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01

Soft Tissue Laser Ablation with CO_2 Lasers

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Purpose: Due to various habits of chewing tobacco, lime and betel nuts in India, a large number of lesions related to this habit occur in the oral cavity. Most lesions occur in the oral mucosa and are either benign or premalignant.

Materials and Methods: Twenty patients with various oral lesions were chosen from the Department of Oral Diagnosis, M.A. Rangoonwala College of Dental Sciences and Research Center, Pune, India. Initial diagnosis was made on the basis of toluedine blue test, and stained areas were treated with CO_2 laser ablation.

Results: 18 month follow-up of these patients showed no recurrence of the lesion, highlighting the distinct advantages of incorporating CO_2 laser in treating a large population inflicted with such lesions who visit the hospital.

Conclusion: Lasers offer an easy and less traumatic method to treat such lesions by ablation of damaged epithelium without causing any harm to the subjacent tissues. Because of the advantages of a relatively bloodless surgery, decreased postoperative discomfort, minimal swelling and scarring, and the laser's ability to coagulate, vaporize, or cut, the CO_2 surgical laser offers the dental surgeon a viable and in many cases an improved alternative to the scalpel.

02

A Comparative Clinical and Histological Study of CW and Gated Diode Lasers

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Over the last 13 years, GaAlAs diode lasers have become more and more popular. Due to their small size, their good electro-optical coupling and delicate glass fibers, this type of laser fits into most offices. The first diode lasers and still most lasers on the market run on CW or an on/off ratio of 1:1. With the use of these settings, high tempratures in the tissue are inevitable. The aim of the study to examine the difference in cutting efficacy, and the clinical and histological outcome of excisional biopsies. Eighty excisional biopsies of fibromas and epulites fissurata were performed with two diode lasers, both using a 400-micron fiber (Elexxion Claros and Elexxion Claros Nano, Elexxion AG, Radolfzell Germany).

Group I:	12000Hz gated, 16 microsec PD, 15W
Group II:	14000Hz gated, 16 microsec PD, 15W
Group III:	10000Hz gated, 10 microsec PD, 30W
Group IV:	12000Hz gated, 10 microsec PD, 30W
Group V:	14000Hz gated, 10 microsec PD, 30W
Group VI:	16000Hz gated, 10 microsec PD, 30W
Group VII:	18000Hz gated, 10 microsec PD, 30W
Group VIII:	CW mode, 1.5 W output power

The macroscopic results and postoperative period of the patients in group IV were best. Scarring and post-operative discomfort were more intense in the CW group. The histological findings showed more thermal damage in groups VI-VIII. The lasers showed good cutting efficiency. CW mode and higher pulsation showed more thermal damage.

03

Prospective Study of Diode Laser of 532 nm versus Diode Laser of 980 nm in the Surgery of Hyperplasic Lesions in the Oral Cavity: Design and Methodology

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Purpose: To conduct a prospective study to determine which diode wavelength is more suitable for the exeresis of hyperplastic lesions in the buccal mucosa.

Materials and Methods: Hyperplastic lesions of the oral mucosa in groups of 20 patients each treated with either 532-nm or 980-nm laser were surveyed in a 4-week follow-up (days 2, 3, 8, 14, and 28 after surgery). There was no antibiotic therapy. For the excision the used fiber diameter was 320 μm, the power was 1.5 W continuous wave in both groups. The examination parameters were: treatment time and applied energy, amount of pain killers, grade of inflammation, pain index of the patient. The data gathered were statistically evaluated.

Results: In both groups, the need for pain killers was minimal, no additional antibiotic treatment was necessary, no infection was found after the treatment, the grade of inflammation was similar, and the healing time almost the same. The energy needed with the 532-nm laser was about 1/3 lower.

Conclusions: The use of a new 532-nm laser is safe and favorable in the treatment of hyperplastic lesions of the oral mucosa. In the follow-up, the results between the 980-nm laser and the 532-nm were not significantly different. Due to better absorption in pigmented tissue, the needed energy of the 532-nm laser was about 1/3 lower than with the 980-nm laser.

04

Achieving the Best Gingival Esthetics in Gingivally Hyperpigmentated Patients with Er,Cr:YSGG Lasers

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Purpose: Every single day in our practice, we come across patients that are in need of some soft tissue treatments to have a better smile. The most well-known unaesthetic dental appearances are due to hyperpigmented gingiva, irregularity of the gums, or gummy smile. By choosing the right and the suitable wavelength, we can make excellent improvements in the esthetics of our patients mostly without any anesthesia or other conventional post-operative measures.

Materials and Methods: All the patients that were treated in this study were having similar problems of not being happy with their smile due to hyperpigmentations. Er,Cr:YSGG laser (2780 nm) was used in order to remove the hyperpigmentated regions without any anesthesia with settings of 1.0-2.0 W at 15-30 Hz and 5-15% water, 12-40% air.

Results: All the treatments were completed successfully with minimum bleeding, without any need of periodontal dressing applications, in a very short working time, with fast healing. Also the patients' survey results were 100% positive about the comfort of the laser treatments. For all the cases, no analgesics were prescribed.

Conclusion: Even though similar treatments can be done successfully with conventional techniques, laser treatments can give us the opportunity to accomplish the results in a better way; without shots, without post-op discomfort and long term steady results.

05

Vestibuloplasty with a Free Ceratine Mucosa Graft

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In a presentation from a dental practice for dental practice, the question is answered whether a tissue graft transplantation is possible with a laser or not.

The healing process of the vestibuloplasty with a transplanted ceratine tissue graft, taken from the maxilla, is shown based on 4 cases. It is demonstrated that

1. The Erbium Chrome YSGG Laser does not damage the structure of the transplant, so that a transplantation will be possible.
2. This procedure lets us dissect a tissue graft with no or less bleeding and allows maintenance of a functional periosteum.
3. This procedure is combined with much less pain and without significant swelling.
4. The specific effects on the tissue of the different lasers regarding healing have to be analyzed more specifically.

This laser operation method is illustrated step by step, so that other operators can put this method into practice immediately in their dental practices.

06

Frenectomy by Er,Cr:YSGG and Diode Lasers

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Purpose: Frenectomy done by laser can be used to achieve more comfortable treatment for the patient (less bleeding, less swelling, less pain, less anesthesia). There is no need for a gingivoplasty or sutures. Another appointment for suture removal is not necessary. Laser therapy is not as frightening for children as treatment by scalpel.

Materials and Methods: Three cases of children, 10 to 12 years old, with upper diastema were treated by different laser systems. Er,Cr:YSGG (2780 nm) or superpulsed diode (810 nm) or pulsed diode (940 nm). Therapy was conducted without gingivoplasty. No sutures were applied. Medical observation after 2 days, 1 week, and 4 weeks followed.

Results: Complete healing of soft tissue was observed. In all cases, the size of the diastema decreased. No swelling or pain after treatment occurred. Only in cases of the diode laser treatment was a minimal infiltration anesthesia necessary. The procedure was done without any bleeding but with prolonged healing time. Treatment by Er,Cr:YSGG laser required only topical anesthesia, but there was a certain amount of bleeding and minimally delayed healing compared to scalpel treatment. Cutting with Er,Cr:YSGG laser showed a nicer and faster cut than in the case of the diodes and there was no carbonization visible. No gingivoplasty or sutures were needed, no secondary treatment was required.

Conclusion: Laser therapy of frenula is possible by Er,Cr:YSGG and diode lasers. It is more comfortable for patient and surgeon and it simplifies the surgical procedure. Children's compliance and acceptance of laser therapy is much higher than it is for classical treatment by scalpel.

07

New Approaches to Laser Treatment in Prosthodontics

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Background: Different worldwide methods of laser treatment in prosthetic dentistry have been applied up to now. Interest in the application of different laser units in prosthodontics is constantly increasing . It is well known that the rehabilitation of the masticatory system is a complex process of medical procedures consistently applied. The author offers a systematic program of successive laser methods.

This lecture presents guidelines about laser usage to enchance patients' overall appearance and to achieve excellent smile esthetics.

The goal is to help practitioners to determine the appropriate laser for a given clinical situation. The most important goal was to establish an original working hypothesis about the rehabilitative effect of laser biosynergetics on the orofacial complex. The author offers a new, original, clinical approach, based on the paradigm of this hypothesis.

Materials and Methods: The GaAs (904 nm) was used for bone regeneration and periodontal laser healing. The InGaA1P (630-700 nm) diode laser was applied for laser biostimulation. Combination probes of two laser wavelengths with 3 laser diodes with LEDs of various wavelengths ("cluster probe") were also applied extraorally.

The following suggested treatment dosages were applied: 2 to 3 J/cm^2 two or three times a week on gingival tissues; 4 to 6 J/cm^2 two or three times a week on muscles; 6 to 10 J/cm^2 once or twice a week on a TM joint; and 2 to 4 J/cm^2 directly on the tooth or indirectly above the apex or osseous structures.

The illustrations demonstrate the sequence of the laser procedures.

Results and Discussion: The combined laser prosthetic treatment was applied and excellent results were achieved 2 months immediately after the first laser session.

The author suggests a new clinical approach for muscle skeletal, bone, TMJ and soft tissue rehabilitation during teeth preparation for functional harmonization and esthetic restoration.

08

The Influence of Low-Level Laser Therapy on Gingival Inflammation

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Purpose: The aim of this study was to investigate the influence of low-level laser therapy (LLLT) on gingival inflammation in diabetic patients. Extensive studies of periodontal therapy in diabetic patients have been conduced worldwide in order to improve their oral health.

Materials and Methods: 150 patients with chronic periodontitis enrolled in the study had no history of periodontal treatment or any antibiotic therapy during the last 6 months. They were divided into three separate groups. The first group (A) was the control, and patients were systemically healthy (50 patients), patients in the second group (B) suffered from diabetes mellitus type I (50 patients), and in the third group (C) from diabetes mellitus type II (50 patients). Basic periodontal therapy was applied for five consecutive days in order to remove supra- and subgingival bacterial deposits. Also during this period, laser therapy was applied using GaAlAs diode laser, 670 nm, 5 mW, CW, 14 minutes, lased area was from 17-11. In each patient, gingival inflammation was evaluated in areas 17-11 and 21-27 using a gingival index (GI) before therapy, after the 1st and 5th treatment, and one month after finished laser therapy.

Results: There was no difference in mean GI values between investigated groups before therapy. Results showed that mean GI values were statistically significantly lower in lased areas compared to nonlased areas in all groups after the 1st ($p<0.001$) and 5th treatment (A: $p<0.05$, B: $p<0.001$, C: $p<0.01$). It was noticed that GI had the same low value in all investigated groups in the lased area even one month after finished therapy.

Conclusion: Low level laser therapy can be successfully used during periodontal therapy of diabetic patients and can significantly improve periodontal health of diabetic patients.

09

Endo-Perio Lesions Successfully Treated Conservatively with the Adjunctive Use of KTP Laser. Clinical Evaluation and 24-month Follow-up Results

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Purpose: Treatment of endo-perio lesions is challenging for the clinician. A combination of root canal treatment and periodontal treatment is needed in order to provide good results. There is a high failure rate due to the difficulty in eliminating the microflora that colonizes and complicates the lesion.

Materials and Methods: During the period between 2006 and 2007, some 40 endo-perio lesions in anterior and posterior teeth were treated. The follow-up period was 24 months. The root canal treatment was performed by one endodontist without any laser application, and the periodontal treatment was completed by a periodontist. The instrumentation used for the periodontal treatment was ultrasound, scaler and the KTP laser. Clinical parameters (probing depth (PD), attachment level (AL), bleeding on probing (BoP), suppuration (P), mobility (Mob)) and radiological examination were evaluated prior to the procedure and then postoperatively, and 8 and 24 months after the treatment.

Results: During the follow-up period, no BoP or suppuration was noted. 8 months after the treatment, all of the lesions had PD 4-6mm and increasing AL 6-8mm. 24 months after the treatment 89.5% of the lesions had PD<=4mm and 81.6% of those had an AL of 4-6mm. The mobility of the teeth that were not splinted also improved. The radiological examination showed new bone formation both horizontally and vertically.

Conclusion: The treatment of the endo-perio lesions with the adjunctive use of the KTP laser is safe and can produce excellent results.

10

The Presence of Porphyromonas Gingivalis and Aggregatibacter Actinomycetemcomitans Among Children with Gingivitis Before and After Low Level Laser Therapy

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Purpose: Continuous accumulation of biofilm results in gingivitis. This inflammation occurs as a direct response to bacteria in the oral biofilm. Porphyromonas gingivalis (P.g.) and Aggregatibacter actinomycetemcomitans (A.a.) are the two most important microorganisms which are implicated in triggering gingivitis and periodontal disease. The aim of this work was to clinically evaluate children with chronic gingivitis and to assess the prevalence of P.g. and A.a., by means of multiplex PCR, in their gingival pockets, before and after low level laser therapy (LLLT).

Materials and Methods: 50 children with permanent dentition and chronic gingivitis were enrolled in the study. The content from the gingival pockets was analyzed by PCR for P.g. and A.a. identification before and after LLLT. LLLT was applied with a Scorpion–Dental–Optima apparatus (wavelength 635 nm, starting strength 25mV, exposure time 120s) at 5 daily sessions.

Results: A.a. was identified in the gingival pocket in 4% of the examinees, P.g. was identified 8%, while both A.a. and P.g. were identified in 6% of the patients before therapy. After therapy, A.a. was identified in the contents of the gingival sulcus in 2% of the patients, and P.g. was also identified in 2% of the patients. After therapy, the incidence of A.a. and P.g. was decreased, but without statistical significance.

Conclusion: P.g. and A.a. are found in the gingival pockets of children with chronic gingivitis before and after low level laser therapy, without statistically significant differences. However, the presence of P.g. and A.a. in the gingival sulcus after therapy could be a risk factor for repeated development of gingivitis and its progression into periodontal desease. Low level laser therapy should be used in the treatment of gingival inflammation because of its anti-inflammatory effects, as an adjuvant to basic therapy.

11

Low Level Laser Therapy as an Alternative Treatment of Oral Mucositis in Pediatric Oncology Patients

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Introduction: Chemotherapy or radiotherapy treatment frequently results in mucositis, which can lead to serious complications, such as fungal, viral, and bacterial infections, capable of causing systemic infection. As it is a severe and limiting complication of cancer treatment, several alternatives have been used in an effort to prevent and treat oral mucositis. So far, however, mucositis treatment is palliative, consisting of diminishing the symptoms and preventing infection. In recent decades, low-level laser irradiation has appeared as a new treatment option to reduce tissue inflammation.

Purpose: The purpose of of this study is to evaluate the efficacy of low level laser therapy(LLLT) on healing oral mucositis in pediatric oncology patients.

Materials and Methods: In this study, 12 pediatric oncology patients who underwent therapy at the Marmara University Oncology Department received intraoral irradiation with a diode laser after chemotherapy and radiotherapy treatment. To analyze the results, the World Health Organization (WHO) scale was used to rate their mucositis, and a visual analogue scale (VAS) was used for pain evaluation.

Results: The results showed that low level laser therapy affected and healed oral mucositis, and the patients had no pain symptoms.

Conclusion: Low level laser therapy was a safe and effective method for healing oral mucositis in this case study. However, studies with more patients are needed to prove the efficacy of this method.

Keywords: oral mucositis, low level laser therapy.

12

The Use of a Soft Laser (LLLT, 808 nm) in Various Dental Applications

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The beneficial effects of an 808-nm Softlaser on nerve regeneration, periodontal disease (with long term follow-up), herpes, traumatic facial lesions, and other applications is demonstrated and documented, based on 20 years of experience.

It is demonstrated how nerve injuries have been regenerated using GaAIA laser of 830nm (33mW) and 808nm (500mW). The treatment was performed giving 20-30 Joules to the damaged nerve a few times a week for 4 – 5 weeks.

Regeneration of N. Facialis (trauma related to operation) and N. Alveolaris inf. (trauma related to the removal of wisdom teeth) is shown.

The results show that the nerve functions normally after 10 to 15 treatments.

It is shown how the antiinflammatory and healing properties have been utilized treating all forms of dental operations and periodontal inflammations.

Patients suffer less pain because of less swollen tissue and faster healing.

Severe gingivitis was treated with 500 mW LLLT 2 Joule/papilla. Less bleeding and swollen tissue was noted already a day after the first treatment. Because of these benefits, it should it be much easier to perform suffient tooth cleaning and root planing. The benefit of LLLT after the removal of wisdom teeth is also shown. This results in less swollen tissue, faster healing, and no trismus.

The anti-inflammatory effect and faster healing has a very good effect after implant insertion using 500 mW and 10 to 20 Joules.

Other abstracts have shown that the bone healing around implants is faster using LLLT than placebo laser.

13

How Do Different Laser Preparation Parameters Influence Bonding Qualitites?

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Purpose: The aim of the study was to analyze the morphology of dentin by ESEM after modification with Er,Cr:YSGG laser, acid etching and treatment of the dentin surface with different types of bonding systems.

Materials and Methods: 96 human wisdom teeth were used which had no caries, no discoloration, no endodontic treatment or any kind of destruction. The teeth were cut by band saw into 1-mm-thick slices. The test groups were divided into 3 main groups: I: acid etching, II: laser preparation, III: laser and acid etching. The 3 main groups were divided into 4 subgroups corresponding to 4 different bonding systems. After preparation of the dentin surfaces, the composite resins were bonded following the manufacturer's instructions. The dentin slices were stored in NaCl 0.9% at room temperature until the investigation on the ESEM.

Results: The formation of the tags depends on the kind of surface treatment and not on the different types of bonding systems. After phosphoric acid etching, there are funnel-shaped tags with a wide base and anastomoses. After laser preparation the resin-tags are regular, cylindrical and well rounded at the end. A combination of laser preparation and phosphoric acid etching shows an intermediate stage. Self-etching systems which use maleic acid yield an insufficiently moist and modified dentin surface.

Conclusion: After laser preparation the dentin offers an ideal surface for composite restaurations.

Keywords: resin tags, phosphoric acid, Er,Cr:YSGG laser.

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Black to Pink - the Esthetic Quotient Towards a Beautiful Smile

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Purpose: Four different wavelengths of lasers were applied for depigmentation of gingiva to assess the best suited laser wavelength, the ease of operation, patient comfort, and the healing period and the recurrence on follow up at 120 days.

Materials and Methods: Five patients who required full mouth gingival depigmentation were included in the study. The four quadrants of each patient's mouth were served as study sites wherein each quadrant was treated with a different laser. A different laser wavelength (CO_2, diode, Nd:YAG and Er:YAG) was used on each quadrant in each patient. The treatment was completed on the same day with minimal local anesthesia for each patient. The visual analog scale was utilised for the pain evaluation. Bleeding control, homogenity and ease of application were considered for the operator's comfort. Healing was analysed at 24 hrs, 3 days, 7 days, 14 days, 21 days and one month. Reassement for recurrence was done at the 120th post-operative day. Clinical intra-oral standardised photographs were taken.

Results: CO_2 laser was best suited in noncontact mode and the ease of handling for the operator and patient comfort were satisfactory. However, the Er:YAG was seen to have best healing and homogeneity of the treated site but had poor bleeding control. Nd:YAG and diode did achieve satisfactory results but had poor operator and patient comfort.

Conclusion: The Er:YAG and CO_2 lasers fulfill most of the criteria that were set prior to the study.

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Thermal Changes During Light-Curing Process using a Blue LED and Argon Laser

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Cancelled.

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Pulsed Laser Irradiation for Debonding Ceramic Brackets

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Background: Laser irradiation decreases the bonding strength while heating the bracket that reduces the risk of enamel damage. However, temperature rises in excess of +5.5 °C can cause irreversible pulpal responses and a temperature rise of +11 °C may cause necrosis of the pulp. In this study, polycrystalline ceramic orthodontic brackets were irradiated by a 1070-nm Ytterbium Fiber Laser in pulsed mode. 5.5 °C is accepted as the threshold value for difference in intra-pulpal temperature.

Aim: To determine the suitable 1070-nm Ytterbium Fiber Laser parameters for debonding ceramic brackets which also ensure that intrapulpal temperature changes remain below the threshold value.

Materials and Method: Polycrystalline ceramic orthodontic brackets were bonded on bovine teeth by bis-GMA adhesive resin. Laser irradiated brackets were debonded with a material testing machine. Laser irradiation in pulse mode

was used in three different groups. In Group A, laser was applied for 200 ms on and 600 ms off; in Group B laser was applied for 300 ms on and 900 ms off, and in Group C laser was applied for 400 ms on and 1200 ms off. Breaking time and the load at the breaking point were measured. Intrapulpal temperature changes were recorded by a K-type thermocouple.

Results and Conclusion: For all laser groups, intrapulpal temperature rise was found below the threshold value of 5.5 °C. Significantly less debonding force and application time were required for Group A and Group B. Results showed that 1070-nm pulsed laser irradiation for debonding ceramic brackets is a promising method.

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Laser Assisted Tooth Whitening: Comparing Wavelengths, Materials and Methods

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Purpose: The aim of this clinical research study was to evaluate the effect of laser activation of different wavelengths, on different bleaching agents during tooth whitening procedures.

Materials and Methods: A series of patients was selected for undergoing different tooth whitening procedures. Laser-assisted tooth whitening groups included:

- 810-nm diode laser (LaserSmile810, Biolase Irvine, California), bleaching handpiece, CW 10 Watts, 15 seconds per quadrant, 12 cycles with Laser-White 10 gel
- 810-nm diode laser (LaserSmile810, Biolase, Irvine, California), bleaching handpiece, CW 10 Watts, 15 seconds per quadrant, 12 cycles with JWhite gel
- 940-nm diode laser (ezlase, Biolase), bleaching handpiece, defocussed, CW 7 Watts, 150 Joules per quadrant, 12 cycles with LaserWhite 10 gel
- 940-nm diode laser (ezlase), bleaching handpiece, defocussed, CW 7 Watts, 150 Joules per quadrant, 12 cycles with LaserWhite 20 gel
- 940-nm diode laser (ezlase), bleaching handpiece, defocussed, CW 7 Watts, 150 Joules per quadrant, 12 cycles with JWhite gel
- 532-nm KTP laser (SmartLite, DEKA, Firenze, Italy), bleaching handpiece, CW 0.7 Watt, 7 seconds per tooth, 6 cycles with KLOX gel

Comparisons were performed as split mouth studies. The color was determined with a spectrophotometric device (SpectroShade MHT, Arbizzano di Negrar, Italy) before starting the procedure, 2 days after finishing, and 1 week, 1 month, 3 and 6 months later. Digital photos were also taken.

Results: All wavelengths and gels used are more efficient compared to conventional non-laser-activated methods. The lowest contact time was achieved with Klox activated by 532nm laser. The lowest sensitivities resulted when JWhite Gel was used activated by a diode laser. The color outcome is more stable compared to conventional methods.

Conclusion: As one of the least invasive procedures in dentistry, tooth whitening has to be effective fast and painless for the patient. This is only possible by combining lasers with their wavelength-particular whitening gel. The 3 more recently developed materials are promising the best long-term results.

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Er:YAG Laser for Vital and Non-Vital Teeth Bleaching

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Purpose: Er:YAG is a very popular laser in dentistry, specially because of its efficacy and safety in removal of hard dental tissue. The wavelength, which has the highest absorption in water among all lasers, makes Er:YAG laser an ideal candidate for laser-assisted tooth whitening procedures in which the absorption of laser light in bleaching gel is the main

bleaching mechanism. The purpose of this study was to evaluate the ability of Er:YAG to perform tooth whitening and to compare it with other laser-assisted bleaching methods.

Materials and Methods: 16 teeth in 5 patients were treated with Er:YAG laser (Fidelis Fotona), using a collimated handpiece with a 5-mm spot and Fotona bleaching gel 35% H_2O_2. Laser parameter settings were: fluence 0.3 J/cm^2, pulse duration 1000 µs (VLP), frequency 15-20 Hz. Single tooth irradiation time was between 80 and 160 seconds in sequences 3 (to 5) x 15 or 20 seconds of irradiation, with 10 seconds of pause intervals. Depending of the intensity of discoloration patients were treated in one or two sessions.

Results: None of the treated patients reported pain or discomfort during treatment. All treated teeth (16 -12 vital and 4 non-vital) achieved a satisfactory bleaching effect (3 non-vital darker than A4 to D2; 1 from C4 to D2; 12 vital teeth from A3 to A1).

Conclusion: The results suggested that Er:YAG laser could be safe and effective for tooth whitening of vital and non-vital tooth discoloration. Adding another indication for use (tooth whitening) in the indication range of these lasers would be beneficial to dentists, as they would not have to buy a special additional laser for tooth whitening only.

Keywords: Er:YAG laser, bleaching gel, tooth whitening

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Er,Cr:YSGG in Peri-implant Diseases

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Background and Purpose: In 2009 more than 10 million dental implants will be implanted in about 3.5 millon people. But a significant number of those will develop complications, ranging from simple inflamation to the complete loss of the implant, placing peri-implant pathology as one of the most frequent oral pathologies in the future. At the next congress of the EAP, in a workshop dedicated to peri-implant diseases, Jan Lindhe declared "Peri-implant mucositis occurs in about 80% of subjects (50% of sites) restored with implants, and peri-implantitis in between 28% and 56% of subjects (12-40% of sites)". At the 3rd European Consensus Conference (EuCC) in Cologne 2008 (Prevention –Diagnosis –Therapy), peri-implantitis was defined as the term for inflammatory, pathological reactions in the surrounding soft and/or hard tissue of an osseointegrated implant. Even if the etiology of peri-implantitis is neither mechanical nor infectious, the dental biofilm and its transformation (from a gram + to gram - bacterial flora) is the main etiologic factor in the pathogenesis of peri-implant diseases. Like in periodontology, all perennial therapy, even systemic, should be adapted to etiology and not symptomatologically to the pathology. Peri-implant pathology is defined in mainly 2 stages: mucositis which is reversible and limited to soft tissues, and peri-implantitis, which is irreversible and affects also hard tissues. In both stages, laser assisted therapies have been tried with different wavelengths applied.

Materials and Methods: The presentation will review conventional and new treatment procedures with different laser wavelengths.

Results: In case of evoluted peri-implantitis, the best results have been found using Er:YAG and Er,Cr:YSGG, considering they are more athermic and can be used on both soft and hard tissus. But due to its penetration and great bactericidal effect the use of a defocussed CO_2 is of great help for a deep decontamination.

Conclusion: Although many authors claim Erbuim light has no effect on the superficial structure of titanium implants, power settings of the laser beam must be limited. Numerous other authors have found an increase of biocompatibility of the titanium suface. Further investigations or new studies using thermal or PDT effect or other wavelengths like excimer lasers are necessery to determine more clearly delineated indications for each technique.

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Efficacy of Ultrasonic Versus Laser Activated Irrigation to Remove Artificially Placed Dentin Debris Plugs

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Purpose: Laser activated irrigation (LAI) has been proposed as an alternative for passive ultrasonic irrigation (PUI) in root canals. Both methods appear to be based on induction of cavitation bubbles. A comparison in this respect between the cavitation effects induced with an Er:YAG or Er,Cr:YSGG laser has not yet been made. The aim of this study was therefore to compare the efficacy of LAI with two different erbium lasers and PUI at the irrigation time proposed for LAI and at the irrigation time as proposed by van der Sluis et al. (2007) for the intermittent flush technique.

Materials and Methods: A split root model with an artificial root canal wall groove according to Lee et al. (2004) was used – roots were prepared to an apical size ISO 40 with ProFiles 0.06. Five groups of five straight canine roots were evaluated, i.e., G1: hand irrigation for 20 s with 2.5% NaOCl (CI); G2: PUI for 20 s with the size 20 Irrisafe (Satelec Acteon group, Merignac, France) (PUI 1); G3: PUI for 3x 20 s with the Irrisafe (PUI 2); G4: LAI with the Er,Cr:YSGG laser and Z2 (200 µm) Endolase tip (Biolase, San Clemente, CA, USA) at 75 mJ for 4x 5s (LAI 1); G5: LAI with the Er:YAG laser (HoYa Versawave, Cortaboeuf, France) and a 200 µm endodontic fiber at 75 mJ for 4x 5s (LAI 2). Before and after irrigation, images of the groove were made. The quantity of the dentin debris in the groove after the experimental protocols was evaluated using a scoring system.

Results: Statistically significant differences ($p<0.05$) were found between CI and all other groups, between PUI 1 and the other groups.

Conclusion: Laser activated irrigation with erbium lasers (Er:YAG or Er,Cr:YSGG) for 20 s (4x 5s) is as efficient as passive ultrasonic irrigation with the intermittent flush technique (3x 20s).

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Optical Fibers with Optimized Emission Characteristics for Endodontic Diode Laser Application

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Purpose: In conventional root canal treatment with diode lasers, bare fibers were used. Most of the laser energy propagated in an axial direction resulted in a hazardous temperature rise at the apex. The purpose of our study was to develop fiber tips with modified emission characteristics for more effective and safer application.

Materials and Methods: Three different fiber tips (Taper, fiber with bevelled proximal end and a fiber with angular coupling) with a radial radiant characteristic were designed which should enable directing less light along the root canal lumen and more onto the canal wall. Theoretical simulations regarding the light distribution and the resulting temperature distribution in the tooth were done. To confirm these results, measurements of the temperature profile followed. These were performed on extracted human teeth, which were vertically sectioned along the root canal and surrounded by an agar-blood-mixture. 2D temperature profiles were observed by an IR-high-speed-camera (880fps).

Results: Measured temperature profiles show clear differences with regard to the radiant characteristics of each tip. Whereas most of the power from the bare fiber is transmitted directly to the apex and heats it, the tapered fiber demonstrates a distinct heating of the canal wall. The tip with the bevelled proximal end and the fiber with an angular coupling are slightly inferior compared to the taper, however the protection of the apex is still guaranteed.

Conclusion: To protect the apex during root canal treatment with a diode laser fiber, tips with radial radiant characteristic are useful. Among the evaluated designs the tapered tip has the best performance. However, the most feasible solution is a fiber with a bevelled proximal end.

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Full Mouth Disinfection and Photodynamic Assisted Periodontal Treatment. A Proposed Protocol

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There is considerable evidence to support scaling and root planing (SRP) as one of the most effective procedures for the treatment of infectious periodontal diseases. Treatment strategies used in periodontal treatment include full mouth disinfection although there is only a minor additive effect compared to conventional SRP. There is general agreement that SRP in addition to improving clinical parameters reduces the microbial load and results in a shift toward a more

health-compatible microflora. However, there are conflicting reports about the ability of SRP to completely eradicate or suppress important periodontal pathogens.

Photodynamic therapy (PDT) has been introduced as an adjunctive new approach of antibacterial treatment that might compliment the conventional treatment. PDT is based on the principle that a photoactivatable substance, the photosensitizer, binds to the target cell and can be activated by light of a suitable wavelength. During this process, free radicals are formed (among them singlet oxygen), which then produce an effect that is toxic to the cell.

A gel has been used comprising photosensitizers of specific absorption to blue - green light (450-530) that at the same time are bacterial disclosers. The substrate following reaction with biofilm releases healing factors that interfere in the regeneration mechanism of the tissues. This gel has been applied to all treatment stages as follows:

The first session included meticulous oral hygiene instructions (OHI). Thereafter the gel was applied in supragingival scaling, facilitating the detachment of calculus and stains, conferring light anaesthesia and controlling bleeding during this procedure.

In the second session the gel was applied during full mouth subgingival instrumentation. Local anaesthesia was selectively needed. SRP was performed until the operator felt that the root surfaces were adequately debrided and planed. Subsequently the session was completed using the gel as a photosensitiser which was applied with a blunt needle to the instrumented sites starting from the apical end of the pocket and moving coronally to avoid entrapment of air bubbles. A 532nm KTP at 0.7W power was applied into the pockets.

This new proposed protocol as described above has been applied in 3 chronic periodontitis patients who formed the test group. Three other chronic periodontitis patients received conventional non surgical periodontal treatment consisting of scaling and root planing under local anaesthesia which was completed within 48 hours and served as control.

All patients received oral hygiene instructions at baseline. The clinical parameters that were recorded at baseline included Clinical Attachment Level (CAL) and Bleeding upon Probing (BOP).

The CAL from 5.92 $\pm$ 1.92 mm at the first visit dropped to 4.38 $\pm$ 1.69mm two weeks post treatment in the test group, the difference being 1.54 mm, and from 5.74 $\pm$ 1.73 mm to 4.94 $\pm$ 1.92 mm in the control group, the difference being 0.8mm.

This new proposed protocol diminished the number of sessions demanded for the conventional periodontal treatment; minimized the need of local anaesthesia during SRP; the operation field was clear; patients showed greater compliance and the clinical parameters were dramatically improved two weeks following SRP+ PTD.

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The Latest Techniques and Research in the Use of the Er,Cr:YSGG Laser in the Treatment of Periodontal Disease

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In order to achieve predictable results in treating periodontal disease, we must be able to remove the plaque and calculus, decontaminate the root surfaces and depths of the pockets, remove the diseased inner sulcular epithelial lining, etch the root surfaces for reattachment and prevent or delay reepithelialization so fibroblastic and odontoblastic activity can occur. Soft tissue dental lasers have been used in the treatment of periodontal disease since at least the early 1990s with some success. It is with the introduction of the Erbium lasers, however, that laser assisted periodontal therapy is reaching a new level of predictability and success. With the Er, Cr:YSGG laser and new specially designed tips, we are able to meet all the criteria for successful treatment and many are seeing a dramatic reduction in pocket depth without the need for osseous surgery and bone grafts, and when surgery is needed, results are predictable, less stressful and more comfortable for the patient. In addition to this evidence based dentistry, the scientific studies necessary to support our clinical results are being performed. Our latest research not only shows that a laser etched root surface yields superior fibroblastic attachment while preserving vital cementum, but also which tips, power and settings will yield the best results. This paradigm shift in philosophy and technique has the ability, I believe, to change the face of periodontal therapy.

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Clinical and Radiographic Evaluation of Diode Laser Pulpotomy on Human Primary Teeth

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Purpose: A high demand is reported among young individuals for pulp treatment due to pain reported following progressive caries. Formocresol is a widely accepted medication used for pulpotomy in primary teeth judged to have inflammation limited to the coronal pulp. However, long term clinical use of formocresol became a concern following reports of widespread tissue distribution of the medication beyond the apices. Certain laser energies such as diodes are very helpful in managing pigmented soft tissues, as they are highly absorbed by hemoglobin, inducing effective homeostasis. The purpose of this study was to compare clinical and radiographic effects of diode laser pulpotomy to that of the formocresol on human primary molars.

Materials and Methods: A randomized, double-blind, split-mouth study was designed with a sample of 14 children, aged from 3 to 9 years (mean age=6.4 yrs). A total of 20 pairs of teeth were selected which were judged as requiring vital pulpotomy based on their pulpal exposure by caries, using clinical and radiographic criteria. One tooth from each pair was randomly assigned to the diode laser group while the otherone was asigned to formocresol group. Coronal pulp was removed as routine using a sharp excavator. Diode laser at 10 W (Laser smile, Biolase, USA), was applied on the remaining pulp while a cotton pellet soaked with a diluted formocresol solution was placed in the pulp of other group after homeostasis. Zinc oxide eugenol paste was then placed over the pulp stumps, and the teeth were restored either with stainless steel crown or amalgam. All teeth were followed up clinically and radiographically at 6 and 12 months.

Results: Clinical success was seen in all of the teeth (100%), while this rate was at 95% and 90% in radiographic control of 6 and 12 months. Similar clinical findings were obtained in control (FC) group, (100% success) with radiographic success of 90% at both 6 and 12 months. These results were not significant using Fisher exact test ($p>0.05$).

Conclusion: No significant difference was found between diode laser and formocresol pulpotomy on human primary teeth after 6 and 12 months indicating a potentially safe use in pulp treatment of primary teeth.

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A 14-year Clinical Assessment of the Effect of the Nd:YAG Laser on a Broad Spectrum of Endodontic Pathology

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Background: The Nd:YAG laser has now been used by the author in a general practice for fourteen years. In total, 2250 teeth have been treated with a single session of laser irradiation disinfection for forty to eighty seconds in duration.

This study analyzes the effect of the laser irradiation on one hundred and twenty-five teeth exhibiting periapical radiolucencies indicative of periodontitis. Analysis of these cases indicates the types of endodontic pathosis that have responded to laser treatment.

Materials and Methods: The teeth studied were chosen primarily based on the presence of radiographic pathology. Secondly, the clinical presence of swelling or sinus tracts associated with the teeth was noted. All teeth were treated endodontically with disinfection provided by irradiation with an Nd:YAG laser (American Dental) 1064 nm at 0.75 Watts and 15 Hertz with water lubrication. The laser fiber was a 200-micron glass fiber which was placed 1mm short of the working length, moved in a reciprocating motion for 2mm followed by a coronal spiraling motion at 10 second intervals for forty seconds. Sinus tracts were tracked by gutta percha points radiographically. All teeth received a single laser treatment.

Results: Radiographic follow up revealed resolution of radiolucencies in some cases in as short a time as four months. Cases were categorized in groups according to the symptoms of pathology present; acute apical periodontitis, chronic apical periodontitis, and suppurative apical periodontitis. Overall success observed during the the study is 95%.

Conclusion: The use of the Nd:YAG laser is an effective method for treating all types of endodontic pathology.

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Generalised Severe Chronic Periodontitis Treated with Cause-Related Periodontal Treatment and KTP Laser Application. Results from a Three-Year Follow-Up Period

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Purpose: The mode of treatment of generalized severe chronic periodontitis is a matter of debate between clinicians, since additional tooth loss can complicate the treatment plan. The aim of this study was to evaluate the safety, feasibility and results of KTP laser application in addition to cause-related treatment.

Materials and Methods: 50 patients with severe chronic periodontitis with some 1107 teeth were treated. The results were evaluated by x-ray and clinical examination just prior the treatment, and after six weeks and three years. Clinical parameters, such as probing depth (PD), attachment level (AL), bleeding on probing (BoP), suppuration (P) and mobility (Mob) were examined. After the initial treatment, all patients attended a strict supportive periodontal treatment protocol.

Results: Prior to the treatment 86.4% of the examined teeth had PD>=7mm and 87.1% had AL>=7mm. Six weeks after the treatment there was an improvement in both PD and AL which dropped to 2.4% and 20.4% respectively. Continuous improvement was noted even three years after the treatment where these percentages fell to 0.4% and 18.6% respectively. BoP was eliminated from 95% before the treatment to 6.2% six weeks after the treatment and to 8.9% at three-year follow-up. No suppuration was noted. Mobility was also improved. Before the treatment, 83.4% of the teeth had mobility grade II, which improved to 66.4% and 29.3% six weeks and three years after treatment, respectively. During the treatment protocol, 16 teeth were lost.

Conclusion: The conservative periodontal treatment (cause-related therapy and KTP laser application) on patients with generalized severe chronic periodontitis was successful, with excellent results which were not only maintained but even improved in a three-year follow-up period.

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Effect of 810-nm Diode Laser on Patients with Chronic Periodontitis Treated Non-Surgically

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Background and Purpose: Periodontal disease is a major health problem affecting the periodontium and prognosis of dentition.There are different types of periodontal disease, including inflammatory, degenerative or neoplastic. However, the major clinical features are pocket formation and bone loss. This study is designed to clinically evaluate the effect of 810-nm diode laser in the reduction of periodontal pocket depth, as well as to compare the effectiveness 810-nm with non-surgical periodontal therapy in terms of the reduction of pocket depth and gingival inflammation.

Materials and Methods: Six patients (males and females) complaining of chronic periodontitis with pocket depth of 5-8mm met all the criteria for selection. A case control study was applied, so one sextant was considered as a case and the other one as a control group which were allocated randomly. After scaling and root planing, 810-nm diode laser, 1 W, with a 400-micron glass fiber was applied for 30 seconds followed by rinsing with normal saline. The parameters measured at days 0, 30, and 60 were PLI, GI, PPD, and recession.

Results: The result was a significant reduction in the pocket depth from a mean of 5.25 to 3.34 on the laser treated side as well as reduction in gingival inflammation (Grade 2 to Grade 1), the same as many similar studies.

Conclusion: The 810-nm diode laser is effective in the treatment of chronic periodontitis through its reduction of pocket depth and gingival inflammation.

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Basic Research in Laser Dentistry. Mechanisms of Bacterial Inactivation

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Purpose: Lasers are used in dentistry for a variety of indications. One of these is the disinfection of root canals or the sterilisation of residual caries. A lot of studies have demonstrated the capacity of several laser types to kill bacteria. Despite numerous experiments with various setups the fundamental mechanism of the laser effect remains quite unclear. With our experiments we wanted to find out whether the killing of bacteria can primarily be characterized as a) a photothermal mechanism with light absorption by the bacteria themselves, b) a thermal mechanism with medium temperature being the relevant parameter, c) a photochemical mechanism.

Materials and Methods: In order to differentiate between mechanisms a) and b) we designed an experimental setup which allowed heating the sample cuvette by a water bath and by a diode laser (940 nm) with the same temporal temperature course. To test hypothesis c), bacterial solutions were irradiated while the temperature was fixed by ice water. Besides this, we also tested whether a laser induced activation of NaOCl at very low concentration (1.25 10-3%; 0.63 10-3%) would contribute to bacterial killing. For the reason of practicability, a non pathogenic stain of E. coli was used as the test object. Killing of bacteria was measured via fluorescence labelling.

Results: Comparison of killing rates between laser and water based heating showed no significant differences. The most important parameter is the maximum temperature. Laser irradiation of bacteria at low temperatures did not result in killing. Laser irradiation of a very low concentration of NaOCl resulting in maximum temperatures below 50°C did not increase the sterilisation effect.

Conclusions: In low density solutions of E. coli bactericidal effects of diode laser irradiation seem to rely on the average temperature rather than on light absorption by individual bacteria

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Cytotoxic and Genotoxic Effect of Narrow Band Light Sources on Cell Cultures, a Preliminary Study

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Purpose: Soft lasers have been well known for many years for their stimulatory effect in medical therapies. But due to their high costs, other narrow band light sources are in the focus of interest as alternative sources in light therapy. However, only a few studies have been made under both laboratory and clinical conditions. The aim of this study was to assess the cytotoxicity effect of LED light on the cellular level in order to evaluate the chances for their implementation to improve cell proliferation as one of the stages of wound healing.

Materials and Methods: Primary human gingiva fibroblast cells (HGF) were selected for this study and a cytogenetic analysis for cytotoxic and genotoxic effects was performed. HGF cells were cultured on cover slips in 24-well tissue culture plates until they became subconfluent. The culture plates were irradiated with LEDs of different wavelengths with varied output power and exposure time. After irradiation, the cells were incubated for 24 hours and then fixed and stained. All control and test cultures were analyzed by fluorescence microscopy. Cell proliferation expressed by mitotic index as well as induction of apoptosis and primary necrosis were evaluated. In this first approach, triplicate experiments were made to allow appropriate statistical analysis.

Results: In the investigated range of exposure settings, no cytotoxic or genotoxic effects on HGF were observed for the applied LEDs. No evidence for DNA damage occurred between treated and control cells.

Conclusion: Narrow band light irradiation from LEDs seems to cause no cytotoxic or genotoxic effects within the range of the investigated irradiation parameters.

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Selective Removal of Caries Using Experimental Caries-detecting Dye Solutions with a High Rate of Laser Absorption

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Purpose: In this study, to examine the color-related specificity of laser absorption at various wavelengths, we irradiated filter paper, which had been stained with red, blue, green, and purple caries-detecting solution (CDS), with a laser, measured the energy from the laser penetrating the dentin specimens using a laser energy sensor, and calculated the rate of absorption.

Materials and Methods: In addition to commercially available red and blue CDS, we prepared purple and green experimental CDS, and used them in this experiment. One drop of the CDS was placed on dentin specimens (thickness: 1.00 mm), and dried. Then, we measured the energy penetrating the specimens using a laser power meter. In this study, we used a P-LASER as diode laser generator, an Erwin AdvErL as Er:YAG laser generator, and a Panalas C05 as CO_2 laser generator. We calculated the absorption rate of staining-related irradiation energy, regarding values obtained by laser irradiation without the specimens as controls. The data were statistically analyzed using one-way variance analysis and Tukey's test (n=3).

Results: Green showed the highest absorption rate of the Er:YAG, followed by blue of Er:YAG and Blue of CO2. There were significant differences between the absorption values for red and purple of diode ($p<0.01$). Purple showed the highest rate of absorption of the CO_2 laser, followed by green, red, and blue. Neither the Er:YAG nor CO_2 laser showed any significant differences in their absorption rates among the colors.

Conclusions: These findings suggest that caries staining with green CDS for the laser treatment facilitates selective removal.

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The Effect of Initial Archwire Engagement on Human Pulpal Blood Flow

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Background and Purpose: Any alteration in blood flow or vascular pressure caused by a trauma may damage the pulp tissue. Laser Doppler Flowmetry provides a means of recording pulpal blood flow within teeth and has been described as a very sensitive method for tooth vitality evaluation. The purpose of this study was to evaluate the human pulpal blood flow changes after orthodontic force application.

Materials and Methods: Recordings were made of 5 volunteers scheduled for fixed orthodontic therapy, with interdental spaces between teeth 33-34 and 34-35 or 43-44 and 44-45. Pulpal blood flow was recorded by means of Laser Doppler Flowmetry for each of the 15 teeth, before treatment, 24 hours after the initial archwire engagement and 5 days later. The Laser Doppler Flowmetry probe was held in place by a splint constructed of a silicon impression material, to prevent instability and to permit reproducibility of the probe position. An opaque rubber dam was applied to the teeth during laser doppler flowmetry measurement. All data acquisitioned were collected and analyzed using specific software provided by the equipment producer.

Results: The Student t-test was used for statistical analysis. The comparison of basal pulpal blood flow during the three observation periods showed a significant pulpal blood flow decrease 24 hours after archwire engagement ($P < 0.005$), followed by a partial recovery 5 days after.

Conclusion: The results indicate that the measurement technique used in the study is able to detect pulpal blood flow changes produced by orthodontic force application and could be used as a diagnostic tool for determining aggressive forces over the pulpal biological limits of tolerance.

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Development and Evaluation of a Novel Handpiece for Improved Diode Laser Oral Surgery

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State of the art for use of the fiber guided diode laser in dental therapy is the application of bare fibers with various diameters, which were cut after each treatment. The aim of this study is the development of a dental handpiece for the diode laser with exchangeable fiber tips. This concept enables not only the use of new sterilized fiber tips for each patient but also the development of tips with special and optimized geometries for various applications, especially here for oral surgery. Our approach is to enhance the cutting efficacy by decreasing the spot size and thus increasing the laser light intensity at the tip end.

For this purpose various designs of tip geometry were developed and investigated by optical simulation, realized, and afterwards evaluated. In order to investigate the cutting quality and efficiency several cuts were made in porcine soft tissue with a manually directed handpiece, various laser parameters (940 nm, 5W/cw; 7W/mod.), and different tip geometries. The cutting process was recorded by video camera in order to characterize the handling influenced by the different tip geometries. From the cuts histological sections were prepared by a cryo-microtome and microscopically analyzed to determine the cut depths and the thermal damage zones. The cuts made with the manually directed handpiece show much better handling for the optimized fiber tip compared to the bare fibers. Also the cuts of the optimized fiber tip are more regular and deeper. The deepest cuts were achieved with the optimized fiber taper (5W/cw: 2393µm ± 468µm; 7W/mod.: 1536µm ± 74µm), compared to the bare fiber (5W/cw: 711µm ± 268µm; 7W/mod.: 580µm ± 294µm). The thermal damage zones of the cuts (about 100µm to 400µm) are comparable for the various tips and fibers. In conclusion, the results of our study show that the cutting quality and efficiency of diode laser on soft tissue has been significantly improved by optimization of the fiber tip geometry.

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Identification of Genes Related to LLLT in Human Gingival Cells Using Complementary DNA Microarray Analysis

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Background and Objectives: Differential expression of genes in human periodontal cells (PDC) under low level laser therapy (LLLT) is thought to be involved in the rearranging of the gene of PDC and periodontal tissues. However, little is known about the genes expressed in PDC under phototherapy.

Materials and Methods: We employed a new high-capacity system which has been developed to monitor the expression of many genes in parallel. Microarrays prepared by high-speed roboting printing of complementary DNAs on glass were used for quantitative expression measurements of the corresponding genes. Because of the small format and high density of the arrays, hybridization volumes of 2 microliters could be used that enabled detection of rare transcript in probe mixures derived from 2 micrograms of total cellular messenger RNA. Differential expression measurements were made by means of simultaneous two-color fluorescence hybridization. A total of 45 subjects (20-59 years old, mean age 35 ± 14) were investigated. Their gingival biopsies were divided into three groups: group I patients (n = 15) with moderately advanced periodontitis; group II patients (n = 15) which received LLLT prior to study with periodontitis activity almost identical to periodontal disease as group I patients; and group III (n = 15) healthy volunteers (CPITN =0). LLLT in group II was done with simultaneous application of three different wavelengths: 626 nm, 875 nm and 904 nm at 1.45 J/cm^2 based upon an action spectrum and a given fluence (where Bunsen-Rosco Law of Reciprocity applied); the protocol of treatment was developed by the author SK.

Results: The microarray data revealed that 106 genes were differentially expressed by LLLT. Among them, 22 genes were up-regulated by phototherapy, while 84 genes were down-regulated, judging by the threshold of two-fold increase/decrease compared with the controls. The majority of these differentially expressed genes were cytokines that are among the most potent and multifactorial cell activators described in immunology and cell biology. The spectrum of action of these cytokines encompassed cells of hematopoetic origin and cells of mesenhymal and epithelial origin. LLLT were down-regulated interleukin (IL) IL-1, 6-, 8, receptor activator of NF-kappa B ligand (RANKL), tumor necrosis factor. On the other hand, osteoprotegerin (OPG), matrix mettaloproteinase-8, IL-10 were up-regulated. Furthermore,

phototherapy may involved effects of RANKL/OPG and IL-6/IL-8 ratios. However, several genes differentially expressed in our microarray data have not been well defined as LLLT-response molecules.

Conclusion: Our microarray is the first to show the gene profile in PDC caused by LLLT as well as the tight linkage between phototherapy and mediators of cellular immune response. However, further studies to clarify the physiological function of these molecules in PDC are required.

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Changes in the Infrared Absorption Bands(FTIR) due to Tubules Orientation

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The purpose of this study was to evaluate the compositional changes at intracanal dentin after Er,Cr:YSGG laser irradiation, when the irradiation was performed orthogonally or parallel to the tubules. Intracanal dentin was obtained from single root teeth, splitted longitudinally in two samples, in a total of 6 samples. The control and the irradiated samples were obtained from the same root specimen at same region, but opposite sides. The irradiation was performed by an Er,Cr:YSGG (2.78µm, 20Hz, 600ìm diameter). The handpiece was fixed perpendicularly to the sample, with movement controlled by an X-Y motor, avoiding overlapping or unlased regions by irradiating each sample 3 times. Infrared absorption spectra were recorded by using a FTIR spectrometer (ThermoNicolet 6700) accomplished to a micro-Attenuated Total Reflection accessory, to analyze the compositional changes occurred. The phosphate, carbonate, amides, hydroxyl and water bands were monitored between 4000 cm-1 to 400 cm-1. Spectra of irradiated intracanal dentine showed changes regarding the control, as well as there were differences between the spectra of samples irradiated orthogonally or parallel regarding the direction of tubules. These results indicate that there are important differences in the way the laser beam hits the inner canal surface which can direct the choice of the best laser tip to be used.

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Laser-Tissue Interaction in the Root Canal: Getting Rid of the Limitations of the Straight Forwarded Laser Beam

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A clear limitation of the use of a laser beam is its unilateral emission. In root canals there is the need to move the fiber in a spiral motion along the root canal wall and to repeat this procedure to expose the whole root canal wall to the energy of the laser.

A number of modifications for optical fibers have now been reported and introduced in dentistry e.g. hollow wave guide extensions to optical fibers for erbium lasers and hollow metal conical tips with slits for lateral emission. There is also the induction of cavitation in a liquid and hence the cleaning of the root canal wall thanks to acoustic streaming and/or shock induction. The idea of photoactivated disinfection is interesting, though PAD was not always efficient. New possibilities have now been created by the use of other photosensitizers and/or dyes with a better impregnation ability.

Where photodynamic therapy classically refers to activation of particles used to produce high energy oxygen molecules which will chemically react with and destroy most organic molecules that are next to them, newer approaches have been made possible by using nanoparticles in stead of dyes. This type of nanomedicine with nanoparticles being more reactive in this form than the macroparticle is not new and has opened new perspectives for therapy and has potential for a noninvasive procedure for dealing with diseases, growths, and tumors. The introduction of nanoparticles which can be activated, stimulated or energized by means of laser light can also open perspectives for a more efficient application of laser light in dentistry.

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980 nm Diode Laser Adjunctive to Non-Surgical Periodontal Treatment of Chronic Periodontitis: Evaluation of Clinical Parameters

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Aim: The aim of this 12-month, parallel design, randomized controlled clinical trial was to evaluate the clinical effect of the adjunctive use of a 980 nm diode laser on the non-surgical periodontal treatment of generalized chronic periodontitis (ChP).

Materials and Methods: Sixty ChP patients (44.8 ± 2.7 years) were randomly assigned to two experimental groups. All patients received supragingival debridement, tooth polishing and repeated oral hygiene instructions. The control group was treated with scaling/root planing (SRP) performed per quadrant under local anaesthesia in four visits at all sites exhibiting a PD > 4 mm. The test group received scaling/root planing adjunctively with a 980 nm diode laser (SmilePro980TM, Biolitec), (SRP+LAS) at 2W power settings in a chopped focused mode with ton=0.05s, toff=0.10s. The power density was 943.6 W/cm^2 and the pulse energy/area was 127.38 J/cm^2/pulse. Both groups received dental prophylaxis at 3, 6 and 12 months. The following parameters were evaluated at baseline (BL) and at 3, 6 and 12 months post-therapy: full mouth bleeding on probing (BOP) probing pocket depth (PPD), clinical attachment level (CAL) and gingival recession.

Results: For both treatment groups, BOP was significantly reduced and remained below BL levels over the monitoring period ($p<0.001$). Mean PPD decreased significantly following treatment ($p<0.001$): 5.7 0±1.3 at BL to 4.3±1.1 at 3 months, 4.2±1.2 at 6 months and 3.9±0.8 at 12 months following SRP, 5.8±1.2 at BL to 3.4 ±0.9 at 3 months, 3.5±1.0 at 6 months and 3.2± 0.6 at 12 months following SRP+LAS. Statistically significant differences were detected in the mean reduction of PPD, and CAL gain between the treatment groups in favor of SRP+LAS.

Conclusion: Diode laser assisted periodontal treatment showed a better effect than SRP alone on the clinical parameters of ChP over a monitoring period of 12 months.

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Newest 1064 Semiconductor Lasers Effectiveness in Periodontics and Endodontics

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The laser wavelength of 1064 nm has long been associated with the Nd:YAG. All the inherent properties of the Nd:YAG govern the wavelength, pulse duration and pulse peak power. The newest 1064 is a semiconductor InGaAsP with different pulse power and pulse duration characteristics. The purpose of the present study was to examine the effectiveness of this laser to treat periodontal disease, perform laser assisted endodontics and soft tissue surgery. As part of this study the bactericidal capability was tested in deep periodontal pockets at different power settings. Studies were also performed on splitting bacterial endotoxins to inactivate them.

Clinical cases of periodontal disease and endodontic infection were examined radiographically before and after treatment with the 1064 diode laser. Deep pockets were probed before treatment (control), after ultrasonic debridement, and after laser exposure at different pulsed settings (0.5, 1.0, 1.5, 2.0 Watts). These probes were then used for bacteriological study on blood agar plates incubated at 37 degrees Celsius for 48 hours. These same energy parameters were used to expose bacterial endotoxins and analyzed by high performance liquid chromatography (HP 1100 C 18, in a reverse phase column).

The results of our bactericidal tests showed consistently a 96% effectiveness or greater at reducing bacterial growth at all power levels. In comparison, the traditional ultrasonic treatment produced a 0% effect on reducing bacterial growth. The endotoxins were split by this laser at 80% level and were shown to be split in as many as six different locations with a 20 second exposure.

These data indicated that this laser is very useful to reduce bacteria and the endotoxins associated with endodontic and periodontal infections. This 1064 laser was shown to achieve clinical results of healing infections that would have

been difficult or impossible to heal by tradition procedures. Surgical applications of this efficient wavelength are also shown in a wide variety of clinical cases to show the usefulness, value, and efficacy of this new laser.

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Effect of Er:YAG Laser and MTAD on Smear Layer Removal in Root Canals of Extracted Human Teeth: an SEM Evaluation

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Introduction and Aim: The success of endodontic treatment depends on the root canal system being thoroughly cleaned, disinfected and obturated. It has been recognized for many years that root canal instrumentation produces a smear layer that covers the prepared canal walls. Various methods have been used to remove the smear layer. The purpose of this study was to determine the effectiveness of Er:YAG laser and MTAD (a mixture of a tetracycline isomer, an acid, and a detergent) to remove the smear layer, compared with that of 17% EDTA and 5.25% sodium hypochlorite (NaOCl).

Materials and Methods: Twenty-eight extracted maxillary and mandibular single-rooted human teeth were prepared by a crown-down technique using rotary nickel-titanium ProTaper files. 5.25% sodium hypochlorite was used as the intracanal irrigant. The roots were divided randomly into 4 groups of 7 roots each. The canals were then treated with (1) Er:YAG laser, (2) 5 mL MTAD, (3) 5mL 17% EDTA and (4) 5 mL 5.25% sodium hypochlorite (NaOCl). The presence or absence of smear layer in the coronal, middle and apical portion of each canal was examined with a scanning electron microscope.

The data were statistically analyzed.

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Antimicrobial Photodynamic Therapy in Periodontal Treatment

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Removing the plaque biofilm and mineralized deposits from the tooth surface are fundamental aspects of periodontal therapy. However, completeness of periodontal debridement procedures decreases with increasing probing depth and furcation involvement. Thus, bacterial reservoirs can remain on the root surface and affect periodontal healing following treatment. Locally administered adjunctive antimicrobials are difficult to maintain at a therapeutic concentration in the oral cavity and there is an increased concern regarding the development of antibiotic resistance. Especially the use of systemic antibiotics should therefore be restricted to specific groups of periodontal patients, for example those with highly active disease or a specific microbiological profile. As a consequence, there is a need to develop alternative antimicrobial approaches for prophylactic and therapeutic periodontal regimes. Antimicrobial photodynamic therapy (aPDT) is a treatment procedure that uses light energy to activate a photosensitizing agent (photosensitizer) in the presence of oxygen. The working principle of this so called photosensitizing is that the photosensitizer undergoes a transition to a higher energy state, producing a highly reactive state of oxygen. This singlet oxygen might cause a toxic effect in microorganisms and can be used for adjunctive periodontal treatment. It was demonstrated that aPDT can be effective to kill periodontopathogenic bacteria such as Porphyromonas gingivalis or Fusobacterium nucleatum in vitro. Assessing the impact of aPDT on the treatment of aggressive parodontitis, photosensitization and scaling and root planing showed similar clinical results. Studies on the comparison of conventional debridement and the same therapy with adjunctive use of aPDT in chronic periodontitis suggested higher improvements of clinical parameters in the photosensitization group. Thus, the method may be an adjunct to conventional antibacterial measures in periodontology.

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Investigation of the Number and Description of Laser Assisted Treatments and Patient Opinion of This Technique

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Purpose and Objective: Lasers are efficient tools in dentistry allowing a high therapeutic quality, yet lasers are rather expensive. This study investigates the proportion of laser assisted treatments in a general dental practice as well as the patients' opinion about it. Both may indicate the success of an investment in a laser device.

Materials and Methods: The investigation was done in a dental office with two dentists working in conservative dentistry, oral surgery, periodontology, implantology and endodontology. The available lasers were Diode 980nm, Nd:YAG-, 2 Er:YAG- and CO_2. All clinical cases were recorded over a period of two months. In this time, 1144 patients with a total 3089 teeth were treated. The following parameters were registered: indication of laser therapy; if yes, acceptance by the patient, applied laser type, alternative laser types, interview of the patient regarding comparison to conventional treatments, motive of acceptance and preference.

Results: The preliminary outcome shows that over 60% of the cases were indicated for laser therapy. More than 85% of the patients agreed to this technique. The most suitable laser type due to the range of possible indications was the Er:YAG (hard and soft tissue, periodontology, endodontology), followed by Diode and Nd:YAG (soft tissue, periodontology and endodontology), and CO_2 (soft tissue) – depending on the office focus, of course. The interviews revealed that 1. patients felt higher comfort during and after the treatment, 2. pain reduction and decontamination were most important, 3. very high preference of laser treatments up to indispensability.

The final results will be reported at the conference.

Conclusion: The use of dental lasers yields very good clinical results, leading to high patient satisfaction. Furthermore, it is one of the reasons for many patients to choose a dental practice. By this, realization of satisfying economic results is possible also for an average dental office.

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Soft Tissue Grafts with Lasers

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There exists a variety of clinical soft tissue defects, which have been a definite liability to tooth health and longevity. Often, these defects present a particular challenge cosmetically when an esthetic rehabilitation is desirable. Over the years, different soft tissue grafts have been developed in an attempt to eliminate tissue deformities in an efficient and comfortable approach as possible. Using different types of graft materials from the patient (epithelial or connective tissue) or from different sources (cadaver harvested), a variety of graft designs have been developed. Most grafting techniques are performed with a scalpel. Now we have graft techniques which can utilize lasers.

In our new approach to grafting, an Er:YSGG (Waterlase) was used to perform many different grafting techniques. Different laser tips and approaches were devised to take advantage of these new surgical techniques. Debridement procedures were performed as roots to allow reattachment using special stages in the treatment planning. The newest semiconductor laser with 1064nm wavelength (InGaAsP) was also used to show new development of techniques and tissue desensitizing uses.

The results of our study of new surgical techniques have shown a very favorable healing of soft tissue grafts. Healing time was reduced only slightly, but comfort of the procedure was much improved. The techniques presented will be free gingival graft, lateral repositioning graft and sliding curtain diastema graft. Results will be given for the first injectable-anesthetic-free gingival grafts and a variety of patients will be presented that preferred this technique.

With lasers many things are possible. Here is a full collection of soft tissue grafts to help patients with the esthetics, health and longevity of jeopardized teeth. Many other techniques will be possible in the future, and only our imagination is the limiting factor.

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Laser Light Transmission Through Sapphire Crystal Using Dental Wavelengths 532, 810, 980 and 1064 nm and Cutting of Soft Tissue

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Purpose: The combination of the precise cut of a sapphire scalpel combined with the coagulation of diode laser light was developed to provide both advantages for surgical incisions.

Materials and Methods: Sapphire crystals were ground into scalpel forms used in oral surgery and connected to diode lasers of common wavelengths used in dentistry. The angles of the scalpel that are important to get the laser light at the cutting edge were calculated and ground in a special process. Then the pressure needed for cutting was measured and compared to normal scalpels. After this the forms of the knife that were capable of cutting soft tissue were coupled into a fiber transmission of 320 µm diameter and the amount of transmission at the cutting edge was measured. After this, a histological study of the peripheral zone of necrosis was investigated in sections of pork mucosa and liver. First clinical cases and follow ups are presented.

Results: It is possible to grind a sapphire crystal in the form of a dental knife that is able to cut oral soft tissue using force between 10 and 20 N. Diode laser light can be coupled into a fiber system reaching transmission in a range between 88 and 93% at the blade edge. Tissue alteration in the in vitro cuts is only achieved when color is present. In vivo cuts cut be done without bleeding, the healing was not prolonged and patients' pain was comparable to laser procedures.

Conclusion: The effect on tissue of transmitted light after cutting with sapphire scalpel can be controlled by adequate power settings depending on the wavelength and the coloration of the tissue. First clinical follow ups encourage further clinical study.

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CO_2 Laser Surgery for the Excision of Leukoplakia: A Comparison with Traditional Techniques

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Purpose: CO_2 laser biopsy and photothermal ablation has been accepted as a diagnostic/treatment modality for leukoplakia. We hypothesized that CO_2 laser would be an excellent tool for diagnosis/treatment of leukoplakia, facilitating improved outcome and patient satisfaction.

Materials and Methods: A retrospective study was performed comparing CO_2 laser to the standard surgical technique considering the treatment protocol and patient compliance. In toto, 8 patients were diagnosed using the clinical features prominent for leukoplakia. These were further subdivided into two categories. Category A included patients undergoing bilateral treatment with CO_2 laser and a traditional surgical technique. Category B was further divided into two subcategories with patients undergoing CO_2 laser or a traditional technique. Immediately postoperatively. the samples thus obtained were subjected to histopathological study. After treatment, the patients were asked to determine rate the pain on different scales. A follow up of the patients was done after 7, 14 and 21 days.

Results: Operating conditions were better, healing was more rapid than for other thermal instruments, minimal tissue handling was required, and patients' compliance improved.

Conclusion: Because of its comfort level for the operator and patient, the CO_2 laser brings benefits to dental therapy. It is a precise means of removing soft tissue lesions in selected patients. Patient postoperative satisfaction after laser excision was greater when compared with those who had conventional excisions. Postoperative pain was less, as was the pain experienced during the first week of recovery

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The Latest Techniques and Materials for Predictable Minimally Invasive Esthetic Grafts and Cosmetic Surgery using the Er,Cr:YSGG Laser

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In recent times we have developed new techniques for using the Er,Cr:YSGG laser to predictably cover exposed root surfaces and reduce gummy smiles with minimally invasive procedures. In many cases stripped we are able, for example, to gain creeping reattachment back up root surfaces along with increased attached gingiva with an innovative frenectomy technique developed by Dr. Larry Nurin, from the US, often eliminating the need for more invasive free gingival or subepithelial connective tissue grafts. We have also developed less invasive, rapid healing methods of performing coronally repositioned flaps when indicated. When it is necessary to perform a graft procedure the laser is used to minimize loss of palatal tissue and reduce post operative discomfort. There is even now a new technique for esthetic grafting that eliminates the need for patient tissue grafts or even Alloderm (acellular cadaver tissue) that many patients do not want. Using Gem 21S synthetic bone material in conjunction with collagen tape we are now able to not only cover the exposed root surface with gingival tissue with long junctional epithelial attachment, but also to actually grow bone over the exposed surface replacing that which had been lost. Finally Dr. Nurin and I have developed a modified reverse vestibuloplasty procedure to lower the lip line or smile line for patients with extreme gummy smile. Performed with the laser, this procedure is safe, predictable and yields superior results with rapid healing and little post operative pain.

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Use of Diode Laser (810 nm) for Treatment of Gingival Overgrowth Induced by Cyclosporine

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Purpose: Gingival overgrowth is one of the oral side-effects of cyclosporine. It has a prevalence between 8-100%. There are a number of treatment options, including drug withdrawal and replacement by Tacrolimus, the use of antibiotics such as Azithromycin, classical surgical intervention by scalpel and recently laser surgery. The objective was to evaluate the effectiveness of diode laser 810 nm in comparison to classical surgery for treatment of gingival overgrowth.

Subjects and Methods: A comparative study was conducted of 9 kidney transplanted patients (35-60 years old) under cyclosporine therapy with gingival overgrowth. Ethical approval and patient consent to treatment by laser for the maxilla and scalpel surgery for the mandible were obtained. Treatment was performed in a laser institute (Sudan University of Science and Technology). Laser was done followed by scalpel surgery after 3 days. Anesthetic need, bleeding and pain intraoperatively, pain and inflammation postoperatively and recurrence after 6 months were assessed. The laser used was diode 810 nm (Ora-laser jet 20 Orallia Company) with max. power of 20 W, energy 1.8 J/s and frequency10,000 Hz in continuous mode by 400 μm glass fiber.

Results: On the laser site there was no local anesthesia by injection, only 2% Xylocaine spray, no pain, and no bleeding during operation, and also no postoperative pain. Patients required no analgesic, no periodontal pack, and all patients maintained their oral hygiene as usual. One patient complained of dentin hypersensitivty after three days. After six months, only one patient showed recurrence surprisingly more marked in laser site.

Conclusion: The ability to perform the laser treatment without pain or bleeding is an essentially stress free procedure for both the patient and clinician.

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Re-Engineering the Biologic Response in Aesthetic and Implant Dentistry

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Traditional surgical techniques result in a classic inflammatory cascade. This wound response may be adaptive in an evolutionary sense, but may have unintended consequences for clinical outcomes in aesthetic and implant dentistry. Our understanding of cellular pathways, and our ability to control the wound response, expands our capacity to provide enhanced aesthetics and compress healing times in oral implantology. The reduction or elimination of the catabolic phase of tissue regeneration speeds up osseointegration, prevents crestal bone remodeling, maintains papillary form, and increases biotype around dental implants. This enhanced tissue response allows us to predictably treat even the most complex surgical cases and to compress treatment time. This lecture will demonstrate clinical applications of laser therapy in treatment of the complex, infected implant site prior to bone grafting and implant placement. Following laser treatment of the target tissues, the use of dental implants with bioactive surfaces gives us an additional opportunity to completely re-engineer the biological response in aesthetic and implant dentistry.

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Children's Acceptance and Behavior Before and After Pit-and-Fissure Sealant Applications with Er:YAG Laser

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Purpose: Pit-and-fissure sealants are widely used preventive methods in public health and pediatric dentistry and probably one of the first treatment procedures that children encounter at the dentist. This study aimed to evaluate the children's acceptence and behavior during and after the laser asisted and conventional fissure sealent treatment procedures.

Materials and Methods: A group of 126 patients from 5 to 7 years of age with first permanent molars just erupted was selected and a direct comparison was made between 2940 nm Er:YAG laser preparation and conventional preparation of pits and fissures using a split-mouth design. Before and after the treatment the children's experience was tested with modified facial image scale (FIS) and Venham Picture Test (VPT) and also the time required for both methods was recorded.

Results: The analysis of anxiety and comfort of the children indicated that 86% of children felt comfortable and not anxious at all with the laser preparation. Er:YAG laser procedure took about 1.5 times longer to prepare the teeth and 85% of the children said that they would prefer laser preparation for further dental therapies.

Conclusion: Preparation of the first permanent teeth for pit-and-fissure sealants with the Er:YAG laser would seem to be a good treatment option for children that are having one of their first visits to dentist.

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Effect of Laser Pulse Energy, Pulse Duration and Frequency on Pulp – A Histological Study

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Purpose: To histologically evaluate the immediate effect of different pulse energies, pulse durations and frequencies on the pulp.

Material and Methods: Teeth which are indicated for extraction for orthodontic purposes were selected. The procedure was explained to the patient and informed consent was given. Cavities of 3mm diameter and 4mm depth were prepared using Er:YAG laser (2940 nm) on occlusal surfaces. Varnish was coated on the walls of the cavity and Cavit was placed in the cavity. Teeth were extracted immediately and sent for histological examination. The teeth were then examined under a light microscope and a fluorescent microscope. The teeth were then evaluated for remaining dentin and pulp tissue. Slides were interpreted and compared with conventional techniques. The following parameters were selected for different groups: Group 1: Frequency and duration is constant and energy is changed; A. 20Hz, SSP, 250mJ; B. 20Hz, SSP, 300mJ; C. 20Hz, SSP, 400mJ. Group 2: Energy and frequency is constant and pulse duration is changed; A. 20Hz, 250mJ, VSP; B. 20Hz, 250mJ, SSP; C. 20Hz, 250mJ, SP. Group 3: Energy and pulse duration is constant and frequency is changed; A. 250mJ, SSP, 15 Hz; B. 250mJ, SSP, 20 Hz; C. 250mJ, SSP, 30 Hz.

Results and Conclusion: Since the current study is still in progress, the results and conclusion have yet to be finalized.

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Treatment of Peri-Implantitis with Er,Cr:YSGG Laser: A SEM Study

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Introduction: The aim of this study was to observe the effects of usage of Er,Cr:YSGG laser for cleaning of failed implants due to a commonly seen problem – peri-implantitis – with the help of macroscopic, microscopic and SEM analysis.

Materials and Methods: In our study, different laser power settings were applied on several implants which had been explanted due to 4-wall bony defects with preserved bacterial biofilm layer. The effects of the lasing procedure were evaluated with macroscopic pictures, microscopic pictures and SEM analysis.

Results: With suitable settings, no surface alteration or thermal damage on implant surfaces were recorded and the surface morphology was just fine after lasing procedure.

Discussion: By choosing the correct laser, wavelength and power settings, the cleaning of contaminated implants with Er,Cr:YSGG laser was found to be successful. Also, since this laser wavelength is not absorbed by titanium, it is also suitable for the second surgery of the implant treatment.

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Laser Activated Fluor Effect on Human Enamel Microhardness in Erosive Solution

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Aim: The aim of this in vitro study was to detect human enamel microhardness after application of fluor and/or laser, in erosive solution.

Method: In this study, ten sound human third molars were used. They were sectioned into vestibular-palatinal halves and embedded in acrylic resin blocks. Enamel surfaces were flattened and sectioned into 5 slices per tooth. Firstly, the enamel microhardnesses of the 5 sections was measured by the Vickers Hardness Test at the baseline. Sections were kept in distilled water divided into 5 groups. Group 1, negative control group: no treatment. Group 2, positive control group: only 1.23% APF gel application for 1 min. Group 3: irradiated with continuous surface modification mode (150mJ/10Hz energy density) of an Er:YAG laser (Fotona Fidelis III Er:YAG-Nd laser combination). Group 4: Er:YAG laser application following 1.23% APF gel. Group 5: 1.23% APF gel following Er:YAG laser application. The demineralization process was done by immersion of specimens in a Cola-drink for 10 minutes, and then the microhardness values were reevaluated with the Vickers Hardness Test. For statistical analysis, the NCSS 2007&PASS 2008 Statistical Software (Utah, USA) program was used. To analyze the findings within groups, the Kruskal-Wallis test was performed, and for comparing the groups, the paired sample t test was used. Significance was set at $p<0.05$.

Results: We found that LAF therapy is effective on erosive demineralization.

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The Effect of Argon Laser Irradiation on Initial Demineralized Lesions on Enamel Around Orthodontic Brackets

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Purpose: Argon lasers, because of their significant time savings over conventional curing lights, have been investigated for use in bonding orthodontic brackets. They are also being investigated for their ability to confer demineralization resistance on enamel, which is of great interest in orthodontics. The purpose of this study was to investigate the effects of argon laser irradiation on demineralization resistance of enamel at three time points i.e. before, during and after bracket placement. The effects of argon laser irradiation on decalcified enamel also investigated.

Materials and Methods: Fifty human premolars were divided into 5 groups. In groups 1 (control) and 2 the brackets were bonded with conventional light or argon laser (resp.) using low-fluence irradiation at 13.5 joules per square centimeter (0.270 Watts, 5-millimeter beam, 10-milliseconds pulsewidth, 10 seconds). In groups 3 and 4 the enamel

was prelased and then brackets were bonded with conventional light or argon laser, resp. Brackets in group 5 were bonded conventionally, and after 2 days immersing in artificial carious solution, were lased. All of the samples were immersed in Ten Cate solution for 10 days to induce enamel demineralization. Average lesion depths were calculated from three depth measurements.

Results: Laser irradiation before, during or after bracket placement could reduce enamel lesion depth significantly ($P < 0.05$), although the laser irradiation after mild decalcification had the lowest lesion depth.

Conclusion: According to the results of this in vitro study, irradiation of argon laser for 10 seconds before or during bonding brackets can increase caries resistance of enamel. Also, irradiation of argon laser for 10 seconds on enamel with initial demineralized lesions can improve its caries resistance.

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Photochemical Laserbleaching: What next?

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Throughout the centuries people have sought ways to improve their smile. About 40 years ago, hydrogen peroxide became the standard active ingredient in tooth whitening or bleaching. The hydrogen peroxide is decomposed into free radicals. These reactive free radicals are capable of penetrating through the enamel and induce a redox reaction in the staining molecules incorporated in the outer layers of the dentin. This leads to smaller, less light absorbing molecules with a subsequent whitening of the teeth. In order to increase the free radical production heat sources were introduced with the aim of warming up the hydrogen peroxide with an increased free radical release, so-called photothermal bleaching. With the introduction of the KTP laser into dentistry, a new era of tooth whitening arose. At present, the KTP laser (532 nm) is the only commercially available wavelength capable of inducing true photobleaching, i.e., a direct bleaching of the stained dentin with light. In addition, a very limited photothermal process, but especially photocatalytic and photochemical processes have been demonstrated. The combination of these processes leads to an enhanced bleaching effect without thermal injuries to the vital pulp tissues and with improved efficacy. As research continues, new ways are explored in the attempt to further increase the bleaching effect together with a decrease of hydrogen peroxide concentration: thus in an even safer way. New light sources incorporating the beneficial photobleaching capabilities were investigated as an alternative to the expensive KTP laser. It is the intention of this lecture to present the state of the art in the development of this fourth generation bleaching procedure.

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Waveguide Properties of Tooth

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Development of laser dentistry attained substantial results in endodontics. First of all, it touches the methods of the transcanal cleaning and thermal treatment of walls of root canal of tooth. Today doctor has a very wide choice of laser equipment. To his basic descriptions it follows to take the spectral range of radiation, time and power modes.

In endodontics important is a mean of delivery of laser beam in the root canal of the tooth. Use of flexible wavwguide aplicators is possible only in the visible and near infra-red of spectrum.

In this work the spectral range of laser irradiation is examined which is able to penetrate and realize a baktericidle effect even in the peripheral microcanal structures of dentine. The structure of enamel (centred mikroprizms), dentine (mikrocanals), and their orientation is analysed. Comparison of characteristic sizes (transversal size of prism of enamel of 4-6 mkm and diameter of mikrocanals of 0.85-2.5 mkm) with lengths of waves of spectral range of key-in in the area of transparency of tooth (0.4-2 mkm), gives grounds to explanation of conformities to law of the directed distribution of light in hard fabrics of tooth.

In such spectral terms an optical waveguide capture takes place scattered the enamel of light, or its waveguide distribution in the peripheral structures of dentine. Thus, for realization of the bakteriotoksicity operating on a patogenic germ in dental mikrocanals of irradiation it follows to conduct a diode (wave-length 0.65- 1.31 mkm) or Nd:YAG

(1.06.mkm) by a laser. For heat treatment of walls of root canal a determining role is taken power and sentinel system generation of laser options in the pulse-mode.

An idea comes into question that hard dental tissues are a natural optical focon through which transporting of certain light energy of quantum is carried out for providing of congratulatory processes of pulp.

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Early Detection of Dental Wear in Bruxing Patients by En Face Optical Coherence Tomography

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Purpose: Excessive dental wear (pathological attrition and/or abfractions) is a frequent complication in bruxing patients. Although the patients are unaware of their bruxing habit, these unwanted events could be avoided by an early diagnosis of the occlusal overload generated by the parafunction. The aim of this study is the early detection and monitoring of occlusal overload in bruxing patients.

Materials and Methods: En-face optical coherence tomography was used for investigating and imaging several extracted teeth with normal morphology, taken from patients with with occlusal overload induced by active bruxism and from subjects without parafunction. The optical configuration uses two single mode directional couplers with a superluminescent diode as the source. The scanning procedure is similar to that used in any confocal microscope, where the fast scanning is en-face (line rate) and the depth scanning is much slower (at the frame rate). The en-face scans provide an instant comparison to the familiar sight provided by direct view or via a conventional microscope. Features seen with the naked eye could easily be compared with features hidden in depth.

Results: In preliminary OCT investigations we identified a characteristic microstructural pattern for teeth with various degrees of dental wear. Despite the normal morphology of teeth extracted from patients with first degree bruxism, the OCT images showed signs of enamel damage. The occlusal overload produced a characteristic pattern of enamel cracks, which didn't reach the tooth surface.

Conclusion: En-face OCT is a promising noninvasive alternative technique which will enable the practician to identify an occlusal overload simultaneously with the detection of carious lesions. The technology may also allow the evaluation of restoration accuracy. This examination will permit early detection of the microstructural signs of occlusal overload, before extensive tooth wear occurs.

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Lasers in Orthodontics: Soft Tissue Management and Enhancing the Smile Arch

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Cosmetic dentistry defines the desirable characteristics of tooth shape and proportions, gingival aesthetic characteristics, and what constitutes esthetic tooth- and gingival relationships. In the interdisciplinary approach, smile enhancement is a very important topic nowadays in the dental specialties. Through our orthodontic treatment we try to achieve the best vertical placement of the anterior teeth to the upper lip at rest and during smiling with an adequate transverse smile dimension.

Nowadays we have expanded our diagnosis of the smile to further refine the finishing of anterior aesthetics for our patients by reshaping the soft tissues. By using the KTP laser there is a variety of indications for soft tissue treatment in orthodontics. One application for lasers in orthodontics is cosmetic gingival contouring as preparing and finishing anterior esthetic orthodontic outcomes make our final results better than ever. Another issue where the KTP laser will be beneficial is solving tooth eruption and retrieving impacted teeth. Finally the laser will facilitate efficient and optimal orthodontic finishing, thus creating a beautiful smile at the end of treatment.

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Bactericidal Effect of Lasers at Different Distances from the Root Canal Wall of Human Teeth

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Objective: The aim of this in vitro study was to investigate the antibacterial depth effect of laser irradiation with wavelength between 532 and 2796 nm in the root canal wall dentin of human teeth.

Materials and Methods: A total of 300 human teeth were prepared. They were cut evenly on the upper side. One central canal was drilled in the middle to imitate the root canal. Then another 4 canals were drilled at different distances (0.25, 0.5, 0.75, 1.0, 1.25, 1.5mm). Two of the marginal holes were inoculated with 2 µl of an Entercoccus faecalis suspension and the other two holes with 2 µl of an Escherichia coli suspension of defined concentration. 5 samples per defined distance from the central canal served as a control group. The other samples were irradiated either with a KTP, Diode 810 nm, Diode 980 nm, Nd:YAG or Er,Cr:YSGG lasers. They were irradiated twice under constant corono-apical movement for 5 seconds with 6 recurrences and with intermissions of 10 seconds.

Results: Microbiology indicated that all investigated laser systems except for the Er,Cr:YSGG laser are effective to disinfect deep layers of dentin.

Conclusions: Er,Cr:YSGG lasers have only a bactericidal effect in the root canal itself and the directly adjacent dentin with a complete eradication of the the test germs up to 0.5 mm.

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Evaluation of Adhesive Materials Comparing Laser and Conventional Preparation Using CAD/CAM Technology

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Background and Purpose: The designing of Cerec (ceramic reconstruction) inlays, onlays and crowns using CAD/CAM technology (computer aided design, computer aided manufacturing, resp.) is a well established method of both fabricating small fillings and reconstructing heavily damaged teeth. One leading factor in guaranteeing the long-term survival of a technical ceramic reconstruction is the correct way of fixation. Nevertheless, there is less information about which adhesive materials are best to create a tight bond which can also resist pressure. Furthermore it is unknown if there are any positive effects by preparing the teeth with laser. Therefore we examined diverse adhesive materials with regard to their resistance in relation to stress in vitro. Additionally we evaluated the shear bond strength of these adhesive materials on human dentin after laser and conventional preparation.

Materials and Methods: Cerec-manufactured disks were either luted on human dentin using the light curing adhesive cement Variolink® II in combination with Syntac® or Excite®, or they were luted on human dentin using the self-adhesive cement RelyXTM Unicem. The human dentin preparations were processed in two different ways: laser preparation and conventional preparation.

After water storage and addition mechanical and thermal loading to simulate the oral environment, marginal integrity was evaluated using scanning electron microscopy (SEM) and dye penetration tests. Furthermore, shear bond strength was measured using a universal testing machine at a crosshead speed of 1 mm/min.

Results: in progress

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A New Approach in Laser-Assisted Endodontic Treatment

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Introduction: Since the introduction of laser in dentistry, several studies have shown the effect of different laser devices on dentin 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 tp pulp capping, cleaning and disinfecting the root canal system and the stimulation of healing.

Materials and Methods: Four different wavelengths were used for direct and indirect pulp capping (980, 1064, 2940 and 10600 nm). The evaluation method was represented by Laser Doppler Flowmetry (LDF). Three different laser devices (980 nm diode laser, Nd:YAG laser and Er:YAG laser) were used for cleaning and disinfecting the root canal. The method of evaluation was Scanning Electronic Microscopy (SEM) and different microleakage tests (en-face OCT, photoacoustic spectroscopy method, microspectral analysis and optical microscopy).

Results: LDF showed that all four wavelengths can be used for direct and indirect pulp capping. The most efficient was CO_2 laser, but after statistical analysis, non significant differences were noticed between the laser study groups ($p>0.005$). SEM investigation revealed that the use of the newly developed Er:YAG laser fiber tip led to a root canal dentin surface free of smear layer and with opened dentinal tubuli. The investigation methods used demonstrated a reduction of microleakage in apical area after laser assisted preparation of the root canal.

Conclusion: In conclusion, the proper laser parameters used for pulp capping leads to the preservation of the pulp vitality. The newly developed Er:YAG laser fiber tip can be used for removal of smear layer. The three laser devices used for endodontic treatment determine a reduction of the microleakage in the apical area.

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The Use of Er,Cr:YSGG Laser in Subgingival Treatment

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In a controlled, blind, split mouth study, the effectivity of Er,Cr:YSGG laser in the treatment of advanced chronic periodontitis was examined. The efficiency of laser treatment in 30 patients was correlated with subgingival treatment performed by an ultrasonic scaler. Settings of laser treatment were based on previous microbiological and ultrastructural examinations. Laser activity inside the periodontal pocket was divided into two steps. The first one was directed to calculus removal and 1W, 11% water and 15% air were used. The second step - bacterial decontamination - was performed with 2 W, 15% water and 15% air. Clinical parameters such as a bleeding on probing (BOP), pocket depth (PD) and clinical attachment level (CAL) were recorded before treatment and after 2 months. BOP values in the laser group (75%) and ultrasonic group (77%) before treatment were significantly decreased after both types of treatment (28% and 24%, resp.). Improvement of mean PD values in ultrasonic group reached 1.8 mm and 3.5 mm in the laser group. The difference is statistically significant ($p< 0.005$). The gain of CAL was significantly ($p< 0.005$) higher in the laser group (3.2 mm) than in the ultrasonic group (1.6 mm). Within the limits of the present study, it may be concluded that Er,Cr:YSGG laser is more efficient in the subgingival treatment than ultrasonic instrumentation. Superior results are probably due to the better accessibility of bacterial deposits and direct destruction of bacterial cells by laser.

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Antimicrobial Efficacy of Nd:YAG and Er:YAG Irradiation on Enterococcus Faecalis Biofilms on Dentin Disks

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Aim: To assess the antimicrobial efficacy of sodium hypochlorite, Nd:YAG and Er:YAG laser irradiation on Enterococcus faecalis biofilms grown on dentin disks in vitro.

Methodology: 24-hour E. faecalis biofilms were grown on dentin disks in a microtiter plate and subjected to the following treatment or control groups: Nd:YAG laser irradiation (1064 nm, 2W, 15 Hz, 40s, defocus mode), Er:YAG laser irradiation (2940 nm, 50mJ and 100mJ, 15Hz, 40s, defocus mode), and immersion in sodium hypochlorite (NaOCl) 2.5% for 1 and 30 min. The effect of Er:YAG irradiation after a sublethal (0,25%) NaOCl treatment was also investigated. Surviving bacteria were harvested and the number of colony-forming units (CFUs) per disk was determined by plate count.

Results: Significant differences ($P<0.01$) in viable counts compared to untreated controls were observed for: Er:YAG irradiation using 100mJ pulses (5 log10 reduction), all NaOCl treatments (4.7 – 8.3 log10 reduction) and the combination of NaOCl and Er:YAG irradiation using 100mJ pulses (7.9 log10 reduction). NaOCl 2.5% for 30 minutes effec-

tively eliminated all bacteria. Er:YAG irradiation using 50mJ pulses and Nd:YAG treatment caused a reduction in the viable counts of < 1 log10 but these results were not significantly different from the untreated controls (P>0.05).

Conclusions: Er:YAG laser irradiation permits killing biofilm-grown E. faecalis cells from a distance. Sodium hypochlorite is as effective but requires direct contact and sufficiently lengthy contact times.

60

Endodontic Laser Therapy - Managing Fractured Root Canal Instruments

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Fractured root canal instruments can create a difficult situation during root canal preparation. The broken instrument can be a relevant factor for the outcome and the prognosis of the root canal therapy. The main questions are when and where the instrument fractured. It is also of interest when it is necessary to remove it or if it is at all removable. In this case, it is important to remove the instrument without losing a lot of dentin, so the tooth does not becomed weakened. Many techniques and devices have been invented to remove broken instruments. All of these have different indications and more or less try to minimize the substance loss of the tooth concerned.

This lecture will give suggestions when and how to remove fractured instruments from the root canal and will present a new technique using the dental laser to manage a conservative removal which sacrifice less tooth substance.

61

Development of the Photolase® System as a New Approach in Antimicrobial Photodynamic Therapy

J. Arentz
Hamburg, Germany

This lecture addresses a new approach to antimicrobial photodynamic therapy based on phenothiazine derivates combined with an 810-nm coherent light source. It is shown that there is a possibility to obtain a higher output of singlet oxygen and reactive oxygen species in combination with a depot bactericidal effect and a deeper penetration into the tissue to reduce treatment time in comparison to conventional aPDT systems, for example, for full mouth disinfection and to increase wound healing effects. Case reports are shown of periodontitis, periimplantitis, endodontical problems and treatments in veterinary medicine.

Keywords: aPDT, phenothiazine, diode laser 810 nm, reactive oxygen species, periimplantitis

62

The Use of Different Dental Lasers in Reducing Bacterial Load in Periodontal Pockets

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Purpose: Periodontal disease is a chronic inflammatory disorder caused by bacterial infection. Laser treatment demonstrates specific bactericidal and detoxification characteristics that may be valuable in managing periodontal disease The objective of this study was to systematically review the evidence on the effectiveness of laser therapy as an adjunct to non-surgical periodontal treatment in adults with chronic and aggressive periodontitis.

Materials and Methods: A search was conducted for randomized controlled trials comparing the outcome of conventional and laser-assisted therapy in patients suffering from chronic or aggressive periodontal disease. The electronic databases, PubMed and Cochrane Central Register of Controlled Trials, were used as data sources. Screening, data abstraction, and quality assessment were conducted independently by the reviewers (RA and HKh). The primary outcome measures evaluated were changes in clinical attachment level, probing depth, and bleeding on probing.

Results: The laser adjunctive therapy showed statistically significantly lower total bacterial load and bacterial levels of P. gingivalis and T. denticola at 6 months post-treatment compared to scaling alone. Laser assisted treatment showed a superior effect over a conventional approach alone for certain microbial and clinical parameters in patients with aggressive periodontitis. However, the additional treatment with laser may lead to a slight improvement of clinical parameters,

whereas no significant differences were found between test and control group in reduction of periodontopathogens in chronic periodontitis.

Conclusion: No consistent evidence supports the efficacy of laser treatment as an adjunct to non-surgical periodontal treatment in adults with chronic periodontitis. Utilization of laser as an auxiliary in subgingival scaling and root planing did not provide any apparent clinical benefit for teeth with shallow to moderate pockets. The laser itself appears as a valid alternative to conventional therapy, in relation to the young age of the patients and for individuals with coagulation and platelet function disorders.

63

20 Years of Laser-assisted Periodontal Treatments

R. Blum
Echternach, Luxemburg

The 10th anniversary of SOLA International (formerly ESOLA) is an ideal opportunity to draw a broad overview of what the role of lasers in periodontology has been in the last 20 years, where this enthusiasm came from, which wavelengths have been used, are used and what will be the future of laser-assisted periodontal treatments, especially when we focus on the highly acute problem of periimplantitis, which seems to emerge as a major problem for the future.
Furthermore, a résumé of the currently used wavelengths will be presented in order to orientate the practitioner's choice.

This includes critically analyzing scientific articles and publications. The sometimes contradictory results of the past have certainly influenced the opinion of dentists on whether lasers should be used or not. In contrast to the enthusiasm of laser users (and their patients!) who work with lasers daily, stands the skepticism of a large part of the dental community. Especially leading periodontists have ignored the advantages of this fascinating technique, although lasers have been used in many other fields of medicine.

However, when writing this at the end of May 2009, some 5 speakers (among them J. Kamma as Past President of the European Society of Periodontology and member of the scientific board of the SOLA Academy) will present their conclusions during the international congress of Europerio-6 in Stockholm this year, supported by the subjects of the poster session.

Last but not least, I hope that a fruitful and open minded discussion will take place in Vienna.

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Lasers in Daily Practice

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While making the treatment plans of our patients we have to think of the interdisciplinary treatment techniques and the new technologies. This would make us a very successful dentist with the high patient satisfaction.

Especially the possibility of cavity preparations and gingival treatments without anesthesia improves their attitude toward dental treatments. Lasers which are on the market today can ease our job compared to conventional techniques and let our patients to stay calmer on our chair .Besides ; lasers create a chance to treat impossible cases ; as the pregnant ladies in their first 3 months or the people with allergies to local anesthetics or with any other complications.

The first Laser device was invented in 1960 at USA by Theodore Maiman. Some dentists think or talk as the lasers are still in experimental period or they need to be developed, which is not true. For using the lasers in the mouth; FDA gave the first approval to soft tissue lasers in 1980 and then to hard tissue lasers in 1997. The most important thing in laser use is; the doctors need to be trained at least about basic laser physics and gain skill in using the device. Also the doctors should know that there's different interaction in the tissues with different lasers so the laser type should be chosen accordingly.

In this presentation treatment examples of a 30 year of professionalism using 3 different laser types (810 nm. Diyode & 2 different 2780nm Er.Cr.:YSGG Lasers) in oral cavity will be presented.

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New Standards in Laser-Assisted Pediatric Dentistry: The Laserkids® Treatment Concept

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Introduction: Can laser-assisted dentistry be an improvement in pediatric dentistry? The biggest challenge in pediatric dentistry is the children's fear of pain, of dental treatments, of noises and of things they do not know. Compared to treatment in adults, laser supported treatments used in pediatric dentistry have different, specific parameters which have to be considered. Children often are too young to understand the necessity of treatment procedures. Time slots for treatments are very short dependent on age.

Materials and Methods: The Laserkids® concept (Schindler Masterhesis RWTH Aachen 2008) was developed as a guideline for pediatric laser treatments consisting of four main pillars: facility, desensitizing, behavioral management and laser-assisted pediatric dentistry – diagnosis and laser indications, specific laser parameters and treatment procedures for hard and soft tissue procedures in pediatric dentistry. Special laser parameters for pediatric dentistry were determined.

The acceptance of laser therapy by children was evaluated in an investigation carried out on 30 children aged between 3-12 years with Er,Cr:YSGG laser (2780nm) cavity preparation versus high speed cavity preparation in split-mouth design. For 15 children the clinical procedure followed the Laserkids® concept.

Results: Compliance and acceptance rate of the laser treatment was higher than the acceptance rate of the high-speed treatment. The acceptance rate in the Laserkids® concept group was higher compared to the standard clinical procedure group. Over 85% had no pain or only little pain during laser treatment and over 90% would prefer laser preparation for further caries therapy.

Conclusion: Laser-assisted therapy has benefits compared to conventional treatment methods: no anesthesia needed, selective, minimally invasive, less traumatic, less pain. In combination with the right clinical procedure, the compliance and acceptance of the children is high. Laser-assisted therapy in pediatric dentistry is a useful addition and fills a long-standing gap in the treatment options available for young children.

66

Pitfalls in Laser Dentistry

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Background and Purpose: The merits of laser techniques in clinical dentistry have been presented in many publications. However, there is a limited number of papers focused on failures or accidents while using such techniques. Eye damage, skin damage, emphysema, pulp necrosis, sequestrum, paralysis, gingival attachment loss have been caused by misuse of the technique and negligence of necessary safety procedures. Actual accidents in clinical cases are examined, and tips and procedures for avoiding these complications and minimizing adverse effects are presented.

Conclusions: In the enthusiasm to broaden the application of lasers in dentistry, the negative aspects of laser dentistry are often ignored. Much more attention needs to be paid to proper use and safety procedures for laser dentistry. Open and honest discussion of accidents in clinical cases will help minimize unfortunate and avoidable accidents and enable more sophisticated use of lasers in dentistry.

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Multi Wavelength Laser Dentistry - High and Low Intensity

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This is a clinical presentation that utilises both the surgical and therapeutic effects of lasers to deliver a high standard of care in dentistry. Lasers are now being used in dental practices for routine procedures, both hard and soft tissue, as they have proven to offer some advantages over conventional treatment. The purpose of this presentation is to demon-

strate the application of a number of wavelengths that are used in a general dental practice setting. The advantages and optimum application of the various wavelengths as they pertain to some routine procedures will be discussed. Management of the dental patient to enhance the recovery of the patient and of the tissues involved to avoid complications using therapeutic lasers will show that this in time is likely to become the standard of care in dentistry. The mechanisms of pain management and wound healing will be discussed briefly. The response of the patient to these treatments was very favorable compared to their experiences with conventional treatment they had previously.

68

Management of Peri-Implant Disease; a Clinical Protocol

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The introduction and increasing popularity of dental implantology introduced a new problem at the same time: peri-implantitis.

Peri-implantitis is a multifactorial disease resulting in an infection around implants with irreversible bone loss. At this time there is no validated protocol for the treatment of peri-implantitis, so there is a need for developing such a protocol as clinicians now have to rely on their own knowledge and on the existing experience of their colleagues.

A presentation of a clinical protocol to treat or prevent peri-implantitis using the Er:YAG laser, in combination with guided bone regeneration and augmentation with autogenous bone and biooss and the use of the Nd:YAG laser to optimize periodonral health, can provide guidelines for the clinician.

P01

Dental Laser Safety

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Purpose: Safety is an integral part of providing dental treatment with a laser instrument. The subject covers many topics including regulations and hazard recognition that affect the device, environment, surgical team, and target tissue of the patient. There are three facets to laser safety: (1) The manufacturing process of the instrument, (2) proper operation of the device, and (3) the personal protection of the surgical team and the patient.

Materials and Methods: Laser classifications are based chiefly on the potential of the primary laser beam or the reflected beam to cause the different kind of dangers (1). Class I, Class IIa, Class IIb, Class IIIa, Class IIIb, Class IV. Laser hazards can be divided into the following categories to facilitate discussion: mechanical, environmental, macrobiological, microbiological and iatrogenic. Mechanical hazards: Before treating the patient, the laser surgeon should test the selected laser settings on a tongue depressor to confirm spot size, fluency and pattern aimed at the intended location. Environmental hazards: The main environmental hazard is fire. For prevention of this hazard we can: use wet or fire-retardant materials in the operative field. Microbiologic hazards:

*Eyes: The primary human hazard is ocular injury. Eye protection includes two components: patient safety and physician/personal safety so all of them must wear protective eyewear.

*Skin: Thermal injury can result in various degree of erythematic, blistering or ulceration, but skin hazards rarely occur.

*Teeth: Melting and resolidification of enamel, dental charring, cracking and flaking were reported. Microbiological hazards include pulmonary hazard, infections. Iatrogenic hazards: perhaps the most important laser safety feature is the competence of the physician.

Result: In order to provide patients with the benefits of laser treatment, the physician must be well-versed in safety and use safe approaches.

Conclusion: Dentists should pay attention to laser safety because of dangerous hazards which can be caused by less attention to safety rules.

P02

Effect of CO_2 Laser Irradiation on Wound Healing of Exposed Rat Pulp

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Purpose: This study examined the irradiation effects of super-pulsed CO_2 laser on the wound healing process of experimentally exposed rat pulp at 1, 3, 7, 14, and 28 days postoperatively.

Materials and Methods: In experimental group I, the exposed pulp surface was irradiated with a CO_2 laser apparatus (Opelaser®; 03S II SP, Yoshida Dental, Tokyo, Japan) and capped with Clearfil Mega bond®; (MB: Kuraray Medical Inc, Okayama, Japan). The irradiation conditions were as follows: a power output of 0.5W, a super-pulse wave mode 1, a repeat pulse mode (a cycle of 10msec irradiation and 10msec interval), a defocused beam (approximate distance of 20 mm from pulp surface) and an irradiation time of three seconds with air cooling. Experimental group II was capped with MB without laser irradiation. Experimental group III was capped directly with commercial calcium hydroxide, Dycal®; (Dentsply Caulk, Milford, DE, USA) and then MB was applied. The specimens were alternately stained with H&E, reticulin silver impregnation stain, Hucker-Conn bacterial stain and immunohistochemical stain with the SAB method on TGF-beta1, DMP1 and HSP47. Evaluation parameters were as follows: pulp tissue disorganization, inflammatory cell infiltration, reparative dentin formation and bacterial penetration. The results were statistically analyzed using the Kruskal-Wallis test for differences among the groups at each observation period.

Results: There were no significant differences among the experimental groups for all parameters at each postoperative period ($p>0.05$). CO_2 laser irradiated teeth showed newly differentiated odontoblasts-like cells and irregular fibrous dentin matrix in the surrounding heat-denatured and carbonized tissue on day 14. Only one specimen exhibited a complete dentin bridge on day 28. Bleeding from the exposed pulp was completely stemmed by the laser irradiation.

Conclusion: CO_2 laser irradiation was effective in arresting hemorrhage, but showed a tendency toward delayed reparative dentin formation compared to the application of calcium hydroxide.

P03

Comparison of Er,Cr:YSGG Laser and Hand Instrumentation on the Attachment of Periodontal Ligament Fibroblasts to Periodontally Diseased Root Surfaces: an In Vitro Study

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Purpose: The goal of this study was to investigate the effects of erbium, chromium:yttrium-scandium-gallium-garnet (Er,Cr:YSGG) laser irradiation and hand instrumentation on the attachment of periodontal ligament (PDL) fibroblasts to periodontally involved root surfaces.

Materials and Methods: Twenty four single-rooted periodontally involved human teeth for test groups and 6 healthy premolar teeth extracted for orthodontic reasons as a control group were included in this study. A total of 45 root slices were obtained from all selected teeth and were assigned to the following five groups; 1) untreated healthy group (+ control), 2) untreated periodontally diseased group (- control), 3) hand instrumentation group (Gracey curet), 4) Er,Cr:YSGG laser irradiation setting-I (short pulse), 5) Er,Cr:YSGG laser irradiation setting-II (long pulse). All of the root slices were sterilized in PBS and slices were placed on to cell culture inserts. PDL fibroblast were placed at the density of 80,000 cells on the root slice (5x6 mm) and incubated for 48 hrs and transferred to a 24 well-plate. PDL fibroblasts attachment on the root slices were observed using confocal microscopy and scanning electron microscopy at 12 hrs and on days 3 and 7, and an MTT assay was performed on day 5 for PDL fibroblast survival.

Results: The MTT assay showed that while laser-treated specimens showed a significantly higher cell density number, the Gracey-treated group showed a lower cell density number when compared to positive control group ($p<0.05$). Based on confocal microscopy, apparent reduction was observed in the attachment of PDL cells to the periodontally diseased root surfaces. In the laser and Gracey groups, cells look well-oriented to the root surfaces. However a slight increase was observed in the attachment of PDL cells in Laser I groups.

Conclusion: The results of the study indicate that laser-treated specimens showed a significantly higher cell density number. Moreover, the short-pulse Laser setup looks more promising regarding the attachment, spreading and orientation of PDL cells.

P04

Influence of Er:YAG Laser Beam Angle and Focal Distance on Dentin Morphology- An ESEM Investigation

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Cancelled.

P05

Influence of Beam Angle and Focal Distance of Er:YAG Laser on Enamel Morphology – An ESEM Investigation

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Objective: To evaluate the ultrastructural morphology of enamel irradiated with a variable beam angle and focal distance of the Er:YAG laser and its effect on clinical procedures involving enamel.

Materials and Methods: Thirty-five non-carious human premolars that were extracted for orthodontic purposes were selected and randomly divided into 7 groups. The teeth of groups 1-4 were evaluated for different beam angles and the teeth of groups 5-7 were evaluated for variable focal distances. When evaluating different beam angles of 90, 60, 45 and 30 degrees, the focal distance was kept constant at 7mm for groups 1-4. When evaluating variable focal distances of 5mm, 7mm, and 10mm the beam angle was kept constant at 90 degrees for groups 5-7. The laser irradiation was performed in a noncontact mode with Er:YAG laser (2940 nm) in all teeth. The teeth of each group were irradiated for 10 sec. The parameters that were kept constant for all groups were pulse energy of 250mJ with 15Hz frequency at very short pulse (VSP). After irradiation enamel surfaces were analyzed under ESEM.

Results and Conclusion: Regarding beam angle, 60° provides increased microretentive features and surface roughness at 7mm focal distance; hence it is preferred for procedures requiring etched enamel surfaces. The focal distance of 7mm with beam angle of 90° facilitates increased ablation of enamel surfaces with considerable surface roughness as well, thus making it suitable to be used for caries removal.

P06

Quality Assessment of Laser Welding Procedures of Dental Alloys

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Purpose: Laser welding procedures of dental alloys in an inert gas environment have led to substantial improvements in the traditional joining procedures used in dental prosthestic technology. The laser welding technique was chosen for its versatility in the repair of metal framworks of various dental prostheses.The aim of this study was to assess the accuracy, quality and reproducibility of this technique as applied to dental alloys, depending on the structure morphology and joining method.

Materials and Methods: Welding procedures were oriented on those areas that require optimizations in practical use. The alloy's ability to weld was evaluated with a 1064 nm wavelength, pulsed Nd:YAG laser equipment. The optimal parameters were correlated with the type of welded alloy, the framework structure, flaw type and size, working stage, and welding procedure. All the repairs were made manually under an argon shielding atmosphere. In order to evaluate the joining, various cast wires with different diameters were used. Nondestructive and destructive analyses served the purpose of assessing the welding quality. The efficiency of the joining was measured with tensile tests. Microhardness was measured in the base metal (BM), weld metal (WM) and heat affected zone (HAZ) for all samples.

Results: The investigations confirm the quality of laser welding. The welding parameters were determined for each defect type and working step (fixing, joining, filling, surface fining). A very important change in the microstructure due to the effect of the laser was pointed out in the welding zone, increasing its microhardness.

Conclusion: New welding procedures have to be refined and produced for implementation in dental technology. In order to obtain maximum precision and high quality weldings, which would fulfill current requirements, it is important that modern analysis concepts be used for each particular case, based on an interdisciplinary collaboration.

P07

Numerical Simulation and Photoelasticity Approach on Biomechanical Comportment of the Material Defects Inside the Ceramic Prostheses Depicted with En-face Optical Coherence Tomography

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Purpose: The purpose of this study is to analyze the existence of possible defects inside the ceramics, possible fractures caused by such defects and the type of crack propagation in several metal–ceramic and integral ceramic fixed partial dentures using non invasive methods: optical coherence tomography and numerical simulation.

Materials and Methods: Two en-face optical coherence tomography (OCT) systems were used. Both use similar pigtailed super-luminescent diodes (SLD) emitting at 1300 nm and having spectral bandwidths of 65 nm which determine an OCT longitudinal resolution of around 17.3 microns in tissue. The first OCT system is a combined OCT/confocal system, which is equipped in addition with a confocal channel at 970 nm and uses high NA interface optics allowing 1 mm image size. The configuration of the second system uses two single mode directional couplers. The numerical simulation was performed in FEM using COSMOS/M software package. In order to simulate the cracking inside the ceramics a fracture analysis code FRANC2D/L was used. The tensions generated by the defects in the structures and the initiations of the fracture lines were investigated with photo elasticity method considering one, two and than three defects connected inside the ceramic layers.

Results: Using OCT incisal scanning, many pores were found which can cause possible fractures of the investigated dental bridges due to its dimensions and its positions. The simulation of crack propagation shows that the crack could initiate from the upper or lower limits of the defect and propagate through the ceramic material where a tensile stress field is present. This is a major factor in failure of metal-ceramic fixed partial dentures.

Conclusion: Early detection of substance defects within these layers allows for optimal corrections before inserting them and applying masticatory stress together with reduction of fractures.

P08

In Vitro Antimicrobial Activity of Light-Activated Phthalocyanine Derivates

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Phthalocyanine derivates (PCs) represent a potential group of photosensitisers, which have been proven to have a significant antimicrobial effect in photodynamic therapy. The aim of this paper was to evaluate the antibacterial and antifungal effects of phthalocyanine derivatives. Fifteen different PCs of anionic, cationic and amphiphilic structure were investigated. Photokilling ability was tested on Staphylococcus aureus, Escherichia coli, and Candida albicans strains. After treating microbial cells with PC in concentrations 1mg/l, 2 mg/l, 4 mg/l, and 8 mg/l for 30 minutes, the cultures were irradiated by laser-induced low-power monochromatic light (635 nm, 20 J/cm^2, 40 J/cm^2). The efficacy of the photoinactivation was evaluated based on the decrease of a number (log10) of viable microorganisms in tested samples and correlated with control tests without irradiation. A total of eight tested PCs revealed an antimicrobial effect against at least one type of microorganism. The most effective against Staphylococcus aureus was ammonium salt of disulphonated zinc PC (PC1), sulphonated tetramethylammonium hydroxyaluminum PC (PC2) and sulphonated zinc PC (3-diethylammonium)-propylsulphonamide (PC3). All these photosensitisers significantly reduced the number of viable cells by 7 logs. In the case of Escherichia coli it was tetramethylenepyridinium chloride of hydroxyaluminum PC (PC4), tetrakis(N-methylpyridinium-3-oxy)zinc PC tetraiodide (PC5), and PC3 (7, 6, 3 log decrease of viable cells, respectively). Derivates PC3 and PC4 also revealed an antifungal effect on Candida albicans. The most effective phthalocyanines caused a significant decrease of viable counts of S. aureus, E. coli, and C. albicans. This may represent new promising antimicrobial agents for potential use in the photodynamic therapy of various infectious diseases including dental plaque-associated infections. The study was supported by the research project 2B06104 "Photosensitisers in Dentistry" of the National Research Program II, Ministry of Education, Czech Republic.

P09

The Comparison of Photodynamic and Antibiotic Therapy in Patients with Aggressive Periodontitis: Preliminary Results

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Purpose: Many different protocols have been established for the treatment of aggressive periodontitis. One of the most efficient protocols has shown to be an adjunctive course of systemic antibiotics (ATB) to scaling and root planing (SRP). However, there are very limited data on treatment of aggressive periodontitis with photodynamic therapy (PDT). The aim of this study was to compare the effect of SRP + ATB to the effect of SRP + PDT.

Materials and Methods: Ten subjects, with untreated aggressive periodontitis were included in the study. Patients were randomly divided into 2 groups of which one group received ATB for 8 days (amoxicillin and metronidazole) and the other group received PDT (two episodes of photodynamic therapy using a laser source with a wavelength of 660nm and power output of 20 mW associated with a HELBO Blue photosenzitizer; the laser probe tip was placed at the depth of the pocket and moved circumferentially around the tooth for 1 minute). Clinical parameters of probing depth (PD), clinical attachment level (CAL) and bleeding on probing (BOP) were measured at baseline and 3 months after treatment.

Results: In both groups, all clinical parameters improved after 3 months. The mean PD decreased in the ATB group from 3.10 ± 1.66mm at baseline to 2.48 ± 0.86mm after 3 months ($p < 0.005$) and in the PDT group from 3.85 ± 1.88mm at baseline to 2.85 ± 1.08mm after 3 months ($p < 0.005$). The mean CAL decreased in the ATB group from 3.40 ± 1.84mm at baseline to 2.92 ± 1.26mm after 3 months ($p < 0.005$) and in the PDT group from 4.05 ± 2.02mm to 3.20 ± 1.40mm after 3 months ($p < 0.005$). A significant reduction of BOP occurred in both groups after 3 months ($p < 0.005$).

Conclusions: Both therapy modes of aggressive periodontitis showed a significant reduction in all clinical results.

P10

Effect of Nd:YAG Laser Irradiation on Surface Roughness of Three Different Ceramics

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Purpose: The purpose of this study was to evaluate the effect of Nd:YAG laser irradiation on surface roughness of three different ceramics.

Materials and Methods: Ninety square-shaped (5 x 5 x 2 mm) ceramic specimens were fabricated for three different ceramics [(yttrium partially stabilized zirconia (Y-TZP) (ICE Zirkon, ZirkonZahn); leucite-reinforced glass-ceramic (IPS Empress Esthetic, Ivoclar-Vivadent AG); lithium disilicate glass-ceramic (IPS e.max Press, Ivoclar-Vivadent AG)] according to the manufacturers' instructions and their surfaces were polished with 600-, 800- and 1200-grit silicon carbide paper under water coolant and cleaned for 10 minutes in a ultrasonic bath containing distilled water, and were then air dried. The specimens were subdivided into 3 groups according to the following treatment conditions (n=10): Group 1: Sandblasted with 50 μm Al_2O_3 particles; Group 2: Sandblasted with 110 μm Al_2O_3 particles; Group 3: Irradiated with Nd:YAG laser (Fidelis Plus 3, Fotona). The laser optical fiber (300 μm in diameter) was kept 1 mm from the surface and scanned the whole ceramic area. The laser parameters used were 20 Hz (pulse per seconds), 2W, 100mJ. Surface roughness values (Ra) were determined using a profilometer and observed under a scanning electron microscope. Data were analyzed by two-way ANOVA and Tukey HSD tests ($p<0.05$).

Results: No significant differences were observed among groups in terms of surface treatments ($p>0.05$). The ICE Zirkon exhibited significantly the lowest surface roughness values. There were no significant differences between IPS Empress Esthetic and IPS e.max Press groups ($p<0.05$).

Conclusion: Surface treatments were more effective for the IPS Empress Esthetic and IPS e.max Press groups than ICE Zirkon. The Nd:YAG laser irradiation did not significantly effect surface roughness in comparison to sandblasting.

P11

Effect of Er:YAG Laser Irradiation on Surface Roughness of Three Different Ceramics

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Purpose: The aim of this study was to evaluate the effect of Er:YAG laser irradiation on surface roughness of three different ceramics.

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Results: No significant differences were observed among groups in terms of surface treatments ($p>0.05$). The ICE Zirkon exhibited significantly the lowest surface roughness values. There were no significant differences between IPS Empress Esthetic and IPS e.max Press groups ($p<0.05$).

Conclusion: Er:YAG laser irradiation did not significantly effect the surface roughness against sandblasting application. All surface treatments were more effective for the glass-ceramic than Y-TZP.

P12

Lasers in Cosmetic Dentistry: Cases of Frenectomy

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Background and Purpose: The dental laser offers revolutionary advantages over traditional cosmetic dental treatment for our patients. These advantages include precision, hemostasis, sterility, and minimal postoperative pain and swelling. It is used in periodontal plastic surgery, gingivectomy, crown lengthening, gingival retraction, frenectomy and more.
A frenum is a fold of tissue or muscle connecting the lips, cheek or tongue to the jawbone. Sometimes a frenum can be attached too high on the gums. An abnormal upper labial frenum is capable of retracting the gingival margin, creating a diastema, limiting lip movement, and in cases of a high smile line, also affecting esthetics. Surgical removal of the frenum can be required. The procedure to remove this is a called labial frenectomy. Frenectomy can be accomplished conventionally using scalpels and periodontal knives or by using a soft tissue laser.

This case report presents five maxillary labial frenectomies using an AlGaAs Diode Laser.

Methods: Five female patients between 17 and 42 years old having high smile lines are presented in this paper. An AlGaAs Diode Laser (OROTIG DIODE LASER LD-5, Italy) was used. Frenectomy cases were performed with 320 μm fiber tip, CW, 3W, contact mode. Standardized format photographs were taken.

Results: The results indicated that the diode laser had the following advantages. 1. Soft tissue cutting was efficient, with no bleeding, giving a clear operative field during operation. 2. There was no need to use sutures. 3. The surgery itself was simple and less time-consuming. 4. There was no postsurgical infection. As a result, there was no need for analgesics or antibiotics, as post-surgical pain and infection were prevented. 5. Wound contraction and scarring were decreased or eliminated.

Conclusion: Considering the above advantages, it can be concluded that the use of diode laser safe and effective for frenectomy.

Keywords: Lasers, pain, frenectomy postoperative complications.

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Degree of Conversion and DSC of an Adhesive Luting Material

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Cancelled.

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Temperature Increase Caused by Photo-Activation with Argon Laser

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Cancelled.

P15

The Effect of KTP Laser Bleaching as Compared to Four Conventional Bleaching Procedures on Enamel Microhardness

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Purpose: This in vitro study evaluated the effects of KTP laser bleaching versus different conventional vital bleaching techniques on the microhardness of bleached bovine enamel.

Materials and Methods: Sixty bovine enamel samples were distributed among six (A-I), each having 10 samples. Half of each surface remained unbleached; the other halves were bleached with (A) Opalescence 35%, (B) Opalescence 20%, (C) KTP laser / Smartbleach 1W - 30 sec, (D) KTP laser / Smartbleach 3 W – 10 sec, (E) Nite White 22%, (F) Nite White 16% [A-B: Ultradent Products, South Jordan, UT, USA; C-D: KTP laser and Smartbleach, High Tech Laser and SBI, Herzele, Belgium; E-F: Discus Dental, Culver City, CA, USA]. The Knoop microhardness (KHN) of each specimen was determined at baseline (1) after removal from the skull, at baseline after immersion in artificial saline during 14 days or pre-bleaching (2), immediately after bleaching (3) and post-bleaching after 10 days (4) and after 6 weeks (5).

Results: Bleaching led to a statistically significant decrease of KHN in Groups A3-B3-E3-F3 (non-laser bleached), compared to Groups C3-D3, where microhardness values did differ significantly from the baseline values. The post-bleaching values demonstrated an increase in microhardness, demonstrating a recovery of the enamel microhardness.

Conclusions: KTP laser bleaching with the Smartbleach system resulted in an unaltered enamel surface. In the non-laser bleached groups, a statistically significant decrease in enamel microhardness was observed immediately after leaching, followed by a recovery of the enamel microhardness as a function of time.

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In Vitro Microhardness Evaluation of Glass-Ionomer Cement Sealant Application After Different Enamel Treatment Procedures

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Purpose: The aim of this in vitro study was to evaluate the microhardness of enamel sealed with a high fluoride content glass-ionomer cement (GIC) material (GC Fuji VII) after laser, bur or air abrasion treatment procedures using a Vickers apparatus.

Materials and Methods: Two hundred freshly extracted non-carious human molars were divided into ten groups: G1: Air-abrasion was applied (Mach 4.1 Kreativ Inc,, USA); G2: Air-abrasion was applied, then fissures were condi-

tioned with 20% polyacrylic acid (GC cavity conditioner); G3: Er,Cr:YSGG laser was applied (Biolase Tech., San Clemente, CA, USA); G4: Er,Cr:YSGG laser was applied then fissures were conditioned; G5: Ameloplasty with a diamond bur specially designed for preparing fissures (Komet #8833); G6: Ameloplasty, then fissures were conditioned; G7: 20% polyacrylic acid application and all fissures sealed with GC Fuji VII; G8: No fissure treatment was applied but the material was applied directly to the fissures (control); G9: 37% orthophosphoric acid application and fissures sealed with resin based sealant (Fissurit; Voco, Germany) (control). G10: No treatment (control). Half of each group of teeth were left in artificial saliva for one month and the rest for three months. The teeth were then sectioned and microhardness was measured using a Vickers apparatus.

Results: One-month results showed that the hardness of the basal and lateral walls of the fissures were significantly higher in Groups 1, 2, 3, 4, 5, 6, 7 and 8 than in Groups 9 and 10 ($p < 0.01$), but no difference was seen between treatment procedures. Conditioning the enamel with polyacrylic acid also showed significantly increased enamel hardness in all treatment groups ($p<0.05$) except G4 which was not statistically different from G3. G3 and G4 had the hardest values in all groups. Three-month results showed similar findings with even increased values for all groups.

Conclusion: The results of this in vitro study showed that concentration of fluoride in GIC material seemed to be effective in increasing the hardness of the adjacent enamel tissue.

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The Effect of a Bonding Agent on Microleakage of a Fissure Sealant to Enamel after Acid or Er,Cr:YSGG Laser Etching

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Purpose: The aim of this in vitro study was to evaluate the effect of a bonding agent on the microleakage of a fissure sealant to enamel after acid or Er,Cr: YSGG laser etching.

Methods: Forty sound, extracted premolars were divided into four groups: Group I: etched with acid and the fissure sealant (Clinpro TM / 3M ESPE) was placed without bonding, Group II: etched with acid and the sealant was placed with bonding (Single Bond, 3M ESPE), Group III: Er,Cr:YSGG laser etching (Waterlase MD/ Biolase) at 1.25W/ 10 Hz and the sealant was placed without bonding, Group IV: Er,Cr:YSGG laser etching at 1.25 W/ 10 Hz and the sealant was placed with bonding. The sealed teeth were thermocyled (x1000, 5 and 55°C), and then immersed in 0.5% basic fuchsin solution for 24 h, embeded in acrylic resin. Each tooth was sectioned in the bucco-lingual direction and the sections were examined for leakage using a stereomicroscope(40X magnification). A 4-criteria ranked scale was used to score dye penetration. The results were statistically analysed by Kruskal Wallis test.

Results: There were no statistically significant differences in microleakage of fissure sealants etched using acid or Er,Cr:YSGG laser with or without bonding agent ($p>0.05$).

Conclusion: The use of bonding agent did not affect the microleakage of fissure sealents placed either using acid or laser etching.

Keywords: Fissure sealant, Er, Cr:YSGG laser, bonding agent, microleakage

P18

Low Level Laser Therapy for Treatment of Tempromandibular Disorders

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Purpose: Tempromandibular disorder is characterized by symptoms involving muscles of mastication, TMJ and orofacial structures resulting from a dysfunction of the stomatognathic system. There are several treatments for this problem. Low level laser therapy is suggested in management of TMD because of its analgesic, anti-inflammatory and biostimulatory effects.

Materials and Methods: The GaAlAs laser with the wavelength of 830 to 904 nm was used. The laser therapy was used over the painful area in definite sessions. Changes in pain were assessed.

Results: Significant improvements in treatment of pain caused by TMJ disorders were obtained. Also, it was shown

that the low level laser therapy had an effective impact on the objective parameters such as mouth opening and lateral motions.

Conclusion: Low level laser therapy is a useful method in reduction of pain in patients with TMJ disorders.

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The Effect of CO_2 Laser in Treatment of Oral Leukoplakia

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Purpose: Oral leukoplakia is the most common precancerous lesion of the oral mucosa. Definite treatment of oral leukoplakia is very important because of its recurrences and malignant transformation depending on the location, clinical features, degree of dysplasia and etiological factors. There are different kinds of treatment for this lesion, but using high power laser has some advantages like less pain, swelling, prevention of metastasis, edema, less bleeding (dry surgery) and infection.

Materials and Method: A 53-year-old man with a leukoplakia lesion with moderate dysplasia on the left side of the ventral surface of the tongue was selected for treatment with CO_2 laser (DEKA, US20 D). The average power was set on 6.2 (frequency 20 Hz). The radiation mode was non contact and spot size was about 0.7 cm^2. The entire lesion evaporated by the laser (2 mm safety margin was considered).

Results: In this case, 80% of the lesion had disappeared after 5 weeks and the 20% residual was evaporated again with the same parameters as the first time. 4 weeks after the second follow up, the lesion had completely disappeared. Less clinical difference was seen between the normal and laser-treated tissue.

Conclusion: Using laser in the treatment of oral lesions has many advantages like selective removal of the affected tissues and minimal damage to surrounding tissue, which leads to excellent wound healing with no or minimal scar and good functional results.

P20

Evaluation of the Usefulness of Using CO_2 Laser in Treating Oral Premalignant Lesions: Can We Achieve Disease-free Margins?

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Objectives: Oral precancerous lesion (OPLs) are graded according to severity of dysplasia and this is used to identify white patches at greater risk of malignant change. Dysplasia is graded following incisional and subsequently excisional biopsies, but the decision whether or not to remove a white patch is largely based on the initial biopsy. The purpose was to asses the clinical usefulness of interventional CO_2 laser surgery in treating oral precancer lesions with histologically confirmed dysplasia, with two years postoperative follow up. In addition, agreement was assessed between the histopathology of incisional biopsies vs laser excision specimens for OPLs and to examine possible influences on clinical treatment outcomes.

Methods: 78 patients with OPLs underwent incisional biopsy with a scalpel and excisional biopsy with the Ultrapulse CO_2 laser, model 1000, supplied by Coherent (The Medical Group, Cambridge, UK). To rationalise treatment decisions for oral dysplastic lesions, histopathological diagnoses were considered as mild, moderate, or severe dysplasia using WHO criteria (2005). Statistical analyses were carried out using SPSS software.

Results: There was no correlation between treatment outcome and the degree of agreement between the incisional and excisional biopsies (rho=0.04, p=0.74). Resection margins of excisional specimens were clear in 55.1% of cases and, whilst 39.7% displayed mild or moderate dysplasia, only 5.1% showed severe dysplasia. 3 patients with clear margins developed SCC.

Conclusions: In the absence of standardised treatment protocols for OPLs, particularly those manifesting dysplastic features, CO_2 laser remains the most effective tool, offering precise tissue excision with minimal postoperative morbidity.

There is significant disparity in grading of dysplasia between incisional and excisional biopsies which is important for clinical management and confirms that entire lesions should be excised wherever possible.

P21

Low level ultraviolet lasers and their batericidal activities against S. mutans

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Bacterial etiology of frequently occured oral diseases is a very attractive field of interests for oral laser users. Moreover a progress of laser technologies enables application of lasers in limited dimensions of oral cavity. These facts prodded us to the construction ofdiode laser devices for intraoral use with wavelengths 260, 280 and 300 nm. The laser beam is focused to the aplicator- quartz fiber 0,6 mm in diameter. By the operation parameters 12V and 20 mA the power density 180 mW/cm^2 was reached on the top of quartz fiber.

Homogenous culture of S. mutans was inoculated on the surface of solid cultivation medium and subsequently a strongly defined area was irradiated by tested lasers for 20, 30, 60 and 120 sec. After treatment the cultivation was performed under aerobic conditions by 37o C. Results of cultivation were red after 24, 48 and 72 hours.

No bactericidal effect was observed for wavelength 300 nm after all periods of irradiation. Partial reduction of colony forming units of S. mutans was detected at wavelength of 280 nm after 1 minute and more. Complete killing of S. mutans cells was recorded at 260 nm after 20 sec.

Our results suggest that laser irradiation at 260 nm has a very strong bactericidal effect on S. mutans. The depth of laser effect in biofilms formed in vivo is yet to be established. However the bactericidal effect against S. mutans could be clinically relevant in treatment of caries or infected root canals under our experimental conditions.

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Soft Tissue Treatments with Er:YAG Lasers in Children: Case Reports

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Background: Generally, soft tissue surgery on young children was completed in the operating room under a general anesthetic agent or using sedation methods. But laser asisted dentistry is a modern technology that can be used by pediatric dentists to treat these kinds of oral lesions and should be considered as an alternative to conventional surgery. Traditional methods of oral surgery using scalpels or electrosurgery may produce significant postoperative discomfort and require sutures and prolonged healing. Lasers provide a simple and safe in-office alternative for children while at the same time reducing the chances of infection, swelling, discomfort, and scaring. Especially Erbium lasers offers minimally invasive dentistry for hard- and soft-tissue procedures.

Cases: In this poster we'll present some cases with maxillary frenectomy, tongue-tie, eruption cysts and eruption problems and gingivectomy in children almost without anesthesia.

Conclusion: Er-YAG lasers reduces operating time and offers simple operative procedures and acceptable to good cooperation and also no post-surgical infection and scarring for children.

P23

Case Presentation: Laser-assisted Uncovering of an Impacted Tooth – Challenges in Pediatric Dental Surgery

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Purpose: The greatest challenge in pediatric dentistry is the child's fear of pain and dental treatment. Can laser-assisted dental surgery be used to make the patient more cooperative and the treatment more convenient?

Materials and Methods: A healthy nine-year-old boy with a Class I denticulation and crossbite of the right upper and lower primary canine had delayed second dentition – left first incisor missing, strong, dense, compact gingiva in this region. X-ray findings confirm an impacted, retained incisor and show lack of space in the upper front and crowding. The treatment plan was removal of gingiva and bone with laser because of the boy's anxiety, to facilitate and accelerate eruption of the second dentition. The clinical procedure followed the Laserkids® concept (Schindler Masterthesis RWTH Aachen 2008). After topical anesthesia, uncovering was performed with Er,Cr:YSGG laser 2780 nm (C3 tip; pulse duration: 700 µs; 1.5 W, 30 Hz, water: 7%, air: 11%; in contact).

Results: There was almost no bleeding, and a clear view for the surgeon, good cutting efficiency, and no pain during treatment. Good, rapid wound healing was noted, as was fibrine coating after one day and early vascularization. There was no postoperative pain, bleeding, swelling, or scarring. Follow-up over 7 months showed accelerated growth and good alignment of the first left incisor.

Conclusion: Laser-assisted uncovering of an impacted tooth shows advantages compared to regular conventional surgical treatment procedures. It was more comfortable for the patient because no local anesthesia was needed. The wound healing was very good and there was no postoperative pain. The acceptance of laser therapy by the young patient and his compliance during the laser treatment was very high.