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OF THE WORLD FEDERATION FOR LASER IN DENTISTRY

Abstracts from
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World Federation for Laser in Dentistry
European Division
June 20–22, 2019
Parma, Italy

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Abstracts from the 7th Congress of the World Federation for Laser in Dentistry European Division June 20–22, 2019, Parma, Italy

ORAL COMMUNICATIONS

SPONTANEOUS BONE SEQUESTRATION IN PATIENTS AFFECTED BY MEDICATION-RELATED OSTEONECROSIS OF THE JAW: ROLE OF PHOTOBIMODULATION

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Background: Medication Related Osteonecrosis of the Jaw (MRONJ) has been reported as a side effect of antiresorptive and antiangiogenic medications. Photobiomodulation (PBM) has been proposed as an adjunctive modality for the management of MRONJ.

Objective: To present retrospectively clinical cases of MRONJ showing spontaneous bone sequestration after PBM.

Methods: A retrospective study of MRONJ patients who underwent PBM from 2016 to 2019 was done. Inclusion criteria were MRONJ patients with exposed bone and subjected to a minimum one PBM cycle. Exclusion criteria were MRONJ patients subjected to surgical approach. In all patients, controlling oral health conditions, antibiotic therapy, and PBM were done. PBM was applied (8 sessions per cycle) using a multidiodic laser (Lumix C.P.S. Dental, FISIOLINE, Verduno, Cuneo, Italy) emitting simultaneously 650 nm, 810 nm, and 910 nm. The parameters (for session) were Power of 0.6 W, Time of 15 min, Frequency of 30 KHz, and Total Energy of 577.4 J in scanning mode.

Results: 6 patients (5 females and 1 male) out of 30 patients showed a spontaneous bone sequestration after PBM. In these patients, the distribution of MRONJ was 83% in maxilla and 17% in mandible. All patients had history of antiresorptive medications administration (bisphosphonates in 4 cases and denosumab in 2 cases). Bone sequestrum was observed after different number of cycles (4 of them after 2 cycles).

Conclusions: These clinical cases may highlight the need for further investigations on PBM as an adjunctive modality in the management of MRONJ, especially when the conservative approach is favorable.

IS THE NEWEST PROTOCOL OF 810 NM (DIODE LASER) WITH 2 WATT IN LASER ASSISTED ENDODONTICS SAFE FOR ROOT SURFACES OF TOOTH?

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Clinical investigations of the temperature rises in apical, middle and cervical thirds of root surface with the newest protocol in laser assisted Endodontics compare to body temperature, an in vivo study.

Number of patients in this clinical study was 30. Each patient with a single canal tooth for root canal therapy. Canals were sterilized with 810 nm, power 2 W, fibre 200 μ m in the continuous mode (CW), radiation time 2 mm/sec, after 5 sec irradiation a 5 sec rest, 4 times for each canal from apical to coronal with circular movement. Temperature of apical, middle and cervical thirds were recorded by digital thermometer. Body temperature was recorded for each patient exactly around the same tooth before treatment too.

The highest temperature rises are shown at cervical thirds with mean 37.4867°C, standard deviation 1.44096°C. A normal range, not far from the critical value and very safe for body.

This newest protocol in world of laser for root canal therapy with 810 nm (diode laser) at 2 W, with continuous mode (CW) can be used in clinic safely.

PHOTOBIMODULATION WITH FLAT-TOP HAND-PIECE: FROM RESEARCH TO THE CLINIC

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Nowadays, photobiomodulation bases on some “like-dogmas” that do not consider the advances in the field of the bio-photonic-technologies. Higher-energies uncouple mitochondrial activities, higher-energies deplete cell’s energy, fluences higher than 10 J/cm² damage cell’s DNA, are some of those. Recently, a hand-piece with a flat-top irradiation profile has been developed and marketed. This hand-piece generates a more homogenous irradiation and the same spot size from contact to 105 cm distance from the target tissue. Thanks to the peculiar features of the flat-top hand-piece we tested the effect of a higher-energy laser-therapy (808 nm, 1 W/cm², 60 J/cm², 1W, 60 sec, continuous-wave) on a wide range of cellular and animal models. The higher-energy laser-therapy is able to induce higher ATP production than the low-level-energy (96% vs 24%) and stimulate oxygen consumption and cell proliferation as well as intracellular calcium fluxes, in cell model. The higher-energy does not uncouple the mitochondria respiratory-chain of extracted mitochondria and does not induces DNA damage in animal model. Conversely, it affects murine-mesenchymal stem cells by reducing the inflammation process and stimulating cellular growth, osteoblast differentiation

and mineralized matrix deposition as well as promotes the wound-healing in invertebrate-animal model. Plus, it induces the release of neurotransmitters by nerve terminals and positively modulates the metabolism and the wound-healing of human-endothelial cells. In conclusion, the flat-top hand-piece features allow effective and not-dangerous photobiomodulatory effects by irradiation of higher-energy laser-therapy. The effects at cellular level are more evident than the low-level-energy therapy. We showed that a reconsideration for a higher-fluence with a higher-energy should be addressed.

BIOFILM REMOVAL METHODS FROM IMPLANTS TITANIUM SURFACE: COMPARATIVE STUDY IN VIVO

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Background: Presence of bacteria on the implant surface may lead to inflammation of the mucous membrane around the implant. For the treatment of periimplantitis it is important to remove bacterial plaque and inflammatory tissues.

Objective: To evaluate the efficacy of laser technology for eliminating of oral biofilm attached to titanium implants.

Methods: For study were used 3 types of titanium disks: machined surfaces; titanium-nitride coating; acid etched and sand blasting titanium surface.

Titanium specimens were fixed into individual removable acrylic splints (12 discs in each splint), which worn by 40 volunteers (age 20–25 years) for 24 h. All discs were divided into six groups: 1 group - control, 2-nd - cleaning with Er:YAG laser, 3-d PDT (photodynamic therapy), 4 group - combination of mechanical debridement and cleaning with Er:YAG laser, 5 group - combination of mechanical debridement and PDT, 6 group - mechanical debridement. After cleaning all discs were giving under microbiological evaluations. Three types of grows media were used. Samples were incubated under aerobic conditions. For visualization the impact of methods, the samples were giving under scanning electron microscopy and chemical analysis

Conclusions: Statistical analysis showed that 4th group has demonstrated the best results on all samples. Other groups (2,3,5,6) showed lower rate of growth of bacteria compared with group 1.

All methods were able to reduce the total number of microorganisms from titanium implants. The best results of eliminating biofilms were achieved by synergistic effect (combination of mechanical debridement and irradiation with Er:YAG laser).

CHRONIC ORAL CANDIDIADIS AND LLLT

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Background: Candida is present in 45–65% of healthy infants and 30–55% of healthy adults. In humans, the most common species found in oral candidiasis (OC) is *Candida Albicans*. Symptoms of OC are commonly mild, but it can be difficult to

heal or become relapsing or recurrent. Besides, OC has been growingly associated with the pathogenesis of pre-cancerous lesions. A variety systemic factors, such as extreme age, underlying diseases, immunodeficiency, promote a switch from commensal to pathogenic *Candida*. Local factors (dentures, local steroid and xerostomia) can be involved too.

Objective: To study the effects of Low Level Laser Therapies (LLLT) in the disinfection of the oral mucous membranes and in the local treatment of chronic OC. Bio-stimulation of contaminated oral epithelial tissues will be provided with double wavelength laser light (980 and 635 nm). Treatment will be performed on a homogeneous group of 10 patients, reaching a 10 J/cm² fluence.

Results: Results will be compared with LLLT in vitro effects from parallel study.

Conclusions: LLLT in decontamination of oral mucosa can be a valid aid in the therapy and prevention of OC. Therefore, effective bio-stimulation would be able to reduce the risk of developing a pre-cancerous oral condition.

Er,Cr:YSGG LASER EFFECT ON THE SURFACE OF IMPLANTS WITH 3 DIFFERENT TIPS AND PULSE ENERGIES

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The main biological complications of dental implants are peri-implant diseases. Presently there is controversy regarding laser parameters for implant decontamination. The objective of this study was to identify by means of scanning electronic microscopy (SEM) the safe parameters of application of the Er,Cr:YSGG laser on dental implants and to describe the defects caused by laser radiation on implant surfaces with different energies per pulse and different tips. The design was experimental in vitro. We irradiated 30 areas of Avinent dental implants with an Er,Cr:YSGG laser with different power densities and different energies per pulse and studied the surfaces with SEM. We irradiated 2 areas of 15 implants with each of the following tips (10 surfaces per tip): conical (RTF3-17 mm), side firing (SFT8-18 mm) and cylindrical 600 micrometers. We developed a classification of surface damage (Chegeni-Arnabat): no damage (a), small surface damage (b),

metal fall and craters (c), and destruction with carbonization (d). Implants irradiated with the tip RTF3-17 mm with a power density of 1250 W/cm² presented a class B damage while with 2083.33 W/cm² presented a class C damage, the lateral and cylindrical tips presented class B damage, the less damaging tip being the Side firing tip with 300 W/cm². LASER radiation with a lateral tip of 800 micrometers at a power of 1.5 W 30 Hz 40% water 50% air for 60 sec was considered safe for the implant surface.

LASER AND SDB (SLEEP-DISORDERED BREATHING): HOW THE LIGHT CAN HELP THE SLEEP!

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Among the indications on the treatment of patients suffering from SDB (Sleep-Disordered Breathing), related to sleep apnea, there are those of a minimally invasive approach. The choice of treatment depends on the diagnostic clinical classification of the patient, which must be rigorous and multidisciplinary. The first prescription, in the case of a polysomnographic diagnosis of OSA (Obstructive Sleep Apnea) medium or severe, is the use of CPAP (Continuous Positive Airway Pressure), followed by the possible application of a MAD (Mandibular Advanced Device). The surgical approach, which involves the uvula, the soft palate and the oropharynx, can be more or less complex, treating the patient with minimally invasive procedures (Pillar procedure, Coblation, Snoreplasty with Sclerosing injections) or invasive (Reductive uvulopalatoplasty, reserved for complex cases). For some years, the use of the Erbium laser: YAG 2940 nm, has been proposed in association with non-invasive techniques for the non-ablative treatment of the soft palate and adjacent tissues. The topic of the report will focus on the illustration of the method for which the preoperative situation, the laser use parameters and the therapeutic results will be taken into consideration. We will also discuss the various problems concerning the learning curve and the operating difficulties concerning the appropriate choice of laser's parameters.

THE PHOTOBIMODULATION EFFECT OF NEAR INFRARED LASER ON DENTAL FOLLICLE STEM CELLS CULTURED ON NANOMATERIAL SCAFFOLD

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Near infrared laser wavelengths could produce a photobiomodulation effect on human cells. The aim of this in vitro study was to assess the effect of laser with low-level and different

pulse duration on viability and proliferation of dental follicle stem cells (DFSC) cultured on a scaffold based on composite nanomaterials.

The DFSC was cultured on a composite nanomaterial substrate containing nanostructured hydroxyapatite (HA) +1% gold nanoparticles (AuNPs) +1.6% graphenes. For the irradiation was used a laser with 1064 nm wavelength produced by a LightWalker system (Fotona d.o.o). To deliver the laser beam on the DFSC cultured on substrate it was used a GENOVA flat-top handpiece. The laser irradiation used similar parameters (0.25–0.5 W, 10 Hz, 30 sec) but with different laser pulse duration (MSP, SP, VLP). Cell viability was measured by MTT assay at 24, 48, 72 h after laser irradiation. Also, after 24, 48, and 72 h, the number of cells was counted in microscopy pictures. During the laser irradiation the temperature average was measured.

The MTT assay results showed that the viability of DFSC increased after laser irradiation at 24 and 72 h. The number of cells also increased when it was used MSP mode. The temperature measured ranged between 25 and 36 degrees Celsius.

The laser wavelength of 1064 nm increase the viability and stem cells proliferation in case of irradiation with low-level energy and micro-short pulses. The presence of the composite nanomaterial influence the absorption of the laser radiation in cells and the temperature average.

THE PHOTOBIMODULATION (PBM) IN ORAL PAIN MANAGEMENT. NEUROLOGICAL AND CLINICAL CONSIDERATIONS

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Pain management through the Photobiomodulation (PBM) in Dentistry and General Medicine has been widely investigated along the last 40 years. However, the mechanisms involved in this action are not clearly understood.

Many Authors suggest that PBM anti-inflammatory action, through the reduction of mediators release as PGE, IL-1 β and TNF α , has an important role in pain control, like the one of several drugs.

Secondly, the reduction of cellular oxidative stress was also considered, especially in muscular pain; it is based upon the reduction of muscular fatigue that is the origin of many myalgias. Another mechanisms related to PBM pain relief could be its selective efficiency in the blockage of neural transmission, especially in A δ and C fibers which transmit the nociceptive sensations to the Central Nervous System; this action could derive both by the inhibition of the production of neurotransmitters, or by the production of vacuoles in neural axons, that blocks their function.

These actions, individually or in different combinations, are involved in pain management of many conditions as: dentin hypersensitivity, TMJ dysfunctions, oral mucositis, MRONJ, teeth orthodontic movement and even in the so-called Burning Mouth Syndrome, in which PBM may substitute the administration of conventional painkillers or anti-inflammatory drugs.

Further studies are needed to better understand the neurologic mechanisms involved in this action and to establish standardized protocols which could permit great benefits for patients, especially in the case of drug sensitivities or concurrent systemic diseases that limit the possibility to recur to conventional pharmacological treatments.

All teeth had the root canals biomechanically instrumented using the ProTaper system Dentsply, Maillefer, Ballaigues, Switzerland) and Crown-down.

DENTINAL HYPERSENSITIVITY TREATMENT USING DIODE LASER 980 NM: IN VIVO STUDY

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Discomfort of patients due to dentinal hypersensitivity (DH) is a main challenge. Difficulties treating DH gave rise to many therapies. In this study, graphite paste was used on the area irradiated. The aim is to evaluate effectiveness of diode laser with graphite paste. Null hypothesis was no reduction in pain after treatment. In addition, In Vitro: temperature increase in pulp due to irradiation was measured to assess treatment's safety. 184 patients enrolled in the study, pain was evaluated by visual analogue scale, graphite paste was applied on the exposed dentine, application of diode laser with continuous mode, backward motion, and tangential incidence of the beam in non-contact mode and a delivery output of 1W. Fiber's diameter was 320 μm and total exposure time depended on the time to remove the graphite. Statistical analyses were performed with Prism 5[®] software. 12 human adult impacted wisdom teeth were used to assess the pulp rise of temperature after treatment. Reduction of dentinal hypersensitivity occurred in post-operative. Pain level averages and standards deviations were: 6.505 \pm 1.608 for the initial pain, 0.8909 \pm 1.045 after treatment, 1.318 \pm 2.124 at 3 after treatment and 1.409 \pm 2.153 at 6 months. Pain in post-operative significantly decreased immediately after treatment. All values were under the tolerable increase in temperature. Diode laser 980 nm coupled to graphite paste provides a safe and statistically significant decrease in the DH immediately after application and within 6 months follow-up. Therefore, the null hypothesis was rejected.

PHOTOBIMODULATION WITH A 645 NM DIODE LASER: IN VITRO EVALUATION OF PROLIFERATION AND DIFFERENTIATION OF SAOS-2 CELL LINE WITH OR WITHOUT PLATELETS RICH PLASMA

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Objective: This in vitro study aimed to investigate possible outcomes resulting by combined use of mesenchymal stem cells, LLLT and PRP. Chosen wavelength was 645 nm; the study included a case-control structure.

Methods: Experiment was conducted on Saos-2-ATT-HTB-85TM Human Osteosarcoma Cell Line. LLLT was performed every other day for six times in total. Fluence values of 2 J/cm², 5 J/cm², and 10 J/cm² were applied for 1, 2, or 4 min. Cell viability was assessed by resazurin reduction assay. Cell differentiation was assessed by alizarin-red assay.

Results: For proliferation's rate no main differences between protocols were highlighted.

For differentiation's rate was observed that inside control wells stem cells with PRP showed higher concentration of Calcium salts deposits than stem cells without PRP, with a mean concentration of 0.8 mM vs 0.11 mM. Protocols applying 2 J/cm² showed no significant differences between wells with or without PRP. Highest values of Calcium salt deposition were registered for 5 J/cm² in 2 min application; same results were obtained applying the protocol of 10 J/cm² in 4 min. Results were statistically sig-

nificant ($p=0.017$) compared to Calcium salt deposition in not irradiated wells (Fisher's Chi² test).

Conclusions: The combination of LLLT and PRP leads to statistically significant increase of both proliferation and differentiation rates. The laser application of 5 J/cm² delivered in 2 min with Power Density of 130 mW/cm², meaning a total Energy of 7.8 J and Power of 65 mW, was proven to be the most effective.

AUTO-FLUORESCENCE AS A DIAGNOSTIC TOOL FOR ORAL CARCINOMA AND OSTEONECROSIS OF THE JAW

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Background: AutoFluorescence (AF) is a peculiar visual property of some tissues directly associated to the concentration and distribution of specific fluorophores.

Methods: 114 lesions suspicious for oral epithelial dysplasia (OED) and oral squamous cell carcinoma (OSCC) were included in the present evaluation. A system emitting 400–460 nm light (VELscopeVx - LED Medical Diagnostics Inc., Barnaby, Canada) was used to assess AF. Each specimen was classified as normo-/hypo-/hyper-/ fluorescent and the histopathological pattern was analyzed. Lesions were graded as having: no dysplasia; dysplasia (mild or moderate) and carcinoma.

Furthermore, AF pattern of 56 bone specimens have been evaluated.

Results: A strong statistically significant association between histological alteration (OED or carcinoma) and AF alteration considering both hypo- and hyper-fluorescence was highlighted ($p=0.005$). A statistically significant difference in the AF alteration related to diagnosis, with progressing value from no dysplasia to dysplasia and then carcinoma was demonstrated. (No dysplasia: altered AF in 42.9% of cases; Mild/Moderate dysplasia: altered AF in 78.9% of cases; In situ Ca/OSCC: altered AF in 100% of cases - $p<0.001$). 100% of hypo-fluorescent specimens was necrotic bone; 86% of hyper-fluorescent specimens was normo-structured bone ($p<0.001$).

Conclusions: AF alteration is statistically related to histological alteration. So, not only hypo-fluorescence, but also hyper-fluorescence should be taken into consideration.

Moreover, a strong correlation between AF and bone vitality have been demonstrated and AF can be useful in highlighting surgical margins of osteonecrosis of the jaws.

DEBONDING OF CERAMIC LAMINATES WITH Er,Cr:YSGG LASER, IN TWO MATERIALS, WITH DIFFERENT THICKNESS AND DIFFERENT PARAMETERS OF IRRADIATION

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Objective: To promote the Er,Cr:YSGG laser to remove ceramic veneers, three researches are presented, comparing the debonding resistance of ceramic laminates and determine the type of failure, after treatment with and without Er,Cr:YSGG laser, with different fluences, two type of materials and four different thicknesses.

Methods: Three researches used bovine teeth. In each of them, a 6 mm diameter ceramic laminate, was bonded with a resin cement. Some of the veneers were irradiated with an Er,Cr:YSGG laser of 2.780 nanometers (Waterlase iPlus® Biolase), during 60 sec. In each of the three studies the following parameters were modified:

1: 63 teeth - 3 groups: (n=21) – Feldspathic laminates. Thickness: 0.8 mm. The two experimental groups of laminates were irradiated with two fluences: 4 J/cm² and 2.7 J/cm². The control group was not irradiated.

2: 60 teeth - 3 groups (n=20) – Lithium disilicate laminates. Thickness: 0.8 mm. The two experimental groups of laminates were irradiated with two fluences: 4 J/cm² and 5.33 J/cm². The control group was not irradiated.

3: 72 teeth - 4 groups (n=18) – Lithium disilicate laminates. Thickness: 0.4–0.8–1.2–1.6 mm. All laminates were irradiated with 5,33 J/cm².

Debonding resistance tests were performed with an universal testing device and samples were observed under the stereomicroscope, at 20 X magnification.

Results and conclusions: Using Er,Cr:YSGG laser is an adequate and safe technique to remove ceramic veneers. The thickness of veneers influences the debonding resistance.

EFFECTIVENESS OF PHOTOBIOMODULATION WITH LOW-LEVEL LASERS ON THE ACCELERATION OF ORTHODONTIC TOOTH MOVEMENT: SYSTEMATIC REVIEW AND META-ANALYSIS

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Background: The forces causing tooth movement trigger an inflammatory reaction of tissues, stimulating bone remodeling, but patients refer pain and discomfort. Low-level laser therapy (LLLT) stimulates collagen synthesis, bone remodeling and increases the speed of orthodontic tooth movement (OTM). Studies on acceleration of tooth movement were found with different results due to variations in LLLT application protocols.

Objective: This systematic review aims to determine the effectiveness of low-level lasers on the acceleration of OTM during canine retraction and develop a meta-analysis in which the effectiveness of LLLT on the acceleration of OTM is evaluated.

Methods: This research was conducted based on Cochrane and PRISMA statements. The studies were searched in 5 electronic databases. Randomized clinical trials were selected. Orthodontic treatments with first upper premolars extractions using canine retraction mechanics were included. The effectiveness of LLLT was evaluated during canine retraction and quality and risk of bias were evaluated. The main data of the studies were recorded and results were analyzed using a meta-analysis with randomized effects model.

Results: 430 publications were found in databases and 15 studies were selected. Qualitative and quantitative analyzes were carried out. 9 studies had significant results to accelerate OTM with LLLT. A greater tendency of lasers to induce the canine retraction movement was found, during months 2 and 3, with high heterogeneity among the selected studies.

Conclusions: A tendency of LLLT was determined to be effective on the acceleration of OTM during upper canine retraction. There was high heterogeneity among the studies selected for the meta-analysis.

DIODE LASER APPLICATIONS IN ORTHODONTICS: CLINICAL REPORT

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Objective: The purpose of the work is to illustrate the versatility of diode laser in orthodontics.

Materials and methods: The study describes the use of diode lasers in low invasiveness surgical procedures that are frequently performed during orthodontic treatment. The following procedures will be described: gingivectomy, gum flap (operculum) opening, treatment of gingival hypertrophy, included teeth uncovering, labial and lingual frenulectomy, gingival recontouring for aesthetic purposes.

Results: The diffusion of diode laser as an instrument of ordinary use in orthodontic clinical practice is desirable from the point of view of the versatility of this instrument. The use of the laser allows to carry out minimally invasive procedures, to reduce the patient/operator stress, to have a reduced use of anesthetic; it does not require the application of sutures and it has an important antiseptic action, simultaneously with the surgical effect, reducing or eliminating the use of antibiotics in the post-operative phase. Moreover, its cutting precision with a contextual hemostatic action, allows to obtain an optimal control of the bleeding in the gingival recontouring allowing the laser to be considered as the instrument of choice for this procedure. Finally we have to mention that the current literature contains many articles that report the laser application in accelerating the orthodontic movement.

Conclusions: Laser can be considered a valid instrument in the daily activity of the orthodontist. Its use certainly has countless advantages compared to the execution of the same procedures in a conventional manner.

PHOTOBIOMODULATION EFFECT OF 810 nm DIODE LASER ON NEUROSENSORY RECOVERY: BEHAVIORAL ASSESSMENT IN RATS

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Nerve tissue injuries may occur during various dental & routine surgical procedures and inferior alveolar nerve (IAN) is the most affected nerve in this area, considering the limitations of conventional treatments and encouraging results of previous studies on the effect of photobiomodulation (PBM) on nerve injuries, we aimed to assess the photobiomodulation effect of 810 nm diode laser on neurosensory recovery of crushed inferior alveolar nerve in rats by behavioral analysis. 36 male wistar rats were enrolled in the study in 3 groups of: IAN injury+laser treatment, IAN injury+sham laser and IAN without injury. before surgery neurosensory threshold of IAN in each group was recorded with von-frey filaments test. in groups of 1 and 2: IAN was exposed and crushed and in group 3: the rats had the sham surgery without injury. one day after surgery, laser therapy with 810 nm laser was done every other day in laser group and sensory thresholds of the nerve in all groups were monitored in one month period after surgery. after IAN injury in group of 1 and 2 we had the increase in the neurosensory threshold of the nerve that in laser group was recovered to the baseline in maximum of 15 days postsurgery, while in untreated IAN injury group we didn't observe complete recovery after 1 month post-surgery. PMB with 810 nm diode laser significantly enhanced neurosensory recovery of injured IAN in rats. According to the encouraging results of this study, PBM can be proposed as a novel and noninvasive treatment modality in neurosensory disturbances.

EVALUATION OF THE DEPTH OF CEMENTUM ABLATION BY Er:YAG LASER CAUSED BY DIFFERENT ENERGY LEVELS: A PRELIMINARY IN VITRO STUDY

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Objective: Evaluation of the depth of cementum ablation caused by different energy levels of the Er:YAG laser.

Materials and methods: 48 roots decay free, of upper and lower molars of human adults were used. The roots were scaled preliminary to the study by an ultrasound device, and randomly distributed to be analyzed after different energies levels delivered by Er-YAG laser (Fortona).

A chiseled tip was used under water irrigation and air cooling at a ratio of 70 to 30 as indicated by the manufacturer. The energies per pulse used were 80 mJ, 90 mJ, 100 mJ, and 120 mJ. The repetition rate was 15 Hz, and with an inclination of 15 to 30 degrees. One single passage was performed, at a speed of 1 mm per second.

Results: The energy higher than 120 mJ provoked the entire removal of the cementum layer.

Conclusions: The energy used for a superficial removal of the cementum has to be lower than 100 mJ.

THE USE OF THE ELECTROMAGNETIC FIELD AND LED LIGHT THERAPY IN REGENERATION OF PERIAPICAL BONE STRUCTURES OF THE TEETH IN THE ENDODONTIC TREATMENT

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Chronic periapical tissue inflammation is a disease characterized by a slow, long-lasting course. Despite the growing knowledge, the choice of treatment for chronic periapical inflammation, remains problematic. The aim of the study was to evaluate the effect of the combined physiotherapeutic method, including extremely low frequency electric and magnetic field (ELF-EMF) with high-energy LEDs to accelerate the regeneration of periapical tissues.

The study involved 69 patients with osteolytic lesions in the course of chronic periapical tissue inflammation. The subjects were of both sexes, aged from 16 to 82, divided into two groups: L- study group of 38 patients (45 teeth), treated with additional ELF-EMF and LED diodes therapy and K- control group, 31 people (38 teeth) treated without physical therapy.

The analysis revealed that an average of 36 physical procedures should be performed to achieve a satisfactory effect. The smallest number of procedures (29) required lesions in the lateral part of the maxilla, while in the lateral part of the mandible 31. The type of endodontic treatment had no effect on the final result. The fastest completed reconstructive process were observed in people under 35 y.o. In L group, the mean time to obtain bone regeneration was 8.5 weeks, when in the K group it was 44 weeks.

The research confirmed the effectiveness of physical therapy in the elimination of osteolytic foci.

ELF-EMF and high-energy LEDs is an auxiliary procedure useful in all age groups with the effect to accelerate the healing of osteolytic lesions caused by chronic inflammation of periapical tissues.

IN VITRO DETERMINATION OF THE CRITICAL pH DEMINERALIZATION OF HUMAN DENTAL ENAMEL IRRADIATED WITH Nd:YAG LASER ASSOCIATED WITH FLUORIDATED PRODUCT

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The use of fluoride products associated with high intensity laser irradiation are beneficial for dental caries prevention because it increases the surface area, improving the formation of fluorapatite (FA), which gives greater acid-resistance of enamel against bacterial acids. The objective of this study is to determine the critical pH of dental enamel treated with acid fluoride phosphate 12,300 µF/g (APF) and Nd:YAG laser 84 J/cm², as there is no precedent to determine this pH. The study consisted of 4 groups (n=15): G1: Negative Control; G2: APF; G3: Nd:YAG; G4: APF+Nd:YAG. Each group was randomized into three subgroups (n=5) for pH cycling. The cycling was designed to simulate three conditions: below critical pH of enamel hydroxyapatite (pH 5.0); pH below critical for hydroxyapatite and fluorapatite (pH 4.5); condition further below the critical situation to investigate extent of acid resistance of the enamel (pH 4.0). The samples were

analyzed by scanning electron microscopy (SEM), Fourier infrared spectroscopy (FTIR) and solutions were quantified fluoride (specific ion electrode) and phosphate (colorimetric method). In SEM and FTIR (phosphate band) at pH 5, only the APF and APF + Nd:YAG groups did not present demineralization. At pH 4.5, only the APF + Nd:YAG group was integrated. At pH 4, APF + Nd:YAG showed signs of mild demineralization while the other groups showed aggressive signals. It is concluded that the irradiated fluorapatite has critical dissolution pH different from fluorapatite formed only with the application of fluorine.

RESEARCH-BASED FUTURE WITH Nd:YAG AND Er:YAG LASERS IN INFLAMED PERIODONTAL TISSUE

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Periodontal disease represents oral inflammatory infections initiated by oral pathogens and their endotoxins which cause destruction to tooth supportive tissues. Conventional non-surgical methods in the treatment of periodontal pockets have their limitations, including difficulties in access of manual or ultrasonic instruments to deep pockets, furcations or grooves. Additional use of laser treatment has been advocated as an efficient supplement to non-surgical treatment. Several types of lasers offer new technical modalities for the decontamination of periodontal pockets and root surfaces in nonsurgical treatment for effective ablation and strong bactericidal and detoxificative effects. Among laser types, erbium-doped:yttrium-aluminium-garnet (Er:YAG) laser and neodymium-doped:yttrium-aluminium-garnet (Nd:YAG) laser appear to be the most suitable to be used in periodontal treatment. Nd:YAG can eradicate periopathogens and can cause significantly higher reduction of the gingival index, probing pocket depth and clinical attachment level when used as an adjunct to conventional debridement. Er:YAG laser removes deposits and biofilm thoroughly, creating biocompatible surfaces more conducive for re-attachment than those obtained with conventional methods and can be effectively used to reduce the number of bacteria residing in biofilms. Literature has shown that treatment with high-power lasers can result in regeneration of the cementum and bone and new connective tissue attachment. The concept of periodontal laser treatment is based on reducing bacterial penetration in the infected periodontal pocket. Biological effects including bactericidal and detoxification effects with laser therapy may help accelerate wound healing and tissue regeneration.

LLLT AND BURNING MOUTH SYNDROME

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Burning Mouth Syndrome (BMS) is considered an oral disease with uncertain etiology. It is characterized by oral burning symptomatology, without clinical signs. Pathogenetical hypotheses would indicate a possible neuropathic suffering as a potential cause. However, psycho-allogenic disorders are increasingly considered. To date, therapeutic indication for chronic oral burning are still unclear. From January to October 2017, at the oral pathology and medicine unit of University Hospital of Milan, a monocentric clinical

case-control study was conducted to evaluate the effectiveness of Low Level Laser Therapy LLLT in patients with chronic BMS.

Fifty-two BMS patients, were randomly divided into 2 groups: a test group, that received real LLLT therapies (300 mW power, 635 nm wavelength); a control group, that received inactive/placebo laser treatments. Effectiveness was assessed with Numerical Rating Scale (NRS), McGill Pain Questionnaire-Short Form (MGPQ-SF), Hamilton Anxiety Test (HAM-A) and Hamilton Depression Test (HAM-D).

Pain and anxiety scores at NRS, MGPQ and HAM-A showed to be significantly lower in treatment group according with Independent Sample tTest, $p < 0.05$.

Patients were followed-up over the following 12 months and improvements on average kept statistically unchanged.

Based on our preliminary experience, we can state LLLT should be considered an effective tool in relieving from oral burning over time and healing peripheral neuropathic pains.

DIFFERENT PROTOCOLS OF PHOTOBIMODULATION FOR MEDICATION-RELATED OSTEONECROSIS OF THE JAW

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Background: Medication-related osteonecrosis of the jaw (MRONJ) is still without consensus on a standard treatment since the first report in 2003. The clinical management of MRONJ is comprised of medical, surgical approach or combined.

Objective: This study aims to present our treatment protocols of Photo-biomodulation (PBM) as an adjunct to the management of patients with MRONJ.

Materials and methods: A multidiodic laser (Lumix C.P.S. Dental, FISIOLINE, Verduno, Cuneo, Italy) emitting 650 nm, 810 nm, and 910 nm wavelengths simultaneously was used with power of 0.6W and spot diameter of 8 mm in scanning mode for 15 mins (per session). After a confirmed diagnosis of MRONJ, PBM was applied in three different aspects with antibiotic coverage. In treatment modality (a), PBM (5 sessions per cycle) was applied as an analgesic and anti-inflammatory as the surgical approach was not feasible. In treatment modality (b), it was applied as an adjunct (4 sessions per cycle) to the surgical approach with L-Platelet-Rich Fibrin (PRF). In treatment modality (c), the PBM (8 sessions per cycle) was applied in patients with osteonecrosis and bone exposure to support spontaneous sequestration.

Results: In modality A, a significant reduction of pain and inflammation was observed. In modality B, most of the patients showed complete healing after the surgical approach with L-PRF. In modality C, in some patients spontaneous sequestration occurred with complete healing without the need for surgical intervention.

Conclusions: The utilization of PBM in different ways according to the patient clinical situation may be a promising adjunctive modality for treating this challenging disease.

LASER TREATMENT OF ORAL LEUKOPLAKIA. WHERE ARE WE NOW?

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Oral Leukoplakia is one of the most common potentially malignant disorder with an annual malignant transformation rate of 1–3%. Several treatments have been proposed, although with controversial discussion. Conventional surgical treatment has several challenges and difficulties, especially in lesions with large size or in some anatomical location. Lasers have opened new possibilities of treatment with very interesting results being at the moment one of the treatment modalities more suggested in the literature. With the new advances in adjunctive diagnostic tools, such as contact endoscopy, a new protocol of the use of different wavelength to treat oral leukoplakias could be chose regarding the diagnosis and prognosis. In this lecture, we will focus the laser surgical treatment of oral leukoplakias with various wavelengths, namely with the Er:YAG Laser (2940 nm), which may be one of the most interesting treatment options for oral leukoplakias.

THE EFFECTIVENESS OF Nd:YAG LASER BEAM IN REMOVAL OF FRACTURED NITI ENDODONTIC FILES. AN IN VITRO PILOT STUDY

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Background: Along the classic methods to remove broken endo files (by passing, ultrasonic vibration and surgical removal by apicectomy) new methods are developing for conservative removal with the use of Lasers according to their wavelength absorption by metals.

Objective: The aim of our study is to (i) determine the feasibility of Laser in removing fractured endodontic Ni-Ti files and (ii) The average of temperature rise during irradiation to determine the safest irradiation protocol in order to prevent periodontal damages.

Material and methods: Sixty four human mono-root and caries free extracted teeth were used. The 2 mm tip of RECIPROC® R25 File- VDW GmbH was notched and driven in the apical third of the root canal using a handpiece until the instruments fractured and lodged in. The laser treatment was performed following the manufacturer recommendation. The temperature variation at the root surfaces was measured by a thermocouple during irradiation.

Results: The bypass with K 10 file was possible in 89.7% of treated root during an average of 7.61 sec and in 10.30% of samples with a total removal of the fractured endo file.

Conclusions: Within the limitation of this study and respecting specific irradiation protocol, Laser beam can be considered an easy, fast and safe procedure for ablating the endodontic fractured NiTi files.

CLEANING OF DENTAL IMPLANT SURFACES BY Er:YAG LASER. IN VITRO STUDY

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Objective: The aim of our study is to evaluate, by assessing the content in carbon, the decontamination of failed implants after

irradiation by low energy of Er:YAG laser until getting a surface free of organic matters; and to find the appropriate procedure for dental implant surface decontamination.

Materials and methods: Ninety implants were used. Thirty sterile implants were kept as a negative control. Thirty failed implants were irradiated by Er:YAG laser for one passage and the other thirty for multiple passages. We evaluated by scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX) the surfaces' content in carbon for sterile implants, contaminated, and lased by one and multiple passages. Statistical analysis was performed by ANOVA.

Results: Our results showed that implants irradiated by three passages present similarity with the sterile ones regarding the carbon content without surface alteration.

Conclusions: The decontamination of implant surfaces with a low energy of Er:YAG laser after three passages appears to be a promising procedure.

PHOTOBIO-MODULATION (PBM) AND ACCELERATION ORTHODONTIC MOVEMENT: THE NEW TOOLS

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Nowadays, the demand and accessibility of orthodontic treatment for adults patients has increased. We prioritize our goal in describing the effectiveness of PBM. The second objective is which of wavelengths and the most favorable dosimetry. The last objective is to determine the scientific evidence that endorses the clinical protocol.

The PRISMA, reporting guidelines are followed. The search strategy was done by one author in three major databases Pubmed, Google Scholar and Cochrane Database. The search filters were included, Time: 2004–2019, English and Full text papers were relevant.

The MESH Terms employed were: Laser, LLLT (Low Level Laser Therapy), PBM (Photobiomodulation) AND Tooth Movement. The eligibility criteria was: Human study, Randomized Controlled Trials, and the accelerated Orthodontic movement independent the others items. The excluded Criteria was: In vitro animals studies, opinion or narrative papers, systematic review.

The papers selected was 53, once our inclusion and exclusion criteria were applied, we extracted data from the 10 of them that met our criteria. Regarding the effectiveness of the use of LLLT or PBM, for 80% of the authors accelerated the orthodontic movement and could reduce treatment time. The wavelength ideal by authors are in agreement that NIR, 633 nm, 720 nm has ideal in LEDs or PBM and 780–810 nm by diode laser, based in the Tina Karu works. The protocol used was DE between 1–4 J/cm².

- The red and NIR at its different wavelengths are more suitable.

- It is still difficult to stablish advanced protocol as new studies multicenter designs are still needed.

ADVANTAGES AND DISADVANTAGES IN THE USE OF LASER IN THE BIOPSY OF THE SQUAMOUS PAPILOMA

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Objective: This work aims to evaluate the guaranteed benefits in the excision of SP with laser approach, including postoperative advantages, for what concerns healing and the possible presence of recurrences. The surgical approaches to this kind of lesion are several and they include traditional surgical approach with scalpel or laser ablation. The latter was usually applied with diode or CO₂ laser and, in relation with its advantages, is considered one of the best therapeutic choices.

Methods: Surgery and postoperative healing have been photographically recorded. After the excisional biopsy, the patients were visited one week, one month and three months later in order to check healing and possible recurrence of the lesion.

Results and conclusions: According to the literature, laser surgery with its several advantages such as optimal hemostasis, very high precision in tissue ablation, wound sterilization, second intention healing without sutures, minimal post-operative pain and edema is a reliable, valid and tolerated treatment for SP. The decrease of recurrences is related both to the complete excision obtained with laser approach and to a direct effect of photocoagulation on viral proteins. The follow-up showed a complete healing due to successful removal of SP, thanks to the laser photo-thermal effect that kills the virus with a supposed complete removal of HPV without recurrences.

HISTORY AND REALITY OF DECONTAMINATION BY "PHOTODYNAMIC THERAPY WITHOUT DYE." CURRENT MEDICAL RESEARCHES ON ANTIBIO-RESISTANT BACTERIA

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The use of lasers in the treatment of periodontal infections generates a significant thermal stress which requires a careful use of the energy of penetrating radiation.

Many researches were conducted in Montpellier in the 90s to limit this thermal effect by maintaining a significant penetration of laser radiation. The first results in 1995 lead to the discovery of effective decontamination by "Photodynamic Therapy without Dye" which will be verified by a lot of tests in research laboratory in vitro and in vivo.

The clinical use of periodontal and peri-implantitis infections has been part of the acquired data from science since 2003 and is taught in several universities. The results, always repeatable, have attracted the interest of several medical specialties in a research conducted between 2017 and 2019 on antibio-resistant bacteria and on the development of a protocol of treatment for osteonecrosis for diabetics.

This collaboration has allowed to verify the interest of using Peroxide of Hydrogen as a substitute for dyes for the destruction in depth of pathogens without thermal stress. The results in our field of Odontostomatology are particularly promising in terms of prevention, general health, and budget saving!

IS THE ASSOCIATION OF PHOTOBIMODULATION AND L-PRF EFFECTIVE FOR MRONJ MANAGEMENT? PRELIMINARY RESULTS

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Aim of this study was to evaluate the effectiveness of photobiomodulation (PBM) and Leucocyte- and platelet-rich fibrin (L-PRF) association on medication-related osteonecrosis of the jaw (MRONJ) patients healing.

25 MRONJ patients were randomly subdivided in 4 groups according to treatment: Drug therapy (D) plus PBM (n=6), D plus Surgery (S) (n=6), D plus S plus PBM (n=6), D plus S plus PBM plus L-PRF (n=7).

D consists: Amoxicillin/Clavulanic Acid 1g and Metronidazole 250 mg twice a day and 0,2% chlorhexidine gluconate rinses three times/day for 10 days; PBM was performed by a multidiodic laser simultaneously emitting at 650, 810, and 910 nm (Lumix Dental; FISIOLINE, Italy) in no contact mode, for 15' and 577,4J for 7 following days; the S was the necrotic bone removal by rotary burs or piezosurgery; L-PRF membranes were obtained by single autologous blood centrifugation, 12' at 400 rpm (Intraspin by IntraLock® International, Italy). Statistical analysis by Chi-square test ($\alpha p=0.05$) was performed.

At 3 months follow-up, patients treated with D+S+PBM+L-PRF showed better outcomes with complete resolutions, statistically significant compared to other groups ($p=0.04$)

Our preliminary results show that combination of PBM and L-PRF with D and S, effectively contribute to outcome in MRONJ patients.

LASER OSTEOTOMY: FROM RESEARCH TO MINIMAL-INVASIVE CLINICAL APPLICATIONS

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Especially in oral and maxillofacial surgery surgical reconstruction of bony defects is often very challenging as thin and fragile bony structures are prone to fracture. The massive application of pressure through conventional mechanical instruments favours these complications emphasizing the need of precise and delicate osteotomy equipment. Based on numerous studies since the late 1960s various laser wavelengths have been advocated as possible and promising alternatives to conventional instruments in different medical and surgical disciplines. Cutting vital bone by laser offers many advantages, especially a non-contact, blood- and vibration-reduced surgical technique, free choice of cut geometry, a small operation field, and the prevention of massive bone flour and/or debris including metal abrasion. For a clinical implementation of laser osteotomy as a matter of routine, however, major prerequisites are an undisturbed bone healing process as well as a practicable and safe osteotomy method with reasonable time requirements. The following presentation will give a short overview about experimental and clinical approaches to laser osteotomy. In this context also current concepts of computer and robotic assistance as well as navigation systems are discussed to tap the full potential of laser osteotomy.

THE BENEFIT OF LASER THERAPY IN THE PREDICTABILITY OF TOOTH CONSERVATION

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This lecture will present the most important non-invasive laser-based methods for diagnostic and treatment in order to increase

the preservation of the tooth. Since the introduction of laser in dentistry, several studies have shown the effect of different laser devices on dentine and pulp tissue. This lecture presents an overview of the current knowledge in laser-assisted treatment in endodontics, based on our different research records, in regard with saving the pulp vitality until the cleaning and disinfecting the root canal system and the stimulation of periapical tissue healing.

Lasers have been used in endodontics to assist the conventional treatment for optimizing the outcome of clinical procedures. The clinical indications will be presented according to the use of high-intensity or low-intensity laser radiation in pulp preservation as well as in endodontic therapy.

The laser devices employed in root apical surgery has the ability to provide a better retro preparation or apicectomy in order to increase the preservation of the tooth on the arch. The biomodulation with low intensity laser energy can have important benefits such as analgesic and anti-inflammatory effects and can also improve tissue healing processes.

Nowadays the gold standard therapy in endodontic is considered the endodontic treatment assisted by laser. Moreover, the use of different wavelengths will be discussed according to their indications.

In conclusion, using the proper laser parameters in pulp preservation and treatment of the endodontic system and periapical tissue conduce to the increase of the healing process success rate.

DEBONDING THE VENEERS WITH Er,Cr:YSGG 2780 NM – STUDY 3DCT- IN VITRO

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Objective: Dental aesthetic and minimally invasive therapies are also very popular nowadays.

The purpose of this study is to evaluate a minimal invasive procedure for debonding the veneers with laser Er,Cr:YSGG 2780 nm.

Materials and methods: We used for this study 10 human teeth extracted from the front maxillary area. Two groups were created, each including five teeth.

The teeth from first group of samples were prepared conventionally with drill and the teeth from second group of samples were prepared with the laser Er,Cr:YSGG 2780 nm. After preparation, the veneers were prepared in the dental laboratory and for bonding protocol we used Variolink Esthetic LC- adhesion composite resin with a high radioopacity. For analysed the layer of cement, a 3D-CT was made, before the bonding protocol and after the debonding protocol. Laser Er,Cr:YSGG was used for debonding protocol by photo-ablation process.

Results: The layer of cement remains on the dental surface. The significant difference between cement volume before debonding and after debonding the veneers can be observed.

The average of the thickness for the first samples which was 0.28 mm and the for secondary samples was 0.24 mm. The thickness of the adhesive layer after debonding was between 0.15–0.1 for the samples with conventionally preparation and between 0.15–0.25 mm for the samples with laser preparation.

Conclusions: The procedure of laser Er,Cr:YSGG: 2780 nm photo-ablation is safe, minimally invasive, nontraumatic and fast protocol.

APPLICATION OF Er:YAG LASER IN SURGICALLY- AIDED ORTHODONTIC TREATMENT. A LONG TERM CLINICAL REVIEW

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Objective: The current purpose of the corticotomies in Orthodontics is to determine a local osteopenia to induce the physiological reactivation of alveolar bone (RAP). In presence of severe dental crowding, the alveolar bone can result hypoplastic and weakly vascularized. In these cases is important to obtain the complete healing of the surgical site. The aim of this study is to present the long term effects of an original protocol.

Methods: 15 patients who showed severe crowding were choose to be treated following an original protocol: after a local anesthesia surgery, a full flap exposure of the entire arch, the intraradicular corticotomies performed by Er:YAG laser and L-PRF/equine deantigenated bone graft. The orthodontic treatment started when the suture were removed. For all the patients X-ray panoramic, lateral and frontal skull were requested before and after the surgery. All the patients treated were called every 6 months for almost 5 years. During the follow up, X-ray were repeated to observe the long term results.

Results: The correction of the malocclusion was achieved in all the patients treated using the protocol. A light reduction of the treatment time was observed in all the cases. Surgically-aided orthodontic allows to obtain difficult orthodontic movement reducing the stress on the periodontal tissues and gingiva. Long term examination confirms the efficacy of the protocol, in particular in patient who used the retention daily.

Conclusions: The protocol suggested is particularly indicated in border-line patient, in which the indication to extraction treatment or maxillo-facial surgery is not completely clear.

COMBINED USE OF PBM AND PRF: A PROMISING NEW MODALITY FOR THE MANAGEMENT OF MRONJ CASES

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Medication-Related OsteoNecrosis of the Jaws is an adverse drug reaction consisting of progressive bone destruction that can occur after exposure to certain agents (bisphosphonates, denosumab or angiogenesis inhibitors) predominantly used to reduce skeletal complications in patients with malignant bone diseases, osteoporosis, Paget’s disease and hypercalcemia. The etiology of MRONJ still remains unclear, the pathogenesis seems multifactorial and associated with medication -related risk factors, local trauma, infection and systemic co-morbidities. Despite the growing body of evidence that has been published on the diagnosis, staging, prevention and management of this debilitating complication, specific and predictable guidelines for successful treatment are still lacking. Besides the conservative non-surgical and extensive surgical procedures, alternative treatments have been also

proposed like teriparatide, bone morphogenetic proteins, platelet concentrates, hyperbaric oxygen, ozone therapy and lasers but still are all considered as adjunctive therapies. Regarding lasers, the high-power Erbium family has been effectively used either for bone debridement or evaporation of necrotic sites, due to the increased (wavelength-dependent) absorption from water and hydroxyapatite. LLLT has also been introduced into the clinical practice as it possesses anti-inflammatory, analgesic and biostimulatory properties with favorable action on bacterial control, wound healing and bone formation. The combined approach including piezosurgery +PRF +LLLT that has been successfully used in our dental department will be presented. The utilization of different high-technology devices with minimally invasive surgical techniques can result in reduced postsurgical morbidity, pain elimination, tissue healing promotion and bone regeneration, representing a promising therapeutic modality for the management of different MRONJ cases.

DENTAL TRAUMA IN PEDIATRIC DENTISTRY: A NEW APPROACH BY LASER THERAPY

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In Paediatric Dentistry, dental traumas are very common and they represent a real emergency. Maxillary central incisors (50%) and maxillary lateral incisors (30%) are the teeth most frequently affected, in primary and in permanent dentition.

Dental traumas require a precise therapeutic choice in order to promote the correct evolution of dento-alveolar structures. Nowadays, the evolutions of technologies and restorative materials have improved the prognosis in dental trauma and could realize better aesthetic results, if compared to the past.

Laser technology represents a new therapeutic strategy to obtain a better patient's compliance and a micro-invasive restoration of the traumatized teeth. In fact, laser could simplify and reduce the treatment time, perform, in the same time, decontamination of the treated dental and/or gingival surface, a more conservative preparation in respect of dental anatomy

Photo-biostimulation induced by laser irradiation has anti-inflammatory and anti-oedemigenous effect, reduces post-traumatic pain, avoiding the necessity to take medications and promote tissue repair. Unfortunately, there are no well-coded guidelines for laser applications in these clinical events.

Aim of this lecture is to give some guidelines and protocols with specific doses and application sites.

Er,Cr:YSGG LASER IRRADIATION ASSOCIATED TO FLUORIDE FOR IN SITU MODEL USING GAMMA STERILIZED DENTIN AND ENAMEL

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The in situ intraoral model uses human dental enamel samples (HDE) in order to analyse the de-remineralization processes using the buccal environment without interfering into the patients' natural dentition. The main ethical concern from this model is the biosafety. Gamma radiation is a very efficient sterilization method that is not expected to alter the mineral content of the hard tissues, avoiding biases in the results. Thus 40 HDE samples were irradiated through a source of ⁶⁰Co multipurpose irradiator aiming complete sterilization (25 KGy/h) with the purpose of accumulating the native plaque on them at an in situ study. An Er,Cr:YSGG laser was used alone and in combination with the topical applications of: 1-dentifrice (1,100 µg F/g) or 2-APF (12,300 µg F/g). Morphological analyses were performed by scanning electron microscopy (SEM), determination of alkali-soluble fluoride concentration by specific ion electrode and microhardness determination. Then, the 15 volunteers used palatal devices containing previously treated HDE samples and remained using F dentifrice. The FTIR findings established that gamma radiation could be used aiming HDE sterilization. The Knoop hardness number was within the range of that of natural dentin of human origin. X-ray fluorescence shows that irradiated dentin has great similarity with natural dentin from the point of view of chemical composition. SEM analyses showed that there was no thermal damage or interprismatic morphological changes in the hydroxyapatite structure of human dental dentin outside the buccal environment when using doses of gamma irradiation up to 25 kGy.

CURRENT SURGICAL AND THERAPEUTIC USES WITH FUTURE PROSPECTS FOR CO₂ LASERS IN ORAL SURGERY AND PERIODONTOLOGY

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There is a growing acceptance of laser applications for their effectiveness in the management of dental conditions, with predictable and reproducible results. The experience to use lasers to cut, vaporize and coagulate with favorable biological responses is consistent from established energy parameters and techniques.

CO₂ laser called light scalpel is one of precise tool for removal of various soft tissues lesions (Leukoplakia, Epulis, Hemangioma, fibroma, warts,...) Pre-prosthetic laser surgery provides better outcomes in broad-based mucosa lesions.

Overall cure rate for pre-malignant conditions is good and laser ablation for difficult oral cancers provide better functional and aesthetic results

Advantages include significant reduction of pathogens, better homeostasis, less healing time and postoperative sequelae and improved patient comfort.

For periodontal procedures, lasers excised diseased gingival and bone reduce bacteria, prepare a better environment for re-attachment of connective tissue to root surfaces and shape and sculpt both hard and soft tissues for predictable healing.

POSTERS

PALATALLY IMPACTED CANINE AND DIODE LASER SURGERY

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Parallel to the common scalpel surgery, laser systems allow many clinical applications in oral surgical procedures. The Diode lasers are, nowadays, modern laser systems with many advantages in dental practice like excellent quality of incision, very good hemostatic properties, photo-bio-stimulation with analgesic and anti-inflammatory effects and reduction of post-operative pain.

This work reports a case of a 17.5-year-old female patient that was referred to the Dept. of Paediatric Dentistry in University of Pavia, in order to perform a surgical exposure of an impacted upper canine for subsequent orthodontic traction.

Clinical and radiological findings led to the diagnosis of palatally impacted maxillary left cuspid. After local anesthesia (Septanest, articaine chlorhydrate 4% with adrenaline 1/100.000), diode laser (Fotona XD-2, Ljubana, Slovenia) was used to perform surgical incision with the following parameters: 810 nm wavelength, continuous wave mode with a power output of 3 Watt and a 0.4 mm diameter optical fiber. No suture was necessary.

Diode laser provided a combination of clean cutting of the tissue and hemostasis, permitting immediate bracket bonding and speedy beginning for orthodontic traction. The photo-bio-stimulated effects of laser irradiation avoided the post-operative side-effects due to traditional surgical procedures.

Diode laser surgery is a very efficient system to allow a faster and better procedure in the orthodontic traction of impacted teeth.

SURGICAL TREATMENT WITH DIODE LASER OF ORAL LICHEN PLANUS LESIONS FOR AESTHETIC REASONS

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Background and objective: Oral Lichen Planus (OLP) is a chronic inflammatory disease that affects the oral mucosa. There is reported malignant transformation that requires careful examination, treatment protocol and regular follow-up sessions.

Methods: A male patient of 50 years of age was referred to our unit because of the presence of white plaques in his mouth. At clinical inspection, there was evidence of asymptomatic, not ulcerated and not bleeding white lesions on the dorsum of the tongue, while on the cheek mucosa he had reticular, bilateral, symmetric lesions. Incisional biopsy was performed with the traditional scalpel and following histopathological examination a final diagnosis of OLP was rendered. After 5 months, the patient

complained for aesthetic discomfort for the lesions on the tongue and he asked for lesions removal. A second incisional biopsy was performed with the cold scalpel and, in the same surgical session, asportation of the tongue lesions with diode laser. After 1 week the tongue showed a very good healing. The presence of a small whitish lesion was noticed and a second laser removal was performed. In the following 6 months the patient did not show any lesions.

Results: Following 2 laser sessions the healing was excellent, with limited contraction of the treated areas. The aesthetic result was satisfactory. The use of the diode laser for the vaporization of lesions has provided numerous advantages: the haemostatic effect, brief therapeutic intervention, reduced traumatization of surrounding tissues.

Conclusions: The diode laser can be considered a reliable tool for aesthetic treatment OLP lesions.

Er:YAG LASER DEPIGMENTATION OF GINGIVAL SMOKER MELANOSIS. A CASE SERIES STUDY

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Smoker melanosis is a melanin pigmentation caused by tobacco smoking and a main cause in Portugal of gingival pigmentation. In cases where aesthetic problems are significant for patients some interventions could be performed including chemical agents, cryosurgery, conventional surgical techniques, and the use of lasers. Erbium-doped:yttrium, aluminum, and garnet (Er:YAG) laser is an instrument that could be used for gingival depigmentation by ablation of epithelium. Our aim is to evaluate the efficacy of the use of Er:YAG laser for the treatment of gingival smoker melanosis.

We include 10 cases of gingival pigmentation with diagnosis of smoker's melanosis after performing contact endoscopy to verify the benign nature of the lesion. After the diagnosis and with informed consent of the patient we performed a laser depigmentation using an Er:YAG laser 2940 nm (LightWalker ATS, FOTONA®, Eslovenia), 120 mJ, 20 Hz, QSP mode, using the H14 handpiece with a cylinder typ of 0.8 mm-spot. Pain score (using visual analog scale - VAS), satisfaction score, complications score and efficacy score treatment were recorded in a follow-up of one and 3 months. A tobacco cessation program was given for every patient.

The Er:YAG laser effectively ablated the gingival epithelial tissue with melanin pigmentation. At 3-month after the treatment, there were no recurrences of the cases. The postoperative pain (VAS 0 to 10) corresponded to 0 in 8 cases and to 2 in 2 patients (between the first day and second day). There were no complications. A high satisfaction rate was achieved in all cases.

The Er:YAG laser is a useful, minimally-invasive and effective instrument for a gingival depigmentation procedure associated with absence of significant symptoms and complications. Other studies should be performed including control groups to confirm our results.

Nd-YAG LASER TREATMENT OF PERIODONTAL DISEASES

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This work presents a non-surgical laser assisted periodontal therapy which allows, by using a Nd-YAG laser source, to obtain a microbiological, clinical and radiographic healing.

The clinical assessment methods include analysis of family history, attachment level, probing depth, bleeding on probing, mobility index and radiographic assessment of alveolar bone loss.

In particular, we combine molecular microbiological and genetic tests that produce accurate and reliable laboratory data, essential to formulate a specific treatment for each patient.

The microbiological test enables us to identify microorganisms, which are the major etiologic factors of periodontitis. The genetic test purpose is to calculate the patient's susceptibility to periodontal disease. The effect of genetic factors on periodontal disease is under extensive research and it has already explained the role of polymorphisms of immune mediators, which rule disease response.

The proposed treatment involves procedures such as scaling by ultrasonic device, root planning with surgical microscope and laser therapy. The number of laser treatments depends on clinical, microbiological and genetics tests results. This is a full mouth disinfection: firstly, we make a topic premedication into pockets with an acetylsalicylic acid solution; secondly, we use a 320 nm laser fibre with an improved Nd-YAG laser bactericides effect by alternatively using either Betadine or a hydrogen peroxide solution.

The microbiological healing with a reduction of pocket depth, gum bleeding and tooth mobility demonstrates the clinic success of the treatment. The follow up consists in clinical controls every 45 days for the next 2 years to verify the radiographic healing as well.

XEROSTOMIA AND LLLT

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Background: Xerostomia is defined as the complaint of oral dryness, caused by radiotherapies and chemotherapies but also dysmetabolic and immunitary diseases (Sjogren's Syndrome - SS).

Objective: To evaluate the effectiveness of topical applications of Low Lever Laser Therapies (LLLTs) in the stimulation of glandular tissues and therefore in the production of saliva.

Methods: Three homogeneous groups of patients were selected:

- Patients with immune disorders (SS) (n-16)
- Patients after Radiotherapies (n-10)
- Patients with neuro-functional disorders (BMS) (n-22)

We evaluated salivary secretions (spontaneous and stimulated saliva). All patients were treated at the level of the bilateral sub-mandibular regions with LLLT. 635 nm wavelength and 300 mW power were selected for laser treatment (4 min each session).

Results: The SS patients group responded positively to LLLTs. The group of irradiated patients presented a minimal increase in salivary flows because LLLTs would be able to stimulate the mitochondrial respiratory chains of the cholinergic parasympathetic fibers. We observed a minimal increase of salivary flows in patients with BMS because their salivary fluids are normally present. Patients treated on T1 were re-evaluated 6 months later (T2) and the clinical stability obtained was appreciated.

Conclusions: The marked local antinflammatory actions of LLLTs have demonstrated the therapeutic efficacy in salivary glands tissues.

ADJUNCTIVE USE OF ANTIMICROBIAL PHOTODYNAMIC THERAPY IN THE TREATMENT OF COMBINED ENDO-PERIODONTAL LESIONS

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Background: Endo-periodontal lesions are clinical conditions involving the dental pulp and the supporting periodontal tissues. Both sites of infection are anaerobic environments. Antimicrobial photodynamic therapy (aPDT) is a potential strategy to eliminate infection in the specific tissue.

Objective: To evaluate the effects of using aPDT in patients with endo-periodontal lesions.

Methods: A split-mouth randomized clinical trial was designed. Sixteen patients with endo-periodontal lesions were treated. The treatment consisted at first traditional endodontic therapy and then periodontal treatment with either subgingival scaling and root planning (SRP) followed by a single episode of aPDT (HELBO Photodynamic Systems, Bredent Medical, Germany; phenothiazine chloride; a diode laser unit: W 660 nm, PD 100 mW/cm²) (test group) or SRP alone (control group). Probing pocket depth (PD), clinical attachment level, plaque index and gingival bleeding index (GBI) were evaluated at baseline, 3 and 6 months after treatment. Only sites with PD ≥4 mm at baseline were calculated.

Results: All periodontal parameters were significantly improved in both groups at 3 and 6 months after treatment. All parameters in test group were better than that control group, with statistically significant differences of GBI and PD ($p < 0.05$) at 3 and 6 months after treatment. Radiological parameters were also better in the test group of patients with endo-periodontal lesions at 6 months after treatment.

Conclusions: The adjunctive use of aPDT provided positive effect in the treatment of combined endo-periodontal lesions.

THERMAL EFFECT EVALUATION OF INCREASING POWER DENSITY DURING PHOTOBIO-MODULATION PERFORMED WITH A DIODE LASER OPERATING AT THE WAVELENGTH OF 980 NM ON DIFFERENT CUTANEOUS PHOTOTYPES

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Objective: To assess the thermal effects of increasing power density (PD) during photobiomodulation (PBM) performed with 980 nm Diode laser on individuals carrying each one of the six (I-VI) Fitzpatrick phototypes.

Methods: Twelve healthy subjects (6 F; 6 M; mean age: 40.7 years old) were recruited, two for each Fitzpatrick phototype. 1x1cm² hairless skin of both cheeks was chosen. 980nm Diode laser was used (Raffaello DMT, Lissone-Italy), CW, connected to collimated handpiece (spot size: 0.5 cm²) kept perpendicularly 2 mm far from each skin site, with an off-contact approach.

With a fixed energy density of 4 J/cm², three power densities (Protocol 1: 0.2 W/cm²; Protocol 2: 0.4 W/cm²; Protocol 3: 0.6 W/cm²) were tested for three consecutive times on right and left cheeks, with 5-min intervals between each session. Thermal camera (Fluke Ti450 Infrared Camera) was used at 25 cm far from the skin, with a steady room temperature of 22°C. Each skin site had thermograms taken before PBM (T0), right after end of PBM (T1), and 30 sec after PBM (T2).

Results: PBM sessions did not induce a worrisome increase of temperature, with an average of thermal increase [$\Delta(T1-T0)$] varying from +0.1°C for phototype III after Protocol 1, to +0.31°C for phototype IV after Protocol 2. No significant differences were detected among the six Fitzpatrick phototypes. No complaint of heating was registered.

Conclusions: PBM appeared to be a safe treatment, despite the phototype involved. Further studies with larger samples and a wider range of PD and fluences are needed.

CLINICAL AND HISTOLOGICAL EVALUATION AFTER ORAL BIOPSIES PERFORMED BY 450 NM BLUE DIODE LASER

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Background: Blue light diode laser is a recently device adopted in dentistry. It uses a 445 nm wavelength light, congenial to hemoglobin. In addition to traditional laser devices, blue laser has an optimal hemostatic effect due to wound coagulation, with a precise incision, great antiseptic effect, fast tissue healing and post-operative pain relief. Blue laser has a lower tissue penetration and a reduced scattering than IR lasers, reducing tissue damage in soft tissue biopsies, to obtain a reduced peri-incisional thermal damage, due to heat absorption.

Objective: To analyze the “in vivo” thermal effect induced by 445 nm blue laser and clinical efficacy of this device, through the evaluation of some clinical cases.

Methods: 9 excisional biopsies of clinically benign lesions were made, from November 2018 to January 2019. In the surgical procedure, blue laser (Eltech K-Laser s.r.l., Italy) was used. It has a 445 nm \pm 5 nm wavelength and an amount of 4W maximum power, it was used in pulsed way, with 320 μ m optical fiber. All the specimens were histologically analyzed. To check healing, patients were followed with one week and month examination.

Results: In all cases the readability of specimen was optimal. In all histological preparations, especially those of the more vascularized lesions, a slight thermal damage was detected. Clinically, no patients showed both intra- and postoperative complications.

Conclusions: Blue laser is an affective device for soft tissue biopsy of oral benign lesions, it does not cause peri-incisional damage such as to compromise the histological examination of the specimen.

THE EFFECTS OF LOW LEVEL LASER THERAPY ON PROLIFERATION AND DIFFERENTIATION OF MESENCHYMAL STEM CELLS: A LITERATURE REVIEW

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Background: Utilization of a low-energy light intensity within the visible red and near infrared portion of the electromagnetic spectrum has been shown to stimulate irradiated cellular activity. This phenomenon has been referred to as photobiomodulation (PBM) or low level laser therapy (LLLT).

Objective: To highlight the current findings about the effects of PBM on proliferation and differentiation of mesenchymal stem cells. The parameters used to perform LLLT will also be evaluated.

Methods: The electronic search was conducted with PubMed database for English-language articles published until May 2019. Following 14 MeSH terms and keywords were used in combination and/or separately: Low Level Laser Therapy; Low Level Light Therapy; Low Level Laser Irradiation; Low Level Light Irradiation; LLLT; LLLI; Stem Cells; Bone Marrow; Adipose; Periodontal Ligament; Dental Pulp; Mesenchymal; Cell Proliferation; Cell Differentiation. Articles without a case-control design were excluded.

Results: From the preliminary list of 430 papers, 33 articles were included in the present review. All reviewed papers showed positive outcomes both for proliferation's and differentiation's rates except for two. The most widely used stem cells were BMSC (13 papers). Results shows that most frequently PBM was performed with diode laser (InGaAlP) (13 papers), with visible wavelengths of 660 nm (17 papers) and Fluence values between 0.5 and 5 J/cm² (24 papers).

Conclusions: With the appropriate use of LLLT the proliferation and/or differentiation rate of cultured stem cells (MSCs), can be increased, which would be very useful in regenerative medicine.

EFFECT OF LASER IRRADIATION ON THE APICAL LEAKAGE AFTER ROOT CANAL OBTURATION

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Background: The outcome of root canal treatment is based on efficient disinfection of the root canal system and prevention of reinfection. Due to high energy content and specific characteristics of laser light, laser treatment has been proposed for cleaning and disinfecting the root canal system.

Methods:

Objective: To evaluate the effect of different types of laser irradiation (Er:YAG, Nd:YAG, diode laser and photodynamic therapy) on the intracanal dentin and their interference in the apical seal of filled root canals. 72 human single rooted teeth were randomly assigned into 6 groups. Root canal preparation was done using ProTaper rotary system up to F3. The laser irradiation was performed at the end of the traditional endodontic preparation as a final means of decontaminating the endodontic system. Teeth were filled with vertically condensed gutta-percha (Guttacore and AH- plus).

Results: Statistical analysis showed that all groups had significantly less leakage in apical third than the control group. The laser-treated groups presented better results than Group II (Classical disinfection protocol), without statistically significant difference. The morphological changes on the apical intraradicular dentin surface caused by Nd:YAG and Er:YAG laser irradiation resulted in less linear dye apical leakage.

Conclusions: Certain lasers can help in removing the smear layer and debris and can modify the morphology of the root canal wall for better root canal sealing. They still cannot replace sodium hypochlorite and EDTA and should be considered as an adjunct to the current chemical root canal disinfection protocols.

LIP SQUAMOCELL CARCINOMA: CASE REPORT OF A NEW SURGICAL APPROACH GUIDED BY AUTO-FLUORESCENCE

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Background: AF is a property of some tissues directly associated to the concentration and distribution of specific fluorophores. Malignant and potentially malignant changes may therefore result in AF variations, potentially useful for diagnostic purposes.

The VELscope™ device is a non-invasive tool designed for increasing the diagnostic accuracy (DA), specificity (SP) and sensitivity (SE) of the conventional oral examination. VELscope™ emits light in the violet-blue spectrum (400–460 nm) that excites natural fluochromes located within the epithelium and the submucosa. Lip cancer is the most common malignancy of the oral cavity, accounting for 23.6–30% of the oral cavity cancers. Lip squamous cell carcinoma (SCC) is the most common histologic type of lip tumors. Primary management of lip cancer is surgical excision and the therapy success is associated to surgical radicality.

Objective: To describe a new technique for surgical excision of lip SCC guided by AF.

Methods: After irradiation through a 400–460 nm wavelength, lip SCC appear very dark. This dark area is larger than the carcinoma visible with the objective examination. The resection safety margins are decided starting from the end of the AF dark area.

Results: Histopathological examination confirmed presence of a SCC. Margins and bottom of the lesion were free of lesions and the patient did not develop recurrences at 1-year follow up.

Conclusions: AF allows to have a more objective measure in the choice of the resection margins and to take into account mucosal changes not visible with objective examination.

DENOSUMAB RELATED OSTEONECROSIS OF THE JAW (DRONJ): THE ROLE OF LASER PHOTOBIO-MODULATION AND STOPPING THERAPY

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Objective: To compare different therapies of DRONJ and to focus the attention to the treatment outcomes of sites considering the interruption of Denosumab treatment linked to use of laser.

Methods: We considered 29 DRONJ sites. T1: 12 (41.4%) sites treated without surgery; T2: 17 (58.6%) surgically treated with Er:YAG laser (2940 nm, 250 mJ, 20 Hz). T1 and T2 were all treated with Amoxicillin 1g in association with Metronidazole 500 mg (twice a day for 3 weeks). Five, weekly, sessions of LLLT using Nd:YAG laser (1064 nm, 1.25 w, 15 Hz) were also administered in patients in T1 and T2. T1: in 9 (75%) cases Denosumab was interrupted before treatment and 3 (25%) continued Denosumab. T2: in 10 (58.8%) cases Denosumab was interrupted before treatment and 7 (41.2%) continued Denosumab.

Results: T1: 6 (50%) sites clinically improved and 3 (25%) got complete healing. T2: 17 (100%) sites clinically improved and reached complete healing.

T1: 5 (55.6%) of sites that have interrupted Denosumab clinically improved and 3 (33.4%) got complete healing; 1 (33.4%) of sites that continued Denosumab clinically improved and nobody got complete healing. T2: 10 (100%) of sites clinically improved and got complete healing.

Conclusions: Considering the surgery, there was no significant difference between patients that had interrupted Denosumab and those who continued it. Considering the conservative approach, the interruption of Denosumab was a positive prognostic factor for complete healing.

LLLTT allows better results to be obtained in patients who have stopped Denosumab, compared to those who continued therapy.

LLLTT FOR TREATMENT OF IATROGENIC NERVE INJURY IN ORAL SURGERY: A CASE SERIES

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Iatrogenic lesion of inferior alveolar or mental nerve may occur during third molar extraction, implant placement, salivary gland surgery, local injections of anesthetic or during resection of oral tumors.

Low Level Laser Therapy (LLLTT) accelerates and improves nerve regeneration by stimulating axon growth and proliferation of Schwann cells.

Objective: To show author's experience with LLLTT in the treatment of iatrogenic nerve injury.

Methods: 15 patients (3 M, 12 F, mean age 37, range 16–71) referred to our department, who complained of oral paresthesia following iatrogenic nerve injury, were treated.

13 of them using 980-nm diode laser; with a collimated gaussian probe, with a spot size of 0.28 cm². The power was 300 mW, with power density 1.07 W/cm² and fluence of 4 J/cm². application time: 4 sec per point. Two patients were treated using a 645 nm diode laser with the following parameters: fluence: 8 J/cm², power density 0.8 W/cm², power: 400 mW, spot size 0.5 cm², application time: 10 sec per point. LLLTT was delivered in cw mode and the probe was held with 2 mm distance from the mucosa. Patients underwent a laser session weekly and a variable number of sessions was performed, based on individual response.

Results: We obtained nine complete healings, five partial healings and only one non-response case, assessed mapping the area affected by paresthesia through mechanceptive tests before and after LLLTT sessions.

Conclusions: LLLTT proved to be safe and effective in treatment of iatrogenic nerve injury.

EX VIVO STUDY: ABSORPTION OF A 645 NM DIODE LASER ON SWINE HARD TISSUES SAMPLES

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Background: Mesenchymal derived stem cells have emerged as a popular and versatile tool in the field of regenerative medicine.

Objective: The present preliminary ex vivo study aims to assess the possible interaction between complex biological systems and laser light, through irradiation of different hard tissue's samples.

Methods: A 645 nm wavelength diode laser was adopted to perform the present evaluation (Raffaello, DentalMedicalTechnologies, DMT srl. Lissone-MB, Italy). Swine mandible tissue samples were used. Chosen power output value was 220 mW, measurements were performed with a power-meter located underneath irradiated tissues. Emission was performed perpendicularly to the power-meter at approximately 2 cm of distance. Irradiation was performed for 113 sec; chosen laser tip measured 0.337 cm² of area. Two samples of spongy bone of 4.45 mm and 2.9 mm of thickness, and two samples of cortical bone measuring 4.4 mm and 4.7 mm were used.

Irradiation was performed with and without plastic protection.

Results: After 10 cycles of irradiation, data-log were converted into graphics: laser light was never completely absorbed by bone samples.

For each sample values of mean absorption and standard deviation were calculated.

Conclusions: Red-light laser with 645 nm wavelength has the ability to reach cells in each layer of measured tissues. Since thickness of swine samples are comparable to human tissues, protocols based on such laser features can allow to reach deeper targets and lead to possible interactions (photobiomodulation) of human cells. Also sterile and non-sterile devices can be used to isolate the laser tip without interfering.

HISTOPATHOLOGICAL FEATURES RELATED TO AUTO-FLUORESCENCE ALTERATIONS INDUCED BY A 430 NM-WAVELENGTH: CLINICAL-HISTOMORPHOMETRIC ANALYSIS ON 20 CASES OF ORAL CARCINOMAS

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Background: Some malignant and potentially malignant lesions may induce AF variations (hypo- and hyper-fluorescence). This feature can be useful for diagnostic purposes.

Objective: To analyze a series of histopathological variables in relation to AF alterations.

Methods: Twenty oral lesions with histological diagnosis of squamous cell or verrucous carcinoma were included. AF was evaluated before biopsy using a blue-violet light (410–30 nm wavelength, Velscope® system - LED Medical Diagnostics, Inc, Barnaby, BC, Canada).

Eight histological categories were investigated: (a) mean depth of the entire epithelium (MDE); (b) mean depth of the keratin layer (MDK); (c) mean depth of the epithelium without keratin; (d) overall area of the epithelium (OAE); (e) mean depth of inflammatory infiltration (MDI); (f) overall area of blood vessels (OAV); (g) mean area of blood vessels (MAV) and (h) mean diameter of blood vessels (MDV). Data analysis was performed using IBM-SPSS statistical package version 22.

Results: Among hypofluorescent lesions, mean MLK was 41.3 μm while it was 197 μm for hyperfluorescent cancers ($p < 0.001$). Analysis of MDE, MDK and OAV through binomial logistic regression showed that, when the three variables are pooled, they have a prediction value of 100% with regard to the typology of fluorescence (accuracy, sensitivity and specificity of 1.00).

Conclusions: The strongest indicator of AF alteration seems to be keratin, A model which includes MDE, MDK and OAV may potentially be able to indicate the type of AF alteration in 100% of cases.

CO₂ LASER MANAGEMENT OF IDIOPATHIC FIBROUS HYPERPLASIA OF THE PALATE

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Sapienza University of Rome - Master Laser in Dentistry in partnership with EMDOLA (Director U. ROMEO)

Background: Idiopathic Fibrous Hyperplasia (IFH) is a rare benign oral lesion affecting connective tissue. It is characterized by fibrous, slow and progressive increase in gingival volume in posterior lateral hard palate. There are two forms: generalized form has a genetic predisposition; localized form appears from second decade. IFH clinically appears as an increase in swelling of consistency covered by smooth and normal mucosa. IFH treatment is surgical excision. The scalpel surgery was preferred but, with laser devices introduction, carbon dioxide (CO₂) laser has become "gold standard" for surgery of oral benign fibrous lesions, thanks to its affinity with water molecules; it allows a better excision than neodymium and diode lasers that work better in vascular lesions.

Methods: Three IFH cases were treated and diagnosis was based on clinical history, intra-oral examination and histological analysis. After local anesthesia and lesion immobilization with an Ellis clamp, excision was performed by CO₂ laser (SmartUS20D, DEKA, Italy), at 100 Hz and 4 W. No sutures were applied. Follow-up was performed after one and three weeks.

Results: During and after surgery, neither bleeding or pain was observed and follow-up showed complete tissues healing.

Conclusions: CO₂ laser is an optimal device to approach this kind of lesion. Traditional scalpel surgery causes irregular wounds, copious bleeding and a periodontal wrap is necessary to avoid pain and bleeding in patients. CO₂ laser surgery showed minimal bloodless operative field thanks to superficial vessels cauterization, speed, easy and high precision surgical technique, no suture, second intention healing, minimal postoperative pain and edema.

CALCIUM ANALYSIS OF GAMMA STERILIZED HUMAN DENTIN SUBMITTED TO Er,Cr:YSGG LASER IRRADIATION

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Studies report that gamma radiation changes the oral cavity of patients submitted to radiotherapy. These changes include xerostomia, resulting in an unsaturation of calcium and phosphate in the oral cavity. However, human enamel samples isolated from the altered oral environment when irradiated with gamma radiation at doses of up to 25 kGy (much higher than radiotherapy doses) were shown to have undergone no changes in molecular hardness or micro surface. After approval of the Research Ethics Committee, 20 human dentin samples were evaluated before and after irradiation, split randomly into control group (n = 10) and irradiated group (n = 10) treated with 25.0 kGy at the Co⁶⁰ multipurpose irradiator and irradiated with Er,Cr:YSGG laser in the parameters: 8.5 J/cm² in the Fourier Transform Infrared Spectroscopy (FTIR), % surface Microhardness loss and Scanning Electron Microscopy (SEM). At the end, acidic biopsies were performed to quantify the concentration of calcium present in the samples. In the results of FTIR analysis differences were found only in the bands of organic content and in the inorganic content, difference were not found between before and after irradiations. The EDS and % Surface Microhardness loss analysis corroborates these findings, as well as no significant loss of the Calcium content before and after their radiation with Co⁶⁰ at 25 kGy and with the Er,Cr:YSGG laser. These findings lead us to a new hypothesis of behavior of the hydroxyapatite crystal submitted to the gamma irradiation.

PLASMA CELL GINGIVITIS AND LLLT

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Plasma cell gingivitis (PCG) is a benign and chronic inflammatory condition, with an uncertain etiology. Clinical features are typically represented by well delimited red erythematous areas. The gingival lesions are usually asymptomatic. The histopathology examination is mainly characterized by a significant plasma cell infiltrate. We describe the case of a 64-year-old male patient with PCG.

Clinical examination showed a confined gingival area, from tooth 15 to 25, with severe erythema, oedema and hard bleeding, only on the vestibular side, without pathological probing. Histopathologic diagnosis confirmed PCG. The patient has been treated with periodontal therapies (PT) associated with Low Level Laser Therapy (LLLT). 635 nm wavelength and 300 mW power were selected for laser treatment. Combined treatment has been scheduled since May 2018 in two weekly sessions. Treatment was given for a month (total eight doses).

Improvements were observed in both clinical parameters (erythema, oedema, bleeding) and histopathological exam, for the amount of inflammatory cells detected in the peripheral area of lamina propria was decreased.

Our therapeutic program was intended to be an alternative to topical steroid. LLLT procedures have demonstrated adequate and stable anti-inflammatory effects. PT enhanced the anti-inflammatory effects of LLLT by eliminating bacterial contamination and the hypertrophic tissues. Stability of the results was checked in the 6 following months.

SUCCESSFUL EXCISION OF BUCCAL MUCOSA IRRITATIONAL FIBROMA USING 940 NM DIODE LASER

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Background and objective: Irritational fibroma is a common benign exophytic and reactive oral lesion that develops secondary to injury. The most common sites of irritational fibroma are the tongue, buccal mucosa and lower labial mucosa. Differential diagnosis of other lesions including benign tumors and mucocele should be ruled out by biopsy. These lesions may be excised using conventional surgery, electrosurgery or laser. Lasers have recently made tremendous progress in the field of dentistry. The diode laser device has specifications such as a relatively small size, portability, and lower cost that attracts dental practitioners to its use for various surgical procedures in comparison with other laser equipment.

Materials and methods: Twelve patients agreed to undergo surgical removal of superficial proliferative lesions of buccal mucosa under local anesthesia using a 940 nm diode laser in continuous wave mode. Bleeding was stopped using Laser Dry Bandage setting and no suturing was needed. The specimens were sent for histopathological examination. Patients were assessed for intra-operative and post-operative complications.

Results: The procedure was easy to perform with excellent precision and minimum bleeding. It was well accepted by the patients who also reported mild post-operative pain. Optimum healing was achieved with no residual ulceration or scarring. The excised specimens proved adequate for histopathological examination and all lesions were benign.

Conclusions: The 940 nm diode laser can be employed in excisional biopsy of buccal mucosa irritational fibromas with minimum bleeding, discomfort, scarring and postoperative pain and should be considered as a viable alternative to the conventional surgical technique.

AUTO-FLUORESCENCE GUIDED Er:YAG LASER SURGICAL APPROACH OF SQUAMOUS CELL CARCINOMA OF THE TONGUE: A CASE REPORT

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Objective: To present a Er:YAG laser assisted surgical approach for OSCC excision using autofluorescence (AF) for highlighting surgical margins.

Methods: A Caucasian male with an ulcerated white plaque on the left margin of the tongue was referred to the Unit of Oral Medicine and Laser Surgery of the Hospital of Parma. Reduced AF lesions (dark areas) are suspicious for epithelial dysplasia or OSCC, whereas normal mucosa appears bright green. Using VELscopeTM (LED Medical Diagnostics Inc., Barnaby, Canada) system the lesion appeared as an extensive hyper-fluorescent area with a hypo-fluorescent area inside. The diagnostic hypothesis was compatible with leukoplakia with possible dysplasia. An incisional biopsy using cold blade was performed; after the histopathological examination, the lesion was removed with an excisional biopsy using Er:YAG laser (2940 nm FidelisPlus, Fotona-Slovenia 250 mJ, 20 Hz, VSP-Fluence 60 J/cm²). After six months, two small white areas of leukoplakia were detected and they were removed with excisional biopsy using QMR lancet. The follow-up was performed after a week and every months for one year.

Results: Mucosal fragment of the incisional biopsy resulted as a low-grade verrucous carcinoma according to the histopathological evaluation. The excisional biopsy gave the results of initially infiltrating squamous cell carcinoma and of lichenoid type low-grade dysplasia.

Conclusions: This case report demonstrates the validity of the autofluorescence examination as a method for helping in the early diagnosis of OSCC, and the possible use of new technologies (Er:YAG laser and QMR lancet) for treatment of dysplastic lesions and early oral cancer.

PREPROSTHETIC TREATMENTS BY LOW LEVEL LASER THERAPIES

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Background: The existence of a diode can be a beneficial adjuvant treatment solution in the dental office.

Objective: I will present some cases of surgical and pre-prosthetic procedures that can be successfully resolved using a diode. In fixed prosthetics, following prosthetic preparation, laser application has the analgesic, anti-inflammatory and dentin-like effect as therapeutic action.

Materials and methods: The characteristics of the diode used are as follows: wave length 980 nm, power 0.1–16 W, three selectable work modes: assisted, fast and advanced, smart due to assisted working mode that provides safety in any procedure due to work settings preset, adaptable settings for all types of tissues, works with the wireless pedal, SuperCap patented system that allows recharging in just 60 sec, autoclavable tips, maximum hygiene, lower operating cost, quick selection of treatments through the touch screen provided with colored icons in the same color as the tips. There are clinical situations in which the prosthetic fields should be modified to increase the stability and suction of the mobile prosthetic appliances, including vestibuloplasty, bructomy, labial and lingual frenectomy for old ages patients with high-risk, minimally invasive and comfort.

Results: Laser therapy versus classical surgical/preprosthetic therapy proves more advantages within the former.

Conclusions: The presence of a diode in any dental office provides comfortable solutions, especially for the patient, as well as for the physician.

DENTURE-INDUCED FIBROUS HYPERPLASIA TREATED WITH DIODE LASER: A CASE REPORT

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Background: Epulis fissuratum is a reactive fibrous hyperplasia induced by poorly fitting dental prosthesis. These lesions frequently hurt and not allow the normal oral functionality.

Here we report a case of denture-induced fibrous hyperplasia successfully treated through Diode Laser.

Case report: A 55-year-old woman was referred by his dentist to the Section of Oral Medicine and Surgery of the University of Parma (Italy), for a wide hyperplastic neof ormation at the alveolar ridge of the

lower jaw, in denture area. The lesion had smooth surface, without ulceration. The patient reported pain, increased by compression. The lesion was present approximately from 20 years. The clinical features were consistent with denture-induced hyperplasia.

Methods: Complete excision of the lesion was performed with diode laser (445 nm–3.5 W, continuous wave) in local anesthesia. Histopathological examination was requested.

Results: The histopathological examination revealed a diffuse fibrous hyperplasia, compatible with our clinical hypothesis.

After two weeks, the area was completely healed. After 4 months, no recurrence of the lesion was observed, apart for little change of the anatomy induced by the very long course of the disease. The patient referred complete disappearance of the symptoms.

Conclusions: The surgery excision of large lesions in functional area can be difficult with traditional scalpel, because first intention closure would be problematic or induce scars potentially limiting oral functionality. Diode laser, through the possibility to avoiding sutures and a lower post-surgical morbidity, seems to be a better choose for this kind of lesions.

LASER DEVICES IN THE NON-SURGICAL TREATMENT OF PERI-IMPLANT DISEASE: A SYSTEMATIC REVIEW

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Objective: Peri-implantitis is a destructive inflammatory process around implants that leads to the loss of supporting bone. The aim of the present review is to survey the relevant literature on the clinical application of lasers in the non-surgical treatment for peri-implant disease and to evaluate the effectiveness of these tools.

Materials and methods: An electronic research on PubMed for articles published from January 2010 to March 2019 was performed. The research only included case series, clinical trials and randomized clinical trials with a number of patients ≥ 10 and a follow-up period ≥ 6 months.

Results: Amongst a total of 253 studies found, 11 respected the inclusion criteria. The clinical output of the adjunctive laser therapy in non-surgical treatment was evaluated through the analysis of the difference between the weighted mean difference of clinical parameters recorded at baseline and at the end of the trial, such as: PD, BOP, PI.

Conclusions: The results show minimal benefits provided by the use of lasers in adjunction to manual instrumentation. Furthermore, most of them underline the importance of lasers in the healing of the peri-implant wound in the short period. Otherwise it is clear that an advanced inflammatory process has a negative impact on the clinical outcome. The minor traumatic effect and higher action in term of disinfection of roughness of the implant surface are the advantages of lasers. Nevertheless, more human clinical studies are required to evaluate the real role of the laser devices in the non-surgical treatment of peri-implant disease.

MIESCHER'S CHEILITIS AND LLLT

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Background: Miescher's granulomatous cheilitis (MGC) is a rare chronic inflammatory disease that can be part of the Melkersson-Rosenthal syndrome. It is characterised by a labial swelling, with hard non-tender gummy textured tumefaction. The labial lesions have characteristically an intense chronic inflammatory component, rich of cellular and vascular reactivities. The histopathological confirmation of non flesh-eating granulomas is useful to validate the working diagnosis.

Objective: To verify therapeutic results over time of Low Level Laser Therapy (LLLT) in a female 68-year-old patient with MGC.

Methods: The follow-up included clinical examination performed every 15 days for 6 months. The LLLT treatment had been carried out using a Diode Laser with of 635 nm wavelength and 200 mW power. The patient had been treated 3 times a week, with 12 applications (4 weeks).

Results: After 3 months a new incisional biopsy showed a significant decrease of the cellular inflammatory infiltrate and absence of granulomatous alterations. During the next 6 months of follow-up, no signs of inflammatory relapses were detected based on volumetric comparisons of the affected tissue.

Conclusions: Clinical follow-up confirmed the efficacy and stability of the anti-inflammatory and bio-modulatory therapeutic effects of the treatment.

REMOVAL OF LAMINATES WITH Er,Cr:YSGG LASER FROM DENTAL ENAMEL SUBMITTED TO GAMMA RADIATION

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Background: Modern Dentistry is characterized by the search for aesthetic perfection in the smile. Many efforts are made regarding procedures related to manufacturing, cementing, maintenance and removal of ceramic laminates. The laser removal of laminates has become more frequent when the aesthetic procedures needs to be replaced. On the other hand, the head and neck cancer treatment causes comorbidities in the buccal environment when laminates are in place.

Objective: To evaluate in vitro the removal of ceramic fragments by means of Er,Cr:YSGG laser irradiation, after gamma radiation.

Methods: 20 Lithium disilicate veneers were cemented with Variolink® to human dental enamel and then samples were irradiated with 0.07 kGy. After gamma irradiation, the laminates removal with Er,Cr:YSGG laser was performed. The control group was not subjected to gamma radiation. Dental enamel samples were analyzed by Scanning Electron Microscopy (SEM), Fourier Transformed Infrared Spectroscopy (FTIR) and Surface Microhardness Loss (SMH). Results: SEM has shown that less cement was found after removal of the facets in gamma irradiated group when compared to the control. For both groups there was alteration of the SMH possibly due to the use of the adhesive system. When performed intra group analysis, the sample being its own control of baseline in the FTIR analysis, there were no band shifts or formation of new compounds on the surface of human dental enamel.

Conclusions: The Er,Cr:YSGG laser is an effective alternative for laminates removal in human dental enamel even when it is subjected to gamma radiation.

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REMOVAL OF A VOLUMINOUS SUBMANDIBULAR GLAND DUCT STONE THROUGH THE USE OF Nd:YAG LASER

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Background: Sialolithiasis is the most common cause of submandibular gland swelling. Sialolithiasis results in a mechanical obstruction of a salivary duct, possibly causing repetitive swelling during meals. Surgical management is recommended if stones are accessible or when conservative therapies result unsatisfactory. After surgery, the patient might suffer from post-operative complications with permanent injury. An injury to the lingual and hypoglossal nerves is less common, but half of the times can be permanent.

Methods: An 83-year-old woman was evaluated at the Unit of Oral Medicine of the Academic Hospital of Parma(Italy). An asymptomatic swelling zone, at the level of the right submandibular gland, was observed. Duct obstruction was diagnosed due to occlusal projection radiography and for absence of salivary flow even after manual gland stimulation. A surgical access obtained with Nd:YAG laser (1064 wavelength, set at 3.5 Watts, 70 Hertz) allowed the removal of the calculus, and a catheter was inserted inside the salivary duct.

Results: After one-week follow-up visit, no swellings altogether with restored salivary activities were observed. One month after the mucosa was completely healed. The patient undergoes regular follow-up visit to evaluate possible recurrence.

Conclusions: Nd:YAG laser is a useful tool for surgical treatment of salivary occlusion due to sialolithiasis. In the present case, Nd:YAG allowed a good haemostasis, thus giving the operator an excellent view of the area. Such advantage makes it possible to respect important structures. Nd:YAG surgery also reduces post-operative pain and edema.

FLUORESCENCE CONFOCAL LASER MICROSCOPY APPLIED TO MICROSCOPICALLY CONTROLLED SURGERY IN A CASE OF BASAL CELL CARCINOMA OF THE PROLABIUM

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Background: Complex cases of basal cell carcinoma are treated with a surgical procedure which provides "real time" intra-operative pathological examination with the use of frozen sections, in order to save as much as possible tumor free tissue. Ex vivo Fluorescence Confocal Microscopy (FCM) is a novel technology, which provides fast microscopic fluorescence and reflectance tissue imaging with a resolution comparable to that of histopathology.

Objective: We present this new method applied to a case of basal cell carcinoma of the prolabium treated with microscopically controlled surgery.

Methods: The basal cell carcinoma of the prolabium was surgically excised in accordance with Mohs surgery technique. The central part of the fresh tissue excised and all the margins were analyzed with FCM and with the gold-standard histopathological examination.

Results: We detected a perfect concordance between FCM analysis and the gold-standard histopathological examination in all sections examined.

Conclusions: FCM is a promising tool for a rapid intra-operative real time margins assessment of non melanoma skin cancers. The technique is simple and time sparing compared to the traditional histopathological examination, with consequent advantages both for the patient and the public health system.

EX VIVO PILOT STUDY OF A 976 NM DIODE LASER USE IN THE REMOVAL OF ORAL LESIONS

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Objective: Aim of this study was to evaluate, through an histological examination, the thermal effects induced by a 976 nm diode laser (Solase, Lazon medical Laser, Shenyang, China).

Materials and methods: Six ex vivo laser biopsies on a swine tongue were taken at

- 4W-5W-6W in PW (Ton-Toff: 100ms/100ms)
- 4W-5W-6W in CW

Two sections were performed from each sample for histological thermal damage measurement.

Results: The mean thermal epithelial damage of PW samples was 130 μm while in CW it was 196 μm . The mean thermal connective damage was 238 μm in PW and 330 μm in CW.

The peripheral damage never exceeded 0.4 mm and the reability was always good allowing an optimal histological evaluation.

Conclusions: Considering the mean thermal epithelial and connective damages and considering that the highest damage ever found was 319.88 μm in the epithelium and 402.71 μm in the connective tissue, this pilot study showed that a 976 nm diode laser may be safely used in the excision of oral lesions with a suitable width of resection margins. More researches with a larger sample size and in vivo studies are needed to confirm these results.

LOW LEVEL LASER THERAPY IN TEMPOROMANDIBULAR DYSFUNCTION. A CLINICAL STUDY

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Background: Temporomandibular dysfunction (TMD) is defined as a group of disorders affecting the masticatory muscles, temporomandibular joint (TMJ) and associated structures. Pain is a major manifestation of TMD and can affect masticatory muscles, temporomandibular joint, or other adjacent structures. Several treatment options are available including low level laser therapy (LLLT).

Objective: To evaluate the efficacy of LLLT in the treatment of symptomatic TMD.

Methods: An observational clinical study was conducted with 18 patients (13 females and 5 males) diagnosed with temporomandibular dysfunction with painful symptoms during a study period from March to July of 2018. Patients were submitted to a 635 nm wavelength laser (Lasotronix M, Lasotronix Marcin Pokora[®], Piaseczno Żytinia, Poland), 200 mW using an 8-mm spot hand-piece, in a continuous mode for 25 sec, delivering 8 J/cm² in each application point, performed in 4 sessions. Pain score (using visual analog scale - VAS), satisfaction score (0 to 10), complications score and efficacy score treatment were recorded in a follow-up of one month.

Results: The degree of pain after the laser treatment (0.4 ± 0.7) was statistically lower than the degree of pain before treatment (4.8 ± 2.3) ($p < 0.001$). A statistical difference was found for most group muscles comparing before and after the treatment with reduction or elimination of pain on palpation. Regarding the satisfaction of the patients, the mean patient satisfaction level corresponded to 9.6 ± 0.8 . There were no complications on the patients.

Conclusions: Low level laser therapy was effective on the remission of painful symptoms associated with TMD, without complications and with a high level of satisfaction of the patients.

ANALYSIS OF CERAMIC LAMINATES REMOVAL WITH Er,Cr:YSGG LASER BY OPTICAL COHERENCE TOMOGRAPHY

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Porcelain laminated veneers have been widely used. For wear of hard tissue such as enamel and dentin, the diamond rotary instrument is the most traditional, but the laser has become recently used to remove aesthetic facets. Optical coherence tomography (OCT) used as an optical biopsy, is important for morphological analysis and attenuation coefficient is related to the property of the photons to be scattered by the samples. After approval by the Ethics Committee, the present study investigated the detachment of 30 ceramic E-max fragments cemented in human dental enamel of dimensions 3 mm x 3 mm x 0.7 mm with 3 types of resin cements, RelxY Veneer, Relx U200 and Variolink Veneer. The samples (Enamel + Ceramic Fragment) were randomly distributed in the 3 groups and cemented according to the manufacturer. After that, they were prepared for irradiation with the Er,Cr: YSGG laser under pre-determined conditions (3.5 and 3 W, 20Hz, 60% water and 40% air flow). OCT analysis was done before and after irradiation. We observed that the morphological changes of the enamel surface showed an increased surface area due to the cement remaining in the enamel. We concluded that the Er, Cr: YSGG laser, when used in the irradiation protocol tested, seems to be a safe tool for the removal of laminates.