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Traditional implant placement involves two surgical stages. Although the second stage is comparatively less aggressive for the patient, postoperative pain and swelling can be further reduced by the use of laser instead of a scalpel. Correct handling of peri-implant soft tissue is of major importance in obtaining adequate gingival tissue attachment around implants. The presence of this keratinized gingiva ensures adequate esthetic results and maintains implant health. We report on three patients with implants in the anterior area who were operated on under the above conditions. Traditionally, the tissue overlying the implants is removed and eliminated. In seeking a way to preserve the attached gingiva, we raised a trapezoidal flap, uncovering each implant and allowing apical repositioning and transpositioning of keratinized gingiva to the buccal side. The results obtained were compared with those from other patients operated on by conventional scalpel. The erbium, chromium:yttrium-scandium-gallium-garnet (Er,Cr:YSGG) laser minimized postoperative pain, and the time to prosthetic rehabilitation was also shortened. The esthetic results were far superior, and no complications were recorded.
Er,Cr:YSGG laser-assisted surgical treatment of peri-implantitis with 1-year reentry and 18-month follow-up.

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BACKGROUND: Peri-implantitis may occur because of biologic or mechanical factors. It can be treated by a variety of methods. In the present case report, treatment was attempted by regenerative osseous surgery associated with an erbium, chromium-doped:yttrium, scandium, gallium, and garnet (Er,Cr:YSGG) laser. METHODS: A 28-year-old, non-smoking male complained of gum recession around an implant in the area of upper left central incisor. After clinical examination and radiographs, it was found that there was 2 mm recession, a probing depth of 7 mm, mobility grade one, and bone mesially and distally. Regenerative osseous surgery was performed using an Er,Cr:YSGG laser (2,780 nm) at different settings to open the flap, remove the granulation tissues, perforate the bone, and clean the implant surface. A bone graft and a biodegradable membrane were used for bone regeneration. The patient was reevaluated at 3, 6, 12 (with reentry), and 18 months postoperatively. RESULTS: At 3, 6, and 12 months postoperatively, there were no reported complications, with probing depths of 3 to 5 mm, <1 mm recession, no bleeding or implant mobility, and good bone formation. Slight pus discharge was present at 12 months. At 18 months postoperatively, probing depth was 2 mm, recession was <1 mm, there was no bleeding, implant mobility, or discharge, and there was better bone formation. The results were satisfactory to the patient and the clinician. CONCLUSION: The Er,Cr:YSGG laser enabled regenerative osseous surgery around an implant with no complications and with high patient and clinician satisfaction and confidence.
ABSTRACT

This article reviews the technique for osseous crown lengthening with minimal flap reflection using an erbium laser. The following steps of the procedure are described in detail: Creating bleeding points, performing an externally beveled gingivectomy, shaping the free gingival margin, laser troughing, and recontouring and smoothing the bone. A case report, which considers osseous crown lengthening to correct a "gummy smile," is also presented.

Erbium laser treatment of this type requires minimal tissue displacement, and flap preparation is limited to isolated papillae as necessary.

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The purpose of this study was to investigate the efficiency of hand instrumentation and laser irradiation on calculus removal from the root surfaces, in vitro. Thirty-two human teeth, extracted for periodontal reasons, were used in this study. Root surfaces of single-rooted teeth were treated by different methods including (1) conventional hand instruments; (2) hand instruments and tetracycline-hydrochloride (Tet-HCl); (3) erbium, chromium:yttrium-scandium-gallium-garnet (Er,Cr:YSGG) laser irradiation, setting I (short pulse); (4) Er,Cr:YSGG laser irradiation, setting II (long pulse). Three premolar teeth, extracted for orthodontic reasons, served as control. The morphology of the root surfaces was evaluated by light and scanning electron microscopy. Energy dispersive X-ray (EDX) analysis was performed to compare the mineral content of root surfaces treated with hand instrumentation and lasing procedures. The results of this study demonstrated that all treatments were efficient in calculus removal from the root surfaces. Thermal changes, including melting and carbonization, were not observed in either lasing procedure. The surface was rougher in the laser groups than in the groups treated with hand instruments. Moreover, roughness was greater in the long-pulse laser setting than in the short-pulse setting. While increased calcium (Ca) and decreased phosphate (P) (weight concentration percent) were observed in all treatments when compared with the control, laser procedures resulted in a more similar mineral content than in the groups treated with hand instruments. Based on these findings, laser procedures, when used in appropriate settings, are capable of performing scaling and root planing in the treatment of periodontitis. It may be concluded that short pulse laser may be more suitable for the micro-morphology of the root surface. However, additional in vitro and clinical studies are necessary to clarify the success of laser in periodontal therapy.
A pilot study of Er,Cr:YSGG laser therapy used as an adjunct to scaling and root planing in patients with early and moderate periodontitis

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SUMMARY

Objectives: The study aim was to compare the results of an Er,Cr:YSGG laser therapy used in adjunct to scaling and root planing (SRP), and of SRP alone, in a small group of patients with early to moderate periodontitis. Materials and methods: ten adult patients with periodontitis were treated according to split-mouth design, using Protocol A (SRP alone) or, Protocol B (Er,Cr:YSGG laser therapy combined with SRP). At baseline, and 3 months after the treatment the following periodontal parameters were evaluated: bleeding on probing (BOP), probing depth (PD), plaque index (PI). Results: no statistically significant difference in plaque levels was noted before and after the treatment between the treated quadrants, however a tendency of a more pronounced decrease in plaque levels was noted in the group of laser-SRP treated teeth. After three months, 60-68% decrease of BOP-positive teeth compared to baseline status was noted in all treated quadrants, without significant difference between the treatment modes. The decrease of mean PD values was measured after three months compared to baseline: on the lingual surfaces in SRP group the mean PD improvement value was 0.94±1.2, and in the laser-SRP group it was 1.96±1.1, (p<0.001); on the vestibular surfaces the mean improvement values were 0.99±0.14 and 2.03±0.11, respectively (p<0.001). Conclusions: Non-surgical periodontal therapy using both an Er,Cr:YSGG laser + SRP and SRP alone, lead to significant improvements in all the investigated clinical parameters. The combined treatment using laser as an adjunct to root scaling and planing seemed to be advantageous when compared to SRP alone, due to more efficient attachment level restoration.
Effects of erbium, chromium: YSGG laser irradiation on canine mandibular bone.


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BACKGROUND: Only relatively few reports have described the morphological effects on bone produced by erbium, chromium: yttrium, scandium, gallium, garnet (Er, Cr: YSGG) laser irradiation, and none has investigated the atomic changes or estimated the temperature increases involved. The objectives of this study were to investigate the morphological, atomic, and temperature changes in irradiated areas during and after laser irradiation, and to evaluate the cutting effect on canine mandibular bone in vitro. METHODS: Two canine mandibular bones were cut into 3 to 5 cm pieces and irradiated by an Er, Cr: YSGG laser utilizing a water-air spray at 5 W and 6 Hz for 10 or 30 seconds. During and after laser irradiation, temperature increases in the irradiated areas were measured by thermography. The samples were then observed by stereoscopy and scanning electron microscopy to determine morphological changes and by energy dispersive x-ray spectroscopy to evaluate atomic alterations. RESULTS: Regular holes or grooves having sharp edges and smooth walls were produced, but no melting or carbonization was observed. The maximum temperature increase was an average 12.5 degrees C for 30-second irradiation. The continuous time of a temperature increase of more than 10 degrees C was consistently less than 10 seconds. An atomic analytical examination revealed that the calcium:phosphorus ratio was not significantly changed between the lased and unlased areas (P>0.01). CONCLUSION: These results showed that the Er, Cr: YSGG laser cuts canine mandibular bone effectively without burning, melting, or altering the calcium:phosphorus ratio of the irradiated bone.
Procurement of Autogenous Bone from the Mandibular Ramus with Simultaneous Third-Molar Removal for Bone Grafting Using the Er, Cr:YSGG Laser: A Preliminary Report

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Autogenous bone grafting and third-molar removal are surgical procedures routinely performed in dentistry on a daily basis. The purpose of this preliminary report is to describe our clinical experience with the Er, Cr:YSGG laser in the procurement of bone harvested from the ramus and removal of third molars simultaneously from the mandible.
Treatment of the contaminated implant surface using the Er,Cr:YSGG laser.

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Treatment of the contaminated implant surface by mechanical and chemotherapeutic means has met with mixed success. Incomplete surface debridement or alteration of the implant surface could compromise attempts at grafting and reintegration of the implant body. Development of a laser system operating at 2780 nm and using an ablative hydrokinetic process offers the possibility for more efficient decontamination and debridement. The Er,Cr:YSGG laser is evaluated and compared with the most commonly used chemotherapeutic modality for treatment of the implant surface. A scanning electron microscope study is presented comparing YSGG ablation to citric acid treatment of the titanium plasma sprayed and HA-coated implant surface. We can conclude that laser ablation using the YSGG laser is highly efficient at removing potential contaminants on the roughened implant surface while demonstrating no effects on the titanium substrate.
Effects of an erbium, chromium: yttrium, scandium, gallium, garnet laser on mucocutaneous soft tissues.

Oral and Maxillofacial Surgery

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Abstract:
Objectives. Lasers are effective tools for soft tissue surgery. The erbium, chromium: yttrium, scandium, gallium, garnet laser is a new system that incorporates an air-water spray. This study evaluates the cutting margins of this laser and compares healing with laser and conventional scalpel and punch biopsy-induced wounds.

Study design. New Zealand white rabbits were divided into serial sacrifice groups; the tissues were grossly and microscopically analyzed after laser and conventional steel surgical wounding.

Results. Wound margins were found to show minimal edge coagulation artifact and were 20 to 40 mm in width. Laser wounds showed minimal to no hemorrhage and re-epithelialization and collagenization were found to occur by day 7 in both laser and conventional groups.

Conclusions. The new laser system is an effective soft tissue surgical device; wound healing is comparable to that associated with surgical steel wounds. The minimal edge artifact observed with this laser system should allow for the procurement of diagnostic biopsy specimens.
Bactericidal effect of different laser systems in the deep layers of dentin.


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BACKGROUND AND OBJECTIVES: In recent years, various laser systems have gained importance in the field of laser-assisted endodontics, namely the Nd:YAG, the diode, the Er:YAG, and the Er,Cr:YSGG laser. Individual studies have been carried out so far, focusing on the respective wavelength, its specific bactericidal capabilities, and potential usefulness is root-canal disinfection. The present in vitro investigation however, was performed to compare the microbiocidal effect of these laser systems under standardized conditions and to draw a conclusion upon their relative effectiveness in the deep layers of dentin.

STUDY DESIGN/MATERIALS AND METHODS: In total, 360 slices of root dentin with a thickness of 1 mm 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 four 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.

RESULTS: Microbiology indicated that all laser systems were capable of significant reductions in both test strains. At an effective output power of 1 W, E. coli was reduced by at least three log steps in most of the samples by the tested wavelengths, with the best results for the Er:YAG 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 1 W. Using the higher setting of 1.5 W, significant reductions of E. coli were observed with all laser systems, where only the diode and the Er:YAG laser 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 all the wavelengths investigated are suitable for the disinfection of even the deeper layers of dentin and may prove to constitute valuable tools in state-of-the-art endodontics.
Gingival overgrowth in a child with arthrogryposis treated with a Er, Cr:YSGG laser: a case report.

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The present manuscript reports a case of a 21/2 year old girl, diagnosed with arthrogryposis, presenting increasing gingival hyperplasia which was treated with Er, Cr:YSGG Laser. The patient was treated under general anesthesia by the Pediatric Dentistry and Periodontics departments. Er, Cr:YSGG laser G6 tip was used at 1.50 watts, 20 pps, 8% water and 11% air, which is recommended by the manufacturer. Scalpel and periodontal curettes were used to complement the laser. Tissue samples from the anterior maxilla, anterior mandible and palatal sites were formalin-fixed and submitted for evaluation. The samples biopsied revealed prominent hyperplasia of the fibrous connective tissue with areas of the epithelium exhibiting pseudoepitheliomatous hyperplasia. At 1 week and 3 months follow up, oral examination showed appropriate healing of gingival tissue. The use of Er, Cr:YSGG laser in the present case proved to be effective in the removal of large amounts of hyperplastic gingival tissue and resulted in fast healing and mild discomfort.
[Morphological study and Ca/P ratio analysis of Er, Cr:YSGG laser irradiation on periodontal diseased root surfaces]

[Article in Chinese]

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OBJECTIVE: To observe the morphological transformation and Ca/P changes of the periodontally disease root surfaces irradiated by Er, Cr:YSGG Laser. METHODS: 18 periodontally diseased teeth and 6 wisdom teeth were collected in vitro. After 18 periodontally diseased teeth were planed, 12 teeth were randomly selected as the laser treatment group, the others as the acid treatment group. The 6 wisdom teeth were selected as the healthy control. Then the evaluation for root surfaces morphological transformation was conducted by SEM. An energy spectrum analyzer was used to analyze the Ca/P ratio of root surfaces. RESULTS: The root surfaces were clean and even in the laser treatment group. Smear layer could also be effectively eliminated in the laser treatment group and the acid treatment group, but the SEM results were different. Atom content analysis showed that the Ca/P ratio of the laser treatment group and the acid treatment group had no distinct difference. CONCLUSION: It is effective to remove smear layers and infected cementum of surface layers with Er, Cr:YSGG irradiating on the planed periodontal root surfaces.

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BACKGROUND: This in vitro study was performed to determine the appropriate power output setting for an erbium, chromium-doped:yttrium, scandium, gallium, and garnet (Er,Cr:YSGG) laser used in periodontal pocket irradiation by examining the morphologic alterations of the root surfaces and the efficiency of calculus removal. METHODS: Sixty-five non-carious extracted human teeth were used in this study. For morphologic analysis of the root surface, the clean, single roots of 22 teeth were separated into 91 pieces, and these pieces were immersed in acrylic resin. The specimens with root-surface exposure were prepared and divided randomly into three groups: a control group (N=8), an irradiation without water-group (no water [NW] group; N=39), and an irradiation in water to simulate the conditions in a periodontal pocket group (in water [IW] group; N=44). The power output settings for laser irradiation were 0.5, 1.0, 1.5, and 2.0 W for each group. The roughness (R_a), depth (Z), and width (X) of the disk specimens were determined after laser irradiation. Eight other single-rooted teeth were examined by scanning electron microscopy (SEM) after laser irradiation under the same conditions. Thirty-five single- or multirouted teeth with heavy subgingival calculus were used to test the efficiency of laser scaling. The efficiency of calculus removal was quantified by measuring the time needed to remove the calculus completely using the laser. RESULTS: The mean R_a and Z values in the IW group were significantly higher than in the NW group with the same power output. In addition, these values with 0.5- and 1.0-W power output settings were significantly lower than with 1.5- and 2.0-W settings in the NW and IW groups. No obvious morphologic differences could be found between the 0.5- and 1.0-W power output specimens under SEM. Additionally, thermal alterations, i.e., carbonization or melting, were completely absent in the IW group. Regarding the efficiency of calculus removal, the 0.5-W setting (0.11+/−0.035 mm2/second) was significantly inferior to the 1.0-W setting (0.27+/−0.043 mm2/second). However, there was no significant difference between 1.0- and 1.5-W (0.36+/−0.11 mm2/second). The 2.0-W setting (0.63+/−0.272 mm2/second) was much more efficient but resulted in significant morphologic alterations. CONCLUSIONS: Based on these findings, it is appropriate to use a 1.0-W power output setting with an Er,Cr:YSGG laser for root scaling. This may be done without any conspicuous morphologic alterations to the root surface and with acceptably efficient removal of calculus.

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OBJECTIVE: The purpose of this study was to investigate the morphological changes of bovine mandibular bone following Er, Cr: YSGG laser irradiation in different methods in vitro.

BACKGROUND DATA: Recently, an erbium, chromium/yttrium, scandium, garnet (Er, Cr: YSGG) laser device that emits a laser beam at the wavelength of 2.78 microm was introduced. This type of infrared laser proved to ablate dental hard tissues effectively. However, the different effects of bone ablation by this laser in different irradiation methods were still unknown.

MATERIALS AND METHODS: Adult bovine mandibular bones were cut into 24 small pieces, 3-4 cm in length. The parameters of Er, Cr: YSGG laser irradiation were as follows: wavelength was 2.78 microm, pulse duration was 140-200 microsec, repetition rate was 20 pulse/sec, power was 4 W, spot size was 1.26 x 10(-3) mm (2), and energy density was 160 J/cm(2). Irradiation methods were different in four groups (six specimens in each group): group A, fixed position and contact mode; group B, fixed position and noncontact mode; group C, nonfixed position and contact mode; and group D, nonfixed position and noncontact mode.

RESULTS: Ablation depth in group A was significantly greater than in group B (p < 0.01). In group A, thermal damage was apparent. In group B, C, and D, thermal damage was minimal.

CONCLUSION: Er, Cr: YSGG laser allows for precise surgical bone cutting and ablation with minimal thermal damage to adjacent tissue. Irradiation in different methods may achieve different ablation rates and thermal damage.