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Abstracts from the 4th Congress of the World Federation for Laser Dentistry European Division

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ORAL PRESENTATIONS

Laser Dentistry

O-1. A RANDOMIZED CLINICAL AND HISTOPATHOLOGICAL ANALYSIS OF 100 EXCISIONAL BIOPSIES OF FIBROUS HYPERPLASIAS USING CO_2 LASER COMPARING CONTINUOUS WAVE AND CHAR-FREE MODES

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Objective: To compare the thermal damage zone and clinical outcomes performing excisions of fibrous hyerplasias with a CO_2 laser (10.6 μm) using continuous wave (cw) or char-free (cf) modes.

Materials and methods: 100 patients with fibrous hyperplasias on the buccal plane were randomly allocated to cw mode (5 watts) or cf mode (140 Hz, 400 μsec, 33 mJ) groups. All excisions were performed with the Spectra DENTA CO_2 laser (spot size = 0.2 mm). Duration of surgery, intra- and postoperative complications and width of the histopathological thermal damage zone were registered. Patients filled in a visual analogue scale (VAS) for evaluation of postoperative pain sensation and noted complications and analgesic intake.

Results: The mean duration of surgery was 71 s in the cw-group and 77 s in the cf-group ($p = 0.13$). Intraoperative bleeding was similar in both groups (16% for cw, 18% for cf). There was no difference for the median width of the thermal damage zone for both groups (cw 161 μm, cf 152 μm). The differences between postoperative swelling, minor bleeding and VAS-values of the two groups were not statistically significant, while the intake of analgesics was recorded by 10% in cf-group and by 25% in cw-group ($p = 0.04$).

Conclusions: No significant difference was found between the width of the thermal damage zone, the time of surgery, intra- and postoperative complications and VAS pain values. The analgesic intake was slightly higher for the cw-group. Both CO_2 laser modes are appropriate for intraoral biopsies.

O-2. USING ER:YAG LASER IN METHOD OF VESTIBULOPLASTY IN COMBINATION WITH MUCOGRAFT COLLAGEN MATRIX

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Aim: The aim of the study was to compare efficiency of classical and laser method of vestibuloplasty in patients with short vestibulum.

Background: Surgical soft tissue procedures especially vestibuloplasty are not favorite procedures to do for most of the general dentists. In conventional surgical techniques, anesthesia is a problem both for the patient and the doctor. Also bleeding and post-operative discomfort are other disadvantages besides the need for advanced skills to perform the surgeries.

Materials and methods: A study was conducted on 56 patients with shallow vestibulum. In a group with 30 patients, vestibuloplasty was performed with classical technique. In group with 26 patients by using Er:YAG laser (2940 nm). We applied biological material Mucograft® Collagen Matrix in both groups after procedures performed on the wound surface.

Results: In the group where the laser treatment was performed using mucograft treatments had completed with minimum bleeding, without any sutures, in a very short working time, with maximum patients' satisfaction, no sutures had placed and no analgesics were prescribed.

Conclusions: Er:YAG laser did not provoke a coagulation on surgical site. We can perform such surgery without any excess of bleeding. Due to the properties of the wavelength, the absence of the thermal damage gives us the opportunity to decrease post–op discomforts, which can appear after suturing in conventional surgeries.

O-3. MEASURING PSYCHOLOGICAL EFFECTS AND PAIN OR DISCOMFORT PERCEPTION USING THE MAX MODE OF THE FOTONA FIDELIS ER:YAG LASER ON PATIENTS IN CLASS I FISSURE PREPARATIONS: A SECONDARY APPROACH

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Aim: To measure and evaluate patients' perception of pain or discomfort and acceptance of the use of Er:YAG laser in comparison with the high speed drill.

Materials and methods: A RO2 non-contact hand piece of Fotona Fidelis Plus III Er:YAG laser was used at the maximum value of the max mode of 20 W. The high speed hand piece used for comparison was: KAVO GENTLE silence LUX turbine 8000B at maximum speed of 300,000 rpm with a cylinder shaped diamond bur (ISO 314 108 524 009). Both instruments were used with water-air spray and without anesthesia. Forty Class I cavity preparations in permanent molars, one with each method in every patient, were performed in twenty patients, ten males and ten females. Patients' perception and acceptance of both instruments were evaluated using the Wong-Baker faces pain rating scale.

Results: The max mode presented 70% of cases with absence of pain or discomfort, 25% with a small pain or discomfort and 5% with a moderate pain or discomfort, whereas the drill presented 5% with absence of pain or discomfort, 30% with a small pain or discomfort, 50% with a moderate pain or discomfort and 15% with severe pain or discomfort. The average of pain and discomfort measurement was 5 times higher for the drill in comparison with the laser.

Conclusions: The use of the max mode of Er:YAG laser was highly accepted by patients, in comparison to the high speed drill.

O-4. LASER-ASSISTED TREATMENT OF PAPILLOMA AND FIBROMA—TWO CLINICAL CASES

Teodora Semkovska

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Background: Excisional biopsy of benign tumors is accompanied with bleeding and the need of suturing. Lasers are different approach in this treatment. Therefore the aim of the this study is to present excisional biopsies of fibroma with Er:YAG laser and papilloma with diode laser and to compare the wound healing in both treatment modalities.

Materials and methods: In the first clinical case, an excisional biopsy of papilloma was performed with diode laser-980 nm with the following parameters: 4 W, CW, fiber 320 μm. In the second clinical case, excisional biopsy of fibroma was performed with Er:YAG laser-2940 nm with the following settings: 200 mJ, 35 Hz, tip 0.6×17 mm, contact mode. Pathological and histological examination of the biopsies was done in both clinical cases.

Results: After diode laser excision, we observed a moderate necrosis and carbonization at the cutting surfaces. The healing occurred in 10 days. After Er:YAG laser treatment there were no side effects and the healing occurred faster.

Conclusions: The results of the these clinical cases suggest better healing process after Er:YAG laser treatment of benign tumors.

O-5. PHOTODYNAMIC THERAPY FOR ENDODONTIC DISINFECTION: ANTIBACTERIAL EFFECTS IN ROOT CANALS ARTIFICIALLY INFECTED WITH ENTEROCOCCUS FAECALIS

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Aim: The aim of this *in vitro* study was to evaluate the antibacterial effects of PDT as a supplement to instrumentation and irrigation on Enterococcus faecalis biofilms in experimentally infected root canals of extracted teeth.

Materials and methods: Fifty extracted teeth were sectioned on cementum-enamel junction and shaped with endodontic instruments of the Pro Taper® series until reaching F1. The roots were sealed at the apex with resin, sterilized and then infected with E. faecalis and incubated in a humid atmosphere at 37° C for 72 h. The teeth were randomly divided into six groups: control group: no treatment, group 2: mechanical debridement with 5% NaOCl irrigation, group 3 (PDT 1): mechanical debridement and PDT for long time, control group 4 (PDT2): mechanical debridement and PDT for short time, group 5: mechanical debridement with 5% NaOCl irrigation and PDT for long time, group 6: mechanical debridement with 5% NaOCl and PDT for short time. We used a diode laser (635 nm at 100 mW in CW), with a spot size of 200μm. For PDT applications, toluidine blue (TBO) solution at 15 μg/ml remained in the canal for 2 min (T1) before being irradiated by diode laser for 150 s (T2); for PDT2 group 4, the TBO solution was left in the canal for 30 s before being exposed to red light for 30 s.

BioTimer assay (BTA) was used to evaluate the number of E. faecalis in biofilm.

Results: In PDT groups (photodynamic therapy and 5% NaOCl) there was a reduction of bacterial load of respectively 67.5% (PDT1) and 76,84% (PDT2), compared to the control group 2 (66,67%) without laser.

Conclusions: The combination PDT technique, if used in combination with traditional technique (instrumentation and NaOCl 5%), is able to increase the effectiveness of the root canal disinfection.

O-6. THE CLINICAL-BIOCHEMICAL RATIONALE FOR THE USE OF SURGICAL LASER TECHNOLOGY IN TREATMENT OF VERRUCOUS LEUKOPLAKIA

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Objectives: The purpose is to increase efficiency of treating patients with verrucous leukoplakia by application of Er:YAG and CO_2 laser.

Materials and methods: Combined treatment in 108 patients with verrucous leukoplakia of the oral cavity was performed. The surgery in 39 patients was performed following traditional techniques using sutures. Three relapses of disease were detected after using traditional method. CO2 Laser surgery was performed in 22 patients with only one relapse of leukoplakia. Er:YAG laser surgery was performed in 20 patients. 27 patients were to undergo surgical step using Er:YAG and CO_2 lasers. Mucous membrane sites have

been removed to the full extent of lesion in a mode of ablation.

Results: Mucous membrane in postoperative area was soft, elastic, no rough scars were observed. Disease relapses were not detected in 3 years. Protease enzymes activity in incised tissues and saliva was used as criterion of efficiency of the surgical laser. We observed modulation of Caspase and Anneksin indices in saliva and tissues of patients with verrucous leukoplakia. Normally activity of Caspase was not defined in saliva, in patients after surgery concerning leukoplakia indices ranged from 0.01 to 25.1 ng/ml, indices of Anneksin ranged from 0.5 to 30.6 ng/ml.

Conclusions: The use of CO_2 and Er:YAG lasers for the surgical treatment of verrucous leukoplakia allows reduction of treatment steps and prevention of disease relapses. In addition, protease enzymes activity in incised tissues and saliva of patients can be used as criterion of efficiency of laser surgery.

O-7. EFFECT OF ER:YAG LASER IRRADIATION ON ENAMEL SURFACE ERODED: ANALYSIS BY SCANNING ELECTRON MICROSCOPY

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Aim: This *in situ* study evaluated using scanning electron microscopy (SEM), the morphological and structural changes of eroded dental enamel irradiated with the Er:YAG laser.

Materials and methods: 56 enamel slabs were sectioned, flattened, polished and submitted to initial erosive lesion formation with 1% citric acid (pH = 2.3), 5 min, 2x/day, for 2 days. After this, the slabs were divided in two groups: irradiated with Er:YAG laser (2940 nm, 5.2 J/cm^2, 0.15 W, 85 mJ, 2 Hz, 10 sec) and non-irradiated. After a lead-in period, 14 volunteers used an intraoral palatal appliance containing two slabs, in 2 phases of 5 days each. During the intraoral phase, in a crossed-over design, half of the volunteers immersed the appliance in citric acid (erosive challenge) while other half of the volunteers used deionized water (non-erosive challenge), both treatments for 5 min, 3x/day. Three specimens of each group were randomly selected for SEM analysis.

Results: The images obtained by SEM showed that Er:YAG laser irradiation promoted small changes in the regularity of enamel prisms exposure, without causing melting or fusion on the surface. When submitted to *in situ* erosive challenges, the specimens previously irradiated with Er:YAG laser presented a more uniform demineralization than the non-irradiated slabs, which showed a greater demineralization of the interprismatic region.

Conclusions: The Er:YAG laser, with the parameters used in this study, was able to promote morphological changes in the eroded dental enamel, providing a more regular topography compared to the specimen that was non-irradiated, which could favor a reduction in the erosion process (grant FAPESP# 2011/23252-0).

O-8. LASER ASSISTED DEPOSITION OF ANTIBACTERIAL NANOPARTICLES INTO DENTINAL TUBULES

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Background: The inability to completely disinfect root canal system has been attributed to the anatomic complexity of the root canal system and dentin. Our research work was focused on the laser assisted intratubular delivery of nanoparticles and secondary laser mediated excitation of their specific light emission with antibacterial effect.

Materials and methods: Root canals of extracted teeth were mechanically prepared to ISO 35 and subsequently by Waterlase iPlus laser (λ = 2780, 1,25 W, 50 Hz H, air 34%, water 24%, tip RFT3). After irrigation with EDTA root canals were dried and dispersion of magnetic-fluorescent nanoparticles (size 200 nm, density 1.25 g/ cm^3) was placed into root canals and shockwaves caused by Waterlase iPlus (0,75 W, 20 Hz H, air 10%, water 0%, down and up movement 20 times) were used for propagation of nanoparticles. One half of experimental teeth was moreover exposed by magnetic field for 20 min. Cut teeth were examined by confocal scanning laser microscope, fluorescent microscope, SEM, and energy dispersive X-ray spectrometry.

Results: Deposition of nanoparticles according to their morphology and induced fluorescence was monitored and evaluated. Microscopic examination revealed before and after laser excitation clusters of nanoparticles on the surface and in the lumen of root canals. Both treated groups showed nanoparticles penetration inside the dentinal tubules. Depth of penetration in the laser group was dominantly between 400 and 500 μm, in the laser-magnet group around 600 μm and more. Distribution of nanoparticles within the dentinal tubules was not uniform and was tightly connected with ultrastructure of tubules.

Conclusions: This study was supported by a grant NT 13334-4 from the Ministry of Health, Czech Republic.

O-9. COMBINED APPLICATION OF ERBIUM AND DIODE LASERS FOR TREATMENT OF PATIENTS SUFFERED FROM PERIAPICAL LESIONS

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Aim: The aim of research is to increase the effectiveness of surgical treatment patients with periapical lesions using the combined erbium and diode lasers application.

Materials and methods: We have operated 18 patients with radicular cysts of the different size. 8 patients were operated on a traditional method using a scalpel and rotary instruments with water cooling. 10 were operated by common application of the Er:YAG and diode lasers. Operation technique of high-intensive laser application consist of section, bone tissue defect expansion, excision of pathological inflammatory locus and everything was made by erbium laser with 2940 nm wave length. Diode laser with 808 nm wave length and 200 micron fiber was used for root surface processing in ablation melting/glazing mode. We

performed a contact thermometry of surrounded root bone tissue.

Results: We noted a significant reduction of the inflammatory reaction, an absence of complications and relapse in postoperative area as the result of combined high-intensive lasers. Temperature alteration in periapical area was registered in a range from 28° C to 31° C, which is evidence of absence of negative thermal diode laser influence on surrounded root bone tissue.

Conclusions: Thus the combined application of erbium and diode lasers during patients' periapical lesions treatment promote a considerable rise of the conducted surgical treatment effectiveness by decreasing a invasiveness of the procedure, complication risks and term rehabilitation.

O-10. MANAGEMENT OF AN ORTHODONTIC CLINICAL CASE: A MULTI-DISCIPLINARY APPROACH USING THE LLLT

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Aim: The multi-disciplinary approach is the key to obtain the best results. The use of LLLT is helpful in many clinical situations.

Materials and methods: A 15-year-old young female, presented several orthodontic problems: 2 impacted teeth (13 and 47), deep byte and a severe bi-maxillary crowding. The treatment plan was established: (1) orthodontic bi-maxillary fixed appliance; (2) laser-assisted surgery to expose the crown of the impacted teeth crowns and to insert 2 mini-screw helping the orthodontic extrusive forces; and (3) LLLT, after the gingival surgery and also during the orthodontic treatment to reduce pain and to improve teeth movement's speed. Low level laser therapy (LLLT) is light - emitting diodes (in a range of 1–500 mw). It was used in order to obtain: improvement of cellular function and to promote tissue's regeneration, reduction of inflammation and to relieve pain. In every clinical orthodontic control we used diode laser to stimulate soft tissues and orthodontic movement.

Results: In this work, we describe step by step the clinical history of the case, from the initial bonding till the treatment's end, supported by a detailed iconographic section. We treated the patient with laser-assisted surgery which was a great help: less bleeding, no sutures, less pain and excellent recovery.

Conclusions: In this orthodontic, surgical and periodontal case, the cooperation between various dental specialists and therapies (laser-assisted surgery, laser-assisted periodontics and orthodontic treatments) has been the key to obtain optimal clinical results.

O-11. NOMENCLATURE AND SYSTEMATICS OF LASER APPLICATIONS

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Aim: The aim was to introduce an intuitive-logically derived and universally valid nomenclature and systematics of laser applications – analogously to the concept of Linne's classification in biology.

Materials and methods: Multiple laser sources were applied in 2000 patients to solve soft and hard tissue problems. According to the quaternary "wwww" formula "What for – What – Which mode – Wherewith ?" all laser applications were classified. According to the 1st "W" - What for? Different indication groups were classified, e.g., "SURG" for surgery or "CONS" for conservative dentistry. These groups were subclassified in a tree like organigramm according to the 2nd "W" - What? (target tissue) in hard versus soft tissue applications. And according to the 3rd "W" - Which? (mode) these groups were subclassified in ablative versus nonablative applications. And according to the 4th "W" - Wherewith? (protocol) the single applications were finally defined by protocol name, parameters, concept, principle of operation and expected clinical result to ensure reliable repeatability.

Results: Presentation of a universally valid method of classification of laser applications. A complete and assorted overview of laser applications in different dental indication groups is presented. Following the systematics a nomenclature name could be derived for each dental laser application: E.g. the nomenclature name "ORTHO-HA-LBONDING .Er:YAG" stands for a laser application in the indication group (What for?) "ORTHO"-dontics on (What?) "H"-ard tissue in an (Which?) ablative mode with the (Wherewith?) protocol "L"aser "Bonding" (1st attribute protocol name) with the laser source "Er:YAG" (2nd attribute parameter).

Conclusions: By implementing a logically built up classification each laser application can be uniquely named and identified by a nomenclature name.

O-12. THE ROLE OF THE ER,CR:YSGG LASER IN APICAL SURGERY

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Aim: To present the results of an evidence based approach along with clinical reports which accurately explain in detail how to use the full integration of a specific wavelength or combination of wavelengths in apicectomies, in order to increase the outcomes of a periapical surgery.

Background: The Er,Cr:YSGG laser has been demonstrating *in vitro* to be highly effective in apical surgery, namely in terms of soft tissue management, bone cutting, apical resection and disinfection. However, clinical reports are often misleading and do not address the complete clinical benefits of using such wavelength during the complete surgical procedure.

Materials and methods: An extensive literature review was performed in order to assess the effectiveness of the 2780 nm laser for every step of a periapical surgery. Withdrawing the information from currently available scientific data, an evidence based protocol for laser apical surgery was developed and applied in cases of endodontic-related infections with extensive chronic apical periodontitis. Outcomes were assessed by using the periapical index at 6, 12 and 24 months of follow-up. Patient benefits related to this complete laser surgical approach were included and posteriorly assessed.

Results: Scientific literature has clearly shown that the Er,Cr:YSGG laser could be applied in almost every procedures of apical surgery, with relevant advantages over conventional protocols. The beneficial results of the present investigation should be considered to adopt an evidence-based laser assisted protocol in apical surgery.

Conclusions: Despite further extensive blind randomized clinical trials that need to be reported, this study could be considered the first reported clinical evidence that one laser assisted protocol could represent the apical surgery's gold-standard strategy.

O-13. WOUND HEALING BY CO_2 LASER

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Purpose: The lack of myofibroblasts, cells responsible for wound contraction, has been suggested to be the underlying factor to the clinically observed minimal contraction in CO_2 laser wounds. However, the histological background to this phenomenon in laser excisions has not been thoroughly clarified. Therefore, we analyzed the expression of myofibroblasts in healing laser excisions and control excisions made by scalpel.

Materials and methods: CO_2 laser (continuous wave, 5 W) or scalpel excision wounds were created in the dorsal tongue mucosa of 144 rats. Sixteen additional rats were kept as untreated controls. Specimens from the tongues were cut at 16 different healing time points and fixed in 10% formalin. Immuno histo chemical staining with monoclonal antibodies to vimentin and to α-smooth muscle actin were done to determine microscopically the contractile type of myofibroblasts.

Results: The maximum amount of myofibroblasts was almost three times higher in scalpel than in laser excisions. The peak value was reached at 4 days in laser and at 3 days in scalpel wounds. The increase reverted to normal levels at 14 days in laser and at 6 days in scalpel wounds, respectively.

Conclusions: Myofibroblasts appeared and disappeared slower in laser wounds. There were clearly fewer myofibroblasts in CO_2 laser than in corresponding scalpel excisions known to heal by contraction. The lack of contractile myofibroblasts, therefore, is suggested as the reason for the minimal degree of contraction in CO_2 laser excision wounds.

O-14. BLUE-VIOLET LED IRRADIATION IN COMBINATION WITH SPONGEL APPLICATION AMELIORATES SOCKET BLEEDING OF WARFARIN-TAKING PATIENTS

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Aim: Bleeding control after tooth extraction is a major concern in warfarin taking patients. A novel photocoagulation method irradiating blue-violet LED in combination with spongel application was investigated.

Materials and methods: Warfarin taking patients (N = 48) who required tooth extraction divided to three groups. After extraction group A was irradiated LED only. Group B was given spongel and LED irradiation. Group C was given spongel as the control. Haemostasis was evaluated after 30 s. PT-INR was also measured.

Results: PT-INR of 3 groups showed around 2.0 of average. Haemostasis occurred less than 30% by placing spongel, and about a half by LED irradiation. Combination of LED and spongel application showed that most of the socket bleeding (86.7%) caused haemostasis.

Conclusions: Blue-violet LED irradiation combined with spongel application ameliorated socket bleeding of warfarin taking patients. In most of the cases, bleeding was stopped within 30 sec. without suture.

O-15. FIVE YEARS EVALUATION OF WORLDS FIRST IMPLANT BED PREPARATION WITOUT ANAESTHESIA USING LASER AND SURGICAL GUIDE AFTER 3D PLANNING FOR FIRST MANDIBULAR MOLAR REPLACEMENT

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Aim: The purpose of this case report is to evaluate the situation after five years of a minimal invasive method to replace a first mandibular molar, without anaesthesia, with laser and surgical guide, in a compromised phobic patient.

Materials and methods: The Simplant 3D method was used for planning the insertion of a Tapered Screwvent implant in region 36 in a 66 year old high blood pressure phobic male patient. The Simplant surgical guide was fixed on the crest while drilling flapless with an Er,Cr:YSGG laser (250 mJ, 20 Hz,140μs pulse width) by circular movements until 5 mm of depth. Then, the guide was removed and the cavity was lased until the desired depth. The cavity was slightly treated with hand instruments to achieve bone condensation for optimal primer stability. three months later, second stage laser surgery was performed with a 810 nm diode laser (cw and 1,5 W) without anaesthesia.

Results: The implant was inserted in the planned position with sufficient primer stability. The wound healing was rapid and the patient had no pain or swelling in post-op after first and second stage laser surgery. After 5 years of follow-up, the patient did not notice any discomforts.

Conclusions: The use of the surgical guide gives laser preparation without anaesthesia best possible precision with minimal complications and no disorders after five years. This method seems therefore a good alternative for a successful implant treatment in compromised patients.

O-16. COMPARATIVE STUDY OF ADHESION FORCES OBTAINED ON ZIRCONIA CERAMIC ROUGHENED WITH SANDBLASTING METHODS AND A CO_2 LASER

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Aim: This study is aimed to investigate the effect of diferent energy intensities of the CO_2 laser and of air abrasion with Al_2O_3 particles on the roughness of zirconia ceramic surfaces.

Materials and methods: Forty samples of yttrium-stabilized tetragonal zirconia (Y-TZP) ceramic (Lava, 3M ESPE, USA) were randomly divided into four groups for being treated as follows: Group 1 (control), air abrasion with Al_2O_3; Group 2, silicatization; Group 3, irradiation with CO_2 laser at 2 W; and Group 4, CO_2 laser irradiation at 3 W. After the surface treatments, and before build up a composite cylinder onto each of them, a specific primer containing silane plus MDP adhesive monomer was applied onto all the forty samples. Shear bond testing was performed and adhesion values recorded in megapascals (MPa). In order to establish significant statistically differences, Kruskal-Wallis test was applied. Morphological changes on the zirconia ceramic surfaces were visualized using environment scanning electron microscopy (eSEM).

Results: Considering the shear bond strength values and the microscopical data, lased ceramics are better roughened than the sandblasted ones. Group 3 presented higher bond values without cracking (mean value: 21.4 MPa), in comparison with groups 1 and 2 (8,9 and 13,8 respectively). The highest value was founded in group 4, but the ceramic surface cracked (24,5 MPa).

Conclusions: Using a CO_2 laser, in a continuous wave mode, for 30 s, at 2 W and at a focal distance, is a good method in order to roughen zirconia ceramic surfaces, thus being appropriate for obtaining an optimum micromechanical joint with composite.

O-17. RADIOGRAPHIC EXAMINATION OF APICAL EXTRUSION OF ROOT CANAL IRRIGUANTS DURING CAVITATION INDUCED BY ER,CR:YSGG LASER IRRADIATION: AN *IN VIVO* STUDY

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Aim: No *in vivo* studies have examined the extrusion of irrigant into the periapical tissues, the purpose of the present study was to test the hypothesis that apical extrusion of the irriguants occurs during laser-driven irrigation *in vivo*.

Materials and methods: Three hundred human root canals, in 181 patients, were divided into two groups: the no lesion group (NL; n = 140) and the lesion group (L; n = 160). All the root canals were enlarged using a crown-down technique up to size 30–80 K-files, depending on the original condition of the root canal. For the final irrigation, the teeth were irrigated with a mixture of radiopaque contrast medium and NaOCl in solution. The solution was activated for 60 s in teeth with one canal or two canals, and for 120 s in teeth with three or four canals.

Results: Radiopaque contrast medium was absent from the periapical tissues of all samples.

Conclusions: No contrast medium was observed radiographically in the periapical tissues. The hypothesis that apical extrusion of root canal irrigants occurs during laser cavitation was rejected. It appears that laser energy used at 1 W for 1–2 min can drive the irrigation solution to the tip of the canal without harming the apical tissues.

O-18. BIOPHYSICS–UNDERSTANDING ENERGY, POWER, SELECTIVITY, AND BIOLOGICAL EFFECTS

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Aim: For successful treatments in laser-supported medicine and dentistry it is highly important to understand the basics to the underlying biophysical effects which can be evoked by laser radiation.

Materials and methods: Different laser systems offer different application modes, procedures and indications. For doctors just starting in this topic, as well as for users confronted with these devices and procedures, the overwhelming magnitude of different parameters can seem like an obstacle. The parameters and the invoked effects are explained by the means of laser energy as a pseudo medication which can be concentrated or spread out in a region of interest in tissue, over different timeframes by examining the available operation modes of laser devices, such as cw, FRP-pulsed and chopped.

Results: Concepts such as selectivity of laser radiation arise naturally in this deductive process from the laser's wavelength and biological absorbers in the tissue. Clinical examples are shown for different successful treatments as well as different failed treatments as a result of missing biophysical knowledge.

Conclusions: For the dental practitioner, the understanding of the biophysical background is necessary to offer safe and reliable treatments.

O-19. EFFECTS OF LOW LEVEL LASER AND THERAPEUTIC ULTRASOUND ON TISSUE REPAIR IN WISTAR RATS: HISTOPATHOLOGICAL STUDY AND TRANSFORMING GROWTH FACTOR-B1 EXPRESSION

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Aim: Compare the effects of LLLT and TUS, alone and in combination, on the sacr tissue and on transforming growth factor-β1 (TGF-β1) expression during the repair process of surgical skin wounds in Wistar rats.

Materials and methods: After performing a cutaneous wound in the dorsal region, the animals were divided into group control, group subjected to HeNe LLLT infrared emission laser and used with pulsatile, 780 nm wavelength, 70 mW peak power, 15 mW power, 3.8 J/cm^2 dose and 15 s of application, focal spot, group treated with TUS pulsed mode with a 1 MHz frequency, 0.4 W/cm^2 intensity and 3 min of application and animal group receiving both therapies. On the tenth day, the wounds were excised at the euthanasia and processed for histopathological evaluation to assess the density and organization of collagen fibers, quantify angiogenesis and inflammatory infiltrates. Immunohistochemistry was performed to assess TGFβ1 expression.

Results: The density of the inflammatory infiltrate was lower in the samples from group treated with LLLT than in the samples of the other groups ($p < 0.05$). The amount of blood vessels per microscopic field was significantly higher in group treated with LLLT and TUS simultaneously when compared to the other groups ($p < 0.05$). The TGF-β1 expression was not statistically significant between the treated groups ($p < 0.05$).

Conclusions: The results suggested that LLLT had better anti-inflammatory effect when used alone, while therapeutic ultrasound showed higher angiogenic potential. The combination of techniques did not affect the TGFβ1 expression.

O-20. THE EFFECT OF ER:YAG LASER IRRADIATION OF THE CANAL WALLS AND FIBER POST ON THE BOND STRENGTH OF FIBER POST

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Aim: The aim is to evaluate the effect of Er:YAG laser irradiation on canal walls and on bond strengths of fiber glass posts.

Materials and methods: The specimen was divided in 6 groups: Group 1: no treatment was done for canals and fiber posts (control group). Group 2: only fiber posts were irradiated. Group 3: canal irradiated with dose A (power 0.5 W, 25 mJ, 20 Hz, pulse duration 60 μs, 60% water, 40% air) without treatments of fiber posts. Group 4: canal irradiated with dose A (power 0.5 W, 25 mJ, 20 Hz, pulse duration 60 μs, 60% water, 40% air) and laser irradiation of fiber posts. Group 5: canal irradiated with dose B (power 0.8 W, 40 mJ, 20 Hz, pulse duration 60 μs, 60% water, 40% air) without treatments of the fiber post. Group 6: canal irradiated with dose B (power 0.8 W, 40 mJ, 20 Hz, pulse duration 60 μs, 60% water, 40% air) and laser irradiation of fiber posts. Self- etching cement was used for cementation of fiber post. The push out test was done to measure its bond strength to canal wall.

Results: There were significant differences in bond strength of fiber post retention between groups of lased and unlased canals. Groups of lased canals had higher bond strengths independently of doses or of the irradiation or not of fiber posts.

Conclusions: laser irradiation of the canal wall with Er:YAG laser (P = 0.5 or 0.8 W) increases bond strengths between fiber glass posts (irradiated or not) and canal walls cemented with self-etching cement.

O-21. THE APPLICATION OF ERBIUM LASER FAMILY IN TREATMENT OF PERI-IMPLANTITIS

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Objective: The investigations about clinical application of Erbium lasers in treatment of peri-implantitis have been reviewed which is based on the ability of this kind of lasers to kill microorganisms without any adverse effects on implant surfaces.

Background data: Peri-implantitis is an inflammatory disease around implants that leads to loss of supporting bone. It has been shown that bacteria have important role in etiology of peri-implantitis. The principles of all treatment methods of peri-implantitis are based on the eradication of adherent biofilm from the implant surface and creating a clean surface without any microorganisms. Different methods have been suggested for eradication of infected tissues around implant and disinfecting implant surface in treatment of peri-implantitis. However, it has not been introduced a specific method as Gold standard yet. During last decade the application of different kinds of lasers in dental field has increased rapidly.

Methods: New data was gathered from electronic data bank (PubMed and Google scholar). It has been tried to summarize the results by comparison the methods, number of researching cases and laser characteristics to reaching a protocol in treatment of peri-implantitis using this kind of lasers.

Results: Proper energy levels for various implant surfaces should be used, because laser irradiation can cause changes in the implant surfaces at certain energy levels depending on the type of implant surface.

Conclusions: It seems that the erbium lasers are good choices for disinfecting of implant surfaces in peri-implantitis cases. Anyway it seems that more investigations are needed in this field.

O-22. DESCRIPTION IN THE INTERFACE WITH RAMAN WITEC OF 3 SELF-ETCHING ADHESIVES IN DENTINE IRRADIATED AT LOW FLUENCES AND UNIRRADIATED

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Aim: The aim is to assess and quantify the presence of the three adhesives at the interface of the adhesive-dentine union using Raman spectroscopy.

Materials and methods: 24 third molars without caries were used. Occlusal dentin was exposed. Three groups were formed according to the adhesive selected. Within each group, only four molars were lased. The adhesives: Adhese®, Unifil GC Bond and the Clearfil SE Bond were used with their respective fluid composite. Er,Cr:YSGG laser was used at 20 Hz, pulse width: 150μs, 1.5 mm spot, P = 3.20 W, energy per pulse 160 mJ and a fluence of 9.09 J/cm^2, time exposure 30 s). Samples were observed with Raman Laser type.

Results: We noticed in the band of Hydroxyapatite of control groups a percentage of 30% in 10μm and 70% in 20μm and. Laser groups showed 40% and 60% respectively. In the band of Amides of control groups, we noticed a high percentage (80–100%) only in first 10μm. Adhese and Clearfil of laser groups had 90–100% in 10μm and 0–10% in 20μm. However, Unifil laser group had an equal distribution. In the 3rd band (collagen), we noticed that both, control and laser groups showed a 90–100% in 10μm and a low percentage (0–10%) in 20μm.

Conclusions: Unifil GC laser group was the only one that showed percentages distributed equally in bands of Hydroxyapatite and in Amide. The control group of all adhesives showed equal percentages representation in the bands of hydroxyapatite. In the band of amides, only GC Unifil presented an equitable distribution in the 10 and 20μm. AdheSE adhesive had a 100% representation in collagen bands.

O-23. THE EFFECT OF KTP AND HIGH POWER GREEN LED BLEACHING ON ENAMEL MICROHARDNESS

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Aim: To compare and evaluate *in vitro* the effects of KTP laser bleaching and high power green LED bleaching with four conventional vital bleaching techniques on the microhardness of bovine enamel.

Materials and methods: Seventy-two bovine enamel samples were distributed among six groups (A-F). Half of each surface remained unbleached; the other halves were bleached with (A) Opalescence 35% Carbamide peroxide (CPO) (B) Opalescence 20% CPO, (C) KTP laser / Smartbleach 36% H_2O_2 1 W - 30 sec, (D) 3LT 6% H_2O_2, (E) Nite White 22% CPO, (F) Nite White 16% CPO. The Knoop microhardness of each specimen was determined (1) immediately after extraction, (2) pre-bleaching, (3) immediately after bleaching and (4) post-bleaching after 10 days and (5) after 6 weeks.

Results: Bleaching led to a statistically significantly higher decrease of microhardness in Groups A-B-E-F (non-laser bleached) as compared to groups C and D. The

average post-bleach values demonstrated an increase in microhardness and recovery of the enamel microhardness, with the best performance for KTP laser bleaching and 3LT Bleaching after 6 weeks. No statistically significant differences were seen (1) between Nite White and Opalescence, between Laser Bleaching and 3LT bleaching after 10 days and after 6 weeks.

Conclusions: KTP laser bleaching with the Smartbleach system with 36% H_2O_2–gel and 3LT high power green LED bleaching with 6% H_2O_2–gel resulted in a recovered enamel surface after 6 weeks. In the non-light activated bleached groups a statistically significant decrease in enamel microhardness was only observed immediately after bleaching.

O-24. PDT WITH PERIO GREEN®: FIRST RESULTS OF A MULTICENTER STUDY

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Aim: Photodynamic therapy in combination with systematic periodontal therapy (SRP) can lead to improve long term results. Quantity and pathogenicity of the germs will be decreased by PDT. Systemic side effects based on the administration of antibiotics can be avoided.

Materials and methods: 30 patients were treated with diode laser, (Elexxion Claros, 810 nm, 300 mW, 300 μm fiber tip) and the new photosensitizer dye Perio Green® (indocyanine green) after classical SRP- therapy to increase the bactericidal effect. All treatments followed a standardized treatment protocol for better comparability, including clinical aspects and microbiological testing before and 1 week after therapy. 10 dentists from different practices were involved.

Results: To avoid the administration of antibiotics for patients with more than a simple gingivitis, we used an effective, simple and side effect free substitute: the photodynamic therapy. Green photosensitizers are activated by laser light in the range of 810 nm. After treatment of the 30 patients with SRP and PDT, the clinical appearance was much better than before treatment (BOP, redness, swelling, etc.). Additionally microbiological testing was taken before and after PDT, which showed a significant reduction of the germs after photodynamic treatment. None of the patients complained any problem by side effects during and after PDT.

Conclusions: Regarding the excellent results of the clinical study it seems that PDT with Perio Green® is an equivalent substitute for systemic treatment with antibiotics and should be considered in every case of periodontal therapy.

O-25. CLINICAL AND MICROBIOLOGICAL EFFECTIVENESS OF ER:YAG LASER IN CHRONIC PERIODONTITIS

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Aim: The purpose of this study was to evaluate the clinical and microbiological effectiveness of the Er:YAG laser in non-surgical periodontal therapy in comparison to conventional treatment with Gracey curettes.

Materials and methods: 20 persons with chronic periodontitis were treated in a split mouth design either with Er:YAG laser-2940 nm; 1.5 W-test group or with Gracey curettes-control group. Periodontal pocket depth (PPD), Gingival recession (GR), Clinical attachment level (CAL), Plaque index (PI) and Bleeding on probing (BoP) of 909 sites were evaluated baseline, one and three months after treatment. Plaque samples for microbiological examination of 9 periodontal pathogens with real-time PCR (RT-PCR) from 80 periodontal pockets were taken immediately before and one month after treatment.

Results: Sites treated with Gracey curettes demonstrated mean CAL from 4.70 ± 0.03 to 3.60 ± 0.05 ($p < 0.01$) and to 3.13 ± 0.06 ($p < 0.01$) at the first and third month respectively. Sites treated with Er:YAG laser demonstrated mean CAL from 4.70 ± 0.03 to 3.33 ± 0.05 ($p < 0.01$) and to 3.03 ± 0.06 ($p < 0.01$) at the first and third month. The reduction was greater in the laser group 3 months after the treatment ($p < 0.05$). Same results were presented for BoP and PI where the reduction is greater in the laser group at the first ($p < 0.05$) and the third month ($p < 0.01$) Periodontal pathogens decreased significantly after treatment in both groups. Greater reduction was observed in laser group for the red complex.

Conclusions: The results of the present study show that the Er:YAG laser possesses clinical and microbiological effectiveness in the non-surgical periodontal treatment which is greater than hand instruments.

O-26. LOW-LEVEL LASER THERAPY MODULATES THE EXPRESSION OF CYCLOOXYGENASE-2 IN SKIN LESIONS IN NOD MICE

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Aim: In the present study, the effect of LLLT on expression of cyclooxygenase-2 (COX2) at the site of tissue repair was evaluated, using an experimental model with non-obese diabetic mice (NOD) to study cutaneous wound healing.

Materials and methods: Thirty non-obese diabetic mice (NOD) were used, of which 14 were diabetic and were divided into two groups: group I (n = 7) underwent a surgical procedure of skin wounds and group II (n = 7) underwent a surgical procedure of skin wounds and treated with LLLT HeNe. Group II was submitted to LLLT in the following parameters: 15 mW of power, dose of 3.8 J/cm2 and exposure time of 20 s, focal spot. Seven days after surgery and after laser application, animals were euthanized with an overdose of anesthesia and tissue samples were collected for subsequent histological analysis, histomorphometry and immunohistochemistry.

Results: The LLLT has promoted the inhibition of COX2 expression in skin wounds in mice diabetic. Taken together the results suggest that LLLT modulate the expression of cyclooxygenase-2 improved the control of inflammatory reaction in cutaneous wound lesions in NOD mice.

Conclusions: Taken together, the results suggested that LLLT is able to negatively modulate the expression of COX2 enzyme contributing to the inflammatory response in cutaneous wounds in NOD mice.

O-27. STUDY OF IMPLANT SURFACES IRRADIATED WITH ER,CR:YSGG, DIODE 940 NM AND CO_2 LASERS

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Aim: To evaluate the damages on implant surfaces resulting from laser irradiations.

Materials and methods: Six implant surfaces, irradiated with three lasers (Diode 940 nm, CO_2 an Er,Cr:YSGG) were used. Each implant surface was divided in three areas to be irradiated. Samples were examined by SEM. Er,Cr:YSGG was used as following: 0,5 (8,84 J/pulse*cm2) and 1 W (17,86 J/pulse*cm2), 20 Hz, 30%H_2O, 30%Air, spot size of 600 μm, 1,5 mm of irradiation distance during 20 s. For the power of 1 W, we used an irradiation distance of 1,5 mm, 3 mm and 5 mm. For Diode 940 nm, we used a power of 1,5 W, cw mode, spot size of 200μm, and at Contact and No-Contact distance, during 10 s. For CO_2, we used a power of 1 W in cw mode, spot size of 800μm-1600μm-2200μm corresponding to irradiation distances of +1 mm, +3 mm, +5 mm during 10 s.

Results: Er,Cr:YSGG produces damages Class III at 1,5 mm 0,5 W and 1 W to Anodized Oxide/ Phosphate covered surfaces and Class II at 3 mm and 5 mm and, produces Class III damage to Ceramic/ZrO2 surfaces al any distance. It did produce Class I (no damage) at any power, any distance, to any other of the studied surfaces with the exception of Class II damage at 1 W/1,5 mm to SLA surface. Diode 940 nm in Contact with Activated Point Produced damages to all surfaces from Class II to Class V with the exception of AE/?-topography and Ti SB-Double surfaces which presented Class I (no damage). At No-Contact Class II damage was presented by SLA and AE/-topography and Class III with SB/HA surfaces. At No-Contact Damage Class I (no damage) was obtained for Anodized Oxide/Phosphates covered, Ti SB-double and Ceramic/ZrO2 surfaces. CO_2 presented damages from Classes II to VI in all surfaces at DF + 1 mm. At DF + 3 mm Anodized Oxide/Phosphates and SB/HA covered surfaces and, Ceramic/ZrO2 presented damages Class III to VI. SLA, AE/?-topograhy and Ti SB-Double surfaces presented Class I (no damage). At DF*5 mm all surfaces presented Class II-VI damage with the exception of SLA and AE/?-topograhy which shows Class I (no damage).

Conclusions: All of the surfaces with all the lasers presented different damages From Class I (no damage) to Class VI (total destruction) as a function of the irradiation distance and wavelengths

O-28. COMPARATIVE HISTOLOGICAL STUDY OF DENTINOPULPAL RESPONSES IN CLASS I CAVITY TREATED BY ER:YAG LASER AND CONVENTIONAL CAVITY PREPARATIONS: AN *IN VIVO* TRIAL

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Aim: The purpose of this study is to investigate the histopathological response of human dentinopulpal to the Er:YAG laser cavity preparation in comparison with the conventional class I cavity preparation.

Materials and methods: Thirty-five sound human premolars were used and divided in three groups; Group 1; Control group (seven teeth without cavity preparation), Group 2; Conventional cavity preparation group and group 3; Er:YAG laser cavity preparation group. Group 2 and 3 each of them consists of fourteen teeth that is subdivided as following: A. 7 teeth that extracted after two days after cavity preparation and B. 7 teeth that extracted after twenty-one days after cavity preparation. Er:YAG Laser device emits radiation at wavelength of 2940 nm in the infrared region. The laser irradiation was performed in a non-contact mode with a focused beam of (energy density = 155985.96 mJ/cm^2, energy = 600 mJ and a PRRs = 6 Hz for enamel preparation) and (energy density = 64994.151 mJ/cm^2, energy = 250 mJ and a PRRs = 4 Hz for dentin preparation) with a spot diameter 0.7 mm at 12–15 mm distance and at right angle to the tooth surface as possible.

Results: The histopathological results of the cavities prepared by Er:YAG Laser revealed the early proliferation of the odontoblasts in the odontoblastic layer of the coronal part of the pulp which led to the early formation of the reparative dentin in comparison to those prepared by conventional method.

Conclusions: the use of the Er:YAG laser in class I cavity preparation has proved to be an efficient technique in comparison to the conventional cavity preparation.

O-29. NANOLASER TECHNOLOGY IN TREATMENT OF DENTINE HYPERSENSITIVITY

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Aim: Development of new effective treatments for dentin hypersensitivity by using nanolaser technologies.

Materials and methods: Sixty extracted human teeth with dentine hypersensitivity were used and divided into three groups. Group 1: samples remained untreated (control). Group 2: samples were covered with nanodispersed fluorine apatite and irradiated with Er:YAG laser (0.5 W, 50 Hz, 5 times x 5 s). Group 3: samples were covered with Nanodispersed fluorineapatite and irradiated with CO_2 laser (0.5 W, 5 s, 5 times). Samples were cut longitudinally and studied under SEM to evaluate morphological changes induced by laser irradiation.

Results: Fluorine apatite nanoparticles penetrate into open dentinal microtubules and make a closure layer. The next step is the laser irradiation of the area hypersensitive in order to induce the melting of nanoparticles associated with the dimensional effect - the effect of coalescence of nanoparticles resulting in reliable and sealing of dentin microtubules. Laser irradiation was carried out with the wavelength that lies at the maxima of the spectral absorption of calcium fluorineapatite (CO_2 laser - 10.6 microns or Er:YAG laser is 2.94 microns). The energy regimes of laser irradiation were determined by computer simulation in order to minimize the thermal load on the pulp, and correlated with experimental and clinical results.

Conclusions: The proposed and developed method of dentin hypersensitivity laser treatment with the use of calcium fluorineapatite nanoparticles provides reliable, durable and natural CaFAP adhesion in microtubules orifices – obturation and effective re-mineralizing function on the hypersensitive dentin surface. As a result, the treatment of hypersensitive teeth by the proposed method is quite effective.

O-30. COMPARISON OF DIODE LASER AND CONVENTIONAL TECHNIQUE FOR SOFT TISSUE ORAL SURGERY

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Objective: The aim of this study was to compare diode laser and conventional surgery for excision of the oral soft tissue lesions regarding specific clinical parameters and patient's satisfaction rate.

Background data: Healing mechanisms after laser surgery, irrespective of the laser wavelength, will be by secondary intention. It is clinically unimportant as healing after laser surgery starts two days after the procedure.

Methods: Twenty-nine participants with oral fibromas were involved in the study. The diagnosis was established based on clinical appearance of the lesion and confirmed by histopathological evaluation. Study group (16 patients) were treated with high power diode laser, wavelength of 975 nm, power of 5 W and CW, using spot size 0.1–0.5 mm. Control group (13 patients) were treated with conventional scalpel excision and silk sutures. Three days after surgery oedema and haematoma were assessed by the single examiner. Post-operative pain and patient's satisfaction were assessed using VAS. After 3 weeks patients were recalled again for delayed postoperative evaluation. Statistical analysis was performed using $\chi 2$ test and Mann-Whitney test. P-values lower than 0.05 were considered as significant.

Results: No significant differences regarding age and gender of the participants were observed between the groups. Patients in the study group had significantly lower oedema and haematoma scores ($p < 0.05$). Patients in the study group reported significantly lower pain and higher satisfaction rate ($p < 0.05$).

Conclusions: Diode lasers should be employed in oral surgical procedures due to coagulation effect, desinfection of the surgical site, minimal or no swelling and significantly reduced postoperative pain.

O-31. USE OF DIODE LASER AFTER SURGICAL REMOVAL OF IMPACTED LOWER THIRD MOLARS

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Objective: The purpose of this study was to evaluate the possibility of the aPDT and LLLT on wound healing, pain intensity, swelling, halitosis and postoperative usage of analgesics after surgical removal of the lower third molars.

Background data: aPDT and LLLT reduces postoperative discomforts and the use of analgesics after surgical removal of third molars.

Methods: The model group consisted of 150 healthy patients with the absolute indications for removal of lower third molars. Patients were randomly divided into three groups, 50 per each group. The first group received aPDT, second group LLLT and the third was indicated as a control group. The radiation power in aPDT group was 50 mW and the wavelength was 660 nm, while the power in LLLT group was 90 mW and the wavelength was 660 nm. Postoperative visits were scheduled on the third and seventh day when the patients from laser groups, were treated following the same protocol on the day of the surgery. Statistical analysis was performed using $\chi 2$ square, the independent Student's t-test and one-way analysis of variance.

Results: The results of the evaluation of the wound healing showed that there was a statistically significant difference in the all postoperative discomforts and taking analgesics between three patients groups ($p < 0.001$). The patients that were subject to aPDT had the least expressed postoperative problems considering all three groups.

Conclusions: Both used modalities of laser therapy that significantly reduced postoperative problems after the surgical removal of third lower molars.

O-32. THE ANTIMICROBIAL EFFECTIVENESS OF PHOTODYNAMIC THERAPY USED AS AN ADJUNCT TO CONVENTIONAL ENDODONTIC RETREATMENT: A CLINICAL STUDY

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Objective: The aim of this study was to evaluate the efficacy of photodynamic therapy (PDT) used as an adjunct to endodontic retreatment in the eradication of microorganisms.

Background data: PDT is an antimicrobial strategy in which low laser energy is used to activate a photosensitizer, and the singlet oxygen released causes damage to the microorganisms.

Methods: The study sample consisted of 21 patients with chronic periapical periodontitis on single rooted teeth, who have had previously endodontic treatment. Microbiological samples from the root canals were collected after accessing the canal, following endodontic retreatment and after the PDT procedure. Twenty-one teeth were retreated, instrumented with ProTaper files, and irrigated with 2,5% sodium hypochlorite and 17% ethylenediaminetetraacetic acid. Root canals were filled with phenothiazine chloride, which was removed after 2 min. Irradiation was performed with a 3D Endoprobe of a diode laser ($\lambda = 660$ nm, 100 mW) for 1 min. Microbiological samples from the root canals were cultivated on selective plates, and identification was done by

micromorphology, macromorphology and different API strips.

Results: Fourteen bacteria species were isolated from root canals initially, with a mean value of 4.57 species per canal. Although endodontic retreatment alone produced a significant reduction in the number of bacteria species ($p < 0,001$), the combination of endodontic treatment and PDT was statistically more effective ($p < 0,001$), and suceeded in the total elimination of bacteria from 11 root canals.

Conclusions: The results indicate that the PDT used as an adjunct to the conventional endodontic therapy achieves a significant futher reduction of intracanal microbial load.

P-1. PHOTODYNAMIC THERAPY AT PATIENTS WITH HYPERPLASTIC GINGIVITIS

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Aim: The aim is to evaluate the effectiveness of photodynamic therapy (PDT) using light-emitting diode (LED) at treatment of patients with hyperplastic gingivitis (HG).

Materials and methods: 36 patients with clinical diagnosis of HG (age 18–32 years) were included in this study. Control group: 18 patients were treated by scaling and root planning (SRP)—3–4 visits. PDT group: 18 patients were treated by SRP and PDT (in the first and third visits). After SRP each quadrant was assigned LED in the red spectrum (wavelength: 625–635 nm, power peak at 628 nm; power density: 2000 mW/cm^2) using the photosensitizer tolouidine blue O, 0.1 mg/ml. The clinical parameters of bleeding on probing (BOP) and gingival index PMA Parma (%) were measured at baseline and 14 days and 3 months after treatment.

Results: At 14 days and 3 months, both groups showed significant improvements with regard to all clinical parameters compared to baseline. Patients of PDT group showed BOP of 2.35 ± 0.18 at baseline that was reduced to 0.58 ± 0.10, $p < 0.001$ and 0.44 ± 0.09, $p < 0.05$ after 14 days and 3 months, respectively. Patients of control group had BOP, respectively—2.29 ± 0.17 at baseline, 1.34 ± 0.16, $p < 0{,}05$, 1.85 ± 0.20. In PDT group gingival index PMA was equal $59.8 \pm 4.7\%$ at baseline and decreased to $29.9 \pm 3.4\%$, $p < 0.001$ in 14 days and $24.0 \pm 3.1\%$, $p < 0.001$ after 3 months. Patients of control group had index PMA, respectively—$57.8 \pm 4.2\%$ at baseline, $35.0 \pm 3.2\%$, $p < 0\ 5$ and $39.6 \pm 4.7\%$.

Conclusions: The application of PDT using LED with the current setting have additional effects on clinical parameters in patients diagnosed with to hyperplastic gingivitis compared with SRP alone.

P-2. INCREASE OF CLOSURE IN DENTINAL TUBULES BY CO_2 LASER IRRADIATION USING NANO CALCIUM PHOSPHATE GRANULES

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Aim: The aim of this study was to evaluate the effect of CO_2 laser irradiation on the increase of effective ratio.

Background: Recently nano-size materials have been used in many fields. In dental area, nano-size granules of silica glass and calcium phosphate crystal have been applied to treat the dentinal hyper-sensitivity. These granules were applied to close the orifice of dentinal tubules. But the effective ratio of curative was about 60% in clinical treatment.

Materials and methods: To observe the change in dentinal tubules, we cut a crown of molar tooth using hard tissue cutting machine horizontally. The thickness of sample was 2 mm. The surface of the sample was cleaned in ultrasound EDTA solution for 5 min. We used two types of calcium granules (fuloroalmino silicate glass and hydroxyapatite). The mixture of either silicate glass and phosphate solution or hydroxyapatite and distilled water was applied on the surface of the sample. After the application of mixture, we irradiated CO_2 laser to the surface. The irradiation condition was as follows: focused beam (diameter = 0.4 mm), power of 0.5 or 1 W, irradiation time of 5 or 10 s. Before and after laser irradiation, we took the SEM photograph using usual method.

Results: In the hydroxyapatite sample we observed the destruction of crystal, and we found the fusion of silicate glass on the surface of the sample.

Conclusions: The fusion of silicate glass on the surface of samples may increase the effective ratio of curative treatments of the dentinal hyper-sensitivity.

P-3. LOW-LEVEL LASER REDUCES THE PRODUCTION OF TNF-A, IFN-Γ, AND IL-10 INDUCED BY OVA

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Aim: Evaluate the immunomodulating effects of low-level laser therapy (LLLT) on production of tumor necrosis factor-alpha (TNF-α), interferon-gamma (IFN-γ), and interleukin-10 (IL-10) in experimental model of the delayed type hypersensitivity (DTH) reaction to ovalbumin (OVA)

Materials and methods: The effects of HeNe laser therapy (λ 780 nm, 0.06 W/cm^2) of radiation, and fluency of 3.8 J/cm^2, focal spot, in reaction to ovalbumin in Balb/C mice were examined after the induction phase of the hypersensitivity reaction (n = 6). The animals treated with azathioprine (AZA) received a vehicle instead of ovalbumin, and those not immunized served as controls (n = 6) Footpad thickness measurements and hematoxylin-eosin histopathological exams were performed. Proliferation tests were performed spontaneous, in the presence of concanavalin A and ovalbumin to determine the production in mononuclear cells cultures of TNF-α, IFN-γ and IL-10.

Results: In the group of animals irradiated with lasers and in the group treated with AZA, footpad thickness measurements were significantly reduced in comparison to the control group ($p < 0.05$). This reduction was accompanied by a very significant reduction in the density of the inflammatory infiltrate and by a significant reduction in the levels of TNF-α, INF-γ, and IL-10.

Conclusions: LLLT radiation was shown to have an immunomodulating effect on DTH to OVA in Balb/C mice.

P-4. LOW-LEVEL LASER THERAPY IMBIBES THE EXPRESSION OF CYCLOOXYGENASE 2 IN A MODEL OF DTH TO OVA

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Aim: Low-level laser therapy (LLLT) is being used as an adjuvant therapy in medicine, dentistry and physical

therapy; however, its applicability is not yet completely accepted because some of its effects have not been properly clarified, primarily with regards to its anti-inflammatory action. In this study, the *in situ* effects of LLLT on Cyclooxygenase 2 (COX-2) expression after irradiation were examined in an animal model of delayed hypersensitivity reaction (DTH) to ovalbumin (OVA).

Materials and methods: In this study, the experimental model of DTH to OVA was used to evaluate the anti-inflammatory effects of LLLT. The animals were randomly divided into 3 groups: control - (I), not immunized, not treated and challenged (n = 6); control + (II) immunized, not treated and challenged (n = 6); and (III) immunized, treated with laser and challenged (n = 6). The treatment was given after the induction phase and before the sensitization phase in the animals. Footpad thickness and immunohistochemical analyzes for expression of COX-2 were performed.

Results: In the group of animals irradiated with the laser, footpad thickness was significantly reduced compared to animals from the control group. This reduction was accompanied by a significant drop in the expression of COX-2. The results obtained showed that the laser inhibited the DTH. Additionally, low-level laser therapy, in this model, inhibits the expression of COX-2.

Conclusions: Low-level laser therapy showed a reduction in the expression of COX-2 in the DTH model in the footpads of mice.

P-5. LASER-ASSISTED SURGICAL MANAGEMENT OF ORAL LEUKOPLAKIA: A FOLLOW-UP STUDY

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Aim: To report a clinical analysis of cases of Oral Leukoplakia (OLEP) surgically treated with different type of lasers, determining also the surgical instrument of choice to treat OLEP in terms of prevention of recurrence.

Materials and methods: This retrospective study of 79 primary OLEP diagnosed and consecutively submitted to surgical treatment (1996 to 2012) and subclassified according to the instrument used for surgical removals (cold blade – 17 lesions; Nd:YAG laser – 14 lesions; Er:YAG laser - 33 lesions; and CO_2 laser – 15 lesions). Laser parameters were: Nd:YAG laser (320 μm fiber, output power of 3.5 W and 70 Hz; Fluence: 62.5 J/cm^2); Er:YAG laser (vsp mode, E = 250 mJ; 25 Hz; Fluence: 50 J/cm^2); CO_2 laser with angulated mirror hand piece in defocused and continues mode (5 W, 2 mm spot, fluence of 159.2 J/cm^2). Outcome of treatment was assessed as follows: 1) clinical success: complete mucosal healing without reappearance or reduction of 80% of the primary lesion; 2) partial success: presence of the lesion with extension between 20 and 50% of the primary lesion; 3) failure: recurrence of the lesion in the same location of the oral cavity.

Results: When we compare Er:YAG laser group against traditional scalpel we observed a significantly better outcome when compared with the traditional scalpel group (p = 0.015). The comparison of the other instruments against traditional scalpel did not reveal significant differences.

Conclusions: Er:YAG laser could be regarded as the instrument of choice to treat OLEP.

P-6. POTENTIALLY MALIGNANT DISORDERS OF THE ORAL MUCOSA TREATED WITH CO_2 LASER: A PRELIMINARY STUDY OF POSTOPERATIVE COMPLICATIONS

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Aim: The aim of this study was to prospectively evaluate adverse effects of CO_2 laser vaporization of white potentially malignant disorders.

Materials and methods: The CO_2 laser was employed with a focus length of 0.15–2.5 mm. Inclusion criteria were a clinical and histological diagnosis of oral lichen planus (OLP) or oral homogeneus leukoplakia (OL). We elaborated a clinical protocol of possible complications: burning sense, swelling, pain, granuloma formation. To evaluate the pain we used a Visual Analogue Scale (VAS, 1–100 mm). The laser vaporization was carried out under local anaesthesia. The patient received a prescription of paracetamol analgesic and non-steroid anti inflammatory.

Results: In this prospective study, a total of 10 patients (6 women, 4 men) with 12 oral potentially malignant lesion were treated with the CO_2 laser. 6 plaque oral lichen planus and 4 homogeneus oral leukoplakia were included. The mean age was 65.5 years. The applied dosis was determined individualy in each patient, from 3 to 8.5 W (mean 7 W). The mean pain VAS was 5.1 (1 to 10), and the day with more pain was the fifth day. Pain of vaporization cheek (mean = 4) was minor than masticatory mucosa (mean = 5.5). There weren't any other problems.

Conclusions: Local CO_2 laser therapy may be an alternative treatment modality for patients with plaque oral lichen planus and oral homogenous leukoplakia based on the complications that have been registered in this study. It would be right to give analgesic at least five days post-surgery with CO_2.

P-7. CLINICAL EFFECTS OF LOW LEVEL LASER THERAPY ON REGENERATIVE PERIODONTAL TREATMENT IN INTRABONY DEFECTS

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Aim: The aim of this study is to assess the clinical effectiveness of a low level laser therapy (LLLT) with respect to the acceleration of bone regeneration after surgical treatment of intrabony defects.

Materials and methods: Twelve patients, ages 20–45, non-smokers, good health condition present at the time of the surgery, were randomly divided in two groups. Informed consent was obtained. Each patient had at least one periodontal defect treated by regenerative surgery. The test group received a postsurgical treatment with low level laser therapy (LLLT). The equipment used was OsseoPulse AR 300, at an intensity of 20 mW/cm^2 for 20 min per day for 21 consecutive days. The control group received no treatment with LLLT. The following clinical parameters were evaluated in both groups at baseline and 3, 6 months postoperative: probing depth, clinical attachment level and fill level of the intrabony defects.

Results: The mean probing depths and clinical attachment level in the test group decreased in comparison with the

control group ($p < 0.05$). Radiographic evaluation showed more rapid bone regeneration in the test group compared with the control.

Conclusions: With all the limitations regarding the number of patients and the follow-up period, it can be concluded that LLLT can be considered a valuable support improving the outcomes of the regenerative periodontal treatment in intrabony defects. Clinical data indicate the possibility of more rapid wound closure and subsequent healing in zones treated with LLLT as compared with control.

P-8. ANALYSIS OF POSTURAL CHANGE IN CERVICAL VERTEBRAE AND MASTICATORY MUSCLE TONE BEFORE AND AFTER LASER ASSISTED LINGUAL FRENULOTOMY

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Aim: To analyze the postural change in the cervical vertebrae (C1–7) and the tension of the masticatory muscles, in particular masseter (MM) and anterior temporal (TA), before and after laser frenulotomy.

Materials and methods: 25 pediatric patients (range, 7–12 years) were initially selected. Subsequently, they were examined by simple surface electromyography (sEMG) to evaluate the activity of the masticatory muscles at rest, clenching and swallowing. Afterwards orthostatic posture assessment was made by means of Romberg's test (Rt) and photographic study. Finally, lateral teleradiography with cephalometric analysis according to Giannì and Rocabado was performed to estimate the cranial-cervical relationship. The frenulotomy was performed using a diode laser ($\lambda = 890$ nm).

Results: The sEMG values before frenulotomy indicated a clear electrical abnormal activity of the muscles examined (MM and AT) compared to normal basal and functional values. After frenulotomy there was a normalization of basal values which reflected a better postural mandibular position. Besides, the postural position of the hyoid bone, the cervical vertebrae (in particular C3) and the retro-Gnation (more posterior-inferior point of the jaw symphysis) after the operation were significantly better ($p < 0,05$) compared to initial position. Finally, Rt static test showed reduced level of instability after frenulotomy.

Conclusions: According to our results lingual laser assisted frenulotomy has the following advantages: (1) improving mobility and function of the tongue (swallow and speech), (2) normalizing the basal tone of masticatory muscles, (3) promoting a physiological cervical lordosis, and (4) providing a more symmetric and harmonic body posture.

P-9. THE EFFECT OF LOW LEVEL LASER THERAPY ON ORTHODONTIC CANINE RETRACTION RATE

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Aim: The aim of the study was to investigate if low level laser therapy (LLLT) associated to mechanical forces stimulates the rate of orthodontic tooth movement.

Materials and methods: The study was conducted on 10 young adult subjects who required traction of maxillary canines into first premolar extraction sites using tension elastic chain with fixed appliance. LLLT at an intensity of 20 mW / cm^2 was applied for 10 days to the canine on the test side and using a pseudo application on the placebo site. Dental impressions, casts and profile teleradiographs were taken at the beginning of the trial and 10 days post LLLT treatment. Data of the biometrical progress on both sites (study and control) were statistically compared.

Results: All patients showed significant acceleration of the retraction of canines on the side treated with LLLT when compared to the control ($p < 0.05$).

Conclusions: Our findings suggest that LLLT does accelerate human teeth movement and could therefore shorten the whole treatment duration.

P-10. COMPARISON OF PREVENTIVE EFFECT OF DIFFERENT TREATMENTS ON ENAMEL EROSION

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Aim: The aim of this study was to evaluate the effectiveness of different preventive methods against enamel erosion caused by hydrochloric acid (HCl).

Methods: Eighty-one ground flat, polished bovine enamel slabs ($4 \times 4 \times 2$ mm) were selected based upon their Knoop microhardness values. The specimens were isolated with composite resin, leaving an exposed area on their outer surface, which was exposed to preventive treatments and erosive challenge. The specimens were divided into nine groups according to the following treatments ($n = 9$): C – control (no treatment); F (1.23% acidulated fluoride gel); FV (fluoride varnish); CO (CO_2 laser, 0.8 W, 0.96 mJ, 15 s, repeat pulse, irradiation distance of 2.5 mm, without cooling); COF (CO_2 + F); COFV (CO_2 + FV); Nd (Nd:YAG laser, 1 W/ 10 Hz, 100 mJ, extra long pulse, 15 s, contact mode, without cooling); NdF (Nd:YAG + F); NdFV (Nd:YAG + FV). The erosive challenge was performed through exposure of specimens to HCl (pH = 2, 20 s, 4x/d) for 5 days in order to induce erosion-like lesions, simulating the intrinsic erosive process. Volume loss was assessed using confocal laser microscopy (OLS 4000). Data were analyzed by One-Way Analysis of Variance ($\alpha = 0.05$).

Results: It was not observed statistical difference among the groups: C ($8.85 \mu m^3 \pm 0.96$); F ($7.93 \mu m^3 \pm 1.05$); VF ($9.85 \mu m^3 \pm 2.28$); CO ($7.83 \mu m^3 \pm 2.33$); COF ($9.26 \mu m^3 \pm 1.10$); COVF ($9.29 \mu m^3 \pm 3.33$); Nd ($11.17 \mu m^3 \pm 3.29$); NdF ($10.61 \mu m^3 \pm 2.88$); NdVF ($8.82 \mu m^3 \pm 2.00$), although the groups F and CO showed a lower tendency to enamel volume loss.

Conclusions: Any treatments did not prevent the tooth enamel erosion.

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