detaching sufficiently the sinus membrane, the bone window was covered with collagen membrane, and then wound primary closure was done.

Results: About 10 weeks post-OP, It was found that the bottom of the sinus floor was moved up in the radiographic examination. And It reveals new bone formation in the histologic analysis.

Conclusions and clinical implications: In this two cases, blood clot formation can contribute to bone formation without bone substitutes. However, there are other factors, for example, the maintenance of the space or not, will affect the final outcome and results in unpredictable. The two cases provide the other direction of thinking to gain the bone formation in the sinus.

410 Posters – Tissue Augmentation and Engineering

Correction of buccal bony defects in posterior mandible; prospective clinical study

Atef Ismail,[1] Marium Ismail[2]
[1]Private Practice, Cairo, Egypt, [2]Future University, Cairo, Egypt

Background: Extraction in premolar and molar region especially surgical one may produce buccal bony defects with reduction in the bone volume and change of both quantity and position of keratinized mucosa. These changes may influence the implant therapy outcome. Several surgical interventions including bone augmentation may be required to correct the situation.

Aim/Hypothesis: Evaluating the outcome of the correction of buccal bony defects by using Zirconium titanium implant with simultaneous bone augmentation and collagen Derma®.

Material and methods: Sixteen healthy patient indicated for implant placement – All patients exhibit buccal bony defects in posterior mandible – All patients received X-Ray preoperative to determine bone volume – The buccal defects measured on the model using the waxing up of the total defect to the normal contour of the opposite side, connected line from the cementoenamel junction below contact points of the two neighboring teeth, the defects measured by graduated probe between this line and the second line resembling the outer contour – Precise vertical incisions on the crest of the ridge and insertion of zirconium titanium implant with zirconium neck according to surgical protocol – All exposed threads of titanium parts augmented with corticocancellous bone mix – Soft tissue enhancement achieved using collagen Derma®, fashioned around the implant neck and extended to cover all the augmentation material – Careful suturing technique to maintain the flap – All patients evaluated clinically and measurements of the defects through models is performed 4 months post-operatively – All patients evaluated radiographically – All patients received definitive final restoration – Descriptive statistics was expressed as mean + and standard deviation (SD). Soft tissue defects was calculated preoperatively and 4 months postoperatively.

Results: In this prospective study all implants were successfully osseointegrated, the mean value of buccal bony defects significantly reduced from the base line-3.4 + 0.49 to the 4 months post -operative 1.58 + 0.49. Significant increase in the keratinized mucosa is observed around zirconium neck and sound interdental papilla is observed.

Conclusions and clinical implications: Within the limitation of this study concerning the sample size the use of zirconium titanium implant with simultaneous bone augmentation and soft tissue enhancement using collagen Derma may provide a one step surgery to correct buccal bony defects with predictable outcome further studies and other measurements of the defects can be conducted in the future to document the procedure.

411 Posters – Tissue Augmentation and Engineering

Relapse and overcorrection in alveolar distraction osteogenesis for dental implant of mandible

Masahiro Iwata, Atsushi Murayama, Toshihiro Nishioka, Yoko Asai, Hiromi Kasai
Kishiwada Tokushukai Hospital, Kishiwada, Japan

Background: Vertical alveolar distraction osteogenesis is an efficient method for augmentation prior to inserting dental implants. But a relapse of the transport segment and decrease in bone height before implant placement is common.

Aim/Hypothesis: 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.

Material and methods: The subjects were 25 patients, ranged in age from 21 to 52 years with the defect of the mandible (19 males and 6 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. Mean alveolar distraction was 11.5 mm. The mean relapse was 21% (13–27%) after the end of consolidation. One month after distractor removal, 10 patients were performed implant placement (Group A).

Results: The mean relapse was 5% (1–7%) at implant placement. On the other hand, 15 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 27%. In Group A, the need for overcorrection was more than Group B, more than 34%.

412 Posters – Tissue Augmentation and Engineering

Alveolar ridge augmentation using vascularized interpositional periosteal-connective tissue (VIP-CT) flap: two case reports

Seong-Yong Jeong, Keun-Ho Kwon, Seok-Mo Heo
Chonbuk National University, Jeonju, Korea

Background: The subepithelial connective tissue graft is an effective procedure for soft tissue augmentation. Compared with the free soft tissue graft that usually accompanies considerable secondary retraction of the overlying tissues, the pedicle tissue graft allows migration of large soft tissues by sustaining continuous blood supply in the graft region. One of novel soft tissue augmentations using pedicle graft is vascularized interpositional periosteal-connective tissue (VIP-CT) flap. The advantages of the VIP-CT graft are as follows: (1) a large volume of soft tissue augmentation at esthetic sites with a single procedure; (2) intact vascular supply; (3) excellent esthetic blending at the recipient site; (4) minimal postsurgical shrinkage; (5) primary closure of the donor site; (6) dramatically reduced treatment time and patient inconvenience; and (7) enhanced bone graft maturation.

Aim/Hypothesis: After a tooth extraction, a substantial amount of alveolar bone resorption takes place, and consequently, the deficient alveolar ridge may result in patient's esthetic concerns and functional discomforts. Therefore, various methods to augment the alveolar ridge have been proposed in literature. The purpose of the present case reports is to observe a healing process of the alveolar ridge augmentation with the use of the VIP-CT flap on the resorbed alveolar ridge after the extraction of teeth.

Material and methods: Two patients who had shown severe alveolar ridge resorptions after the extraction of teeth were selected. Two buccal vertical incisions are extended onto palatal surface at both mesial and distal aspects of the recipient site. The VIP-CT flap was harvested from the hard palate by a horizontal incision extending to the distal aspect of the second premolar. The flap was then grafted on the recipient bed in the deficient alveolar ridge with elevation of the periosteal connective tissue pedicle.

Results: At the recall examinations, all cases showed considerable volume increase in the deficient alveolar ridge after the VIP-CT flap. The patients were satisfied with the restoration that fulfilled their functional and esthetic demands.

Conclusions and clinical implications: The present study suggests that the alveolar ridge augmentation using the VIP-CT flap is a technically demanding yet effective treatment option for the severely resorbed alveolar ridge showed after the extraction of teeth.

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Minimally invasive lateral ridge augmentation using a subperiostal tunnel technique

Ashish Kakar,[1] Michael Koehli,[2] Kanupriya Kakar,[1] Stefan Stübinger,[3] Harsh Mahajan[4]
[1]Global Health Research Group, New Delhi, India, [2]Degradable Solutions Ag, Schlieren, Switzerland, [3]CABMM, University of Zurich, Zurich, Switzerland, [4]Mahajan Imaging Center, New Delhi, India

Background: Traditional surgical techniques to correct ridge deficiencies include: Guided Bone Regeneration, Onlay Block

Grafts, ridge splitting, forced eruption and distraction osteogenesis. Subperiostal grafting (tunnel technique) for ridge augmentation has been described as a safe, patient-friendly method to augment bone. It utilizes a small incision with minimal tissue dissection and flap reflection to gain access to a defect site without distorting the soft tissue profiles. This approach tends to reduce post-operative pain, discomfort and swelling.

Aim/Hypothesis: The objective of this study was to evaluate this technique for lateral augmentation (tunnel technique) of the atrophied mandibular ridge using *in situ* hardening synthetic bone graft substitutes.

Material and methods: Patients requesting dental implant placement in mandibular posterior areas were included in this monocentric, prospective case series. A subperiostal tunnel was elevated using a single vertical incision placed mesially to the region to be augmented. The recipient bone was thoroughly decorticated, and the alveolar contours were reconstructed using moldable bone graft substitutes that harden *in situ* (easy-graft, Degradable Solutions AG, Switzerland). Ridge width and height before and 5.3 ± 0.9 months after augmentation were compared using cone-beam computer tomography (CBCT) scans. Width was measured 4 mm and 7 mm below the ridge crest. Trephine drill cores taken during implant placement were analyzed histologically. Data are given as mean ± SD.

Results: Four atrophied mandibular ridges (width at 4 mm: 8.8 ± 1.8 mm, at 7 mm: 11.2 ± 1.0 mm) in three patients (58 ± 16 years) were augmented. The tunnel approach appeared to reduce post-operative pain, swelling and discomfort in comparison to more invasive augmentation techniques. Healing was uneventful. Radiologically, the ridge width gain was 2.2 ± 1.8 mm (range: 0.2–3.9 mm) at 4 mm and 1.0 ± 1.8 mm (range: 0.6–3.3 mm) at 7 mm. Vertically, 0.6 ± 0.3 mm (range: 0.3–1.0 mm) were gained. In three ridges, a relevant ridge gain (3–4 mm) was attained. No gain was observed radiologically in one ridge. At surgical re-entry at 22–30 weeks after augmentation, graft consolidation and increased alveolar width was evident. The regenerated hard tissue was firm, variable drilling resistance was experienced during implant site preparation. All planned implants were placed without need for additional grafting. Histologically, incorporation of biomaterial particles revealed an undisturbed healing with conspicuous new bone formation. A close contact between biomaterial and bone was visible on Clinical re-entry. At the interface no soft or granulation tissue was obvious.

Conclusions and clinical implications: Subperiostal augmentation is a minimally invasive alternative to bone block transplantation or guided bone regeneration for lateral augmentation in the mandible. The promising results warrant further investigations, to clarify the influence of biomaterial resorbability on width gain, failure rates, potential and limitations of the technique.

414 Posters – Tissue Augmentation and Engineering

Effects of FGF-2 guided bone augmentation beyond the skeletal envelope within a plastic cap in the rat calvarium

Risa Kigami, Shuichi Sato, Noriko Tsuchiya, Tomohiro Yoshimaki, Yoshinori Arai, Koichi Ito
Nihon University, Tokyo, Japan

Background: Several growth factors have recently received attention because of their ability to actively regulate various cellular functions of bone regeneration. Basic fibroblast growth factor (FGF-2) is a highly potent mitogen for cells of mesodermal origin and has been shown to induce bone regeneration, which is a crucial activity for the enhancement of wound healing. Furthermore, *in vivo* studies have demonstrated that a topical application of exogenous FGF-2 also enhanced the healing process of bone fracture. Osteogenesis have been established as important factors in skeletal healing.

Aim/Hypothesis: The purpose of this study was to evaluate the effect of basic fibroblast growth factor (FGF-2) to promote bone augmentation beyond the skeletal envelope in rat calvarium.

Material and methods: A total of 20 male Fisher rats were exposed and two plastic caps were placed with 0.3% or 0.1% FGF-2 with a collagen sponge (ACS) or ACS alone in the calvarium. Micro-CT and histological sections were used to obtain amount of bone augmentation within the plastic caps repeated from 1 to 12 weeks after surgery. Bone volume (BV) was calculated using BV-measuring software.

Results: The newly formed BV of bone augmentation area in 0.3% and 0.1% FGF-2 were significantly increased compared to the control groups at 12 weeks. However, there was no significant difference between the 0.3% and 0.1% FGF-2 groups.

Conclusions and clinical implications: These results suggest that 0.3% and 0.1% FGF-2 in ACS enhance bone augmentation beyond the skeletal envelope in rat calvarium.

415 Posters – Tissue Augmentation and Engineering

Vertical reconstruction of alveolar ridge with sandwich osteotomy using interpositional heterologous cancellous collagenated block

Miha Kocar
Department of Oral and Maxillofacial Surgery, University Clinical center Ljubljana, Ljubljana, Slovenia

Background: Sandwich osteotomy with interpositional graft (SOIG) is well known method to gain vertical bone dimension. Loss of teeth due to failed treatment consequently means resorption of alveolar bone.

Aim/Hypothesis: The aim of study is to find out if heterologous cancellous collagenated block (HCCB) is suitable for

SOIG to reconstruct a sufficient amount bone for proper insertion of implants.

Material and methods: Reconstruction with SOIG was done at five patients (2 male, 3 female), average age was 42 (26–52). Tooth were lost due to failed endodontic (4) and periodontal (5) treatment. After healing period clinical examination and cone beam computed tomography (CBCT) were done. It was found out that at 9 regions 4–7 mm (average value 5.3 mm) of bone was needed for rehabilitation at mandible (4/4/5/5 mm) and maxilla (5/5/6/7/7 mm). In general (4) or local (1) anesthesia osteotomy and downfracture of residual bone were done. HCCB (Sp-Block, Osteobiol, Tecnoss) was shaped with dimension before insertion and fixation with mini plate between stable and movable segment. In all cases resorbable membranes were used to protect of HCCB. Removable segments height were 3–5 mm. Antibiotics were prescribed for 10 days. According to the protocol radiographs were done. After 20 weeks, mini plates were removed and implants (Ankylos, Dentsply-Friadent) were inserted in mandible (4) and maxilla (5) with additional guided bone regeneration (GBR) to gain horizontal dimension of residual alveolar ridge. Implants were uncovered 4 months later and prosthetics were delivered by protocol.

Results: With SOIGH bone deficiencies was gained (average value 5.1 mm) and gave us conditions for rehabilitation with dental implants. In all cases guided bone regeneration (GBR) were needed at time of implantation. All of them were osseointegrated. One HCCB in maxilla was removed due to non-integration but caudal segment was so stable to allow implantation with GBR.

Conclusions and clinical implications: In all 5 cases with SOIGH vertical deficiencies of alveolar ridge were corrected. HCCB has good physical properties for shaping with rotated instruments. The establish height of alveolar ridge made the insertion of dental implants possible. Improvement of horizontal dimension was established with GBR. Reason for non-integrated HCCB could be perforation of palatal periosteum due too deep insertion of it at the time of SOIGH.

416 Posters – Tissue Augmentation and Engineering

Ridge preservation using *in situ* hardening bone graft substitutes: comparison between a β-TCP and a biphasic calcium phosphate material

Minas Leventis,[1] **Peter Fairbairn**,[2] Orestis Vasiliadis,[1] Annette Lindner,[3] Heiner Nagursky[3]

[1]Department of Oral and Maxillofacial Surgery, Dental School, University of Athens, Athens, Greece, [2]Periodontology and Implant Dentistry, School of Dentistry, University of Detroit Mercy, Detroit, USA, [3]CTA – Cell Tissue Analysis, Department for Oral and Maxillofacial Surgery, University Clinic of Freiburg, Freiburg, Germany

Background: Beta tri-calcium phosphate (β-TCP) and biphasic materials consisting of hydroxyapatite (HA) and β-TCP represent the most commonly used synthetic bone grafts. Coating the synthetic graft granules with polylactide can enhance the handling properties of the material and produce an *in situ* hardening, stable and porous bone graft substitute.

Aim/Hypothesis: To present a clinical case where ridge preservation was achieved by utilizing *in situ* hardening synthetic bone graft substitutes without primary soft tissue closure.

Material and methods: In a female 60 years old patient four maxillary teeth were atraumatically extracted. Two sockets were grafted with *in situ* hardening coated β-TCP (easy-graft CLASSIC, Degradable Solutions AG, Schlieren, Switzerland), one socket was treated with *in situ* hardening coated biphasic calcium phosphate (60% HA/40% β-TCP) (easy-graft CRYSTAL, Degradable Solutions AG, Schlieren, Switzerland) and one socket was filled with both materials. Implants were placed 3 months after extraction. Bone core biopsies were obtained from the grafted post-extraction sites during implant bed preparation and submitted to non-decalcified hard tissue histological analysis.

Results: At surgery both materials showed excellent handling characteristics. After grafting, upon contact with blood, they hardened into a stable scaffold. Primary closure of the sockets was not necessary. After 3 months clinical examination revealed excellent soft-tissue healing, preservation of the ridge contour and no loss of attached keratinized gingiva. Radiological evaluation with CBCT showed a marked radiopacity at the site treated with the biphasic material compared to the sites where β-TCP was used. Post-extraction sites were filled with newly formed bone that could support implant placement. Residual particles were visible. Histological analysis revealed newly formed cancellous bone and bone graft substitute remnants.

Conclusions and clinical implications: The results of this case showed that socket grafting with *in situ* hardening synthetic materials without primary wound closure can preserve the architecture of the alveolar ridge and produce sufficient amounts of vital bone to support implant placement after a 3-months healing period.

417 Posters – Tissue Augmentation and Engineering

Socket preservation in molar sites without primary wound closure: a clinical study

Minas Leventis,[1] Orestis Vasiliadis,[1] Peter Fairbairn,[2] Vasileios Margaritis,[3] Demos Kalyvas[1]

[1]Department of Oral and Maxillofacial Surgery, Dental School, University of Athens, Athens, Greece, [2]School of Dentistry, University of Detroit Mercy, Detroit, MI, USA, [3]School of Health Sciences, Walden University, Minneapolis, MN, USA

Background: Socket grafting without primary wound closure is proposed as a minimally invasive technique that prevents the loss of both soft and hard tissues after tooth extraction.

Aim/Hypothesis: To evaluate clinically the efficacy and predictability of grafting large intact post-extraction sockets in molar sites with beta tri-calcium phosphate (β-TCP) in a calcium sulphate matrix without primary wound closure over a 3-month healing period.

Material and methods: In 10 patients, 10 single extraction sites in the molar area were grafted with β-TCP in a calcium sulphate matrix (Biocomposites®, Etruria, Stoke-on-Trent, England) after atraumatic extraction without raising a flap. In all cases the material was covered with a collagen fleece and a cross-mattress suture was loosely placed over to stabilize the wound without obtaining primary closure. Soft tissue healing was evaluated and documented with clinical photographs in a daily basis. Contour changes of the ridge were measured with a caliper after extraction and at implant placement after 3 months.

Results: The use of β-TCP in a calcium sulphate matrix as a grafting material provided a stable scaffold that, although left uncovered, deterred the ingrowth of unwanted soft tissue, allowing newly formed keratinized soft tissue to proliferate over the healing grafted sockets and gradually cover the sites. After 3 months clinical evaluation revealed excellent soft tissue healing without loss of attached gingiva in all cases. At baseline, the mean width of the alveolar ridge was 12.85 ± 2.31 mm, while at implant placement the ridge measured an average of 11.35 ± 2.56 mm, corresponding to a mean resorption of 1.5 ± 0.58 mm. Upon re-entry, all sites were filled with newly formed bone like hard tissue in continuity with the native bone, that could support implant placement. Residual particles were visible.

Conclusions and clinical implications: The results of this clinical study suggest that grafting of molar post-extraction sites without primary wound closure can be an effective minimally invasive method of preserving the contour and architecture of the alveolar ridge. The handling properties and the hardening characteristics of the grafting material seem to be of great importance for the stability of the healing site and the success of the technique.

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Tissue engineering in a new calcium phosphate cement doped with silicate ions in combination with adipose derived stem cells

Julia Lucas-Aparicio,[1] Jatsue Cabrejos-Azama,[2] Mohammad Alkhraisat,[2] Carmen Rueda-Rodriguez,[2] Luis Blanco-Jerez,[1] Enrique López-Cabarcos[2]

[1]Departamento de Estomatologia III, Facultad de Odontologia, UCM, Madrid, Spain, [2]Departamento de Quimica-Fisica II, Facultad de Farmacia, UCM, Madrid, Spain

Background: Silicon is an essential trace element for metabolic processes associated with the development of bone and connective tissues. The substitution of phosphate ions by silicate ions in calcium phosphate cements may enhance the implant-tissue interaction favoring their bone regeneration. The development of an efficient scaffold that permits stem cells proliferation and differentiation toward target cells to regenerate tissue loss could make a breakthrough in Regenerative Medicine. The abundant and accessible, adipose-derived stem cells (ADSCs) may prove to be desirable cell therapeutics for bone repair and regeneration. Studies have shown that ADSC have similar immunophenotype, multilineage potential, and transcriptase as the bone marrow derived mesenchymal stem cells (BMSC).

Aim/Hypothesis: We fabricated silicon-doped calcium phosphate cements (Si-CPC) in combination of rabbit adipose-derived stem cells that may improve *in vivo* performance.

Material and methods: Silicon-doped calcium phosphate ceramics were mixed with acidic calcium phosphate to produce inorganic matrix of brushite and calcium silicate hydrate. The characterization of the materials was carried out using X-ray diffraction patterns. Adipose stem cells were obtained from subcutaneous adipose peritoneal tissue site of New Zealand White rabbits. We use the standardized protocol for ADSC isolation. The cements were tested *in vivo* as bone substitutes in two titanium cylinders that were fixed into perforated slits made on the parietal cortical bone of each rabbit. One cylinder was filled only with Si-CPC and the other was filled with Si-CPC and ADSCs. Eight weeks after the intervention, the animals were sacrificed and biopsies were taken. Then we analyzed bone tissue augmentation around the cements particles.

Results: The X-ray diffraction indicates the formation of a cement composed of crystalline elements (brushite and hydroxylapatite) and calcium silicate hydrate (C-S-H). The *in vivo* results were assessed by histological evaluation. They showed the bone substitutes to interact efficiently with surrounding bone and in addition Si-CFC with ADSCs induces the formation of more bone tissue.

Conclusions and clinical implications: We think the development of biomaterials with silicon ions with ADSCs have a positive influence on hard tissue. We can conclude that this new cement system could be a promising material in bone engineering.

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Beta-tricalcium phosphate with or without BMP-2 in the production of collagen matrix in rats calvarial defects

Eloá Luvizuto, Cassiano P. Tetuo Okamoto, Sônia R. Panzarini, Celso K. Sonoda, Francisley A. Souza, José A. De Oliveira Roberta Okamoto

University Estadual Paulista – UNESP, Araçatuba Dental School, Araçatuba, Brazil

Background: Biomaterials has been extensively studied and used as bone substitutes for periodontal bone regeneration.

The osteoinductive capacity of bone morphogenetic protein – 2 (BMP-2) constitutes important advance in research of bone regeneration. However carriers and frameworks are essential to maintain the osteoinductive properties of BMPs.

Aim/Hypothesis: The aim of this study was to evaluate the biological role of BMP-2 associated or not with beta-tricalcium phosphate (TCP) carrier in the process of bone regeneration in surgically created cavities in rats calvaria.

Material and methods: Single critical size defects (5-mm-diameter) treated with β-tricalcium phosphate either alone or in the presence of 5 μg of BMP-2 was evaluated after 5, 15 and 30 postoperative days. Untreated defects served as control. The analysis of the biological mechanisms involved in bone regeneration was obtained by histomorphometry and immunohistochemistry analysis, through the expression of collagen type I (Col-I) and metalloproteinase-9 (MMP-9) proteins which are involved in the process of osteoconduction and osteoinduction denoted by collagen matrix formation, bone resorption and mineralization.

Results: Histological analysis and Col-I expression showed increased formation of collagen matrix leading to higher percentage of bone volume per tissue volume, bone substitute volume per tissue volume and mineralized volume per tissue volume of pure TCP group compared to other groups. BMP-2 supplementation caused faster remodeling process of TCP, but no difference was statistically significant comparing the amount of bone formation between the two groups of TCP.

Conclusions and clinical implications: Bone formation in the presence of TCP alone reached a maximal level, as BMP-2 supplementation failed to enhance bone formation however, further studies should be conducted with the TCP to unveil its osteoconductive potential, as well as other concentrations of BMP-2 and other carriers should be tested in order to consistently add to its osteoinductive capacity in the dynamics of bone regeneration.

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Success of implant placement in an autogenous bone block grafting in a patient with osteoporosis: a case report with 3 years of follow-up

Carolina Mandetta,[1] Carolina Dantas,[1] Vitória Tosta,[2] Rodolpho Valentini Neto,[3] Danilo Reino,[1] Sérgio De Souza,[1] Paulo Faria[2]

[1]School of Dentistry of Ribeirão Preto – University of São Paulo, Ribeirão Preto, Brazil, [2]UNAERP, Ribeirão Preto, Brazil, [3]School of Dentistry of Araçatuba – FOA, Araçatuba, Brazil

Background: The use of autologous bone grafts with dental implants is a well-accepted procedure in oral and maxillofacial rehabilitation. Bisphosphonates are biochemical modifiers of bone resorption that are frequently used in the treatment of osteoporosis and are associated with osteonecrosis of the jaw in cases of tooth extraction. However, clinical studies have been demonstrating that dental implant placement is a safe procedure associated to bisphosphonate therapy. Thus, no definitive guideline has been widely accepted, especially for patients undergoing implant-related surgeries such as autogenous block grafting.

Aim/Hypothesis: This case report presents the survival and success of dental implants placed in alveolar bone following augmentation using intraoral block bone grafts in a patient with osteoporosis using alendronate.

Material and methods: A 63 years old non-smoker female, presenting tooth loss and a limited bone volume in the posterior mandible left side wanted an implant-supported prosthesis. The patient reported having osteoporosis and was using alendronate for 30 days. Autogenous bone block grafting was planned to augment the ridge. Particulate grafting material (Bio-Oss®) was added to the space left around the block to fill in voids between the graft and the recipient site, and a collagen membrane (Bio-Gide®) was used to cover the grafted site. The following medications were prescribed: Amoxicylin 500 mg + Clavulanic acid 125 mg 3×/day for 10 days, starting 1 day before the surgical procedure; Ibuprofen 200 mg 4×/day for 3 days and Periogard® rinse 2×/day for 15 days. Healing was uneventful with no membrane exposure or other complications. Implants were successfully installed 6 months after ridge augmentation, and were loaded 3 months after placement. Follow-up period comprised clinical and radiographic evaluations up to 3 years after bone block grafting. Bone height and thickness were evaluated in computerized tomographic slides performed pre-surgically, 6 months and 3 years after surgery.

Results: The bucco-lingual width of the ridge increased from 2.75 to 6.75 mm, allowing placement of three dental implants with 4.0 mm-diameter. The patient showed proper healing of both donor and recipient sites. No osteonecrosis was noticed during the follow-up period.

Conclusions and clinical implications: An intraoral bone graft from the mandibular ramus may be a good treatment modality for ridge augmentation, even in osteoporosis patients using alendronate.

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Bone preservation in an extraction socket using a new nanocrystalline synthetic graft paste: Microtomographic and histological analyses in human

Rafael Mantovani, Leandro Alves Da Costa, José Gabarra Jr, Tulio Pignaton, Valdir Muglia, Sergio Scombatti De Souza

USP, Ribeirao Preto, Brazil

Background: After tooth extraction morphologic changes in healing sockets leads to an inevitable vertical and horizontal

reduction in both buccal and lingual bone walls. The fresh extraction socket in the maxillary anterior region remains a clinical challenge in obtaining esthetic results. Alveolar ridge preservation procedures can be used for maintenance of ridge volume simplifying subsequent treatment procedures, especially when the buccal plate is damaged.

Aim/Hypothesis: This pilot human case report presents a ridge preservation procedure with a new synthetic biomaterial used in a fresh extraction socket in the aesthetic zone, with microtomographic and histological analyses of the newly formed bone.

Material and methods: A 62 years old non-smoker male, presenting a residual root from a superior left cuspid decided to replace it by an implant. The patient had no systemic health conditions that could affect the surgical procedure, and signed an informed consent form authorizing all procedures and scientific documentation. The residual root was carefully extracted with a periotome and a thin and damaged buccal plate remained. A guided bone regeneration procedure was conducted using a nanocrystalline synthetic graft paste (Reprobone Novo®) covered by a collagen membrane (Biomend®), aiming to preserve ridge volume for future implant placement. The flap was sutured to entirely cover the membrane and the following medications were used: Amoxicylin 500 mg + Clavulanic acid 125 mg 3×/day (8/8 h) for 11 days, starting 24 h before surgery; Ibuprofen (Advil) 200 mg 6/6 h for 5 days; PerioGard® rinse twice a day (12/12 h) for 15 days. Healing was uneventful with no membrane exposure or other complications. After 6 months the area was reopened and before placing an implant a bone biopsy was collected for microtomographic and histological analyses.

Results: Clinically, new mineralized tissue can be seen in the previous dental socket and no evidence of remaining biomaterial could be seen. During perforation, the newly formed bone was clinically classified as type 2 and implant was inserted with a final torque of 35 N. The biopsy microtomographic analysis presented 45% of trabecular bone and 6.85% of the remaining synthetic bone graft paste (both in volume). Histological analysis showed new woven bone and scarce biomaterial remaining.

Conclusions and clinical implications: This pilot case suggests that the synthetic graft paste favours a significant amount of bone formation and presents a low residual graft material after 6 months; in this way, it may be a viable alternative for bone preservation in fresh extraction sockets.

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The use of self-inflating soft tissue expanders prior to bone augmentation of atrophied alveolar ridges

Christian Mertens
University of Heidelberg, Heidelberg, Germany

Background: Extensive bone augmentation procedures are frequently performed prior to implant surgery. To achieve tension-free wound closure at the grafted site and thus avoid dehiscence and exposure or total loss of the bone graft, extensive soft-tissue mobilization is required. *In vitro* studies have shown the potential of self-filling osmotic tissue expanders to optimize the amount of resulting soft tissue and vascularization of the recipient site.

Aim/Hypothesis: The purpose of this prospective clinical study was to evaluate the application and complication rate of osmotic hydrogel expanders inserted subperiosteally prior to bone grafting.

Material and methods: In this prospective observational study eight patients were implanted with 11 intraoral osmotic hydrogel expanders prior to bone augmentation procedures. All expanders were placed in subperiosteal positions using the tunnel technique. The occurrence of soft tissue-related complications such as necrosis, perforation, infection or wound dehiscence leading to expander loss was defined as the primary parameter for analysis and evaluation. Further clinical parameters were soft-tissue quality and quantity as well as expansion duration.

Results: The expansion time depended upon defect size and expander dimensions. Complications, i.e. perforation of the expanders through the oral mucosa occurred in two patients (3 expanders) who suffered from extreme preoperative scarring in the treated areas due to prior trauma in one patient and cleft surgery in the other. All remaining patients were grafted with autologous ($n = 5$) or synthetic block grafts ($n = 2$). The expanders were removed during bone grafting surgery. No further dehiscence occurred during the observation period and all patients were treated successfully with dental implants and subsequent prosthetic reconstruction.

Conclusions and clinical implications: Within the limits of this observational clinical study, hydrogel expanders may help to generate additional soft tissue and they might contribute to the overall improvement of the bone augmentation process by reducing the risk of complications related to the lack of soft tissue.

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Guided bone regeneration on posterior mandibular with atrophy using PTFE high density membranes

Gustavo Molina,[1] Manuela García Díaz,[1] Ismael Rodríguez,[2] Enrique Fernandez Bodereau,[2] Daniel Torassa[1]
[1]*Universidad Católica de Córdoba, Córdoba, Argentina,* [2]*Facultad de Odontología, Universidad Nacional de Córdoba, Córdoba, Argentina*

Background: Absence of teeth on the mandibular posterior area may generate a thin ridge displaced towards the tongue, making implant rehabilitation of the mandibular posterior area more difficult. As an attempt to overcome the problem, an ongoing prospective clinical study proposes a regeneration

technique destined to modify the width of the atrophic mandible in the posterior area.

Aim/Hypothesis: A guided bone regeneration technique on posterior mandibular with atrophy using PTFE high density membranes helps to increase the width of the atrophic mandible in the posterior area.

Material and methods: Ten partially toothless female patients, aged 38 to 63 (mean 53) years old, with ridges <3 mm width and resorption process of more than 2 years after the last tooth extraction were included in the study. For carrying out the regeneration process, a ridge crest incision was performed over the ridge without additional incisions. The ridge width was measured with a gauge at two points of the toothless area. An average of both horizontal measurements was found. An allograft (Lifenet Oragraft demineralized bone allograft, Mineross, mineralized bone allograft) was applied for augmenting the ridge and protected by a high-density PFTE membrane (Regentex TXT 200 Cytoplast). Suture was removed fifteen days after surgery and the membrane, fifteen days later. After 5–6 months, a second surgery was performed for implant placement. Ridge widths were measured before installing the implants, using the same references to assess the outcome of regeneration obtained. Clinical and radiographic follow up was carried out at 12, 24, 36 and 48 months after placing the implants. Data was described through mean values (±SE). Student's t-test for paired data was used to assess the difference among mean values observed at the different times studied. Statistical significance was calculated for $P < 0.05$.

Results: In all cases, ridge width augmentations of 3.5 to 5 mm were observed. The mean alveolar ridge width post augmentation was 6.5 mm, showing a significantly increase between the beginning of the procedure and the second surgery ($P < 0.0001$).

Conclusions and clinical implications: Treating resorbed ridge bone tissue with a lingualized crest position in the distal extension of the mandible is a challenge that can be treated with the technique described in this study. The use of the regeneration technique showed ridge width augmentation and made it possible to rehabilitate the areas mentioned with implant supported restorations.

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Influence of nicotine and ovariectomy on healing process of autogenous bone block grafts in the mandible: a histomorphometric study in aged rats

Ricardo Oliveira Moraes,[1] **Edilson José Ferreira**,[1] Marcos Rikio Kuabara,[1] Bruno Vieira,[1] Jéssica Lemos Gulinelli,[1] Renato Gomes,[1] Sueli Sumyassu,[1] Juliano Milanezi Almeida,[2] Danielle Shima Luize,[2] Samara Bonfante[2]
[1]*Imppar, Londrina, Brazil,* [2]*Unesp-Araçtuba Araçatuba Brazil*

Background: The factors that may affect the repair of bone grafts could say the estrogen deficiency and cigarette smoking.

Aim/Hypothesis: The aim of this study was to perform qualitative and quantitative analyses of the effect of ovariectomy and nicotine on autogenous bone block grafts in aged rats and to describe events in the initial healing.

Material and methods: Thirty six 12-month-old female Wistar rats were randomly divided into two groups according to treatment. The experimental group was realized ovariectomy surgery and daily applications with nicotine hemisulfate, while the control group, realized an ovariectomy surgery simulation, without ovaries removing and daily saline solution applications. After 30 days of these procedures was done, in both groups, the autogenous bone block grafts on the angle of mandible, harvested from the calvaria. The animals keep receiving the solutions until moment of euthanize at, 7, 14 or 28 days postoperatively.

Results: The histologic analysis in the experimental group showed a delay in the osteogenic activity in the interface of graft-receptor bed as well as the lower in the organization of granulation tissue. The specimens of experimental group exhibited less bone neoformation and it was poorly cellularized and vascularized. The statistical analysis revealed significantly less bone formation in the experimental group at 14 days (40.92% vs. 57.41%) and 28 days (53.09% vs. 68.35%).

Conclusions and clinical implications: The estrogen depletion and systemic influence of nicotine, although did not prevent, delayed the healing process of autogenous bone block grafts in aged rats.

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Oral rehabilitation using dental implants with distraction osteogenesis after reconstruction in patients with malignant tumor: Report of three cases

Heekyun Oh
Chonnam National University, Gwangju, Korea

Background: Previous treatment for mandibular cancer mainly focused on a wide surgical excision followed by reconstruction using free flap without functional and facial appearance recovery. Recently, however, as oral cancers occur not only in older people but also occur in young people from age of 20–30, reconstruction surgery to rebuild surgically removed mandible to previous condition has become very important. Particularly, as dental implant has become popular, increased number of prosthodontic treatment via dental implant are provided to mandibular cancer patients.

Aim/Hypothesis: This case report was to done to evaluate the reconstructed mandible using free fibular flap and DO for implant placement after segmental mandibulectomy in malignant tumor patients.

Material and methods: Three patients received tumor ablation surgery and reconstruction with vascularized fibular free flap. After 4–6 days of latency phase, distraction protocol was per-

formed at a distraction rate of 0.8–1.2 mm per day. A 12–18 weeks consolidation phase followed. Afterward the distraction device was removed, 5 implants, 10 implants and 10 implants were placed in the distracted area to each patient. Implant second surgery and prosthodontics treatment was done 4–6 months after the implant installation. Vestibuloplasty with palatal mucosal graft and/or apically repositioned flap was done if necessary.

Results: The mean latency period was 4.67 ± 1.15 days and the mean consolidation period was 139.67 ± 37.87. The gained bone heights were 9.3, 11.5, 12.0 mm in three patients respectively. Slight buccal bone defects were observed on the buccal side of distracted gap in two patients, and bone graft was done at the time of implant installation. During 1–4 years follow-up period after the loding, the augmented alveolar bone maintains its height and all implants which were placed in the distracted mandible are well survived without marginal bone resorption.

Conclusions and clinical implications: In our cases, dental rehabilitation using free fibular flap reconstruction and distraction osteogenesis after surgical excision of mandibular cancer showed promising results. Especially, prosthetic treatment after implant installation has recovered previous appearance and function of patients.

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A study on volume stability of hydroxyapatite ß-tricalcium phosphate biphasic material in maxillary sinus floor elevation

Jooyoung Ohe, Yong-Dae Kwon, Baeksoo Lee
[1]Dental Hospital, Kyunghee University, Seoul, South Korea

Background: When maxillary posterior tooth replaced after extraction, edentulous posterior alveolar ridge are severely and irreversively resorbed. Because of such reduced maxilla, prosthodontics rehabilitation with dental implants often fails due to an insufficient bone supply. Sinus floor elevation (SFE) became widely accepted as a routine method. Graft materials for the SFE should be something that can achieve rapid new bone formation with volume stability. Although autogenous bone is gold standard for bone augmentation, it has disadvantages that are potential side effects in the donor sites and resorption of grafted bone. Allograft, xenograft materials also have disadvantages as potential cross-infection, transmission and antigen-antibody reaction. A mixture of Hydroxyapatite (HA) & ß-Tricalcium Phosphate (ß-TCP) is the popular combination of BCP. Graft materials for the maxillary SFE should be something that can achieve rapid new bone formation with long-term volume stability for the implant success. Due to repneumatization of the maxillary sinuses, the grafted volumes may adapt considerably in shape and volume. On this account, precise measurement method of the change of the augmented bone is one of the most important factors for successful implant treatment, as loss of graft height and width might affect the long-term success of implants inserted into the grafted maxilla.

Aim/Hypothesis: The purpose of this study is to confirm volume stability of biphasic calcium phosphate (BCP) through the changes of grafted volume over the time by 3D-CT analyzing software program.

Material and methods: Fifteen patients, 16 sinuses who were scheduled a staged implantation through sinus floor elevation (SFE) – lateral window technique from 2009 to 2011 were included in the study. Of the 15 patients, 8 were male and 7 were female (mean age 50.1). For sinus floor augmentation, BCP with PRF was packed loosely into the Mx. sinus and the grafted site was covered with a collagen membrane. For the evaluation of volume change, 3D-CBCT scans were taken 5 times at pre-operatively (To), post-op 1 week(T1), 1 month (T2), 3 months(T3) and 6 months(T4). Analysing device was Alphard VEGA (Asahi Roentgen Ind. Co., Ltd., Japan).

Results: 84.32% grafted BCP is maintained until post-op 6 month (T4) and the average volume loss is 207.7 mm^3 (about 0.21 cc). Statistically, a significant volume change (decreasing) is observed in 3 groups (T2-T1, T3-T2, T4-T3).

Conclusions and clinical implications: BCP, as a synthetic material, has high volume stability and is a predictable graft material for the successful Sins Floor Elevation. Although some limitations of the 3D analyzing software program, it is a fast, simple, relatively accurate and promising approach to quantifying long-term changes in the grafted area.

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Early osteoinduction of recombinant human bone morphogenetic protein-2 loaded collagenated synthetic bone substitute in rabbit sinus

Jin Young Park
Yonsei University Dental Hospital, Seoul, South Korea

Background: Sinus augmentation procedure to increase bone height in the resorbed maxilla has been successfully performed with satisfactory long-term results. However, extended treatment time and limited bone regeneration of osteoconductive bone substitutes are still problems to be solved. Recombinant human bone morphogenetic protein-2 (rhBMP-2) is known to enhance bone regeneration when used with suitable carrier in order to optimize its delivery.

Aim/Hypothesis: The aim of this study was to determine the osteoinductive effect of collagenated synthetic bone substitute loaded with rhBMP-2 in a standardized rabbit sinus model.

Material and methods: Collagenated bone substitute used as a carrier for rhBMP-2 was composed of biphasic synthetic bone substitute (70% hydroxyapatite and 30% beta tri-calcium phosphate) and natural type I collagen. Bilateral maxillary sinus augmentation was performed in 16 male white rabbits. A circular window was prepared on each maxillary sinus using a trephine

bur (5.5 mm diameter). Following reflection of the sinus membrane, rhBMP-2 loaded carrier of the experimental group was grafted into one randomly selected side and saline-soaked carrier of the control into the other. The animals were sacrificed 2 weeks ($n = 8$) and 4 weeks ($n = 8$) postoperatively. Samples were collected for micro computed tomographic (micro CT) and histological analyses in accordance to three regions of interest (window, middle and Schneiderian membrane). Statistical analyses for the overall grafted area and the regions of interest were performed by T-test and ANOVA, respectively.

Results: Micro CT analysis showed that the total augmented volume was significantly larger in the experimental group than the control at both 2 weeks ($P < 0.05$) and 4 weeks ($P < 0.0001$). Considerable amounts of new bone volume was recorded in the experimental group compared with the control at 4 weeks ($P < 0.0001$). Histological and histometric analysis revealed significantly greater new bone area in the experimental group compared to the control group at 2 ($P < 0.05$) and 4 weeks ($P < 0.01$). In particular, larger proportion of new bone was formed at the membrane region of the experimental group than the control. Area of residual particles was significantly less in the experimental groups than the control in all regions apart from the window area of the 4 week group.

Conclusions and clinical implications: Within the limitations of this study, it can be concluded that the addition of rhBMP-2 increases the total augmented volume and promotes enhanced formation of new bone. In addition, further study should be followed to determine whether rhBMP-2 accelerates degradation of the bone substitute.

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Five year follow-up on usage of porous titanium granules (PTG) in implant dentistry

Ivica Pelivan, Niksa Dulcic
School of Dental Medicine, University of Zagreb, Croatia, Zagreb, Croatia

Background: The use of PTG in dentistry started in 1995, when porous titanium granules were successfully used to enhance bone regeneration in a ridge splitting case of a severely resorbed maxillary dento-alveolar ridge. After that, started a period of using PTG in wide field of dental application such as sinus floor augmentation, peri-implantitis treatment, onlay alveolar ridge augmentation, periodontitis treatment and socket preservation procedures.

Aim/Hypothesis: The aim of this follow-up was to evaluate the possibility of usage of PTG in everyday dental practice as a safe and predictive method for bone augmentation.

Material and methods: This 5 years follow-up report consists of series of clinical cases such as: one-stage sinus floor elevation with simultaneous implant placement in lateral maxilla, onlay alveolar ridge bone augmentation and delayed single implant placement in mandible, bone augmentation of anterior maxilla with simultaneous implant placement and alveolar socket preservation of anterior maxilla. We used Tigran™ PTG White (Tigran, Sweden) as a bone substitute material and XIVE implants (Friadent, Germany) and OSPOL implants (Ospol, Sweden). Following the osseointegration period of 6 months second stage of implant surgery was done and healing abutments were placed. Impressions were taken 14 days after healing abutments were placed. Standard abutments were used as implant build up, and porcelain-fused-to-metal crowns with functionally shaped occlusal surfaces were fabricated.

Results: Regular check-ups patients every 3 months during first year and every six moths during second and third year were done. Radiographs were taken before and immediately after bone augmentation and implant placement procedures, respectively, and after three and 5 years showed regular bone formation without significant bone loss as well as excellent aesthetic and functional results. Sinus floor elevation using PTG and single stage implant placement showed an excellent radiological result and three-dimensional stability over time. PTG, in contrast to bone grafts, are non-resorbable and thus maintain their volume during the period.

Conclusions and clinical implications: The results of 5 year follow-up showed PTG, in contrast to bone grafts, are non-resorbable and thus maintain their volume during the period. Its specific characteristics; commercially pure titanium, porous, irregular and non-resorbable makes it highly biocompatible, offering an exceptional environment for osteoconduction and osseointegration with predictable clinical results.

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Stem cells and alveolar bone regeneration

Alessandro Perini,[1] Giulia Brunello,[1] Nicola Derton,[2] Daniele Botticelli,[3] Mario Berengo,[1] Edoardo Stellini[1]
[1]*Institute of Clinical Dentistry, University of Padova, Padova, Italy,* [2]*Private practice, Treviso, Italy,* [3]*ARDEC-Ariminum Odontologica, Rimini, Italy*

Background: Background: The successful positioning of dental implants requires a sufficient amount of bone. Numerous surgical techniques have been described to augment bone before or in combination with implant insertion. Many findings have been obtained with stem cell-based bone reconstruction techniques. A stem cell is an unspecialized cell with self-renewing and multilineage differentiation properties. They could be classified as embryonic stem cells, adult stem cells, and induced pluripotent stem (iPS) cells. The best-studied adult stem cells are mesenchymal stem cells (MSCs), which play an important role in regenerative medicine thanks to their biological properties, such as multipotency, high proliferation rates, and accessibility.

Aim/Hypothesis: This review discusses the perspectives for bone tissue regeneration and dental implant osseointegration in the field of stem cell-based regenerative medicine.

Material and methods: A pubmed and manual search was conducted, in order to review the current status of regenerative technique based on MSCs employed in dentistry in combination with three dimensional scaffolds. This search was executed with various combination of related keywords. Currently published English-language articles that had employed MSCs in the reconstruction of bony defects in animal and human models were reviewed.

Results: Of the 145 articles found with the keyword regarding the appliance of MSCs in alveolar bone tissue engineering, we considered 25 studies, which completely fulfilled the inclusion criteria for this systematic review. Based on our findings, the most investigated MSCs in this field are dental stem cells, bone marrow stem cells, and adipose stem cells. Substantial differences exist among the studies, such as stem cell sources, type of defects, carriers, scaffolds, and measured parameters.

Conclusions and clinical implications: MSCs in combination with osteoconductive scaffolds and growth and differentiation factors offer a promising construct for the treatment of alveolar bone defects, and seem to enhance a more rapid and significant increase of newly formed bone. These results suggest a potential application of bone-tissue engineering in clinical practice. However, further investigations using comparable study designs and data analysis are needed.

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How much bone loss can be prevented by alveolar ridge preservation?

Bernhard Pommer,[1] Simone Heuberer,[1] Lucas Nahler,[1] Gabriella Dvorak,[1] Georg Watzek[2]
[1]Vienna Medical University, Vienna, Austria, [2]Academy of Oral Implantology, Vienna, Austria

Background: Resorption of alveolar bone following tooth loss represents a major limitation in the use of dental implants. Procedures of ridge or socket preservation have been introduced to maintain bone dimensions and enable prosthetically driven implant positioning, yet circumventing two-stage bone graft surgery.

Aim/Hypothesis: The aim of the present systematic review and meta-analysis was to quantify reduction of alveolar ridge resorption in horizontal as well as vertical dimension (compared to untreated controls) reported in clinical trials on alveolar ridge grafting.

Material and methods: Systematic electronic and hand searches yielded four investigations published between 2000 and 2009 that met the inclusion criteria. A total of 74 ridge preservation procedures and 61 control sites were evaluated 6–7 months after surgery.

Results: Mean loss of bone height and width was 0.3 and 2.5 mm after ridge preservation surgery compared to 1.2 and 3.5 mm in the control group, respectively. Prevention of horizontal shrinkage (mean: 28%, range: 12–55%, OR = 1.6) was significantly less effective ($P = 0.034$) than reduction of vertical bone resorption (mean: 74%, range: 60–88%, OR = 4.9).

Conclusions and clinical implications: Alveolar ridge preservation may be effectively used to increase available bone height and width by 1 mm, on average.

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Functional and esthetic rehabilitation of the patient with unilateral Cleft Lip and Palate: clinical case report

Egor Porosencov, Ion Lupan
State University of Medicine and Pharmacy 'Nicolae Testemitanu' of the Republic of Moldova, Chisinau, Moldova

Background: Despite the modern treatment methods for cleft lip and palate at the stage of implantation it is noticed the deficiency of bone, that indicates that additional late bone grafting is needed after the eruption of permanent dentition for the complete recovery of the dentoalveolar defect.

Aim/Hypothesis: Full rehabilitation of the patient with cleft lip and palate using late bone grafting with autogenous bone, implantation and fixed prosthesis on implant.

Material and methods: A 16 years old female patient presented to our clinic with cleft lip and palate after the orthodontic treatment with complaint of dentoalveolar defect. She did not want the removable prosthesis or dental bridge treatment. After the clinical and paraclinical examinations, we decided to go for late bone grafting with autogenous bone from mandibular symphysis. With Cone Beam Computed Tomography it was seen in the cleft area a thin bone between the roots, the result of the secondary bone grafting, that was not enough for implant placement. The oronasal fistula was not detected. The bone graft from the chin was divided into two plates and fixed with screw from vestibular and palatinal side, around the plates was placed cancellous bone. The wound was closed with the periosteum without using any membrane. After 4 months the Alpha Bio implant was placed and after 3 more months the fixed prosthesis on implant was done.

Results: After 4 months from the late bone grafting radiologically was seen enough bone for implant placement and the final esthetic and functional result was stable after 1 year follow-up.

Conclusions and clinical implications: Late bone grafting is one of the indications before the implant placement in the patients with cleft lip and palate for the esthetic and functional rehabilitation of the dentoalveolar crest and also full integration into society.

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Does the use of grafting material influence the implant stability during trans-alveolar maxillary sinus floor elevation

Dime Sapundziev, Nataša Ihan Hren, Andrej Kansky, Miha Kocar
University Medical Centre Ljubljana, Ljubljana, Slovenia

Background: Trans-alveolar technique for maxillary sinus floor elevation (TAMSFE) is method to gain additional space in atrophic alveolar ridges in posterior regions of the upper jaw to successfully insert dental implants with sufficient length. The use of grafting materials as deproteinized bovine bone mineral (DBBM) or blood cloth (BC) to fill the space under Schneiderian membrane is questionable.

Aim/Hypothesis: The aim was to check the difference of stability during insertion and after osseointegration of implants placed after TAMSFE using DBBM or BC.

Material and methods: In 11 healthy six female and five male patients age 45 to 73 with no evidence of any sinus disease we performed 13 TAMSFE and inserted 13 dental implants. One patient was smoker. The patients were divided in two groups G1 (n = 9) with BC and G2 (n = 4) with DBBM. The primary stability was measured by resonance frequency analyzing (RFA) after implant placement and after osseointegration after four mounts and implant stability quotient (ISQ) was recorded. The patients that received DBBM were on antibiotics for 5 days. Patients with BC did not received antibiotic treatment. The implants were radiographically followed after 1 week, four mounts and once an year. The results were statistically analyzed using repeated measures ANOVA.

Results: The mean residual hight of alveolar ridge was 8.3 mm. The mean height gained after TAMSFE was 3.8 mm in G1 and 3.5 mm in G2. The mean implant length inserted was 11 mm in both groups. On one implant from each group we could not remove the cover screw and ISQ was not possible to measure. In both groups 1 perforation of the Schneiderian membrane occurred. The mean ISQ during implant insertion was 71,7 for G1 and 75,6 for G2. The ISQ after osseointegration was 82,8 for G1 and 81,5 for G2. No implant failure was observed in both groups.

Conclusions and clinical implications: Even thought the obtained ISQ value was higher in the group with DDBM after implant insertion there was no statistically significant difference in the primary stability between two groups. After the osseointegration there were no differences in the ISQ values in both groups. The use of DBBM during implant placement with TAMSFE seams that does not influence the primary implant stability and successful implant outcome. It is the individual preference and experience of the surgeon to decide wether to use DBBM or blood cloth to achieve successful osseointegration and long term maintenance of implants inserted after TAMSFE.

433 Posters – Tissue Augmentation and Engineering

Vestibuloplasty: porcine collagen matrix vs. free gingival graft: a clinical and histological study

Christian Schmitt,[1] Karl Andreas Schlegel,[1] Christian Tudor,[2] Abbas Agaimy,[3] Stefan Eitner[4]
[1]Department of Oral- and Maxillofacial Surgery, University of Erlangen-Nuremberg, Erlangen, Germany, [2]Private Practice, Munich, Germany, [3]Department of Pathology, University of Erlangen- Nuremberg, Erlangen, Germany, [4]Dental Clinic 2, Department of Prosthodontics, University of Erlangen-Nuremberg, Erlangen, Germany

Background: An autologous free gingival transplant (FGT) is currently the gold standard for augmenting small areas of keratinized mucosa. The collagen matrix Mucograft® (MG) represents an alternative to autologous tissue harvesting promising less post surgical morbidities and decreased operation time.

Aim/Hypothesis: This study aimed to compare the CM vs. FGGs for augmenting keratinized peri-implant mucosa, based on clinical and histological evaluations.

Material and methods: The study included 14 patients that underwent a vestibuloplasty, either with a FGG from the palate (n = 7) or with the CM (n = 7). An implant-fixed vestibular retention splint was inserted for 30 days. Follow-up examinations were performed at 4, 10, 30, and 90 days post-surgery. Width of keratinized mucosa was measured in the region of each implant (10th, 30th and 90th day). After 90 days, a biopsy was harvested for histological and immunohistological analyses. To characterize newly formed soft tissue, we stained for tissue and differentiation-specific markers, cytokeratin (CK) 5/6, 13, and 14, to detect presence or absence of keratinization.

Results: The groups showed similar healing, with increased peri-implant keratinized mucosa. The CM group had overall significantly shorter operation times than the FGG group. Both groups showed similar overall shrinkage (CM 32.98% vs. FGG 28.35%) after 90 days. All biopsies showed a multilayered, keratinized, squamous epithelium. Cytokeratins 5/6 and 14 were detected in the basal and suprabasal layers, and spots of cytokeratin 13 were detected in the suprabasal layers. CK expressions in both groups were similar to cytokeratin expression patters of keratinized gingiva.

Conclusions and clinical implications: During the whole observation period, both groups showed comparable clinical and histologic outcomes. This study demonstrated the presence of keratinized gingiva after grafting with Mucograft®. Clinical and histological data indicates that MG seems to be a promising alternative to autologous FGTs for regenerating keratinized mucosa. MG offers less patient morbidity, a shorter operation time, and a more aesthetic outcome.

434 Posters – Tissue Augmentation and Engineering

Vertical ridge augmentation of an atrophic posterior mandible with immediate implant placement: a case report

Gamze Şenol Güven, Gökhan Güven, Gülsüm Ak
Istanbul University, Istanbul, Turkey

Background: Sufficient alveolar bone volume and favorable architecture of the alveolar ridge are essential to obtain ideal functional and esthetic prosthetic reconstruction following implant therapy. Several techniques have been proposed to recreate adequate bone volume and morphology at alveolar edentulous deficient ridges. Guided bone regeneration is a well-documented surgical procedure that was designed to provide atrophic alveolar ridge augmentation. The current challenge in this bone grafting technique is vertical augmentation. Vertical bone grafting is challenging and has a high complication rate. There are two main limitations to vertical grafting; one is the lack of soft tissue to cover the new volume of bone resulting in graft exposure and the second is lack of surface area in contact with the graft to allow incorporation and revascularization.

Aim/Hypothesis: This study aimed to assess vertical bone augmentation with simultaneous implant placement in atrophic posterior mandible using a high-density titanium-reinforced Polytetrafluoroethylene membrane and a combination of inorganic bovine bone and autogenous bone chips.

Material and methods: This case report describes a successful implant prosthetic rehabilitation of an atrophic right posterior mandible in a 56-year-old woman using high – density titanium – reinforced Polytetrafluoroethylene membrane and a combination of inorganic bovine bone and autogenous bone chips which had been harvested from retromolar region using bone scraper. Two tapered implants were placed at augmented area simultaneously, and the vertical defect was measured from crestal height to the neck of the implant. After 6 months of healing, the augmented site was exposed and the membrane was removed, revealing an increase in ridge height. Following the soft tissue healing, the restorative components were placed, impression was taken for permanent prosthesis and metal – ceramic crowns were cemented.

Results: There was no complication such as flap exposure, nerve injury or implant failure during the healing period. Computed tomography and conventional radiography showed a 4-mm mean vertical bone gain.

Conclusions and clinical implications: Vertical augmentation with high – density titanium – reinforced Polytetrafluoroethylene membranes and particulated autografts/xenografts is a safe and predictable treatment and it may be an effective alternative to autogenous onlay block grafting for vertical augmentation of the alveolar ridges.

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Minimally invasive transalveolar sinus-floor elevation and implant placement using calcium phosphosilicate putty via a novel cartridge delivery system

Siddharth Shanbhag,[1] Udatta Kher[2]
[1]Private Practice, Mumbai, India, [2]SDM College of Dental Sciences & Hospital, Dharwad, India

Background: One-stage transalveolar sinus-floor elevation (tSFE) and implant placement in the atrophic posterior maxilla is well-evidenced. Although alloplastic bone substitutes have been successfully used in tSFE, clinical evidence for calcium phosphosilicate (CPS) putty is lacking.

Aim/Hypothesis: To evaluate the clinical, radiographic and patient-based outcomes of one-stage tSFE using CPS-putty via a novel cartridge delivery system; after at least 6 months in a series of partially-edentulous patients.

Material and methods: Twenty patients (12 males) aged 28–70 years (mean = 52 years) with 1 or more missing teeth, and residual ridge height >4 mm, in the posterior maxilla were included. Twenty-eight implants were placed with simultaneous tSFE using CPS-putty (NovaBone Dental Putty®). After osteotomy preparation, the sinus-floor was partly fractured using an osteotome and approximately 0.5 cc of graft was injected via the delivery system, resulting in hydraulic elevation of the bony floor and membrane. Intraoperative membrane perforation (Valsalva manoeuvre) and postoperative patient pain/discomfort were assessed. Average time to loading was 4 months. Clinical and radiographic examinations performed at surgery and the most recent follow-up were compared. Periapical radiographs were digitally calibrated using known distances (implant length/diameter). Quantitative and qualitative graft changes were evaluated using linear measurements (intra-observer r = 0.89) and the Sinus Graft Remodeling Index (SGRI; inter-observer k = 1), respectively. Descriptive statistical analyses [means, standard deviations (SD)] and Wilcoxon signed-rank tests were performed ($P < 0.05$).

Results: The mean residual ridge height was 7.34 mm (SD 2.10 mm) and the mean amount of implant-penetration into the sinus was 3.09 mm (SD 1.41 mm). No incidences of membrane perforation were diagnosed and postoperative pain/discomfort was minimal. At insertion, an average of 2.71 mm (SD 1.36 mm) of graft was present apical to the implants, seen radiographically as 'cloudy structures with original sinus-floor lamina dura still recognizable' (SGRI-score 1). After a mean follow-up of 16 months (range 7–31 months) this reduced to 1.71 mm (SD 1.26 mm). A 'new sinus-floor outline' (SGRI-score 3) was observed in 81.25% patients, while ongoing 'resorption of the original lamina dura' (SGRI-score 2) was still visible in 18.75% patients. Mean radiographic bone gain was 4.95 mm (SD 1.99 mm) with significant differences in pre- and post-operative ridge heights ($P < 0.001$). All implants

were successfully osseointegrated at follow-up (100% survival-rate). No biological or restorative complications were reported. All patients were 'highly-satisfied' with the treatment outcome.

Conclusions and clinical implications: The analyzed CPS-putty is clinically safe and effective for one-stage transalveolar sinus-floor elevation. Consistency of the graft and a novel delivery system offer clinical benefits for minimally invasive yet predictable sinus-floor elevation, with limited complications and patient-morbidity.

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Reconstruction of alveolar bone through autogenous ulna bone graft

Francisley Ávila Souza,[1] **Tânia A Bárbara**,[2] Paulo Perri De Carvalho,[3] Idelmo Rangel Garcia-Júnior,[1] Osvaldo Magro-Filho,[1] Francine Benetti,[1] Bruna Barbieri Martins,[1] Heloísa Helena Nímia[4]

[1]Araçatuba of Dental School, University Est Paulista Júlio de Mesquita Filho – UNESP, Araçatuba, Brazil, [2]São Leopoldo Mandic Center Research, Campinas, Brazil, [3]Bauru of Dental School, São Paulo University – USP, Campinas, Brazil, [4]Pontifical Catholic University – PUC Minas Poços de Caldas Brazil

Background: Loss of a tooth leads to changes in the shape and function of the alveolar ridge, and consequently results in bone resorption, at first making it impossible to place osseointegratable implants. Therefore, it becomes necessary to indicate and perform bone grafts.

Aim/Hypothesis: The aim of this study was to relate a technique for partial reconstruction of the maxilla as regards height and thickness, in addition to sinus membrane elevation by means of autogenous bone graft from the ulna.

Material and methods: A multidisciplinary team performed graft harvesting under local anesthesia. The orthopedist performed an incision and access to the donor area, and the Bucco-Maxillo-Facial surgeon delineated the L-shaped design of the bone graft required for reconstructing the receptor area. After obtaining the graft, an intrabuccal incision was made, and access was obtained to the anterior wall of the maxillary sinus, in addition to elevation of the sinus membrane and decortalization of the vestibular wall. An Inlay type of graft was performed in the sinus cavity below the maxillary sinus mucosa, and afterwards the bone block was fixed with titanium screws, characterizing the Onlay type of graft.

Results: On completion of the stage of bone graft incorporation, which took 6 months, the osseointegratable implant was inserted in the reconstructed area. After waiting 6 months for the period of osseointegration, the prosthetic stage began for the fabrication of an implant supported screw retained denture.

Conclusions and clinical implications: From the clinical result obtained, it was concluded that the bone graft obtained from the ulna donor area presented the bone integration expected, showing that this area may be an alternative to the other bone graft donor areas for reconstruction of alveolar ridge atrophy.

437 Posters – Tissue Augmentation and Engineering

Minimal invasive sinus membrane elevation using the balloon technique

Mahmood Suleiman

Implant and Reconstructive Dentistry, High Wycombe, UK

Background: Posterior maxilla atrophy can affect the predictable placement of dental implants. The Summers technique uses a trans-crestal approach to tent the sinus membrane where a minimum of 5 mm bone exists. With <5 mm, the accepted method involves a sinus membrane elevation through a lateral window approach.

Aim/Hypothesis: A minimally invasive trans-crestal technique is illustrated that uses an inflatable balloon to elevate the sinus membrane in a case with 4 mm of residual bone.

Material and methods: A 33-year-old female presented with missing 16 and 15. Spiral tomography (Scanora, Soredex, Finland) showed a residual bone height of 4 mm in the region and no obvious sinus pathology. The balloon lift control system (Hager and Meisinger, Germany) was used. Under local anaesthesia (2% lidocaine with 1 : 80,000 adrenaline) and antibiotic cover (amoxicillin 3 g), a full thickness crestal incision was made over the 16, 15 ridge with crevicular releasing incisions. A surgical guide was used to prepare two osteotomy sites 1 mm short of the sinus floor. An osteotome was used to gently lift the remaining bone height. A latex balloon was introduced into the sub-antral space and repeatedly insufflated using sterile saline. This progressive action was carried out until the Schneiderian membrane was detached from the floor of the sinus to the desired height. The space was filled with natural bone mineral (BioOss, Geistlich Ag. Switzerland). Post-operative Amoxicillin capsules, 250 mg every 8 h for 7 days were administered. Four months later, two dental implants (AstraTech, Dentsply Implants UK) with lengths of 11 mm and diameters of 5 and 4 mm were respectively placed into the 16 and 15 sites. Exposure surgery occurred after four further months and a two-unit linked prosthesis delivered 1-month later. Resonance frequency readings (Osstell, Osstell Ab, Sweden) were taken at placement and exposure surgery. The case was monitored for 5-years together with radiographic evaluation at annual intervals.

Results: A 5-year follow up of this case has shown a successful outcome with good periodontal health and stable crestal bone levels. The surgical procedure was well tolerated by the patient.

Conclusions and clinical implications: The balloon lift technique provides a minimally invasive approach for sinus membrane elevation where there is a minimum residual bone level of at least 3 mm. This method provides the clinician with an alternative treatment option to improve bone height in the atrophied posterior maxilla.

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The effect of platelet derived growth factor on guided bone augmentation in the rat

Noriko Tsuchiya, Shuichi Sato, Risa Kigami, Tomohiro Yoshimaki, Yoshinori Arai, Koichi Ito
Nihon University, Tokyo, Japan

Background: Our previous study showed that a collagen sponge soaked in platelet derived growth factor (PDGF) enhanced bone formation beyond the skeletal envelope. However, it is not clear whether a chitosan sponge with PDGF is effective for bone augmentation beyond the skeletal envelope.

Aim/Hypothesis: This study evaluated the effect of a chitosan sponge soaked with PDGF on guided bone augmentation in the rat calvarium within plastic caps.

Material and methods: Fourteen male Fischer rats (200–250 g) were divided randomly into 0.01% and 0.03% PDGF groups. In each rat, a circular groove and five holes were made in the calvarium on each side of the midline, using a trephine drill with an inner diameter of 5 mm under profuse irrigation with sterile saline; the procedure was performed carefully, so as not to penetrate the dura. Two plastic caps (standardized column shape measuring 1.5 mm high and 4.4 mm in diameter) were placed in the grooves. Before placement, the plastic cap was pre-filled with a chitosan sponge soaked with 0.03% or 0.01% PDGF for the experimental site or with saline for the control site. Images of bone augmentation within the plastic caps were taken using microfocus computed tomography from 0 to 6 weeks.

Results: Bone augmentation beyond the skeletal envelope occurred in both the PDGF and control groups. The bone volume also increased in both groups, although the increase was smaller in the control group. The difference between the two PDGF concentrations was not significant, although the increase tended to be larger in the 0.03% PDGF group.

Conclusions and clinical implications: These results suggest that PDGF with a chitosan sponge enhanced bone formation beyond the skeletal envelope in rat calvarium.

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Effects of titanium prepared platelet-rich fibrin (T-PRF): a novel platelet concentrate on new bone formation in rabbits

Mustafa Tunali,[1] Hakan Özdemir,[2] Zafer Küçükodacı,[3] Seref Ezirganli,[4] Emre Barış,[5] Serhan Akman,[6] Erhan Firatli[2]
[1]Gulhane Military Medical Academy Haydarpasa, Istanbul, Turkey, [2]Department of Periodontology, Faculty of Dentistry, Cumhuriyet University, Sivas, Turkey, [3]Department of Medical Pathology, GATA Haidarpasa Hospital, Istanbul, Turkey, [4]Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Bezmialem Vakif University, Istanbul, Turkey, [5]Department of Oral Pathology, Facultyof Dentistry, Gazi University, Ankara, Turkey, [6]Department of Prosthodontics, Faculty of Dentistry, Selcuk University, Konya, Turkey

Background: In recent years, there has been a growing interest in the use of platelet-rich products for the treatment of many clinical conditions in dentistry and medicine. In our previous studies, we developed a platelet rich product that we called Titanium Prepared Platelet-Rich Fibrin (T-PRF). T-PRF method is based on the hypothesis that titanium may be more effective at activating platelets than the silica activators used with glass tubes in Chouckroun's platelet-rich fibrin (PRF) method.

Aim/Hypothesis: The aim of study was to assess the effects of T-PRF on bone augmentation when used in conjunction with titanium barrier in a rabbit calvaria model.

Material and methods: Twenty-four adult male New Zealand rabbits were used in this study. Two titanium barriers were fixed on each rabbit's calvarium. The rabbits were divided into four groups (group one is control and the other three groups are experimental) and each group contains six animals. T-PRF alone, anorganic bovine bone (ABB), T-PRF + anorganic bovine bone (ABB) were used with titanium barriers in the experimental groups. Any materials were not used in the control group. Half of the animals were sacrificed after 1 month, and the rest were sacrificed after 3 months. Histomorphometric evaluation was carried out in order to compare new bone formation among the groups.

Results: More new bone area was noted in the T-PRF alone group than in the control group, anorganic bovine bone (ABB) group, and T-PRF + anorganic bovine bone (ABB) group after 1 month. T-PRF alone, anorganic bovine bone (ABB), T-PRF + anorganic bovine bone (ABB) groups also had superior effects in new bone formation area compared to the control group after 1 and 3 months.

Conclusions and clinical implications: When used in conjunction with the titanium barriers, T-PRF alone, and T-PRF + ABB use can increase the quality of the newly formed bone and enhance the rate of bone formation due to the concentration of growth factors. We believe that T-PRF will be widely used in the future; however, more research regarding the clinical parameters of T-PRF, such as its clinical success, are required.

440 Posters – Tissue Augmentation and Engineering

Bone volume changes after sinus floor augmentation with heterogenous graft

Bruno Vieira Rodrigues Da Silva,[1] Jessica Lemos,[1] Ricardo Oliveira De Moraes,[1] Renato De Andrade Gomes,[1] Edilson José Ferreira,[1] Marcos Rikio Kuabara,[1] Gustavo Grolli Klein,[1] Hugo Nary Filho[2]
[1]*Imppar Odontologia, Londrina-Pr, Brazil,* [2]*Instituto-Hnary-USC Bauru-Sp Brazil*

Background: Bone ridge resorption and maxillary sinus pneumatization in the maxillary posterior region are frequently reported after loss of posterior teeth. The edentulous area exhibits poor bone volume and requires bone reconstruction previously to the insertion of dental implants. The lateral window sinus augmentation is an alternative for increase of bone volume. The sinus augmentation has been indicated as a predictable technique with low complication rates for reconstruction with biomaterials before or simultaneoulsly to the implants insertion.

Aim/Hypothesis: The aim of this study was to evaluate the dimensional stability of bone substitute volume (mineralized bovine bone) after maxillary sinus elevation through computed tomography.

Material and methods: A total of fifty-two postoperative CT scans were analyzed including two for each maxillary sinus of thirteen patients submitted to sinus reconstructive surgery. The first scan was performed immediately after surgery (T0) and the second was made after 8 months (T1). The lateral window sinus augmentation with mineralized bovine bone was conducted in 26 maxillary sinuses. The volume measurement was obtained by 3D digital subtraction using the software InVesalius® 3.0.

Results: All patients exhibited increase in bone volume. An increase of 9.47% was observed based on the images of volume measurement. The mean bone volume increase from T0 to T1 was 0.17 cm^3 (0.5–3.09 cm^3; SD ± 6.98). There was statistically significant correlation between bone volume and time ($P = 0.00001229$). The mean bone volume was 1.37 cm^3 (0.10–2.45 cm^3; SD ± 0.56) for T0 and 1.49 cm^3 (0.10–2.48 cm^3; SD ± 0.53 cm^3) for T1.

Conclusions and clinical implications: Within the limited sample, this study demonstrated increase in bone volume after maxillary sinus elevation with mineralized bovine bone in critical defects. So, the results confirmed the biomaterial maintenance without resorption during the healing phase as proposed by the manufacturer.

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Computer aided planning of facial reconstructions with microvascular transplants

Sascha Virnik,[1] Daniel Jamnig,[2] Alexander Gaggl,[3] Christian Kotratschek,[2] Friedrich Chiari[2]
[1]*Klinikum Klagenfurt, Klagenfurt, Austria,* [2]*Department of Oral and Maxillofacial Surgery, Klagenfurt, Austria,* [3]*Department of Oral and Maxillofacial Surgery Salzburg, Salzburg, Austria*

Background: Microvascular transplants are a very important aspect of the reconstruction in the facial surgery to provide the patient more quality of life after tumor resections or different traumata. There are several cases, treated in the year 2012 at the department of facial surgery in Klagenfurt, which we want to present at this congress. The reconstructions are all prepared with computer aided planning to find an optimal donorside and to prepare an ideal transplant.

Aim/Hypothesis: Computer aided planning can be a great benefit to optimize the sequence and the outcome.

Material and methods: At the department of facial surgery there were only reconstructions after facial defects treated with microvascular transplants of the iliac crest or fibula. Three of these cases are presented here, all of them are prepared with computer aided planning, the software used was CSS.

Results: Microvaskular transplants are used successfully for the reconstruction of defects of the alveolar crest.

Conclusions and clinical implications: Microvaskular transplants are used successfully for the reconstruction of defects of the alveolar crest. The transplants can be adapted individually and also be used for dental implants to provided fixed prosthetics. Computer aided planning can be a great benefit to optimize the sequence and the outcome.

442 Posters – Tissue Augmentation and Engineering

Pre-osteoblasts cultured *in vitro* on allograft and applied in bone post-cystectomie defect

Andrzej Wojtowicz,[1] Monica Jodko,[1] Jan Perek,[1] Ewa Olender,[2] Artur Kaminski,[2] Elzbieta Urbanowska[3]
[1]*Warsaw Medical University, Warsaw, Poland,* [2]*Central Tissue Bank, Warsaw Medical University, Warsaw, Poland,* [3]*Hematologic Cells Bank, Medical Warsaw University, Warsaw, Poland*

Background: Bone formation is necessary for the treatment in most of cases after maxillary cystectomies, when dental implants are planned. The efficacy of GBR methodology is not predictable in all cases. Pre-osteoblasts cultured *in vitro* in allogenic scaffolds were apply for bone regeneration in estehetic area in maxilla.

Aim/Hypothesis: Proposed methodology can be an alternative to the autologous bone graft in jaw bone regeneration.

Material and methods: Inclusion and exclusion criteria were apply for patient seLection for this protocol. HIV, HBS, HCV, HPV, and many lab-test in blood and urine were done. Two cystectomies were planned removed prior to bone regeneration. In both cases full thick maxilla in front area were destroyed by growing cysts. In one case (52 year-old woman) the lack of bucccal bone 22–25 teeth site was extend into palatal cortical site and nasal bottom. The second patient (49 year-old woman) had destroyed full bone thick and palatal cortical bone also by growing cyst. In all cases we planned to filled the bone defects by the combine bone graft at the same surgery after cystectomie. CBCT, Simplant methodology were used for evaluation of the deffect, for planning of the surgery, size and shape of the graft as well as visualization the transplantation result. Bone marrow were taken from the pelvis marrow space by the aspiration, stem cells CD34 + were isolated, then cultured *in vitro* for 4–5 weeks (proliferation and differentiation, IMPOMED, licence, Medical University Warsaw, permission No. AEZ/365/S-110/439/2012) and then as a pre-osteoblasts (35 and 50 × 106) filled into allogenic bone blocks (Central Tissue Bank, Warsaw Med. Univ). Combine graft (called Bioreactor): allogenic scaffold filled with autologous pre-osteoblasts were transplanted and fixed with the screwing miniplates into bone defects after cystectomies. The bone metabolism markers (vit D, 1,25 (OH)2D3, osteocalcin, AF – bone alkaline phosphatase, bone collagen marker: deoxypirydynoline, pirydynoline, as well as bone morphology parameters, biochemical and cellular parameters, IL-1, IL-6, CRP were evaluated for monitoring bone and bone marrow metabolism. Mini-biopsy used trephine were taken for histomorphometric analysis during implant installation.

Results: After surgery we observed excellent wound healing, apparently improved by in comparison to allograft without cells. It seems that stem cells/presosteoblasts cultured *in vitro* accelerate scaffold remodeling into newly formed bone, but better mucosal wound healing was observed. We observed focuses of newly form bones and mineralized island on CBCT after 6 months.

Conclusions and clinical implications: This methodology seems to be more effective than GBR, with use autogenic bone block transplantation and is an new and alternative methodology in tissue engeenering.

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Implant treatment outcomes following mandibular reconstruction with double barrel fibula bone grafting or vertical distraction osteogenesis fibula

Yiqun Wu,[1] Feng Wang,[1] Wei Huang,[1] Chenping Zhang,[1] Jian Sun,[1] Jian Sun,[1] Darnell Kaigler[2]

[1]Ninth People's Hospital, Shanghai Jiao Tong University, School of Medicine,, Shanghai, China, [2]Department of periodontics and oral medicine, School of Dentistry, University of Michigan and Michigan Center of Oral Health Research (MCOHR) Ann Arbor, Michigan USA

Background: Over the past 20 years, the fibular free flap technique has become a routine procedure for the functional reconstruction of the mandible to correct mandibular continuity defects that are caused by tumors. The most common problem encountered with this method is the insufficient bone height of the fibula, which results in a gap between the bone margin and the occlusal plane.

Aim/Hypothesis: The purpose of this study was twofold: (1) to compare the bone regeneration after tumor resection through grafting either with a double barrel fibula (DBF) technique or vertical distraction osteogenesis of the fibula (VDOF); (2) to compare the performance of loaded dental implants following either DBF or VDOF with special focus on implant survival, implant success, and bone resorption.

Material and methods: This retrospective clinical study involved 19 patients who underwent implant placement following DBF (group A, $n = 9$) or VDOF (group B, $n = 10$) mandibular reconstruction from March, 2006 to May, 2008. Clinical and radiographic assessments, including vertical bone height (VBH), modified plaque index (mPI), modified sulcus bleeding index (mSBI) and marginal bone level (MBL), were taken for both groups after delivery of the final prostheses and annually thereafter.

Results: Nine patients underwent DBF with 24 implants placed and 10 patients underwent, VDOF with 27 implants placed for mandibular reconstruction after tumor resection. Overall, all DBF and VDOF procedures were successful for group A and group B. VBH for group A and group B were 20 and 17 cm. The mPI (%) and mSBI in group A increased from 12.5 to 25 and from 0.5 to 1.2 and had statistically significant difference between 1-year and 3-year evaluation ($P < 0.01$ and $P < 0.01$). There was a statistically significant difference of mPI and mSBI scores between group A and group B in the 3-year follow-up ($P = 0.03$ and $P = 0.01$). In 4 cases with 8 implants of group A and 2 cases with 3 implants of group B, granulomatous soft tissue grew. Annual higher values for MBL was noticed for group A and group B and had statistically significant difference between 1-year and the 3-year evaluation ($P < 0.01$ and $P = 0.03$). The cumulative survival and success rates of implants for group A were 100% and 87.5%, and for group B were 100% and 85.2% in 3-year follow-up, respectively.

Conclusions and clinical implications: Reconstruction of the mandible with DBF flap or VDOF flap, combined with dental implant therapy, was considered a predictable option. Compared to implants placed in VDOF bone, implants placed in DBF bone had a relative higher incidence of associated gingival inflammation. The DBF bone seems more resistant to peri-implant resorption processes than VDOF bone during functional loading.

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The influence of platelet-rich fibrin on angiogenesis in guided bone regeneration using xenogenic bone substitutes

Hyun Joong Yoon

Yeouido St. Mary's Hospital, Catholic University of Korea, Seoul, Korea

Background: The presence of adequate osseous volume and quality is one of the essential factors for achieving osseointegration of dental implant. Bone augmentation using the guided bone regeneration (GBR) conception can be applied in patients with an inadequate osseous width or height. Over the last decade, considerable attention has focused on the potential application of growth factors to enhance the wound healing process. Growth factors involved in angiogenesis and osteogenesis are diverse. Special attention has been given to the use of platelet concentrates in reconstructive surgery.

Aim/Hypothesis: The purpose of this study was to investigate the influence of platelet-rich fibrin (PRF) on angiogenesis and osteogenesis in guided bone regeneration (GBR) using xenogenic bone substitutes in rabbit cranial defects.

Material and methods: The right and left sections of the calvarium were exposed in 10 rabbits. In each rabbit, 2 circular bone defects, one on either side of the midline, were prepared using a reamer drill, and PRFs were prepared according to the standard protocol. Each of the experimental sites received non-organic bovine bone with PRF, and each of the control sites received non-organic bovine bone alone. The animals were sacrificed at 1 week ($n = 4$), 2 weeks ($n = 3$) and 4 weeks ($n = 3$). Biopsy samples were examined histomorphometrically by light microscopy, and expression of vascular endothelial growth factor (VEGF) was determined by immunohistochemical staining.

Results: One week after surgery, the number of marrow cells was higher in the experimental group than in the control group. At all experimental time points, immunostaining intensity for VEGF was consistently higher in the experimental group than in the control group.

Conclusions and clinical implications: The results of this study suggest that PRF may improve angiogenesis in the GBR using xenogenic bone substitutes and increase the number of marrow cells, especially in the early bone healing phase. Further large-scale studies are needed to confirm our results.