The Effect of a Pulsed Nd:YAG Laser on Subgingival Bacterial Flora and on Cementum: An in Vivo Study.


The purpose of this study was to compare the effects of scaling and Nd:YAG laser treatments with that of scaling alone on cementum and levels of *Actinobacillus actinomycetemcomitans*, *Bacteroides forsythus*, *Porphyromonas gingivalis*, and *Treponema denticola*. Study samples consisted of 14 patients, age 30 to 75 years, 8 females and 6 males, with a total of 150 periodontally involved sites with probing depth ≥ 5mm. Group A consisted of 100 pockets that were subdivided into 4 equal groups that were treated with conventional scaling and pulsed Nd:YAG laser using an optic fiber of 300 wm and 4 different power levels as follows: Group 1: P=0.8 W, f= 10 Hz, E=1000mj/pulse; Group 2: P=1.0 W, f=1.0 Hz, E=100 mj/pulse; Group 3: P=1.2 W, f=12 Hz, E=100 ml/purse; and Group 4: P=1.5 W, f=15 Hz, E=1000 ml/pulse. The time of each treatment was 60 sec per pocket in all 4 groups. Group B consisted of 50 pockets that were treated by conventional scaling alone and served as a control group. Microbiological samples from group A were collected before scaling; after scaling=before laser, just after laser, 2 weeks later, and 10 weeks later. Microbiological analysis of all samples was done by the Institute Fur Angewandte Immunologie (IAI) method. The effects of laser on root surfaces were assessed by SEM Examination and the sample consisted of 13 teeth from 5 different patients. Four sets of 3 teeth each were treated with Nd:YAG laser using 0.8, 1.0, 1.2, and 1.5 W respectively. One tooth was just scaled and not treated with laser to serve as a control. Microbiological analysis of Group A samples indicated post-treatment reduction in levels of all 4 bacterial types tested compared to pretreatment levels and Group B controls. SEM examination of the specimens treated with Nd:YAG laser at the different levels exhibited different features of root surface alterations.

* Periodontal Tissue Regeneration in Beagle Dogs After Laser Therapy.


BackGround. Class III periodontal furcations still represent a challenge for the periodontist. Aim of this study was to test the effect of CO₂ laser on the treatment of class III furcation defects.

Materials and Methods: Class III furcation defects 3 mm deep were surgically induced on mandibular premolars on six male Beagle dogs, for a total of 36 defects. After 6-8 weeks of plaque accumulation, the mean depth was 6.8 mm. Quadrants were randomly assigned to a) CO₂ laser therapy, b) Guided Tissue Regeneration (GTR) procedures using Gore-Tex membranes and c) scaling and Root planing (Sc/Rp). CO₂ laser beam (El.En, Florence) was applied to the root surfaces in defocused pulsed mode at 2W, 1 Hz and a duty cycle of 6%, and on periodontal soft tissues at 13W, 40 Hz, and a duty cycle of 40%. Control quadrants received either GTR procedure or Sc/Rp. Mechanical oral hygiene was provided. At 6 months the animals were sacrificed.
Results: The laser group showed new attachment formation averaging 1.9 mm, and 0.2 mm respectively, being the differences statistically significant between the laser group and both GTR and Sc/Rp groups (p<0.005).

Conclusion: CO₂ laser treatment of class III furcation induced formation of new periodontal ligament, cementum and bone.

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An Alternative surgical procedure for the excision of oral fibromata is described for the two most representative clinical cases. A Nd:YAG laser was used in more than 50 patients for the exeresis of fibromata of different sizes and consistencies. This procedure offers several advantages, most importantly minimal bleeding (absence of sutures) and no need for local infiltration anesthesia because there is almost no stimulation of pain. The fast healing process, the absence of postoperative complications, and the reduction of the recurrence rate make the procedure that first-choice solution for the surgical excision of fibromata and other benign tumors of the oral cavity.

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Laser- Assisted bleaching: Smartbleach


Green laser light, wavelength 514.5 nm (argon laser) and 532 nm (KTP laser), has the unique property of optimal absorption by chromophores which cause tooth discoloration. This makes photobleaching possible, that is, bleaching or lightening of teeth solely through laser energy. With Smartbleach, this concept is used in combination with highly concentrated H₂O₂ in an alkaloid solution which, when mixed with a proprietary chemical powder, is applied as a gel to achieve superior results. The laser energy induces a photochemical reaction in the gel applied to the teeth, which minimizes thermal and subsequent effects to the pulp. The bleaching process can usually be performed in a one-hour appointment. Sensitivity is rare. In cases of severe tetracycline staining, this technique also offers a substantial improvement. Through the incorporation of hydroxyl groups on the breaking points of discoloring molecules, a result is achieved that stands the test of time. The use of a maintained or ever further enhanced.

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Nd:YAG Laser in Soft Tissue Surgery: a Two-year Retrospective Study on 130 Patients


Purpose. To evaluate the efficacy of the Nd:YAG laser therapy in the management of oral mucosal lesions. This retrospective study concerns several clinical cases.
Material and Methods: 130 patients with a variety of benign oral soft tissue lesions were treated with laser excision and ablation. Surgery was performed on all patients with a pulsed, fiberoptically delivered Nd:YAG contact laser (Smarty-10). The most frequent lesions excised or vaporized and biopsied were fibroma, epulis, leukoplakia, lichen planus, hemangioma, mucocele, fiber-mucosal hyperplasia, and squamous papilloma. All patients were included in a postoperative follow-up program for up to 24 months (range 6 to 24 months).

Results: In most cases Nd:YAG laser therapy led to complete resolution of the lesion. Non negative effects were reported during or after this type of laser surgery. Especially for oral mucosal white lesions, this treatment obtained resolution or real control regarding their symptoms and growth.

Conclusion: Based on our results and the international literature, Nd:YAG laser therapy can be considered as effective as traditional surgical techniques in the treatment of benign oral mucosal lesions. Moreover, in addition to its therapeutic excellence, this laser method possesses the great advantage of being much more comfortable (no postoperative problems or pain, no need of sutures, often no need for local anesthesia).

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CO₂ Laser in peri-implant therapy


The important role of CO₂ Laser (10.600 nm) in modern oral implantology.

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Er:YAG Laser (2,94 µm): Apicoectomy and cystectomy.


In the present case, apicectomy with simultaneous cystectomy was performed for the first time with exclusive use of an Er:YAG laser. The laser unit employed was a type 2940 of DEKA, with a wavelength of 2,94 µm. The empirical and histological results correspond chronologically and contentually with the information previously published. Both the soft and hard tissue could be treated virtually sufficiently. This was particularly the case in respect of the ablation effectiveness. Pathological anatomical examination of the alveolar process, which was exposed to 10 Hz and 250-300 ml, gave no indication of laser induced thermal damage. In a comparison of laser surgery and conventional surgery, the duration of the procedure, the level of invasiveness and the healing process are comparable. The subtle and precise manipulation, the absence of post-operative complications and the high level of patient acceptance are positive arguments in favour of laser use. These factors and the expectation of further technical innovations predestine the Er:YAG laser as a significative alternative to the use of classical surgical instruments.

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Esthetic Dentistry with a Smartbleach: An Overview of Clinical Cases.


Several cases are presented which show that by the use of a KTP laser, bleaching can be performed more predictably, faster, and more safely, even in severe cases of tetracycline staining.

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Nd:YAG in Periodontics: Full-mouth Treatment


**Purpose.** The goal of treatment was to create a functional, cosmetically acceptable, healthy dentition and to try to prevent tooth loss in a long term periodontic patient.

**Materials and Methods:** A Nd:YAG laser (El.En laser) with 1064 nm wavelength and very short pulses was used. The delivery system was a 300 wm fiber. The laser was set at 1 to 1.5 W and 10 to 15 Hz. The periodontal pathogens and infected epithelium of the pockets were removed, so that re-attachement of the epithelium was possible.

**Results:** After 12 years of regular treatment with Nd:YAG laser for severe chronic periodontitis, this patient shows a reasonable dentition. Hardly any loss of teeth or gingival vertical dimension was observed.

**Conclusion.** Very short pulsed Nd:YAG laser is valuable tool for treating periodontal cases in a patient-friendly way.

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Innovative Wavelengths in Endodontic Treatment


**Background and Objectives:** The sanitation of the root, canal system and the adjacent dentin has always been a key requirement for successful endodontics. In recent years, various laser systems have provided a major contribution to this aim, namely the Nd:YAG-, the 810 nm Diode-, the Er:YAG-, and the Er,Cr:YSGG laser. Numerous studies could prove their efficiency within the endodontic procedure. Recently, two new wavelengths have been introduced to the field of oral laser applications: The KTP laser emitting at 532nm and the 980nm diode laser. The present in vitro investigation was performed to evaluate the effects of these laser systems focusing on their antibacterial effect in deep layers of dentin and their impact on the root canal dentin.

**Study Design/Materials and Methods:** Two-hundred slices of root dentin with a thickness of 1mm were obtained by longitudinal cuts of freshly extracted human premolars. The samples were steam sterilized and subsequently inoculated with a suspension of either Escherichia coli or Enterococcus faecalis. After the incubation, the samples were randomly assigned to the two different laser systems tested. Each laser group consisted of two different operational settings and a control. The dentinal samples underwent “indirect” laser irradiation through the dentin from the bacteria-free side and were then subjected to a classical
quantitative microbiologic evaluation. To assess the temperature increase during the irradiation procedure, additional measurements were carried out using a thermocouple. To assess the impacts on the root canal walls, 20 additional samples underwent laser irradiation at two different settings and were subjected to scanning electron microscopy.

Results: Microbiology indicated that both laser systems were capable of significant reductions in both test strains. At an effective output power of 1W, E. coli was reduced by at least 3 log steps in most of the samples by the tested wavelengths, with the best results for the KTP laser showing complete eradication of E. coli in 75% of the samples. E. faecalis, a stubborn invader of the root canal, showed minor changes in bacterial count at 1W. Using the higher setting of 1.5 W, significant reductions of E. coli were again observed with both laser systems, where the lasers were capable of complete eradication of E. faecalis to a significant extent. There was no significant relation between the temperature increase and the bactericidal effect.

Conclusions: The present study demonstrates that both wavelengths investigated could be suitable for the disinfection of even the deeper layers of dentin and equal the results achieved by established wavelengths in state of the art endodontics.


The treatment of a peri-implant infrabony defect is difficult because of contamination of the implant surface and adjacent tissues. This case series addresses the ability of a carbon dioxide (CO₂) laser to decontaminate failing implants in 15 patients. Clinical and radiologic data are presented with regard to using the laser in combination with bone grafting and a barrier. Augmentation with autogenous bone grafting material (*n* = 10) or a xenogenic bone grafting material (BioOss) was used, and bone grafts were covered with a collagen membrane. Clinical and radiologic parameters were evaluated postoperatively. After an observation period of 27 months (*x* 17.83), almost complete bone fill in the peri-implant defect was accomplished. These preliminary clinical and radiologic findings suggest that decontamination of the implant surfaces with the CO₂ laser in combination with augmentative techniques can be an effective treatment method for periimplantitis.

* Quantitative Analysis of KTP Laser Photodynamic Bleaching of Tetracycline-Discolored Teeth


Objective and Background Data: Photodynamic bleaching is a recently developed method that may be suitable for photo-oxidation of difficult internal stains. This study examined the outcomes of photodynamic bleaching for treatment of confirmed cases of tetracycline discoloration, when used as a single-appointment procedure.
Materials and Methods: Digital analysis of standardized pre- and post-treatment digital photographs of a total of 90 maxillary incisors from 23 adult patients undergoing photodynamic bleaching was undertaken. The patients were treated by a visible green KTP laser (wavelength 532 nm) combined with a rhodamine-B photosensitizer gel (Smartbleach) applied to the teeth and activated for 30 sec. Each tooth underwent four cycles of 30 sec of laser exposure. Digital image analysis was undertaken in a blinded manner, and we examined changes in the four maxillary incisors in terms of blue pixel intensity (yellowness). Results: Least squares linear regression analysis and a one-tailed paired t-test using the matched pairs of pre- and post-treatment data for mean blue pixel intensity showed that a significant lightening effect was achieved by the bleaching treatment. Significant increases in blue pixel intensity (reductions in yellowness) occurred in 78% of the teeth treated. Conclusions: In-office KTP laser photodynamic bleaching provides a clinically useful improvement in tooth shade in teeth with tetracycline discoloration.

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As the American Academy of Periodontology indicates, the treatment of chronic periodontitis should be achieved in the least invasive manner through nonsurgical periodontal therapy. However, complete removal of subgingival plaque and calculus is hindered with increasing probing depth (PD) and furcation involvement using hand, sonic or ultrasonic instruments. Many authors have suggested that the use of laser as an adjunct to scaling and root planing (SRP) might improve the effectiveness of conventional periodontal treatment. The aim of this study was to evaluate potassium–titanyl–phosphate (KTP) laser in non-surgical periodontal therapy. Seven hundred and thirty sites with probing depths of 4–6 mm were involved in the study. The sites were divided into four groups: control (SRP, chlorhexidine gel 0.5%), group A (SRP, chlorhexidine gel 0.5%, three sessions of KTP laser irradiation); group B (SRP, three sessions of KTP laser irradiation) and group C (SRP, irrigation with povidone-iodine 10%, three sessions of KTP laser irradiation). KTP laser was used with the following parameters: output power 0.6 W, time on 10 ms, time off 50 ms, 30 s per irradiation, fluence 19 J/cm2. All the sites showed improvement in all clinical parameters. Clinical attachment loss (CAL), pocket probing depths (PPDs) and bleeding on probing (BOP), especially in the lased groups, showed significant results (P<0.001). Our experience showed KTP laser to be a significant help in SRP; nevertheless, more studies are necessary to confirm our results.

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Effects of KTP laser on oral soft tissues. An in vitro study


A biopsy is a surgical procedure performed to establish a clear diagnosis of a lesion in order to clarify a clinical diagnostic suspicion. During a biopsy procedure it is fundamental to maintain safe and readable cut margins in order to permit histological visualization of possible marginal infiltrations or malignant transformation of a lesion. The aim of this study was to evaluate the histological peripheral damage caused by application of a KTP (potassium titanium phosphate) laser during oral soft tissue biopsy procedures. A
KTP laser (λ 532 nm) at different power settings and fluences was used to obtain 45 samples from pig cadaver tongues. The samples were then subdivided into five groups of nine samples each. A final specimen was taken by scalpel as a control. All samples were put into test tubes containing 10% buffered formalin solution, and were examined separately under an optical microscope by two pathologists to evaluate the peripheral thermal damage induced by the laser. In all specimens the cut edges of the incision were free from histological artefacts, especially when lower settings were applied. Statistical analysis showed no differences among the groups. The KTP laser demonstrated surgical effectiveness and caused little peripheral damage to the cut edges, and therefore would always allow a safe histological diagnosis to be obtained.

*In Vitro Histological Evaluation of “ultra speed” CO₂ laser effects on oral cavity soft tissues’ biopsy. Preliminary results.*


Integrity and marginal legibility are fundamental in biopsy, especially in potentially dysplastic or neoplastic lesions. The purpose of this study is to analyze histologically the extension of a super pulsed CO₂ laser’s thermal effects.

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