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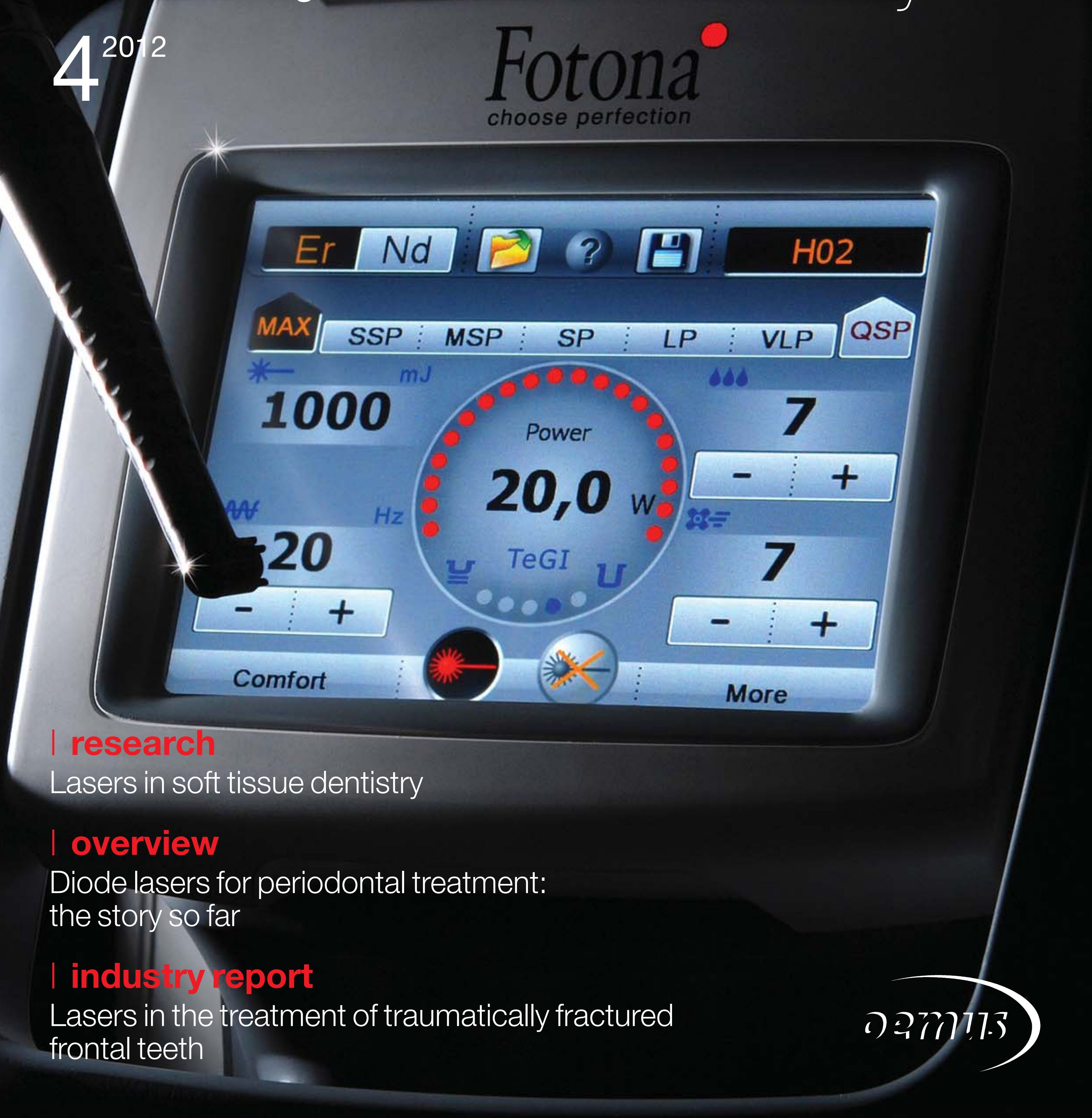

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Laser dentistry—deeply rooted in science

Dr Georg Bach

Dear colleagues,

This year's annual DGL Congress in Leipzig, Germany, has born eloquent witness to how much laser-supported therapies have become rooted in evidence-based dentistry and the dental world of science. However, the congress is only one among many factors which have contributed to this appreciation of laser dentistry.

Not only is laser dentistry's becoming rooted deeply in the scientific field the outcome of this development, but it has also become both the task and the aim not to linger on this sometimes delightful and sometimes stony path, but to keep moving on.

This task also includes fields of laser dentistry which would not be in the focus of our interest in the first place, but which are of great importance nonetheless. In this regard, I would like to recommend to you the baseline report on the preparation of medical products by our colleagues from Bonn, Germany, which you can find on page twelve of this issue.

An exciting and fulfilling year of both applied laser dentistry and studies in laser dentistry is coming to its end. I would like to use this opportunity to thank all authors who have contributed their articles to laser international magazine of laser dentistry over the past year. I furthermore want to thank DGL (Germany Society for Laser Dentistry) for supporting this publication as well as the editors of OEMUS MEDIA AG. I sincerely hope that we will continue our harmonious and constructive collaboration next year!

Dear colleagues and readers of laser international magazine of laser dentistry, I wish you all a happy, healthy and successful new year!

Warm regards,

Georg Bach

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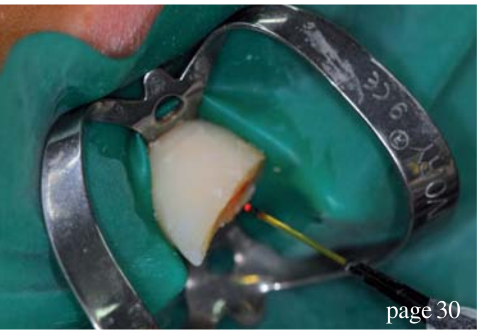

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Lasers in soft tissue dentistry

Author_Dr Vrinda Rattan, India

_Introduction

Lasers have revolutionised the medical management since the 1960s. Unlike many fields of medicine and surgery, where laser treatment represents a sole source of remedy, in dentistry the use of a laser is considered an adjunctive in delivering a stage of tissue management conducive to achieving a completed hard or soft tissue procedure. The adjunctive use of lasers in the field of periodontics has helped to achieve efficient cutting of dental hard tissue, haemostatic ablation of soft tissue, the disinfecting effect through bacterial elimination and an enhanced biochemical pathway associated with tissue healing.

Wonders of "Light Amplification by Stimulated Emission of Radiation"

LASERS are named according to the active elements that are involved in the creation of the energy beam. Thus, lasers commonly used in dentistry consist of a variety of wavelengths delivered as either a continuous, pulsed, or running pulse waveform, e.g., CO_2, Nd:YAG, Ho:YAG, Er:YAG, Er, Cr:YSGG, Nd:YAP, GaAs (diode), and argon.

Lasers emit energy which is essentially a light of one colour (i.e., monochromatic) and, therefore, of one wavelength. This wavelength defines its properties and its usage in various fields. The photons in its energy beam are emitted as a coherent (in phase), unidirectional, monochromatic light that can be collimated into an intensely focused beam that exhibits little divergence. On focusing the energy beam on the target site, the energy can become absorbed, reflected, or scattered. A photothermal phenomenon occurs when this light is further converted into heat energy. This energy can cause coagulation, incision, or tissue vaporization in a biological tissue, depending upon the wavelength of laser used, power, waveform, pulse duration, energy density, duration of exposure, angulation to the target surface, and optical properties of the tissue.

_History of lasers in dentistry

Maiman in 1960 used a crystal medium of ruby that emitted a coherent radiant light from the crystal when stimulated by energy for the extraction of teeth, based on Albert Einstein's theory of spontaneous and stimulated emission of radiation.[1,2] In 1961, Snitzer put forth his publication on the prototype for the Nd:YAG laser.[3] Goldman et al.[4] and Stern and Sognnaes[5] described the effects of the ruby laser on enamel and dentin.

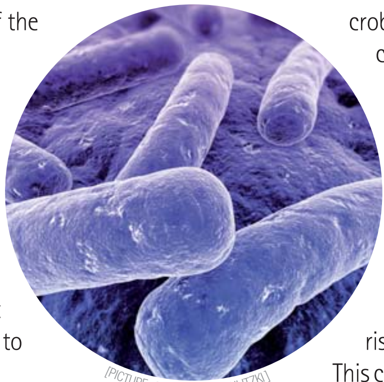
Commercial use of lasers and its marketing was pioneered by Dr Terry Myers.[6] This laser used an active medium of Nd:YAG, emitted pulsed light. In the early 1990s, laser machines which were used in the field of medicine were modified to be made available for dental use.

Different laser systems have gained more significance in the treatment of periodontal diseases. At the same time, it has become important for the surgeon to always be aware of the possibilities and limitations of lasers. The application of lasers is to be regarded as an adjunct to the conventional treatment methods for periodontal diseases.

The use of surgical lasers in periodontology is explored in three areas of treatment:

– Removal of the lining epithelium of the diseased pocket wall.
– Antimicrobial effect of lasers on pocket microbiota.
– Removal of calculus and root surface detoxification.

Benefits of laser use can be employed as an adjunctive, to maximise the outcome of the treatment, but lasers cannot be used as an alternative to conventional periodontal therapy.


[PICTURE: ©SEBASTIAN KAULITZKI]

_Laser and Pocket Debridement

Access into the periodontal pocket was made simple by the advent of the quartz optic fibre delivery system associated with the diode and Nd:YAG groups of lasers. The wavelength of these lasers ranged from 200 to 320 µm. Following the removal of calculus and plaque through scaling and/or root planing, the pocket depth is assessed. The laser fibre is adjusted to a length of one to two millimetres short of the pocket depth. It is made sure that the angle of insertion makes contact with the soft tissue wall at any time. In a light contact mode with sweeping stroke, the soft tissue lining of the pocket wall is ablated, beginning from the base of the pocket and proceeding upwards. Each pocket site should be ablated for a period of about 20–30 seconds, which would mean two minutes per tooth site, with re-treatment nearly at weekly intervals during a maximum period of four weeks. Multiple laser-based studies have been carried out. Case reports[7–10] have suggested that the diode laser (810 nm), along with the Nd:YAG laser (1,064 nm), has shown appreciable improvement in the periodontal status for the treatment of periodontal pockets by laser sub-gingival curettage. A study by Evans[11] reviewed the new attachment procedure on a sample of six cases which showed new cementum and bone growth, including periodontal ligament regeneration. Various controlled studies have assessed the use of laser therapy along with conventional scaling and root planing, although these investigations demonstrated no significant benefit in the treatment outcomes.[12,13]

_Antimicrobial effect of lasers on pocket microbiota

The complexity of the subgingival microbiota has been recognised by various microbiological techniques. The bacteria most commonly implicated in periodontal disease are *Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, Bacteroides forsythus, Treponema denticola* and *Prevotella intermedia*. Many studies have been carried out to demonstrate the antibacterial potential of laser energy on bacterial strains found in the diseased periodontal sites.[14,15] The theoretical basis of the use of laser as an antimicrobial is based on the absorption characteristics of the target bacterial structures like water content and pigments.

The build-up of the denatured protein material on the delivery fibre of the diode laser results in the development of a carbonised tip, which causes a rise in temperature beyond 700 °C. This char, if not removed, leads to a hot tip effect. The carbonised deposits cause secondary emission of radiant energy which leads to an unwanted damage. The bactericidal action can be enhanced by the use of a chemical mediator, such as methylene blue, which acts as a heat sink for the thermal energy. Antimicrobial photodynamic therapy can be readily applied, even in sites where there is limited access for mechanical instrumentation due to the anatomical complexity of the root. The antimicrobial effect of photodynamic therapy can be easily regulated by controlling the amount of light applied to activate the reaction.

_Removal of calculus and root surface detoxification

Laser-induced root surface modification is based on the selection of a wavelength that will effectively remove calculus and not allow any thermal damage to the pulp tissue and unwanted removal of sound root structure. This can be achieved only by the use of wavelength with minimal penetration depth in mineralised tissue. Lasers like CO_2, Nd:YAG, Er:YAG, and the diode have been used to study the surface detoxification of cementum and dentin.[16]

Hydroxyapatite forms the major mineral content of cementum and dentin which has absorption bands in the mid-infrared region. Of all the laser wavelengths studied, the Er:YAG laser proved to be the convincing laser of choice for effective removal of calculus, for root modification, and for surface modification for cell or tissue reattachment.

The CO_2 laser was the first of the wavelengths to be assessed for effects on root surfaces. Studies utilising CO_2 laser-treated surfaces have given conflicting results. Pant et al.[17] and Crespi et al.[18] found an increased *in vitro* attachment of fibroblasts to laser treated surfaces in comparison to controls of SRP or chemically treated surfaces. On the other hand, Fayad et al.[19] found a total lack of fibroblast attachment to irradiated surfaces. Heat-induced cracking of the root surface is a common observation when using the CO_2 laser.

Israel et al.[20] studied effects of CO_2, Nd:YAG, and Er:YAG lasers on root surface changes. At energy densities of 100 to 400 J/cm^2 for the CO_2 and 286 to 1,857 J/cm^2 for the Nd:YAG lasers, the authors found that the degree of morphologic change post laser irradiation was directly related to energy density, but unrelated to the use of an air/water surface coolant. Changes in root surfaces included cavitation defects, globules of melted and resolidified mineral, surface crazing, and production of a superficial char layer.

[PICTURE: ©NINELL]

Chen et al.[21], carried out a study in which cell cultures of human periodontal ligament fibroblasts were subjected to Nd:YAG irradiation at low energy densities. They reported significant decreases in cellular viability and collagen synthesis at five days post-treatment and evidence of mineralisation of necrotic cells at 28 days post-treatment. Laser parameters were 50 mJ of power and 10 Hz, with a defocused beam delivered through a 400-mm-diameter optical fiber, and durations of exposure ranging from 60 to 240 seconds. In contrast to studies reporting negative results, two *in vitro* studies have demonstrated that the Nd:YAG laser, when used at low energy densities or a combination of low energy density with a defocused beam, has the potential to remove root surface smear layers without causing collateral damage to underlying cementum and/or dentin, or causing irreversible pulpal damage or heat cracking.

The first study[22] used GaAs and GaAlAs diode lasers at energy densities between 0.95 and 6.32 J/cm^2, reported the effect of laser irradiation on prostaglandin E2 (PGE2) production and cyclooxygenase-1 (COX-1) and COX-2 gene expression in lipopolysaccharide challenged human gingival fibroblasts. The authors conveyed that irradiation with the GaAlAs diode laser significantly inhibited PGE2 production in a dose dependent manner, which lead to significant reduction of COX-2 mRNA levels. In another study[23], cell cultures of human gingival fibroblasts were irradiated with an Er:YAG laser at energy densities ranging from 1.68 to 3.37 J/cm^2 and actually increased the production of PGE2 and COX-2 mRNA.

_Conclusion

The use of lasers in periodontal treatment becomes even more complex because the periodontium consists of both hard and soft tissues. When lasers are applied to the root surface and alveolar bone, carbonisation and major thermal damage have been reported on target as well as adjacent tissues. Therefore, the use of lasers is limited to soft tissue procedures like gingivectomy, frenectomy, removal of granulation tissue during flap surgery, removal of melanin pigmentation and metal tattoos of the gingiva. The uses of lasers have also been investigated for subgingival debridement and curettage, osseous recontouring, as well as in implant surgery, maintenance of implants, and management of periimplantitis.

_Lasers—a boon or a bane?

A boon

Dental lasers are an asset in soft tissue surgeries because of their proven haemostatic effect. Lasers can be used either alone or in conjunction with conventional surgeries for the treatment of periodontitis. Their high antibacterial efficiency has also been shown to be useful for the resolution of periodontal pockets.

- Less operative time, minimum postoperative pain due to protein coagulum that acts as a biological dressing and seals the ends of sensory nerves.
- Relatively bloodless surgeries, ability to coagulate, vaporise and cut.
- Less mechanical trauma, minimal swelling and scarring.
- Sterilisation of the wound site.
- No incision, sutureless.
- Recommended for patients with systemic conditions like diabetes, heart diseases or for patients taking blood thinners.

A bane

Lasers have been claimed to be more efficient than conventional therapy. But there is limited evidence regarding lasers playing a role in root surface debridement, pocket sterilisation and elimination. Tissue charring or obnoxious fumes often prevent patient acceptance. Although lasers are the painless alternative to surgical treatment, they are still regarded as an adjunct to conventional treatment methods.

_Conclusion

Given the same wavelength, different laser parameters will yield different levels of energy density for varying periods of time and, thereby, different biological effects on the target tissue._

_contact laser

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Lasers in endodontics

Authors_Dr Enrico DiVito, Prof Dr Rolando Crippa, Prof Dr Giuseppe Iaria, Prof Dr Vasilios Kaitsas, Prof Dr Stefano Benedicenti & Prof Dr Giovanni Olivi, USA

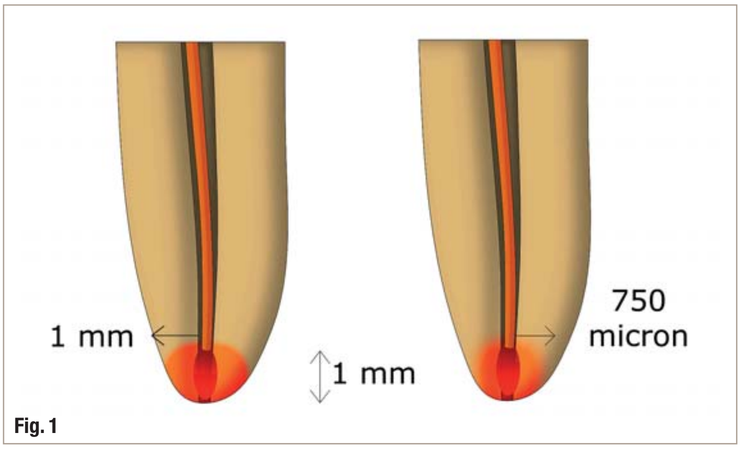


Fig. 1

_Introduction

This article will analyze some of the most important research in the international literature today and the new guidelines for the use of the laser as a source of activation of chemical irrigants.

_Laser-assisted endodontics

Preparation of the access cavity

The preparation of the access cavity can be performed directly with Erbium lasers, which can ablate enamel and dentine. In this case, the use of a short tip is recommended (from 4 to 6 mm), with diameters between 600 and 800 µm, made of quartz to allow the use of higher energy and power. The importance of this technique should not be underestimated.

Owing to its affinity to tissues richest in water (pulp and carious tissue), the laser allows for a minimally invasive access (because it is selective) into the pulp chamber and, at the same time, allows for the decontamination and removal of bacterial debris and pulp tissue. Access to the canal orifices can be accomplished effectively after the number of bacteria has been minimized, thereby avoiding the transposition of bacteria, toxins and debris in the apical direction during the procedure. Chen et al. demonstrated that bacteria are killed during cavity preparation up to a depth of 300 to 400 µm below the radiated surface.[20] Moreover, Erbium lasers are useful in the removal of pulp stones and in the search for calcified canals.

Preparation and shaping of canals

The preparation of the canals with NiTi instruments is still the gold standard in endodontics today. In fact, despite the recognized ablative effect of Erbium lasers (2,780 and 2,940 nm) on hard tissue, their effectiveness in the preparation of root canals appears to be limited at the moment and does not correspond to the endodontic standards reached with NiTi technology.[21–23] However, the Erbium,Chromium:YSGG (Er,Cr:YSGG) and the Erbium:YAG (Er:YAG) lasers have received FDA approval for cleaning, shaping and enlarging canals. A few studies have reported positive re-

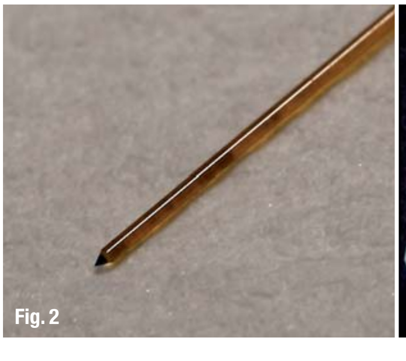


Fig. 2


Fig. 3


Fig. 4

sults for the efficacy of these systems in shaping and enlarging radicular canals.

Shoji et al. used an Er:YAG laser system with a conical tip with 80 pe rcent lateral emission and 20 per cent emission at the tip to enlarge and clean the canals using 10 to 40 mJ energy at 10 Hz, obtaining cleaner dentinal surfaces compared with traditional rotary techniques.[24]

In a preliminary study on the effects of the Er:YAG laser equipped with a microprobe with radial emission of 200 to 400 µm, Kesler et al. found the laser to have good capability for enlarging and shaping in a faster and improved manner compared with the traditional method. The SEM observations demonstrated a uniformly cleaned dentinal surface at the apex of the coronal portion, with an absence of pulp residue and well-cleaned dentinal tubules.[25]

Chen presented clinical studies prepared entirely with the Er,Cr:YSGG laser, the first laser to obtain the FDA patent for the entire endodontic procedure (enlarging, clearing and decontaminating), using tips of 400, 320 and 200 µm in succession and the crown-down technique at 1.5 W and 20 Hz (with air/water spray 35/25 per cent).[26,27]

Stabholz et al. presented positive results of treatment performed entirely using a Er:YAG laser and endodontic lateral emission microprobes.[28,29] Ali et al., Matsuoka et al. and Jahan et al. used the Er,Cr:YSGG laser to prepare straight and curved canals, but in these cases, the results of the experimental group were worse than those of the control group. Using the Er,Cr:YSGG laser with 200 to 320 µm tips at 2 W and 20 Hz on straight and curved canals, they concluded that the laser radiation is able to prepare straight and curved (less than 10 degree) canals, while more severely curved canals demonstrated side effects, such as perforations, burns and canal transportation.[21–23]

Inamoto et al. investigated the cutting ability and the morphological effects of radiation of the Er:YAG laser *in vitro*, using 30 mJ at 10 and 25 Hz with a velocity of extraction of the fibre at 1 and 2 mm/seconds, again with positive results.[30] Minas et al. reported positive results using the Er,Cr:YSGG laser at 1.5, 1.75 and 2.0 W and 20 Hz, with water spray.[31]

The surfaces prepared with the Erbium laser are well cleaned and without smear layer, but often contain l edges, irregularities and charring with the risk of perforations or apical transportation. In effect, canal shaping performed by Erbium laser is still a complicated procedure today that can be performed only in large and straight canals, without any particular advantages.

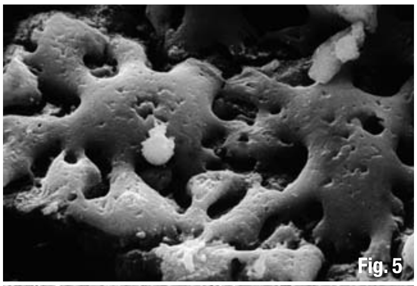
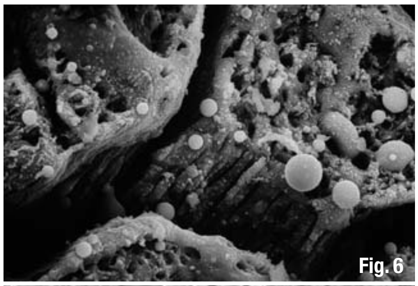


Fig. 5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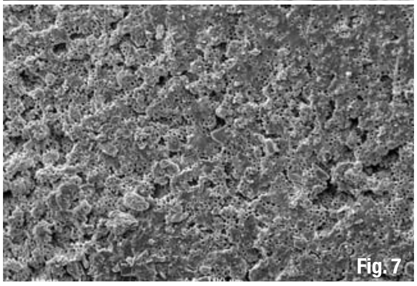
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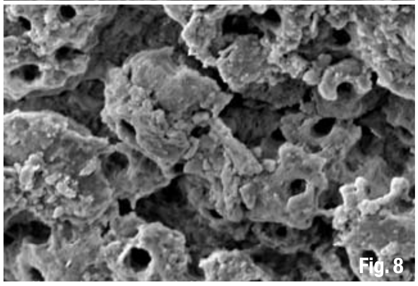


Fig. 8

Decontamination of the endodontic system

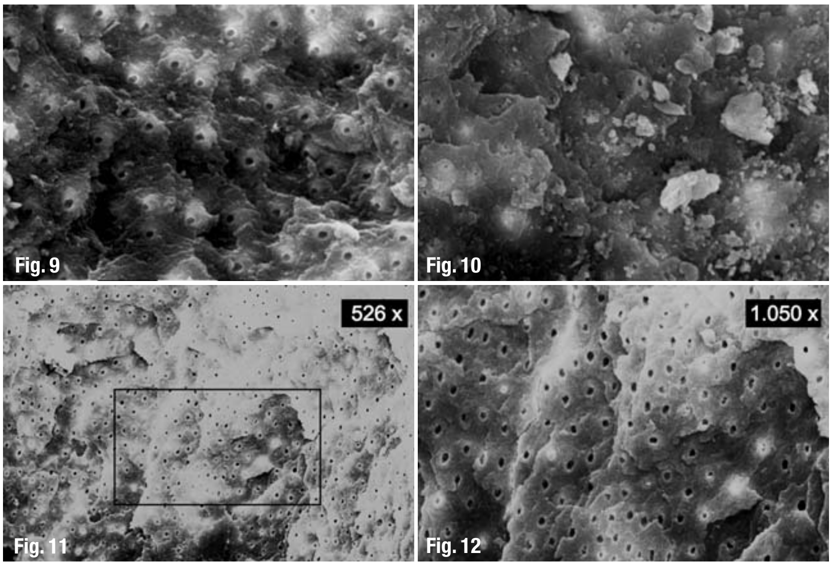
Studies on canal decontamination refer to the action of chemical irrigants (NaClO) commonly used in endodontics, in combination with chelating substances for better cleaning of the dentinal tubules (citric acid and EDTA). One such study is that of Berutti et al., who reported the decontaminating power of NaClO up to a depth of 130 µm on the radicular wall.[32] Lasers were initially introduced in endodontics in an attempt to increase the decontamination of the endodontic system.[2–7]

All the wavelengths have a high bactericidal power because of their thermal effect, which, at different powers and with differing ability to penetrate the dentinal walls, generates important structural modifications in bacteria cells. The initial damage takes place in the cell wall, causing an alteration of the osmotic gradient, leading to swelling and cellular death.[16,34]

Decontamination with near infrared laser

Laser-assisted canal decontamination performed with the near infrared laser requires the canals to be prepared in the traditional way (apical preparation with ISO 25/30), as this wavelength has no affinity and therefore no ablative effect on hard tissue.

The radiation is performed at the end of the traditional endodontic preparation as a final means of decontaminating the endodontic system before obturation. An optical fibre of 200 µm diameter is placed 1 mm from the apex and retracted with a helical movement, moving coronally (in five to 10 seconds according to the different procedures). Today, it is advisable to perform this procedure in a canal filled with endodontic irrigant (preferably, EDTA or citric acid; alternatively, NaClO) to reduce the undesirable thermal morphological effects.[9,35–38]



Using an experimental model, Schoop et al. demonstrated the manner in which lasers spread their energy and penetrate into the dentinal wall, showing them to be physically more efficient than traditional chemical irrigating systems in decontaminating the dentinal walls.[8] The Neodymium:YAG (Nd:YAG; 1,064 nm) laser demonstrated a bacterial reduction of 85 per cent at 1 mm, compared with the diode laser (810 nm) with 63 per cent at 750 µm or less. This marked difference in penetration is due to the low and varying affinity of these wavelengths for hard tissue. The diffusion capacity, which is not uniform, allows the light to reach and destroy bacteria by penetration via the thermal effects (Fig. 1).

Many other microbiological studies have confirmed the strong bactericidal action of the diode and Nd:YAG lasers, with up to 100 per cent decontamination of the bacterial load in the principal canal.[39–43] An *in vitro* study by Benedicenti et al. reported that the use of the diode 810 nm laser in combination with chemical chelating irrigants, such as citric acid and EDTA, brought about a more or less absolute reduction of the bacterial load (99.9 per cent) of *E. faecalis* in the endodontic system.[9]

Decontamination with medium infrared laser

Considering its low efficacy in canal preparation and shaping, using the Erbium laser for decontamination in endodontics requires the use of traditional techniques in canal preparation, with the canals prepared at the apex with ISO 25/30 instruments. The final passage with the laser is possible thanks to the use of long, thin tips (200 and 320 µm), available with various Erbium instruments, allowing for easier reach to the working length (1 mm from apex). In this methodology, the traditional technique is to use a helical movement when retracting the tip (over a 5- to 10-second interval), repeating three to four times depending on the procedure and alternating radiation with irrigation using common chemical irrigants, keeping the canal wet, while performing the procedure (NaClO and/or EDTA) with the integrated spray closed.

The 3-D decontamination of the endodontic system with Erbium lasers is not yet comparable to that of near infrared lasers. The thermal energy created by these lasers is in fact absorbed primarily on the surface (high affinity to dentinal tissue rich in water), where they have the highest bactericidal effect on *E. coli* (Gram-negative bacteria), and *E. faecalis* (Gram-positive bacteria). At 1.5 W, Moritz et al. obtained an almost total eradication (99.64 per cent) of these bacteria.[44] However, these systems do not have a bactericidal effect at depth in the lateral canals, as they only reach 300 µm in depth when tested in the width of the radicular wall.[8]

Further studies have investigated the ability of the Er,Cr:YSGG laser in the decontamination of traditionally prepared canals. Using low power (0.5 W, 10 Hz, 50 mJ with 20 per cent air/water spray), complete eradication of bacteria was not obtained. However, better results for the Er,Cr:YSGG laser were obtained with a 77 per cent reduction at 1 W and of 96 per cent at 1.5 W.[42]

A new area of research has investigated the Erbium laser's ability to remove bacterial biofilm from the apical third,[46] and a recent *in vitro* study has further validated the ability of the Er:YAG laser to remove endodontic biofilm of numerous bacterial species (e.g. *A. naeslundii, E. faecalis, L. casei, P. acnes, F. nucleatum, P. gingivalis* or *P. nigrescens*), with considerable reduction of bacterial cells and disintegration of biofilm. The exception to this is the biofilm formed by *L. casei.*[47]

Ongoing studies are evaluating the efficacy of a new laser technique that uses a newly designed both radial and tapered stripped tip for removal of not only the smear layer, but also bacterial biofilm.[13] The results are very promising.

The Erbium lasers with "end firing" tips—frontal emission at the end of the tip—have little lateral penetration of the dentinal wall. The radial tip was proposed in 2007 for the Er,Cr:YSGG, and Gordon et al. and Schoop et al. have studied the morphological and decontaminating effects of this laser system (Fig. 2).[48–50]

The first study used a tip of 200 µm with radial emission at 20 Hz with air/water spray (34 and 28 per cent) and dry at 10 and 20 mJ and 20 Hz (0.2 and 0.4 W, respectively). The radiation times varied from 15 seconds to two minutes. The maximum bactericidal power was reached at maximum power (0.4 W), with a longer exposure time, without water in dry mode and with a

99.71 per cent bacterial eradication. The minimum time of radiation (15 seconds) with minimum power (0.2 W) and water obtained 94.7 per cent bacterial reduction.[48] The second study used a tip of 300 µm diameter with two different parameters of emission (1 and 1.5 W, 20 Hz), radiating five times for five seconds, with a cooling time of 20 seconds for each passage. The level of decontamination obtained was significantly high, with important differences between 1 and 1.5 W, with a thermal increase contained between 2.7 and 3.2 °C.[49] The same group from Vienna studied other parameters (0.6 and 0.9 W) that produced a very contained thermal rise of 1.3 and 1.6 °C, respectively, showing a high bactericidal effect on *E. coli* and *E. faecalis*.[50]

The need to take advantage of the thermal effect to destroy bacterial cells, however, results in changes at the dentinal and periodontal level. It is important to evaluate the best parameters and explore new techniques that reduce the undesirable thermal effects that lasers have on hard- and soft-tissue structures to a minimum.

Morphological effects on the dentinal surface Numerous studies have investigated the morphological effects of laser radiation on the radicular walls as collateral effects of root-canal decontamination and cleaning performed with different lasers. When they are used dry, both the near and medium infrared lasers produce characteristic thermal effects (Figs. 3 & 4).[51] Near infrared lasers cause characteristic morphological changes to the dentinal wall: the smear layer is only partially removed and the dentinal tubules are primarily closed as a result of melting of the inorganic dentinal structures. Re-crystallisation bubbles and cracks are evident (Figs. 5–8).[52–55]

Water present in the irrigation solutions limits the thermal interaction of the laser beam on the dentinal wall and, at the same time, works thermally activated by a near infrared laser or directly vaporized by a medium infrared laser (target chromophore) with its specific action (disinfecting or chelating). The radiation with the near infrared laser—diode (2.5 W, 15 Hz) and Nd:YAG (1.5 W, 100 mJ, 15 Hz)—performed after using an irrigating solution, produces a better dentinal pattern, similar to that obtained with only an irrigant.

Radiation with NaClO or chlorhexidine produces a morphology with closed dentinal tubules and presence of a smear layer, but with a reduced area of melting, compared with the carbonization seen with dry radiation. The best results were obtained when radiation followed irrigation with EDTA, with surfaces cleaned of the smear layer, with open dentinal tubules and less evidence of thermal damage.[35–38] In the conclusion of their studies on the Erbium laser, Yamazaki et al. and Kimura et al. affirmed that water is necessary to avoid the undesirable morphological aspects markedly present when radiation with the Erbium lasers is performed dry.[56,57] The Erbium lasers used in this way result in signs of ablation and thermal damage as a result of the power used. There is evidence of ledge cracks, areas of superficial melting and vaporisation of the smear layer. A typical pattern arises when dentine is irradiated with the Erbium laser in the presence of water. The thermal damage is reduced and the dentinal tubules are open at the top of the peri-tubular more calcified and less ablated areas. The inter-tubular dentine, which is richer in water however, is more ablated. The smear layer is vaporized by radiation with Erbium lasers and is mostly absent.[58–64] Shoop et al., investigating the

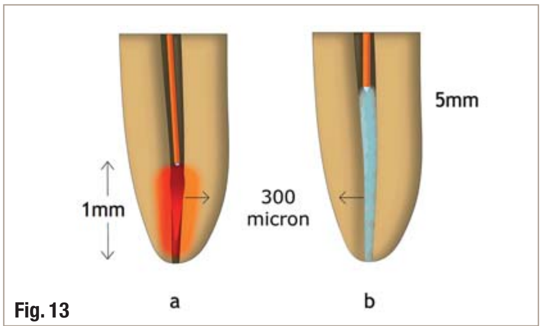


Fig. 13


Fig. 14

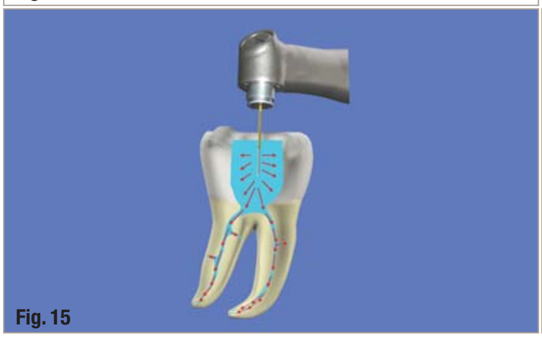


Fig. 15

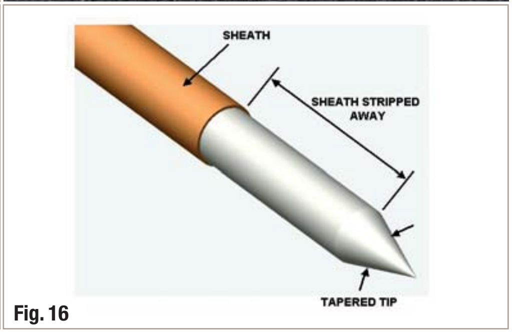


Fig. 16

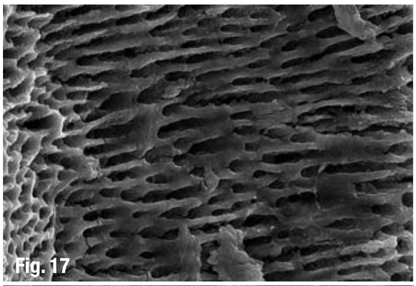


Fig. 17

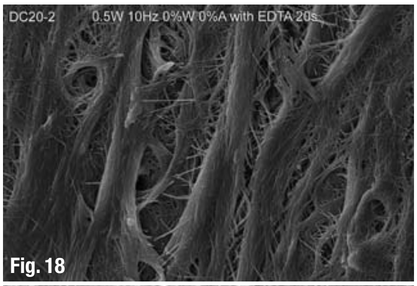


Fig. 18

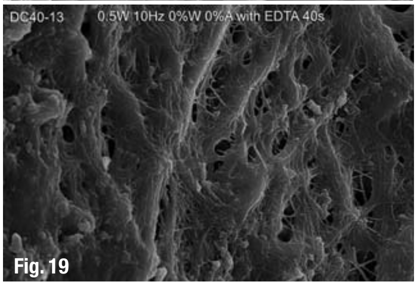


Fig. 19

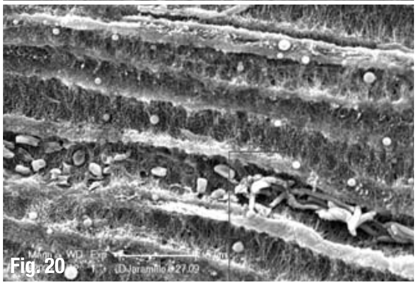


Fig. 20

variations of temperature on the radicular surface *in vitro*, found that the standardised energies (100 mJ, 15 Hz, 1.5 W) produced a measured thermal increase of only 3.5 °C on the periodontal surface. Moritz proposed these parameters as the international standard of use for the Erbium laser in endodontics, claiming it as an efficient means of canal cleaning and decontamination (Figs. 9–12).[14,16]

Even with Erbium lasers, it is advisable to use irrigating solutions. Alternatively, NaClO and EDTA can be utilized during the terminal phase of laser assisted endodontic therapy with a resulting dentinal pattern, with fewer thermal effects. This represents a new area of research in laser-assisted endodontics. Various techniques have been proposed, such as laser-activated irrigation (LAI) and photon-initiated photoacoustic streaming (PIPS).

Photo-thermal and photomechanical phenomena for the removal of smear layer George et al. published the first study that examined the ability of lasers to activate the irrigating liquid inside the root canal to increase its action. In this study, the tips of two laser systems – Er:YAG and Er,Cr:YSGG (400 µm diameter, both flat and conical tips) with the external coating chemically removed – were used to increase the lateral diffusion of energy.

The study was designed to irradiate the root canals that were prepared internally with a dense smear layer grown experimentally. Comparing the results of the groups that were laser radiated with the groups that were not, the study concluded that the laser activation of irrigants (EDTAC, in particular) brought about better cleaning and removal of the smear layer from the dentinal surfaces.[65] In a later study, the authors reported that this procedure, using power of 1 and 0.75 W, produces an increase in temperature of only 2.5 °C without causing damage to the periodontal structures.[66]

Blanken and De Moor also studied the effects of laser activation of irrigants comparing it with conventional irrigation (CI) and passive ultrasound irrigation (PUI). In this study, 2.5 per cent NaClO and the Er,Cr:YSGG laser were used four times for five seconds at 75 mJ, 20 Hz, 1.5 W, with an endodontic tip (200 µm diameter, with flat tip) held steady 5 mm from the apex.

The removal of the smear layer with this procedure led to significantly better results with respect to the other two methods.[67] The photomicrographic study of the experiment suggests that the laser generates a movement of fluids at high speed through a cavitation effect. The expansion and successive implosion of irrigants (by thermal effect) generates a secondary cavitation effect on the intra-canal fluids. It was not necessary to move the fiber up and down in the canal, but sufficient to keep it steady in the middle third, 5 mm from the apex.[68] This concept greatly simplifies the laser technique, without the need to reach the apex and negotiate radicular curves (Fig. 13).

De Moor et al. compared the LAI technique with PUI and they concluded that the laser technique, using lower irrigation times (four times for five seconds), gives results comparable to the ultrasound technique that uses longer irrigation times (three times for 20 seconds).[69] De Groot et al. also confirmed the efficacy of the LAI technique and the improved results obtained in comparison with the PUI. The authors underlined the concept of streaming due to the collapse of the molecules of water in the irrigating solutions used.[70]

Hmud et al. investigated the possibility of using near infrared lasers (940 and 980 nm) with 200 µm fibre to activate the irrigants at powers of 4 W and 10 Hz, and 2.5 W and 25 Hz, respectively. Considering the lack of affinity between these wavelengths and water, higher powers were needed which, via thermal effect and cavitation, produced movement of fluids in the root canal, leading to an increased ability to remove debris and the smear layer.[71] In a later study, the authors also verified the safety of using these higher powers, which caused a rise in temperature of 30 °C in the intra-canal irrigant solution but of only 4 °C on the external radicular surface. The study concluded that irrigation activated by near infrared lasers is highly effective in minimizing the thermal effects on the dentine and the radicular cement.[72]

In a recent study, Macedo et al. referred to the main role of activation as a strong modulator of the reaction rate of NaOCl. During a rest interval of three minutes, the consumption of available chlorine increased significantly after LAI compared with PUI or CI.[73]

Photon initiated photoacoustic streaming (PIPS)

The PIPS technique uses the Erbium laser (Powerlase AT/HT and LightWalker AT, both Fotona) and its interaction with irrigating solutions (EDTA NaOCl or distilled water).[13] The technique uses a different mechanism from the preceding LAI. It exploits exclusively the photoacoustic and photomechanical phenomena, which result from the use of subablative energy of 20 mJ at 15 Hz, with impulses of only 50 microseconds. With an average power of only 0.3 W, each impulse interacts with the water molecules with a peak power of 400 W creating expansion and successive "shock waves" leading to the formation of a powerful streaming of fluids inside the canal, without generating the undesirable thermal effects seen with other methodologies.

The study with thermocouples applied to the radicular apical third revealed only 1.2 °C of thermal rise after 20 seconds and 1.5 °C after 40 seconds of continuous radiation. Another considerable advantage is derived from the insertion of the tip in the pulp chamber at the entrance to the root canal only without the problematic insertion of the tip into the canal or at 1 mm from the apex required by the other techniques (LAI and CI). Newly designed tips—9 mm in length, 600 µm in diameter and with "radial and stripped" tip—are used. The final 3 mm are without coating to allow a greater lateral emission of energy compared to the frontal tip. This mode of energy emission makes better use of the laser energy when, at subablative levels, delivery with very high peak power for each single pulse of 50 microseconds (400 W) produces powerful "shock waves" in the irrigants, leading to a demonstrable and significant mechanical effect on the dentinal wall (Figs. 14–16). The resultant acoustic streaming allows for a three dimensional movement throughout the root canal system allowing the clinician to easier access the complex anatomy often seen in the apical one third.

The studies show the removal of the smear layer to be superior to the control groups with only EDTA or distilled water. The samples treated with laser and EDTA for 20 and 40 seconds show a complete removal of the smear layer with open dentinal tubules (score 1 according to Hulsmann) and the absence of undesirable thermal phenomena, which is characteristic in the dentinal walls treated with traditional laser techniques. With high magnification, the collagen structure is maintained intact, suggesting the ability for minimally invasive endodontic treatment (Figs. 17–19).

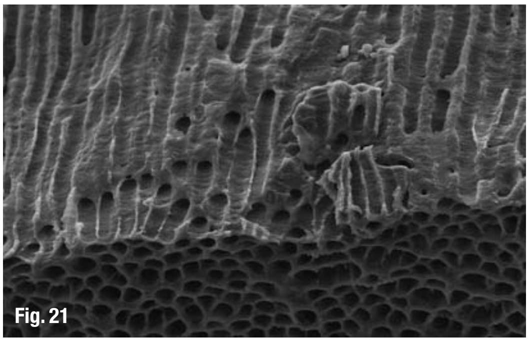


Fig. 21

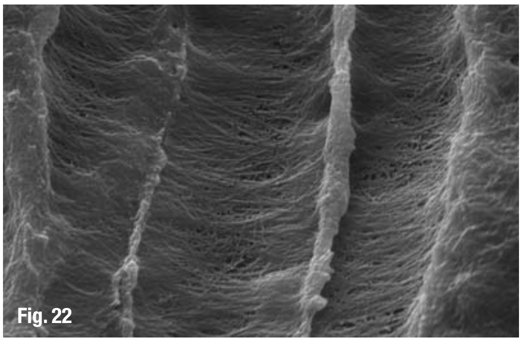


Fig. 22

The Medical Dental Advanced Technologies Group, in affiliation with the University of the Pacific Arthur A. Dugoni School of Dentistry, the University of Genoa and the University of Loma Linda School of Dentistry, University of Tennessee, Boston University, Louisiana State University and the Arizona School of Dentistry and Oral Health, are currently investigating the effects of this technique of root-canal decontamination and the removal of bacterial biofilm in the radicular canal. The results which are about to be published are very promising (Figs. 20–25).

_Discussion and conclusion

Laser technology used in endodontics in the past 20 years has undergone an important evolution. The improved technology has introduced endodontic fibers and tips of a caliber and flexibility that permit insertion up to 1 mm from the apex. Research in recent years has been directed toward producing technologies (impulses of reduced length, "radial firing and stripped" tips) and techniques (LAI and PIPS) that are able to simplify its use in endodontics and minimize the undesirable thermal effects on the dentinal walls, using lower energies in the presence of chemical irrigants. EDTA has proved to be the best solution for LAI technique that activates the liquid and increments its chelating capacity and cleaning of the smear layer. The use of NaClO increases its decontamination activity. Finally, the PIPS technique reduces the thermal effects and exerts a potent cleaning and bactericidal action thanks to its three dimensional streaming of fluids initiated by the photonic energy of the laser. Further studies are currently under way to validate these techniques (LAI and PIPS) as innovative technologies available to endodontics._

Editorial note: An earlier version of this article was published in the international edition of roots, issue 2/2011. A complete list of references is available from the publisher.

_about the author laser

Enrico DiVito, DDS, the lead author of this article, founded his dental practice in Scottsdale, Ariz., in 1980. He is also the founder and director of the state-accredited Arizona School of Dental Assisting. In addition to teaching at the school, DiVito is also a clinical instructor at the Arizona School of Dentistry and Oral Health and is responsible for helping create the Department of Laser Dentistry. He earned his undergraduate degree from Arizona State University and graduated with honors from the Dental School at the University of the Pacific in San Francisco, receiving several Clinical Excellence Awards. He can be contacted at: edivito@azcld.com.

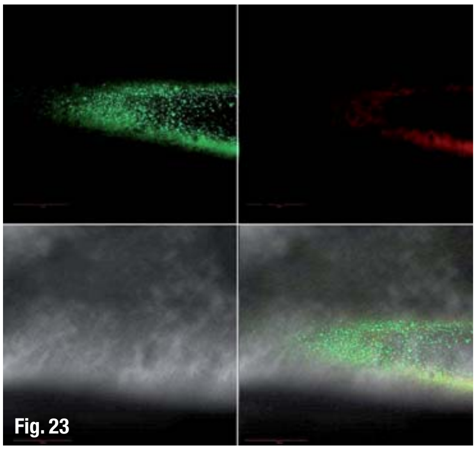
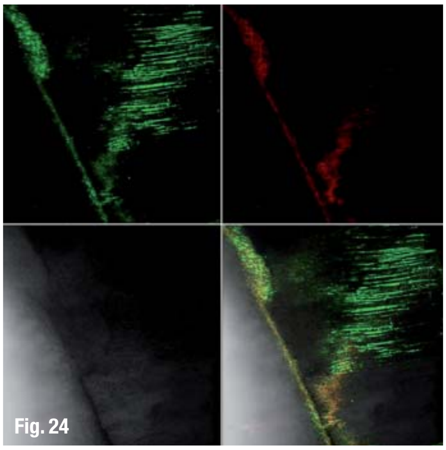


Fig. 23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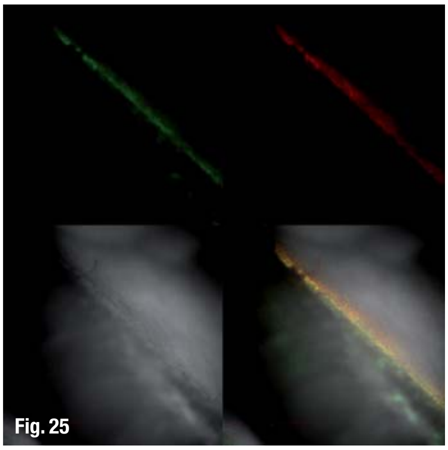
Fig. 25

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Diode lasers for periodontal treatment: the story so far

Authors_Dr Fay Goldstep, Dr George Freedman, Canada

[PICTURE: ©BIZROUG]

_Introduction

The concept of using dental lasers for the treatment of periodontal disease elicits very strong reactions from all sides of the spectrum. Everyone has an opinion. Everyone is certain that their own opinion is correct. But the only certainty is confusion, and the lack of clear direction in the concept of Laser Assisted Periodontal Therapy (LAPT).

Much of this uncertainty stems from not comparing "apples to apples," in terms of the type of lasers utilized and the way that studies are designed. Certain lasers are used specifically for soft tissue treatment. These include the CO_2, Nd:YAG, and diode lasers. Others can be used for both soft and hard tissue applications. These are the Er:YAG and Er,Cr:YSGG lasers. They must be compared within their own category.

Many of these lasers have been shown to provide periodontal treatment benefits. In order to achieve an element of clarity and simplicity on this very complex topic, the following discussion exclusively addresses the use of the diode laser for periodontal treatment.

_A specific instrument

The diode laser has become an important tool in the dental armamentarium due to its exceptional ease of use and affordability. It also has key advantages with regard to periodontal treatment. The diode laser is well absorbed by melanin, haemoglobin, and other chromophores that are present in periodontal disease.[1] Hence the diode specifically targets unhealthy gingival tissues. The laser energy is transmitted through a thin fibre that can easily penetrate into deep periodontal pockets to deliver its therapeutic effects.

The 2002 American Academy of Periodontology statement regarding gingival curettage[2] proposes that "gingival curettage, by whatever method performed, should be considered as a procedure that has no additional benefit to SRP alone in the treatment of chronic periodontitis". Also stated is that all the methods devised for curettage "have the same goal, which is the complete removal of the epithelium" and "none of these alternative methods has a clinical or microbial advantage over the mechanical instrumentation with a curette".

This was the science in 2002. More recent studies have shown that instrumentation of the soft periodontal tissues with a diode laser leads to complete epithelial removal while instrumentation with conventional curettes leaves significant epithelial remnants.[3]

_An effective bactericidal instrument

Periodontal disease is a chronic inflammatory disease caused by a bacterial infection. Hence the bactericidal and detoxifying effect of laser treatment is advantageous in periodontal therapy.[4] The diode laser's bactericidal effectiveness has been well-documented.[5,6,7,8]

Moreover, there is a significant suppression of *A. actinomycetemcomitans*, an invasive bacterium that is associated with aggressive forms of periodontal disease that are not readily treated with conven-

tional scaling and root planing (SRP). *A. actinomycetemcomitans* is not only present on the diseased root surface, but it also invades the adjacent soft tissues, making it difficult to remove by mechanical periodontal instrumentation alone.[7,9,10] This necessitates the use of adjunctive antibiotic therapy.[10] The diode laser provides a non-antibiotic solution. *A. actinomycetemcomitans* has also been found in atherosclerotic plaques[11] and there has been evidence to suggest that subgingival *A. actinomycetemcomitans* may be related to coronary heart disease.[12] This makes it even more compelling to seek methods to control this aggressive pathogen.

_Wound healing

Diode lasers are very effective for soft tissue applications including incision, hemostasis and coagulation.[13] Many advantages of the laser vs. the scalpel blade have been discussed in the literature. These include a bloodless operating field, minimal swelling and scarring, and much less or no postsurgical pain.[14,15] When laser surgical procedures are carried out, the surface produced heals favourably as an open wound, without the need for sutures or surgical dressings.[4] Studies have shown enhanced, faster and more comfortable wound healing when the diode laser is used in conjunction with scaling and root planing (SRP).[7]

_An adjunct to scaling and root planing (srp)

There is very compelling evidence in the dental literature that the addition of diode laser treatment to SRP (the gold standard in non-surgical periodontal treatment) will produce significantly improved results. After SRP, the diode laser is used on the soft tissue side of the periodontal pocket to remove the inflamed soft tissue and reduce the pathogens.[16] Research has demonstrated better removal of the pocket epithelium compared to conventional techniques.[3] Many studies have shown increased reduction of bacteria (especially specific periopathogens) when diode lasers are utilized after SRP.[5,17,18] Significant improvement in decontamination and effective treatment of periimplantitis also occurs with the addition of diode laser therapy.[19]

Gingival health parameters are significantly improved with the addition of the diode laser to SRP. Studies have shown decreased gingival bleeding[17,20] decreased inflammation and pocket depth,[16,17] as well as decreased tooth mobility and decreased clinical attachment loss.[16] This improvement in gingival health remains more stable than with conventional SRP treatment alone and tends to last longer.[21] Moreover, patient comfort is significantly enhanced during the postoperative healing phase, with the addition of diode laser therapy.[7]

The research thus shows diode laser periodontal treatment to be an effective procedure. It is also a

Fig. 1_Scaling and Root Planing are performed first.

Fig. 2_The diode laser tip is placed into the pocket.

Fig. 1

Fig. 2

Fig. 3_Laser energy is applied into the pocket to decontaminate and coagulate the soft tissue.
Fig. 4_Pocket depth is measured before the treatment and three months post treatment.

minimally invasive procedure. Patients are demanding less surgery and the diode laser provides the general dentist with an excellent means of keeping periodontal treatment in the general practice.

_A safe instrument

Histological testing of roots where the diode laser was used after SRP demonstrated no detectable surface alteration to root or cementum. There were no signs of thermal side effects in any of the teeth treated.[22] Many studies have specifically indicated no adverse tissue events, demonstrating the safety of the diode laser.[5,8,17,23]

The diode laser's very effective bactericidal action on periodontal pathogens makes the adjunctive use of antibiotics unnecessary.[10] This eliminates the problem of bacterial resistance and systemic side effects engendered by antibiotic use.[6] The laser is a safer, more effective treatment.

_The protocol so far

The above-cited research has demonstrated that the use of the diode laser after conventional scaling and root planing (SRP) is superior to SRP alone. Various protocols have been developed by clinicians to incorporate this treatment into the busy dental practice. These protocols may be performed by the dentist and /or the hygienist as determined by the regulating organization in the geographic location of the dental practice.

Individual parameters vary depending on the clinician and the particular diode laser that is being used. However, most protocols do follow a simple formula. The hard side of the pocket (tooth and root surface) is first debrided with ultrasonic scalers and hand instrumentation (Fig. 1). This is followed by laser bacterial reduction and coagulation of the soft tissue (epithelial) side of the pocket (Figs. 2 & 3).[1] The laser fiber is measured to a distance of one mm short of the pocket depth. The fiber is used in light contact with a sweeping action that covers the entire epithelial lining, from the base of the pocket upward.[24] The fiber tip is cleaned often with a damp gauze to prevent the build-up of debris. Re-probing of treated sites should not be attempted for three months post operatively (Fig. 4), because healing starts at the base of the pocket and the new tissue remains fragile for this period of time.[1]

The power settings and time parameters are determined by the particular laser used. The diode laser clinician must take training on the specific laser in the practice to be fully able to implement Laser Assisted Periodontal Therapy. With experience, the user will feel comfortable enough to adapt the protocol to his or her particular practice.

In the future, protocols will be modified and fine-tuned by various laser user groups after discussion of their experiences and results. These results will be incorporated into new procedures which will bring Laser Assisted Periodontal Therapy to a new, more effective level.

_The time has come

The time has come to embrace the routine use of lasers for the treatment of periodontal disease. The diode laser has been shown to be effective and safe for this purpose. When, if not now? Patients need treatment. Laser Assisted Periodontal Therapy is non-invasive. With the diode laser, there is a reduced need for systemic or locally applied antimicrobials. This leads to fewer allergic reactions and antibiotic resistance.

There is significant proof that the addition of Laser Assisted Periodontal Therapy to conventional scaling and root planing improves outcomes. This is particularly compelling when considering the periodontal health/systemic health link. It is time to open our minds to laser technology and apply the treatment that is in the best interest of our patients._

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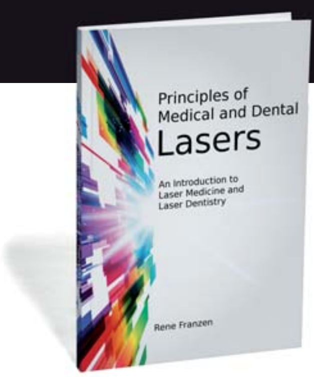
The key concept of laser dentistry

What does a dental laser actually do?

Author_Dr Rene Franzen, Canada

[ORIGINAL BACKGROUND: ©QUINKY]



_In his new book "Principles of Medical and Dental Lasers", Rene Franzen addresses the key issues of laser dentistry in an accessible way, pointing out important facts with regard to laser-tissue interaction relevant for everyday clinical practice. Readers of laser international magazine of laser dentistry can now enjoy a free reprint of an original chapter from this piece of basic laser literature.

_Introduction

If I would have to define a medical or dental laser system in just on sentence, this would be it:

A laser is a concentrator of energy.

This is what we want it to do for medical purposes. Its main properties, which are relevant here, are:

A high spectral energy or power density.

Now, since this is the core issue of medical laser therapies, we need to look at this in detail. Let's start with energy and power. These are different parameters, the first one measured in Joules, the other in Watts. The Joules measure the amount of something, and this something can actually be interpreted as the medication you use on your patient. In pharmacology, we measure the amount of medication in milligrams. Often they are given orally, and the effect is a systemic one. With lasers, our medication is the amount of energy, of Joules, which will cause an effect. Almost always the laser's medication is working only locally as opposed to systemically, making lasers a highly suitable tool for minimally invasive or selective procedures.

_Energy and time

The power, the Watts, is defined as energy per time. One Watt is 1 Joule in 1 second. If you apply the same 1 Joule in only 0.1 seconds, you have a power of 10 Watt. The amount of medication (Joules) is the same, but the effect will differ. Think of the power as what the dosage is in pharmacology. Example: Take 100 pills of a pain killer. Applying these in a time frame of 100 days may be okay for chronic pain issues, but applying the same amount in 10 minutes might be fatal. Same amount—different effect. The same is true

[PICTURE: ©ROBERT KNESCHKE]

for the laser's Joules. The same amount of energy, 500 mJ in the example, can cause non-thermal removal of hard tissue when given in a fast way, and causes no tissue removal but thermal carbonisation when given too slowly. The relationship between energy and power is the time it takes to deliver this amount of energy into the tissue. And this is the first quality in which a laser concentrates energy. For some medical or dental procedures we want to concentrate a lot of energy within a small timeframe, using a pulsed laser so we can have a high power during the pulse.

Let's look at the other words in that line above. Since energy and power are connected by time, high spectral power density remains. Now, high, is an easy property, isn't it? Often we think about lasers being high power devices, pure focussed light...but that is actually not a property of a laser. To understand this, let us examine one example:

_Compare a light bulb to a laser

Why don't we use a 100 W light bulb instead of a laser? It costs about 1 or 2 Euros or Dollars. How much does a 7 W diode laser cost? How much a larger Erbium or Neodymium laser? 10,000 – 50,000 Euros or Dollars, depending on the manufacturer and what market you are in. And yes, the light bulb really gives you more power than those laser systems. Power alone is nothing. It is one quality of the laser, namely the temporal concentration of energy. But there is more. The line above says power density, not just power. And this is another quality of lasers, the spatial concentration of energy.

Let us compare a laser to a light bulb. We take a 1 mW laser pointer, red laser light, and the 100 W bulb illuminating a room of roughly 25 square meters (sqm). The power of the light bulb is 100,000 times larger than that of the pointer. For simplicity, let's assume the pointers beam diameter is about 1 square millimeter (sqmm). It does not chance much when pointing it at different objects in a common room. The power density (or intensity) will be 1 mW/sqmm or 1,000,000 mW/sqm which equals 1,000 W/sqm. The light bulb illuminates the complete room, radiating in all directions since its emission is based on spontaneous emission. The floor is lit, but so are the ceiling and the walls. Again for simplicity, let's assume those add up to roughly 100 sqm, which means we talk about 100 W/100 sqm which is just 1 Watt per square meter at the position of the floor. We can use rough approximates here since we just need to see the order of magnitude which is between them: the pointer has an intensity 1,000 times higher than the bulb, even though the bulb is 100,000 times more powerful. This is concentration of power in space—the laser concentrates energy, in time (Watt) and space (energy or power density).

[PICTURE: ©IR STONE]

When we compare this laser pointer with a common dental diode laser of 7–10 Watt we will arrive at a power density of roughly 7–10 million Watts per square meter. If you would just buy power with your laser, the medical/dental laser should not exceed a sales price of 10 ct, but when comparing power density the bulb is at 1 Euro per 1 W/sqm, so the dental laser would be at 7–10 million Euros. Luckily, the real price is between those two extremes.

_Monochromasy

Going back once more, we see there is only one word left: A high spectral energy or power density. The power density is not just high, it is spectrally high. This relates to the position of the emission in the electromagnetic spectrum, the wavelengths being involved in the emission. The light bulb emits white light, which means that all the visible colours are present. But the light bulb is inefficient, less than 10 % of the power are emitted in the visible range; more than 90 % are emitted as infrared radiation. The red laser pointer is emitting its 1,000 W/sqm on just one narrow wavelength which is around 650 nm for a common diode laser based pointer. The light bulb is of course also emitting 650 nm, among other wavelengths. But in a strict comparison, when we use an optical filter to block out all the light of the bulb which is not between 649 and 651 nm, then what remains? Of the 1 W/sqm only 10 % are in the visible range at best, that's a mere 0.1 W/sqm. And this power density is spread across the complete visible area. So, in fact, we are looking at about 0.001–0.005 W/sqm around 650 nm. This is the value which competes against 1,000 W/sqm of laser pointer intensity, about a million times higher. This is what we mean when we say high spectral power density. A laser can concentrate the energy (the medication!) in time, space and on only one wavelength. Just having one wavelength in the emission is what is called monochromasy.

_The key concept for selective treatments

This is the key element of minimally invasive laser treatments since it enables the doctor to put the medication exactly where it is needed to invoke a certain effect. Monochromasy directly leads to selectivity, in the sense that the optical properties of tissues can be used in conjunction with choosing a suitable laser wavelength, so that certain tissues or components inside a tissue can absorb significantly higher amounts of energy than others. This key concept opens up a tremendous amount of selective laser treatments.

_Selectivity

Using a medical laser system selectively in fact means to not only concentrate energy into a small volume of tissue in a certain time frame, but it also means to concentrate energy on certain components in the tissue.

Let us start with an easy, every-day example. Assume you are on vacation somewhere, staying at a nice hotel or resort with a lovely swimming pool. The pool is surrounded by tiles, white and black ones. The sky is blue and the sun is shining intensely. You walk around the pool just after breakfast. What happens?

Walking on the white tiles, you will feel they are cool, maybe even still cold from the night. The black tiles will feel hot when stepped upon (most pools will therefore not even have black tiles!). This is because the relationship

power is energy divided by time

can also be expressed as

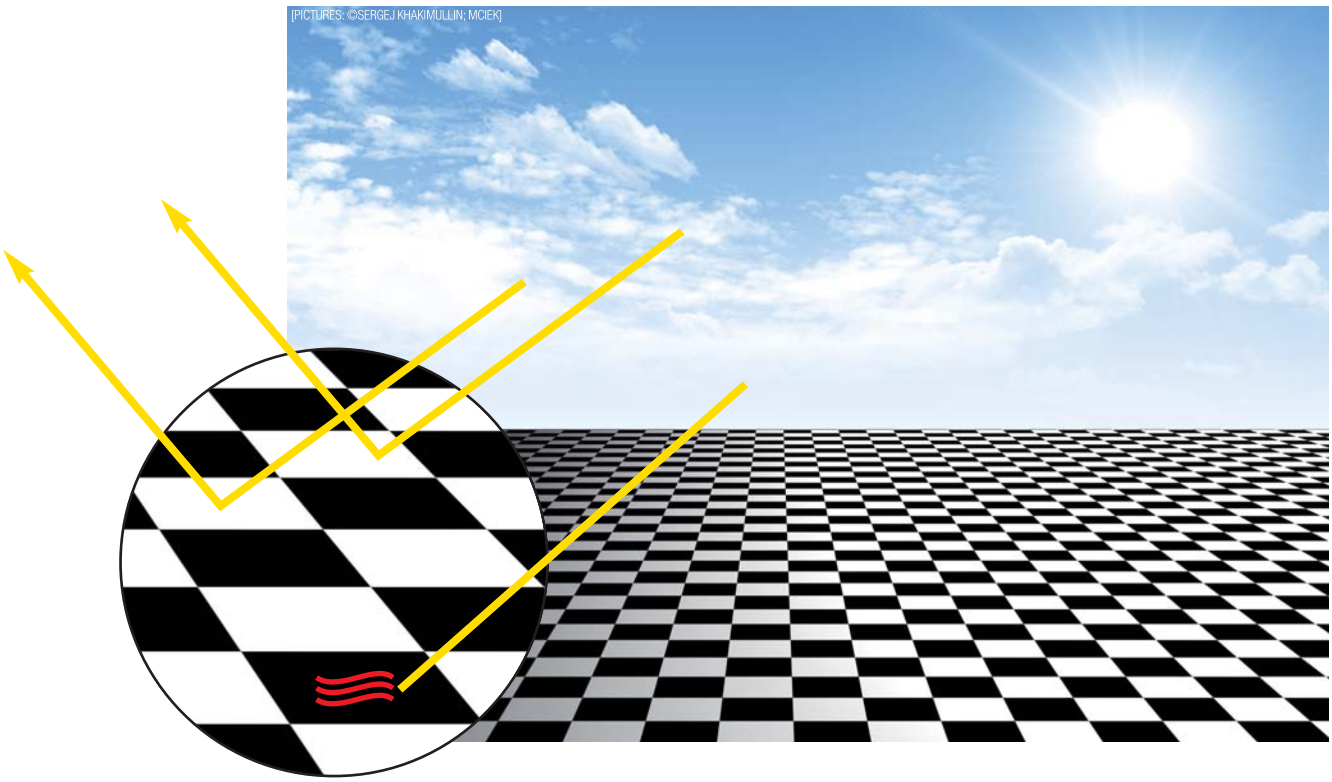
energy is power multiplied time.

Or in this case: absorbed energy (heat) in the tiles is power (sunshine) multiplied time (hours after sunrise). In this simplified example, the absorbed power in the white tiles will be low, because most sunlight will be scattered and reflected. Indeed, this is why they appear white in the first place: most of the sunlight is "bounced off" the tiles and reaches your eyes—the tile is bright. The fact that the tile is bright white is a direct consequence of this "bounced off" light being collimated by your eyes, focussed onto your retinas, where an image is projected. This is what we define as seeing.

The black tiles absorb most of the sunlight. Only a small fraction of the light is being scattered and reflected, only a small amount of light reaches your eyes—the tile appears dark or black. Black is actually no colour in itself but the absence of light. The absorbed energy will be converted mostly into heat and you will find the tile hot under the soles of your feet.

This is selective absorption of energy. A different response by different components, even if in close spatial proximity, and under the same irradiation.

[PICTURES: ©SERGEJ KHAKIMULLIN; MCIEK]



However, there is an important lesson to learn. You revisit the pool at 5 p.m. in the afternoon. The sun has been shining all day. The black tiles are hot. But now the white ones are also hot! The white tiles have heated up at a slower rate, since the absorbed power is lower. But over enough time, an impressive amount of energy can still be collected. At this time, we don't feel a thermal difference between the different tiles. The selectivity is lost.

_You can lose selectivity if you irradiate too long

The example with the pool tiles can be expanded to a dental example: A laser-supported endodontic treatment follows the same concept of selectivity.

One of the main problems of problematic endodontic cases are bacteria migrating into lateral tubes. Research has shown that the bacteria such as *Streptococcus mutans* can migrate 1,100 µm into the tubules[1], while rinsing agents are only effective to about 100 µm.[2] Secondary canals, an isthmus or apical delta will also make conventional cleaning in these cases near to impossible.

But luckily we have a selective situation. More than 95 % of bacterial species in the canal system are pigmented. The remaining fraction is highly sensitive to the residual heat after irradiation. The dentin itself is not pigmented. The bacteria are acting as our black tiles and the dentin acts as white tiles.

We can now choose a laser whose wavelength is highly absorbed in pigments/melanin and is highly scattered and transmitted in dentin.

The question regarding the dose, the amount of medication, the amount of energy need is equivalent to the question "At what time to I need to go to the pool to find the white tiles cold and the black tiles hot". Then we find an answer, something like "At 10:23 a.m.".

In laser medicine, this answer may not be so easy to find. Actually, it involves tremendous efforts in research. For the laser-supported endodontic treatment, already in the 1990's, Prof Dr Norbert Gutknecht tested several irradiation protocols at RWTH Aachen University, measuring bacterial reduction in different depths of dentin. The ideal technique, today known as the Aachen protocol, which we also teach in-depth in courses on our campus, involves specific settings for the laser system, wavelength, average power, temporal modulation (pulsing), fiber diameter and kind, as well as the movement of the fiber inside the open root canal.

If we perform such a treatment, we will have excellent results, because we concentrate energy: in time (pulse duration, repetition rate, movement), in space (movement, different absorption of components—wavelength, fiber diameter), and spectrally (absorption response of dentin and pigments). Don't get lost in too many laser parameters, they all go back to one of these three qualities of concentration. If ever you get confused by a parameter, ask yourself, is this influencing the energy concentration in time, in space, or a certain component?

In our example of an infected root canal, the energy will be concentrated in the bacteria. They will locally overheat and die off due to the absorbed energy, without heating the surrounding dentin up to significant temperatures. We aim to put the medication (energy) selectively into the microorganisms.

And just as in pharmacology, you can overdose and underdose your treatment. If you are too careful, setting only the lowest possible power on your laser, and move out of the canal very quickly, no harm can be done to the dentin and underlying bone structures. But also no harm is done to the bacteria: under dose. This is the same as if you visit the pool just after sunrise. Everything is still cold.

On the other hand, if someone says, "I paid for 10 W, so I will use it, no matter what", and then moves slowly inside the canal, the bacteria will be killed off—along with charring the dentin and destroying significant sections of the bone structure. The same as going to the pool at 5 p.m.: Everything is hot. Selectivity is lost.

At this point I would like to stress that therefore it is very important to learn and study (and understand!) the treatment protocols in medicine. Some things are fundamentally different than with a scalpel.

Continue reading in the book or ebook and learn more about the successful use of laser energy in dental treatments._

Editorial note: The book Principles of Medical and Dental Lasers *by Rene Franzen can be obtained in German, English and Greek, printed or as e-book via www.lulu.com/spotlight/renefranzen and www.amazon.de/Principles-Medical-And-Dental-Lasers/dp/1470905922/ref=cm_cr_pr_product_top as well as via iTunes and iBookstore. A complete list of references is available from the publisher.*

_contact laser

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Does the tongue get the attention it deserves?

Author_Dr Darius Moghtader, Germany

_Introduction

Removing fibromas and fraena is bread-and-butter work for dental practitioners. Laser dentists are even happy to do it spontaneously during a routine check-up.

Laser cutting causes no bleeding at all. The risk of cells being spread is minimized by immediate sealing of the blood vessels. Laser cutting dramatically reduces the microbial count at the operation site and ensures a clean primary wound. The result of successful laser excision is a cleaner, non-bleeding cut with pain-free healing.

The whole "magic" takes no more than ten minutes and includes explanation to the patient, anaesthesia and signing the cost estimate. Patients are happy to accept the offer because it means they do not have to attend the dental practice a second time. They can resume work the next day without any difficulty and do not have to give up a day's holiday. None of my patients want to take a sick leave any more.

_Case presentation

A new patient came to my surgery for a routine check-up, "just to take a look" as she emphasized. Everything was fine, she said, and she had no complaints or questions beforehand.

Examination revealed a 2 x 2 mm neoplasm on the right margin of the tongue. When asked about it, she told me I was the first dentist to talk to her about it and

Fig. 1_Initial situation.
Fig. 2_Situation after removal.

suggest removing it. This thing had been bothering her more and more for twelve months because she worked the "bump" against her tooth and occasionally even bit onto it. She also thought it had grown a little. She claimed to have talked to previous practitioners about it and received either no answer or answers such as "It's not bad, you can leave it". If it bothered her so much, they said, it would be a job for the surgeon and she might have to take a few days off. This is why she did not mention the problem at all.

In short, we decided to remove the neoplasm straight away. It was removed using the pre-set program for fibroma removal with the elexxion claros 810 nm diode laser. Soft laser therapy with the pre-set wound healing program of the elexxion claros was then carried out.

After removal

The results of the diode laser technology of elexxion claros are very clear to see. Because of the patented digital pulse technology with up to 20,000 Hz, there are only minimal or no carbonization of the tissue and its resulting unwanted side effects.

The neoplasm was sent to Pathology as a matter of routine. As well as the usual information, a note regarding the laser excision should be included so that the pathologist is able to interpret the wound margins properly. I send along the photographs as well. The pathologist is very pleased to receive these and regularly asks me whether he can use these photos in his lectures.

Check-up the next day

As expected and predicted, the patient said she had no bleeding, pain or restriction in her work. She told me she was relieved to "finally get rid of this thing".

One week later

The pathology report revealed an irritation fibroma of the tongue. Without laser I would have thought long and hard about its removal. Any dentist who has ever had to contend with a tongue injury is familiar with the heavy, uncontrolled bleeding of the tongue that can happen. Suturing poses a challenge too. It can entirely disrupt the whole practice schedule. Consequently, I would rather use the laser to treat a grateful patient safely, effectively and quickly in my own general dental practice._

_contact laser

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Fig. 3_Check-up the next day.
Fig. 4_One week later.

Fig. 3

Fig. 4

Lasers in the treatment of traumatically fractured frontal teeth

Author_Dr Carlo Fornaini, Italy

_Introduction

Dental traumatology is a multidisciplinary branch of dentistry that requires a number of specific skills. In cases of emergency, decisions have to be made within a limited time frame and with effects that can only be evaluated at a later date.[1] The techniques of tooth fragment re-attachment should be adapted for cases of simple coronal fracture (enamel and superficial dentin) as well as complicated coronal fracture (deep dentin with pulp exposure).[2]

In cases of simple fracture, a fragment may be re-attached immediately, while in complicated coronal fractures, the main concern should be the protection of the pulp and not necessarily the fragment, which should be maintained hydrated and refrigerated in a container marked with the patient's full name and the date of the trauma. The solution in the container should be changed at regular intervals and the seal checked, since in some cases fragments may be stored for several months before being re-attached.[3]

The field of adhesive dentistry was born in 1955 by Buonocore, with the description of the utilisation of orthophosphoric acid and composite resin in order to obtain restorations with high bond strength and reduced microleakage.[4,5] In 1990, laser technology was introduced in conservative dentistry by Hibst and Keller, who described the use of an Er:YAG laser as an alternative to conventional instruments, such as the turbine and micromotor.[6,7] Widespread

Fig. 1_Coronal fracture of the permanent right central incisor.
Fig. 2_After treatment with Er:YAG, SSP mode.
Fig. 3_The reposition of the fragment.
Fig. 4_The preparation of the borderline surface area.
Fig. 5_Completed treatment.
Fig. 6_Crown fracture of the permanent, right central incisor.


Fig. 1


Fig. 2


Fig. 3


Fig. 4


Fig. 5


Fig. 6

Fig. 7_Exposed pulp.

Fig. 8_Nd:YAG laser pulp capping.

Fig. 9_Replaced fragment after the preparation of fragment and tooth bonding surfaces with Er:YAG, SSP mode.

Fig. 10_Final result.

Fig. 11_ Permanent right central incisor longitudinally fractured in the distal portion.

Fig. 12_Gingival margin recontoured with Nd:YAG laser.

interest in employing this new technology is related to its significant number of advantages, as described in several scientific studies. Thanks to the affinity of its wavelength to water and hydroxyapatite, Er:YAG laser technology allows for the efficient ablation of hard dental tissues without the risk of micro- and macro-fractures, which have been observed when using conventional rotating instruments.[8,10] The dentin surface treated by laser appears clean, without a smear-layer and with the tubules open and clear.[11]

Thermal elevation in the pulp, recorded during Er:YAG laser irradiation, is less than that recorded by using turbine and micro-motor, in the same conditions of air/water spray.[12,13] This wavelength also has an antimicrobial decontamination effect on the treated tissues, which destroys both aerobic and anaerobic bacteria.[14] The most interesting aspects of this new technology are related to the goals of modern conservative dentistry, namely "minimally invasive" treatments and better adhesive methods. Er:YAG lasers can reach spot dimensions smaller than 1 mm, which allows the possibility to make a selective ablation of the affected dentin while preserving the sound tissue in order to realise very limited restorations.[15]

Several in-vitro studies demonstrated that the preparation of enamel and dentin by Er:YAG laser, followed by orthophosphoric acid-etching, enhances effectiveness in terms of reduced microleakage and increased bond strength.[16] Several authors have proposed the utilisation of laser technology also for the restoration of frontal teeth fractured by traumatic events.[17]

In some cases of frontal teeth trauma, it is necessary to perform gingival recontouring because the traumatic event has also damaged the soft tissue; in other cases, due to pulp exposure, a pulp-capping procedure is needed. In both of these clinical situations, the utility of laser therapy was demonstrated.[18-20] We prefer to use VSP Er:YAG laser technology for soft- and pulp-tissue treatments, without air/water spray and with a long pulse duration in order to transform all the energy delivered into heat, although the complementary Nd:YAG wavelength (1,064 nm) present in the same device can also be used.

The aim of this clinical study was to demonstrate the usefulness of the Er:YAG laser in the treatment of tooth fractures by showing several cases and describing the advantages of using a device based on VSP technology[21] and an additional integrated wavelength (Nd:YAG).

_Clinical cases

Case 1

A ten-year-old patient came to one of our clinics after an accident during a football game. Upon clinical examination it was evident that there was a coronal fracture of the permanent right central incisor (Fig. 1). The patient, instructed by his coach, had preserved the fractured portion of the tooth in a container of milk. It was decided to re-bond the fragment to the tooth by means of an Er:YAG laser-assisted technique after a vitality check. Both the fragment and the tooth were treated by Er:YAG laser (Fidelis Plus III, Fotona, Slovenia) with the following parameters: SSP mode, 200 mJ, 10 Hz, tipless handpiece (Fig. 2); subsequently they were etched by or-


Fig. 13

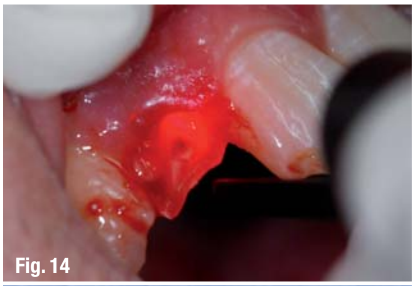
Fig. 14


Fig. 15a


Fig. 15b


Fig. 16

Fig. 13_Completed treatment.
Fig. 14_Gingival margin recontouring and pulp capping with Er:YAG, VLP mode.
Fig. 15a & b_Both hard dental tissues prepared with Er:YAG, SSP mode before the attachment of the fragment.
Fig. 16_Completed intervention.

thophosphoric acid, after which bonding was applied and the fragment was re-positioned with flow composite resin (Fig. 3).

In the borderline surface area, these steps were all repeated to improve the aesthetic result (Fig. 4). During the whole procedure, no anaesthesia were used and the compliance of the patient was very high; he confirmed that there was no pain or discomfort. The tooth was checked monthly for six months and vitality tests were found to be positive (Fig. 5).

Case 2

A fourteen-year-old patient came to one of our clinics presenting a traumatic crown fracture of the permanent, right central incisor (Fig. 6). The patient had preserved the broken fragment in her mouth. To lessen the ordeal for the already traumatized young patient we decided to perform the treatment with the Er:YAG and Nd:YAG lasers we have at hand in our practice (Fidelis Plus III, Fotona, Slovenia). The trauma had left the pulp exposed (Fig. 7); our first decision was to perform a Nd:YAG laser pulp capping (SP mode, 4 W, 40 Hz, 300 µm contact fiber, Fig. 8). We then proceeded to use the same device but with another wavelength (Er:YAG) to prepare both the fragment's and tooth's bonding surfaces (SSP mode, 200 mJ, 10 Hz, tipless handpiece, Fig. 9). The same surfaces were further prepared with orthophosphoric acid, bonding was applied and subsequently flow composite resin was used in order to replace the fragment (Fig 10).

The Er:YAG laser played a pivotal role in this particular case; we were able to work without causing any additional pain to the patient, keeping trauma for both patient and parents to a minimum. In addition, the Er:YAG's inherent lasering effect provided decontamination and increased bond strength. For aesthetic purposes, we prepared the borderline surface area with Er:YAG before once more applying orthophosphoric acid and finally flow composite resin. No form of anaesthesia was deemed necessary by us or even requested by the patient. The tooth was checked monthly for six months and vitality tests were found to be positive.

Case 3

An eight-year-old patient came to our clinic with his permanent right central incisor longitudinally fractured in the distal portion (Fig. 11). He had preserved the fragment in physiological solution. After a check of the vitality and the fragment's fit to the tooth, the gingival margin was recontoured with an Nd:YAG laser (Fidelis Plus III, Fotona, Slovenia; SP mode, 4 W, 40 Hz, 300 µm contact fiber, Fig. 12) in order to expose all the borders of the restoration. Since it was impossible to use a rubber dam, it was decided to use the same device but with the other wavelength (Er:YAG) to prepare both the surfaces of the fragment and the tooth (SSP mode, 200 mJ, 10 Hz, tipless handpiece). After a total etching of the laser-irradiated surfaces, the bonding was applied and the fragment repositioned with a coat of flow composite. A LED lamp was used to polymerize the resin and abrasive discs mounted on a micro-motor were used to polish the restoration (Fig. 13).

During the intervention no anaesthetic was used and the patient confirmed the absence of pain and discomfort. The tooth was checked monthly for six months and vitality tests were found to be positive.

Case 4

An eighteen-year-old patient came to one of our clinics after experiencing a trauma on the face. During the clinical observation, damage to the right lateral permanent upper incisor was noticed. The whole coronal portion of the tooth, while still in position, fractured vertically and in the frontal plane, and pulp tissue was exposed. It was decided to use the Er:YAG laser (Fidelis Plus III, Fotona, Slovenia) in two different ways: without air/water spray (VLP mode, 120 mJ, 15 Hz) to re-contour the gingival margin without bleeding (Fig. 14) and for pulp capping and with air/water spray (SSP mode, 200 mJ, 10 Hz) tipless handpiece to prepare the hard dental tissues in order to provide stronger adhesion (Fig. 15). After the laser preparation, a full-etching was performed with orthophosphoric acid and the attachment of the fragment was made with bonding and flow composite resin (Fig. 16). The intervention was conducted without using anaesthetics, and the compliance of the patient was good since he did not experience pain or discomfort. The tooth was checked monthly for six months and vitality tests were found to be positive.

_Conclusion

Er:YAG lasers may be used in conservative dentistry as an alternative to conventional instruments and in association with orthophosphoric acid, with several advantages, such as better bond strength[22] and reduced microleakage[23], as well as lower discomfort and higher patient satisfaction.[24] The availability of different Er:YAG pulse durations and a complementary Nd:YAG laser in the same device make interventions easier and faster.

This clinical study, even if considered as preliminary due to the limited number of samples, confirms that Er:YAG lasers can also be employed in dental traumatology to restore frontal teeth after coronal fractures, with the advantages of better cooperation from patients (in particular when young), reduced pain, sensitivity and discomfort during the restoration process, and better final results from an aesthetic point of view._

_contact laser

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Laser versus bur and dentinal bonding

Authors_Dr Barbara Cvikl, Dr Alexander Franz, Dr Christoph Kurzmann & Dr Andreas Moritz, Austria

_Introduction

In times of increased awareness of aesthetics, high quality ceramic restorations in dentistry are in great demand. Furthermore, demands for alternative dental preparation techniques like laser preparation which affords non-contacting and vibration-free working, increased. Therefore, laser research and laser application became more and more important in dentistry. However, constantly new developments and this concentrated flow of information can occasionally be a problem for the attending dentist, because it is hardly possible in clinical everyday live to review all new products and information that are given by manufacturers. The purpose of the present work is therefore to provide information about the stability of the adhesive compound between human dentin and ceramic using different laser and conventional preparation tools.

Erbium-based lasers are approved devices for cavity preparation in dentistry.[1-4] Er:YAG laser and Er,Cr:YSGG laser, hard tissue laser with a wavelength of 2,940 nm and 2,780 nm, respectively, offer a high surface effect with only a low depth effect on teeth. Due to the large proportion of water in carious tissue, caries will be removed particularly well. An auxiliary bactericidal effect exists. Furthermore the pulpal increase in temperature is not higher than 2,5 °C through an efficient water cooling system.[5-8] According to a study by Zach et al., temperature increases of less than 6,1 °C are considered to be inoffensive for the dental pulp.[9] All of those elements and other factors like patient-friendly treatment by a vibration-free and contactless preparation technique make Erbium-based lasers the ideal alternative to conventional preparation techniques.[1] Some researchers even suggest that additional acid etching before the adhesive ceramic fixation may not be necessary because of micro roughness, which is achieved by laser treatment.[6,10,11] In contrast, studies by Bahillo et al.,[12] Lee et al.[13] and others[14,15] advice additionally acid etching after laser treatment. Hence, there are still doubts about how laser-treated dentin can bond to adhesive systems. For this reason, we investigated both laser preparation with and without phosphoric acid etching.

Fig. 1_Bernhard Gottlieb University Clinic of Dentistry, Medical University of Vienna, Austria

As ceramic samples, Cerec®-blocks (VITABLOCS Mark II®), conventional feldspar ceramic were used. We used these CEREC®-blocs because the industrial sintering process under vacuum at 1,170 °C, which can be reproduced at any time, ensures a more homogenous microstructure with consistent material quality compared to laboratory sintered and lab-processed ceramic restorations. We were thus able to minimize interference factors from the ceramic that otherwise may influence our study results.[16] As adhesive material for gluing the dentin discs on the ceramic blocks we used Variolink® II plus Syntac® (Ivoclar Vivadent,

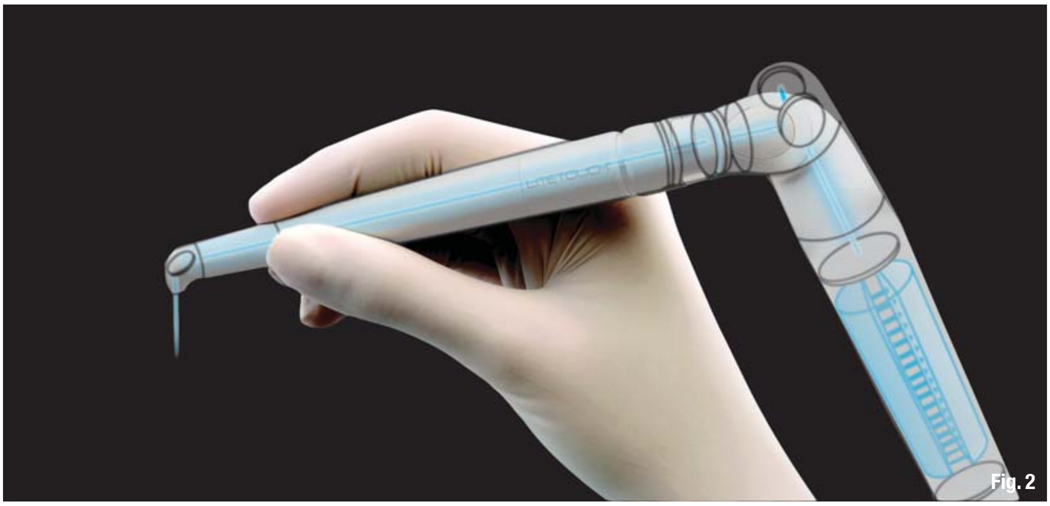

Fig. 2_LiteTouch™ Laser-in-the-Handpiece™: The laser energy is swiftly delivered to the tissue, providing supreme cutting power and precise incisions for hard tissue and bone.

Schaan/Liechtenstein), a classic etch and rinse adhesive system which acts very often as a gold standard.

_Materials and Methods

Extracted third molars were cleaned and stored in physiological saline solution. Using a precision saw, cusps were removed and teeth were cut into uniform dentine discs of a thickness of 1 mm. After removal of enamel, dentine discs were randomly divided into five subgroups representing five different preparation techniques: (i) diamond bur and acid etching; (ii) Er:YAG laser (LiteTouch™, Syneron), 2,940 nm, 4 W, 20 Hz; tip of 0,8 mm; (ii) Er:YAG laser and additional acid etching; (iv) Er,Cr:YSGG laser (Waterlase MD™, Biolase), 2,780 nm, 2 W, 30 Hz with a conical tip of 600 µm (MC 6 Saphir); (v) Er,Cr:YSGG laser and additional acid etching. All laser irradiation settings were executed at an angle of inclination of 30° and with a feed rate of 1 mm per minute.

After treatment, dentine discs were fixed on CEREC® ceramic blocks using the system Syntac®/ Variolink® II (Syntac® etch & rinse adhesive and Variolink® II, Ivoclar Vivadent, Schaan, Liechtenstein). The system Syntac®/Variolink® II was applied according to the manufacturer's instructions. In addition, the application of human dentin discs on CEREC® ceramic blocks was performed following the manufacturer's instructions.

Sample size of each of the five subgroups was n = 15, resulting in a total of 75 dentine discs and 75 CEREC® ceramic blocks. All samples were subjected to thermocycling (10,000 cycles, 5°–55° respectively) to simulate artificial aging. After thermocycling, a shear test was performed using the universal testing machine Zwick (Zwick/Roell, Ulm, Germany) at a crosshead speed of 0.8 mm per minute. The bond strength was registered in megapascals (MPa). Data were analysed using ANOVA with Tukey's post hoc test with a significance level of = 0.05.

_Results

The results of the shear bond strength tests showed the highest values for the group of the Er:YAG laser with and without additionally acid etching. The diamond bur and acid etching group as well as the Er,Cr:YSGG laser group with and without additionally acid etching showed similar but slightly lower values (Fig. 1 and Tab. 1). Overall, there was a trend towards stronger bonding with the Er:YAG-laser treated dentin with additionally acid etching; however, no statistically significant differences were exposed when comparing the five preparation methods ($p = 0.169$). These findings suggest that laser irradiation provides favourable conditions for bonding between dentin and ceramics.

_Discussion

The results of this study suggest that a laser-treated dentin surface provides favourable conditions for bonding. Our findings that laser treatment can provide coequal adhesive conditions to the diamond bur

Fig. 3_Class V – Cavity Preparation using LiteTouch™. (Courtesy of Dr Avi Reyhanian)

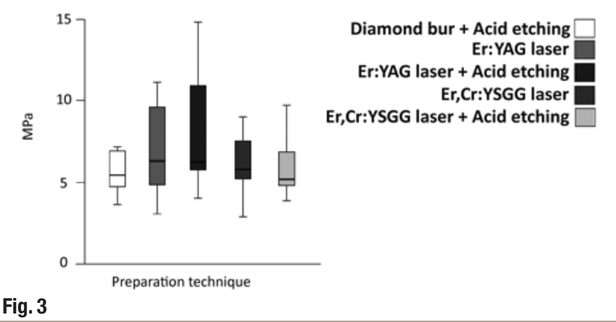

Fig. 3

more, the thickness and especially the size of the dentin discs are of crucial importance, because the bond strength is significantly influenced by the size of the discs.[26] Another important factor of the achieved bond strength is the storage medium in which the extracted molars have been stored pending further processing. While we used physiological saline solution to imitate the natural situation as well as possible, other studies applied distilled water, 0,5 % chloroform solution and other storage solutions.[27,28]

Fig. 4_Comparison of the five preparation techniques with regard to the bonding strength.

Table 1_ Means and standard deviations of shear bond strength tests (MPa)

	Diamond bur + Acid etching	Er:YAG laser	Er:YAG laser + Acid etching	Er,Cr:YSGG laser	Er,Cr:YSGG laser + Acid etching
Variolink®II Syntac®	6.84 +/-3.38	6.89 +/-2.7	8.11 +/-3.18	6.11 +/-1.65	5.85 +/-1.67

are not supported by the majority of similar studies. In comparable studies using human dentin laser treatment resulted in equivalent[17] or even lower[18–20] bond strength to ceramic or composite. However, these studies differed in other experimental aspects (e.g., the laser setting, angle of irradiation, storage conditions for the tooth samples, and the source and preparation of tooth discs).

An explanation for the advantageous results in the laser group could be that we used a standardised process of laser treatment with a constant feed rate and irradiation angle of 30 degrees to the dentin surface. We already obtained promising results with this setting in preliminary tests. We suggest that the superficial part of the laser-irradiated surface is not affected and there are no micro fractures as described in studies with other laser settings.[14,21,22]

In this study we show that Er:YAG-laser treated dentin discs with and without additional acid etching revealed slightly higher mean values than Er,Cr:YSGG laser or bur-treated dentin discs. However, no statistically significant differences were exposed when comparing the different preparation methods. Differences between the results of this study and other studies, which seemed to be comparable at first sight, can be based on a small number of divergences in the study design. A very important factor is the quality and nature of the used adhesive materials and of the dentin discs.

While we used caries-free and mature third molars for the preparation of the dentin discs, other studies applied retained molars, teeth other than molars or enamel surfaces to compare laser preparation with conventional preparation techniques.[23-25] Further-

Our findings have to be interpreted with care because *in vitro* settings only partially reflect the *in vivo* performance. Further studies are necessary to understand if these *in vitro* findings translate into clinical practice. Moreover, the *in vitro* system may not necessarily represent the *in vivo* conditions, in which the temperature and humidity are closer to the physiological situation than in our room temperature setting. Other experimental conditions, such as bonding in a climatic chamber and simulation of mastication cycles or long-term storage, can change the bonding strength. Future studies need to consider these physiological situations. There is still room for maximising the bonding strength of dentin to ceramics by improving the laser protocols for the preparation of dental cavities.

_Conclusion

Taken together, our findings show that dentin surfaces prepared with the Erbium laser can provide a favourable dentin surface for binding ceramics, particularly when using Variolink®II/Syntac® as the adhesive system. Overall, Erbium laser can be an attractive alternative to the conventional preparation technique using a diamond bur._

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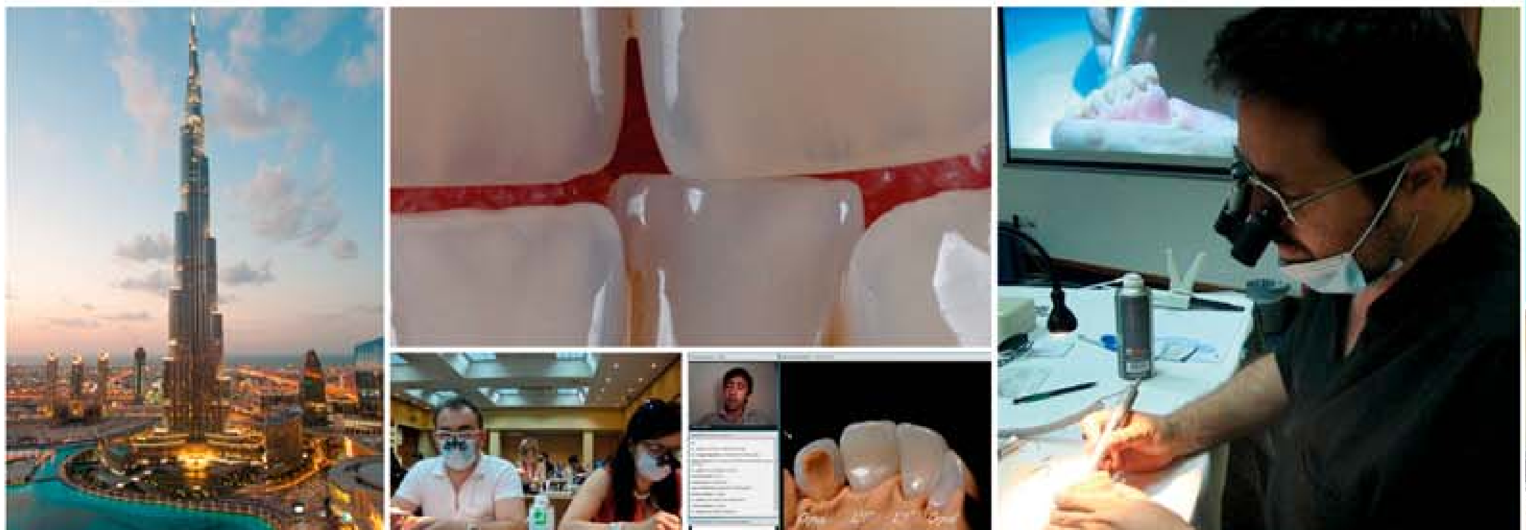

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Biolase

Laser training and new diode laser

Informing themselves about the latest developments and methods in laser applications and taking part in the respective trainings is mandatory for all laser users. Therefore, Biolase has been supporting WCLI (World Clinical Laser Institute) for many years, thus operating in laser education on an international scale. In order to be able to offer certified high-level courses worldwide, Biolase has also recently started a new cooperation with AALZ (Aachen Dental Laser Center) in Aachen, Germany, presided by Prof Norbert Gutknecht. In addition, train-the-trainer seminars will be held for international training practices. For the first time, a workshop will be conducted which combines periodontology and aesthetic surgery/dermatology. Every laser user can gain further qualification in a certification course starting January 2013. Moreover, the release of the new 10-Watts diode laser Epic is eagerly awaited by laser users. A good price-performance ratio, its appealing design and easy handling have already led to such a high demand that it has become hard keep pace with on the production side, resulting in delivery delays. Now, finally, the modern diode-laser system Epic with 25 years of Biolase experience in development is made available worldwide. German-speaking users can pre-order Epic under www.biolase-germany.de.

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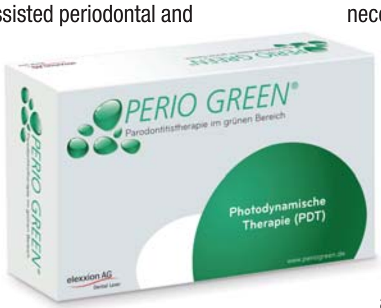
elexxion

Antimicrobial periodontal and peri-implantitis treatment

With the new photodynamic active ingredient Perio Green, elexxion AG based in Radolfzell, Germany, is bringing colour into laser-assisted periodontal and peri-implantitis treatment.



The new class IIa medical device, which is based on the clinically proven PDT dye indocyanine green and reacts specifically to the light frequency of elexxion lasers, provides highly effective and painless adjuvant treatment of periodontitis and peri-implantitis – with no risk to hard dental and soft tissue and without causing discolouration or systemic effects.

If the active ingredient is irradiated by a diode laser with a wavelength of 810 nm, active oxygen is released. This singlet oxygen changes the micro-organisms so that they are no longer able to metabolise and are killed. The treatment is virtually painless for patients because it causes no thermal or mechanical effects; anaesthesia is usually unnecessary.

The actual Perio Green treatment, which can be repeated any time in recall appointments, takes about an hour. If the method is used during a professional oral hygiene session, the time is reduced to only about 30 minutes. Furthermore, as this type of laser-assisted therapy is non-invasive, it can be delegated to a suitably trained dental nurse.

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78315 Radolfzell, Germany

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www.periogreen.com/en

Henry Schein

15th Annual Henry Schein "Back to School" Program


[PICTURE: ©YURYIMAGING]

Henry Schein, Inc. (NASDAQ: HSIC), the world's largest provider of health care products and services to office-based dental, medical and animal health practitioners, is helping more than 2,400 children in 21 U.S. and Canadian cities return to the classroom well-dressed and well-prepared as part of the Company's 15th annual "Back to School" program. Each year Henry Schein's "Back to School" program is eagerly anticipated by the children who participate, the human service organisations that serve them, and the Team Schein Members who sponsor the children. The Program, which started modestly in 1998 by helping 150 children from Long Island, has now sponsored more than 18,000 children in need from communities across North America, providing the children with new school outfits and backpacks filled with school supplies.

"It is the smiles of the children that we remember long after the event is over, and we hope that they take that same happiness and enthusiasm into the classroom," said Gerry Benjamin, Executive Vice President and Chief Administrative Officer for Henry Schein.

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Syneron Dental Lasers

Distribution Partnership in France

Syneron Dental Lasers, provider of innovative dental laser technologies and SCDistribution Laser in France have signed a distribution agreement. SCDistribution will market, sell and provide after-sales services to all LiteTouch™ users in France.


[PICTURE: ©EDHAR]

According to the national order of the French dental surgeons, France has over 40,000 dentists for a population of 60 million. However, the number of practitioners per 100,000 can vary quite significantly from 139 to 38[1]. Dental lasers such as LiteTouch™ can be easily integrated and enable dentists to treat more patients in those areas where the ratio of professionals per population is much lower.

Mr. Cédric Bouchereau, CEO of SCDistribution Laser commented, "I am delighted that SCDistribution has been chosen as the exclusive distributor of LiteTouch in France; following years of experience we had with other hard and soft tissue lasers, we witnessed the advantages of Er:YAG technology (wavelength 2,940 nm)".

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[1] *http://www.ordre-chirurgiens-dentistes.fr/actualites/annee-en-cours/actualites.html?tx_ttnews%5Bpointer%5D=3&tx_ttnews%5Btt_news%5D=251&tx_ttnews%5BbackPid%5D=53&cHash=c4f34de4cf*

Fotona

Facial Aesthetic Treatments with LightWalker®

Fotona has seen increasing demand for its workshops on aesthetic facial skin treatments using the company's new LightWalker AT dental laser. The comprehensive workshops cover a wide range of aesthetic skin treatments that can be performed with the award-winning LightWalker laser, without the need to invest in any additional equipment other than an aesthetic handpiece. Some of the aesthetics & dermatology applications that LightWalker is approved for include: treatments for wrinkles, scars, skin tags, acne, pigmented & vascular lesions, warts, and more.

LightWalker AT dental lasers feature the same core technologies that are built into Fotona's world-class line of aesthetic & surgical lasers systems. As a highly mobile and multi-functional treatment platform, the LightWalker AT uniquely appeals to a growing number of practices that share clinical space and other resources, since switching between applications with LightWalker is effectively as simple as switching handpieces. With the right training (and where permitted by local practice regulations) dental professionals can now utilise their state-of-the-art LightWalker AT laser system for a whole new range of treatment possibilities.

Fotona d.d.
Stegne 7
1000 Ljubljana, Slovenia

www.fotona.com
www.lightwalkerlaser.com

Komet Dental

All-round quality

To mark its 90th anniversary, Komet treats itself and its customers to a brand new Corporate Design. Introduced on 1 September 2012, our fresh and dynamic new Corporate Design captures the spirit of modern times while still representing the traditional Komet values of quality, innovation and tradition.

Our new logo is impressive: The distinctive Komet lettering is now placed above the Komet spiral. These two symbols—standing for dynamics and innovative power—will ensure global brand recognition with our 100,000 customers world-wide. The eye-catching new design will successively appear on all printed matters, our website and at trade fairs. Frank Janßen, our Head of Marketing, says: "We created a dynamic, up-to-date Corporate Design that reflects what we stand for: A reputable company with a professional approach."

When asked how the company will be addressed in future, Mr. Janßen stated: "The brand name Komet will be predominantly used in all our communication, but we will continue to operate as Gebr. Brasseler GmbH & Co. KG."

There's nothing left for us to add, other than, "Happy Birthday, Komet, and congratulations on your great new design!".

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Community board honors dentists for supporting drug education in schools

Author_Dental Tribune America

_The award acknowledged the dentists' dedication in fighting drug abuse in the greater New York area by supporting the office of Dr Bernard Fialkoff and the Fialkoff Dental Study Club's free drug education program for New York City children. The award was given as part of a presentation to the 65 attending dentists, encouraging all to get involved in community activities such as this community service program and the "Healthy Mouths, Healthy Lives" oral health care program for youth.

The event took place at the educational group's monthly meeting at Laterna Restaurant in Bayside, Queens. Fialkoff, a Queens periodontist and dental implant specialist, founded the club in the mid '90s and originated using the Foundation for a Drug Free World's drug education program for New York City children by providing free presentations to schools and after-school programs throughout New York.

Since February, his office has conducted more than 80 free drug education events in the city's five boroughs, including at schools such as JH 190, Dreyfus Intermediate School 11 and PS/IS 217, and such after-school programs as YMCAs, Bronx Works, Police Athletic Leagues and numerous others.

The study club has an audience of 60 to 100 dentists each month. It focuses on raising dental excellence, standards and camaraderie in the New York boroughs. The club will continue its monthly meetings with a presentation in November by Dr Steven M. Katz and in December by Dr Harold Edelman, who will be instructing on the New York State Mandatory Infection Control Course._

Source: Fialkoff Dental Study Club

International events

2012

Dental Hygiene Research Meeting
Pisa, Italy
14–15 December 2012
www.tueor.it

2013

UAE International Dental Conference & Arab Dental Exhibition
Dubai, UAE
5–7 February 2013
www.aeedc.com

ALD Academy of Laser Dentistry Annual Meeting – The 20th Conference and Exhibition
Palm Springs, CA, USA
7–9 February 2013
www.laserdentistry.org

Pacific Dental Conference
Vancouver, CAN
7–9 March 2013
www.pdconfc.com

28th Annual Meeting of the Academy of Osseointegration
Tampa, USA
7–9 March, 2013
www.osseo.org

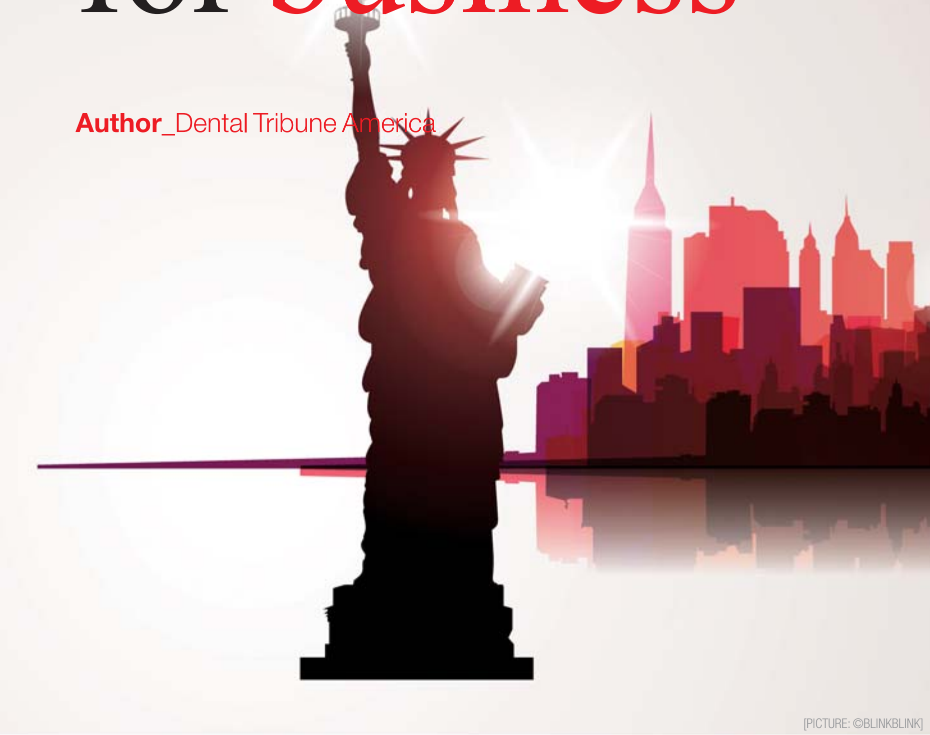
35th IDS International Dental Show
Cologne, Germany
12–16 March 2013
www.ids-cologne.de

46th Scandefa
Copenhagen, DK
11–13 April 2013
www.scandefa.dk

4th Congress of the European Division—WFLD
Brussels, Belgium
11–12 July 2013
www.wfldbrussels2013.com

New York City is open for business

Author_Dental Tribune America



[PICTURE: ©BLINKBLINK]

_Organisers of the Greater New York Dental Meeting have announced that they would like to thank everyone for their thoughts and concerns during this difficult time in New York and New Jersey. "We have been receiving numerous calls, emails and faxes and would like to inform the world that we are open," the organisers said in a statement. The meeting will be held Friday through Wednesday, Nov. 23 to 28.

"The Javits Convention Center and all the hotels are open, the roads and airports are now operating and our registration numbers in all categories are ahead of last year," the organisers said. "We look forward to seeing you in a few weeks and welcoming everyone to the largest and greatest educational and sales event dentistry has ever seen."

Registration is open for the meeting, which is the largest dental congress and health-care meeting in the United States, with 53,789 attendees from all 50 states and 127 countries in 2011. A significantly expanded international program accommodated 6,656 international visitors in 2011, with sessions in French, Spanish, Portuguese, Italian and Russian.

The high-energy event, which never has a pre-registration fee, draws top dental professionals with an expansive exhibit hall and more than 300 educational courses, including full-day and half-day seminars, essays, hands-on workshops and a live, 430-seat, high-tech patient demonstration area.

[PICTURE: ©ONLY FABRIZIO]

New York City is full of cultural enclaves that give attendees the opportunity to experience foods, festivals, arts and more from all over the globe. Few cities offer a wider variety of iconic attractions, historic buildings and cultural sites.

Three major international airports, Newark Liberty (EWR), Kennedy (JFK) and La Guardia (LGA) and discounted hotel rates for registrants, make it easy for any dental professional to visit New York City and attend the meeting.

The GNYDM staff encourages you to see all New York City has to offer during one of its most beautiful times of year._

Milan sees 40th anniversary of International Expodental

Author_Dental Tribune International

_**This autumn,** more than 20,000 visitors and over 300 exhibitors celebrated the 40th anniversary of the annual International Expodental. The event took place in the new exhibition halls at Fiera Milano City in Milan and showcased the latest technologies for dentists and dental technicians.

According to Gianfranco Berrutti, the President of the Italian Dental Industries Association, host of the exhibition held from 18 to 20 October, the event exceeded his organisation's expectations.

In his closing speech, he highlighted the 40th anniversary as noteworthy for the numbers it had attracted: 323 companies exhibited in the 20,000 m² pavilion and an estimated 21,000 participants attended the three-day event. He mentioned that both exhibitors and visitors appreciated particularly the new exhibition spaces and the service provided by Fiera Milano City.

In addition, more than 3,000 visitors joined the various cultural events organised in the scope of the fifth Expodental Forum held alongside the exhibition. At the forum, renowned academics and dental professionals lectured on various scientific topics related to dentistry.

Furthermore, Berrutti said that the event had demonstrated that after 40 years the show is still a major attraction for the entire dental industry. "For three days, our industry has forgotten about the economic crisis and has been able to look forward to the technologies that will shape the dental industry in the upcoming years," he said.

The next International Expodental will take place in Milan from 17 to 19 October 2013. The sixth Expodental Forum will be organised alongside the event and will focus on dental aesthetics, Berrutti said._

"I believe that the future is already here"

[BACKGROUND: ©CIFOTART]

At the latest congress of the World Federation for lasers Dentistry in Barcelona, laser specialist company Syneron Dental Lasers introduced its new LiteTouch model of dental lasers for hard & soft tissue treatments. Laser magazine spoke with the company's President & CEO, Mr Ira Prigat, about the benefits of the new model and future prospects of laser technology in dentistry.

_laser: *Mr Prigat, how does the new LiteTouch model differ from its predecessor?*

The new CE-marked LiteTouch model was unveiled at the World Federation of Laser Dentistry International Congress in Barcelona in mid April 2012, where Syneron Dental Lasers participated as a Gold Sponsor. We showcased Laser-in-the-Handpiece innovative technology and clinical applications of LiteTouch in various fields, including endodontics, periodontics, pediatric dentistry and implantology.

The new LiteTouch model was especially designed to meet high regulatory standards and features an adjustable screen and an angled socket extension to improve the ergonomic positioning of the laser applicator, which is slightly thicker than that of the previous model, but is able to provide our users with improved ergonomic and wider clinical capabilities. Additional elements and accessories in the new model were added based on the feedback provided by users for enhanced device manoeuvrability and portability.

Users will also notice that the new LiteTouch model comes in a variety of new and existing colour options.

_Some of the previous models were found to not fully comply with European regulatory standards. Please elaborate how you have overcome this issue over the past several months?

We at Syneron Dental Lasers believe in keeping high standards of safety, efficacy and service for LiteTouch and take much pride in the feedback we receive from our world-wide users, enthusiastic researchers and speakers. As with other similar cases in the dental industry or other industries, companies can experience deviations. Earlier this year, Syneron Dental Lasers conducted a test which concluded that some LiteTouch systems currently on the EU market were not fully compliant with the Electromagnetic Compatibility (EMC) part of the Annex I of the Medical Devices Directive.

Our foremost concern was to ensure the safety of the machine to both users and patients and to provide our users with an adequate solution, so they could continue to benefit from their LiteTouch system. This is why we instantly commissioned an in-dependent third-party expert analysis of the situation. The results were that there was no risk whatsoever to either users or patients. No safety or efficacy feature of our device was affected by the EMC issue. We then immediately put together a team of international experts in order to provide our stakeholders with quick and reliable solutions covering all aspects, working hand-in-hand with the local authorities in each country. Last, but not least, we developed a new model that not only solved the problem but also provided our users with a new and improved alternative.

After putting in place all these necessary activities to address this issue, Syneron Dental Lasers received reinstatement of the CE certification for its new LiteTouch model from its notifying European body, MDC. For complete user satisfaction and, together with its parent company, Syneron Medical Ltd., the company decided to go beyond just repairing the existing equipment, and offer our users the new LiteTouch model.

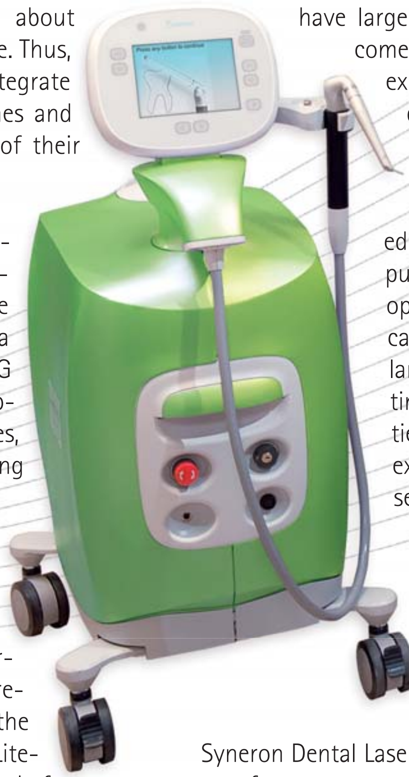
_How have the market and users responded?

Thanks to the special working relations and close synergy with our world-wide partners we were able to address the situation quickly and at the same time receive support for all the actions that were taken. Our partners appreciated our transparent and responsible approach as well as the seriousness with which Syneron Dental Lasers handled the matter. They continue to express their appreciation through their unequivocal commitment to the Syneron Dental Lasers Family. Moreover, we managed to bring on board new distributors in Europe and recently announced the appointment of a new distributor in Germany, the well-known and respected LH Medical GmbH, and a veteran distributor of cutting edge medical, dental and aesthetic products. We spend a lot of time and effort in selecting our distributors because they are the ones who are most in contact with our users and we can say that we are quite fortunate to be able to work with very strong, ethical and highly reputable partners such as LH Medical GmbH in all of the other countries where we are currently selling our products.

The reaction and feedback we are receiving from LiteTouch owners who have already started to work with the new model are excellent. Our users acknowledge that the look & feel of the machine is similar and they are happy with the new features that were incorporated into this new model. The new and modern design is slightly bigger, however, our users who operate at more than one location continue to enjoy the portability of LiteTouch and carry their unit from one clinic to another across different locations.

_How can the new LiteTouch help dentists today?

In the category of hard and soft tissue lasers, LiteTouch is the world's first versatile and only non-fiber Erbium:YAG dental laser. Our system allows dentists to focus on their performance of the clinical treatment and on their patients, rather than be constantly concerned about causing damage to the laser fibre. Thus, dentists can quickly and easily integrate LiteTouch into their daily routines and enjoy the complete expression of their dental mastery.



The new Laser-in-the-Handpiece technology imitates the performance of the turbine drill while integrating all the advantages of a laser. The energy of the Erbium:YAG laser is rapidly and massively absorbed by the water in the tissues, offering thereby great cutting power and precise incisions of both hard tissue and bone. Thanks to LiteTouch, dentists can obtain improved clinical results and can gain lots of time. Their patients benefit from an overall improved experience and reduced healing time. Moreover, the compact and friendly shape of LiteTouch naturally fits into any dental office without intimidating the patients.

Elsewhere, extensive research conducted over a period of three years by leading professors from Europe and Asia concluded that LiteTouch owners enjoy an over 27 per cent increase in their annual revenue shortly after their initial training course. In addition to the technological advantages of LiteTouch, these financial results are contributing to the constant increase in sales per territory.

_What are the prospects of laser technology in general?

It is clear that the dental industry has started advocating lasers, as an increasing number of scholars have been involved in research activities that prove the efficacy of lasers in a wide range of dental procedures. Furthermore, a growing number of universities have already adopted special laser education programs in their curriculums, thus sending a clear message that lasers are the future. More solid proof of this has recently emerged as we learned that the organisers of the most influential event in dentistry, the bi-annual International Dental Show, will be featuring dental laser technology as its major theme during its next meeting in 2013.

I believe that the future is already here. More and more researchers and scholars are becoming enthusiastic about laser technology, because of its proven physical and clinical advantages. Until recently, the main market entry barrier was the lack of knowledge and the exiguous research in this field. We have largely contributed to help overcome these shortcomings and are expecting the market to remain quite dynamic. By feeding back the clinical information gained from doctors to distributors, following various educational programmes, we can pursue the technological development that addresses the clinical needs of dentists, in particular with regard to shorter healing time and greater benefits for patients, enjoy an overall improved experience each time they go see a dentist.

I can tell you that it is exciting to take a central role in the laser revolution and to see my vision brought to life. We are at the dawn of a new era in dentistry thanks to lasers. Syneron Dental Lasers is committed to paving the way for greater access to this technology. Our Erbium:YAG LiteTouch laser has opened the doors to new dental treatment possibilities, significant time and cost savings for a large majority of everyday procedures for which patient comfort is significantly enhanced. Our mission now is to share this knowledge around the world so that dentists may fully enjoy the free expression of their mastery while more and more patients experience better dentistry with laser treatments and finally eliminate their fears of going to see the dentist._

_contact

laser

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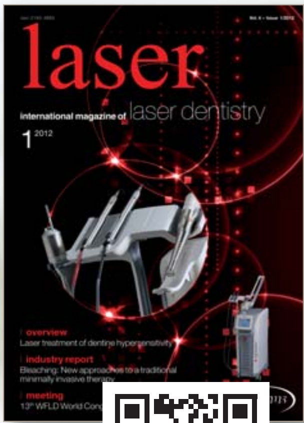
The editors of laser would like to thank all authors for dedicating their time and efforts to this year's issues.



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- Dr Andreas Braun, Germany
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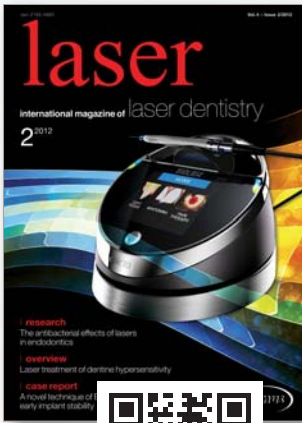
- Prof Dr Gerd Volland, Germany
- Dr Ning Wu, China



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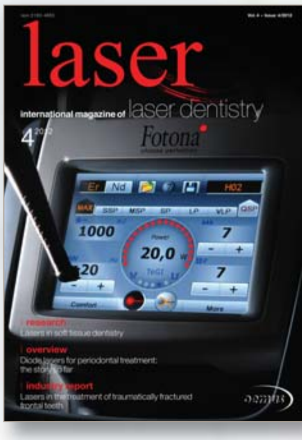

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- Prof Dr Giovanni Olivi, USA
- Dr Vrinda Rattan, India

oemus

become an author
for "laser"

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NEWS

Contact allergies owing to gloves

A growing problem in dentistry

In recent years, researchers have noted a significant increase in contact allergies to rubber additives among health care professionals. Although the cause of this cannot be stated with certainty, experts believe that nitrile gloves, which are most commonly used in dental care today, have contributed significantly.

[PICTURE: ©KARAMYSH]

According to Michiel Paping, director of Budev, a Dutch research and development company focused on natural rubber latex allergens, type I allergic reactions, which are immediate reactions to allergens in a product, are very rare nowadays owing to improved quality standards and production processes. Type IV reactions, however, are delayed reactions to the chemicals used in the production process and are more common and can arise in response to nitrile or vinyl. "In fact, I think that synthetic rubbers cause more contact allergies than natural rubber latex," he told *Dental Tribune Netherlands*.

Alongside the growing number of contact allergies in recent years that are likely caused by added chemicals or antimicrobial agents, Paping and his team have observed an increase in allergic reactions in daily practice. "Recently, we have seen that the professional body is becoming alarmed. Despite this, I am concerned that the average dentist is not aware of this matter," he said.

Source: DTI

Smiling may

Reduce stress and help heart health

Scientists have found that different types of smiling positively affect an individual's ability to recover from episodes of stress. They investigated whether manipulation of facial expressions would influence cardiovascular and affective responses to stress and found that study participants who were instructed to smile had lower heart-rate levels after recovery from stressful activities than participants who adopted neutral facial expressions, even if participants were not aware of their smile.

[PICTURE: ©SERRNOVIK]

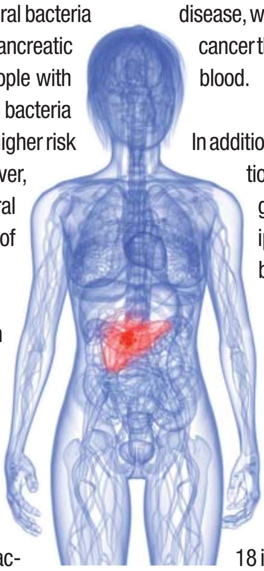
The study was conducted by researchers at the University of Kansas with 170 healthy participants between 18 and 25 (66 per cent female and 44 per cent male. Throughout the experiment, the researchers measured heart rate and self-reported stress level and found that the smiling groups showed lower heart-rate levels during recovery from the tasks, compared with participants in the neutral group. In order to determine whether benefits are also present when awareness of facial expression is absent, half of the group members in each smiling group were not explicitly told to smile but also held the chopsticks in a manner that forced them to. The researchers observed that they too reported positive effects compared with those with neutral expressions although they were not aware of their smiles.

"These findings show that smiling during brief stressors can help to reduce the intensity of the body's stress response, regardless of whether the person actually feels happy," the researchers concluded. The study will be published in the forthcoming issue of the *Psychological Science* journal.

Periodontitis might increase

Pancreatic cancer risk

New research from the US strengthens the suggestion that there is a mechanism linking the oral bacteria that cause periodontal disease and pancreatic cancer. Scientists have found that people with high levels of antibodies to pathogenic bacteria found in the oral cavity have a twofold higher risk of developing pancreatic cancer. However, high levels of another but harmless oral bacterium may indicate a reduced risk of developing the disease.



[PICTURE: ©SEBASTIAN KAULITZKI]

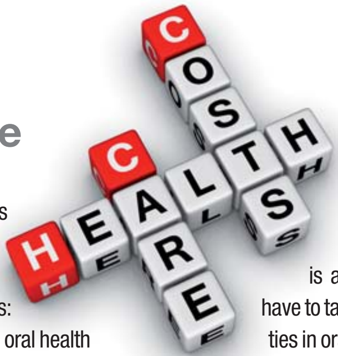
For the study, researchers from Brown University measured antibodies to 25 pathogenic and commensal oral bacteria in blood samples from 405 patients with pancreatic cancer and 416 controls and found that participants exhibiting high levels of antibodies against *Porphyromonas gingivalis*, a bacterium that is implicated in some forms of periodontal disease, were twice as likely to develop pancreatic cancer than participants with lower levels in their blood.

In addition, the researchers explored the association of pancreatic cancer with nonpathogenic oral bacteria and found that participants with overall higher levels of antibodies had a 45 per cent lower risk of pancreatic cancer than participants with overall lower levels of these antibodies. They thus speculate that this may indicate an innate highly active immune response that is protective against cancer.

The study was published online on Sept. 18 in the *Gut* journal ahead of print.

New study reveals

Oral health's growing price tag for Europe



[PICTURE: ©ALMAGAMI]

Treatment costs for oral and dental conditions across Europe often exceed those of other major diseases, including cancer, heart disease, stroke, and dementia, according to a pan-European study released in September 2012. The State of Oral Health in Europe Report estimates current spending in dental treatment in the EU 27 to be close to €79 billion per year, a figure set to reach €93 billion by the year 2020 if adequate action is not taken now. The report reveals that oral health-related costs are still on the rise despite the fact that caries and their complications are highly preventable through a healthy, balanced diet and routine oral hygiene practices.

The study was commissioned by the Platform for Better Oral Health in Europe, a forum that brings together European organisations that work towards the promotion of oral health and the prevention of oral diseases in Europe. The report analysed data from 12 European countries (Austria, Cyprus, Denmark, France, Germany, Ireland, Italy, Lithuania, Poland, Romania, Spain and the United Kingdom). The report shows that–despite significant achievements in the prevention of cavities in Europe – much remains to be done in areas such as: promoting oral health awareness, tackling oral health inequalities and addressing common risk factors. Further indispensable tools in the fight for better oral health in Europe include the development of high quality, comparable oral health data and better cost-effectiveness studies to assess the impact of prevention initiatives.

On the basis of the report findings, the Platform has developed a series of recommendations and calls on policymakers.

Presenting the results of the study at the first European Oral Health Summit, held 5 September, 2012, at the European Parliament in Brussels, Member of the European Parliament Ms. Karin Kadenbach said, "In a time of austerity measures and growing pressure on health-care budgets, this report is a timely reminder that we have to tackle the persisting disparities in oral health across and within EU countries, with regards to socioeconomic status, age, gender, or indeed general health status."

Speaking at the Summit, Professor Kenneth Eaton, Chairman of the Platform for Better Oral Health in Europe, called for more policy attention and action on the topic of oral health. "At the EU level, there is currently a lack of understanding about the integral role oral health plays in overall health and well-being," he said. "On behalf of the Platform for Better Oral Health in Europe, I hope and believe we finally have the adequate tools and procedures in place to work effectively together and foster policy decisions which will benefit the oral health of everyone in Europe in the years to come."

Source: www.oralhealthplatform.eu

Minimally Invasive Surgery

Boosts Outpatient Procedures

More and more surgical procedures are being performed globally every year, driving the demand for new and improved surgical equipment, states a new report by healthcare experts GBI Research. The new report Surgical Equipment Market to 2018—Increased Access to Ambulatory Surgical Centers to Drive Outpatient Surgery Volumes shows that this increase in surgical procedures is due to improving healthcare infrastructure in emerging countries, increasing cases of lifestyle diseases and technological innovations boosting the possible workload of surgeons.

According to the Centre for Disease Control (CDC), approximately 48 million surgical procedures are performed in the US each year, while emerging countries such as India and China hold huge future potential for surgery due to increased healthcare expenditure and huge patient populations. The spread of westernised living standards has led to a worldwide increase in diseases such as obesity, lung cancer, cardiovascular diseases and kidney disorders, expanding the patient population eligible for surgery.

[PICTURE: ©VALERIY VELIKOV]

Accessibility, affordability and patient comfort are also driving up the demand for outpatient procedures. Outpatient surgery is found to be more cost-effective than inpatient surgeries, as they eliminate hospitalization costs, minimize the time spent in the operating theatre, and cut costs for staffing and travel. The increasing volume of surgical procedures being carried out is resulting in a growing demand for surgical equipment such as surgical sutures, electrosurgical devices and hand instruments. The global market for surgical equipment is therefore forecast to exceed $7 billion by 2018, following growth at a Compound Annual Growth Rate (CAGR) of 4.2% during 2011–2018.

Benefits of tooth scaling

Questioned by German organisation

[PICTURE: ©NOBEASTSOFIERCE]

After researching a number of current studies on the procedure, scientists have found that tooth scaling does not offer any proven medical benefits to patients. The investigators of IGeL-Monitor, a website launched earlier this year to monitor individual health services (i.e. those paid for privately) within the German health system, evaluated current scientific studies of adults without periodontitis with regard to the medical benefits of tooth scaling. They said that they found no significant evidence that professional tooth scaling affects oral health positively, as study participants who had undergone tooth scaling in addition to their daily dental care and regular check-ups did not have an improved oral health status. Moreover, possible damage caused by the procedure was only inadequately covered by the studies, they said.

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