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Summertime in Brussels is WFLD-ED laser time

Prof. Dr Norbert Gutknecht
Editor-in-Chief

Dear readers of laser international magazine of laser dentistry,

A very special event is rising on the laser horizon. Laser users, laser specialists and laser researchers from all over Europe are invited to participate in the 4th European Division Congress of the World Federation for Lasers in Dentistry (WFLD).

Coincidently, Brussels is not only the capital of the European Union, but it will also be the hosting city of the conference of the European Division (ED) of WFLD from July 11 to 12, 2013. Although this event has been announced as a European conference, participants from other parts of the world are expected as well.

Aside from the official WFLD ED Congress, the award ceremony of the European Master Certificates (EMDOLA) will be celebrated during this congress.

I think that a lot of "stimulated emission" will therefore be found under the Atomium, one of Brussels iconic landmarks, during this event.

On behalf of laser international magazine of laser dentistry, I wish the organising chairman Prof. Nammour, his team, and all participants an exciting congress time in Brussels.

Yours sincerely,

Prof. Dr Norbert Gutknecht


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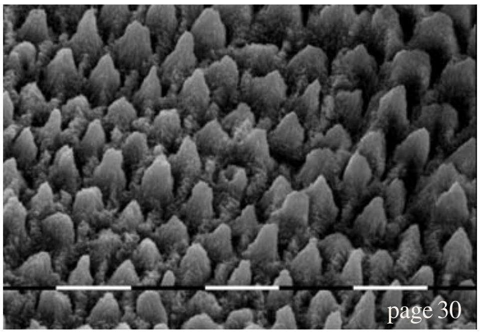
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Nd:YAG lasers in intraoral welding

Author_Prof. Dr Carlo Fornaini, Italy

_Introduction

Laser welding was introduced in jewellery in the 1970s and later successfully used also by dental technicians.[1] The wavelengths that were used firstly were CO_2 and Nd:YAG, but, finally, the market was rapidly conquered by the latter because of the results that were obtained.[2] Laser welding, in fact, gives a great number of advantages in contrast to traditional welding.

First of all, the laser device saves time in the commercial laboratory because all welding is done directly on the master cast. Inaccuracies in assembly caused by transfers from the master cast and investments are reduced.[3] Furthermore, the heat source is a concentrated light beam of high power, which can minimise distortion problems on the prosthetic pieces.[4] Interesting is its possibility to weld very closely to acrylic resin or ceramic parts with no physical (cracking) or colour damage.[5] This results in saving both time and money during the restoration of broken prosthetics or orthodontic appliances because remaking to the not-metallic portions is not necessary.

Fig. 1

This welding technique may be used on every kind of metal, but its property to be very active on titanium makes it specifically qualified for prosthetics over endosseous implants.[6] Many laboratory tests demonstrated that laser welding joints have a high reproducible strength for all metals consistent with that of the substrate alloy.[7] All these advantages resulted in this procedure causing a great unrest in the technicians' laboratories and stimulated the companies to put more and more upgraded appliances on the market.

Some aspects, such as its extensive dimensions, high costs and high costs and fixed-lenses delivery system today still characterise these machines, which strictly limit their use only to technician laboratories.

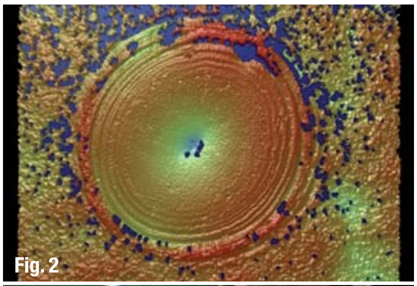

Fig. 2

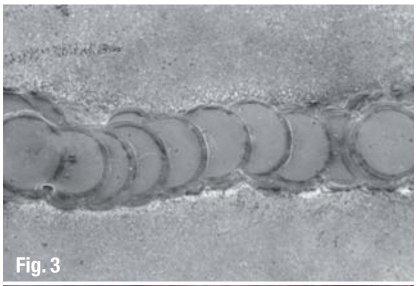

Fig. 3

Fig. 4

Fig. 5

The first aim of this study was to evaluate the possibility to utilise the same device normally used in dental office for laser welding. The second aim was to achieve welding directly in the mouth by employing a fibre-delivered laser after an accurate evaluation of the biological compatibility of the procedure.[8]

_Material and methods

The first step of our research was to determine the wavelength most appropriate for our work among those normally used by the dentist and those applied for welding in the industrial field (CO_2—10,600 nm, Diode laser—810 nm, and Nd:YAG—1,064 nm). We made some tests on metallic plaques for each wave-



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length and we saw that the one able to weld was the Nd:YAG.

While the pulse durations of the dental CO_2 laser are too short and cannot give the thermal elevation necessary to obtain a fusion of metal, the output power of the dental diode laser is too low (from 5 to 10 Watts) and cannot give the energy necessary to support a real welding process. Therefore, we decided to use the appliance FIDELIS PLUS III (FOTONA, Slovenia, Fig. 1) which combines two different wavelengths, Er:YAG (λ = 2,940 nm) and Nd:YAG (λ = 1,064 nm).

The first wavelength allows the dentist to treat hard tissues (enamel, dentin and bone) by a mechanism which causes the explosion of intracellular water molecules by utilizing the affinity of this laser with water and hydroxyapatite, thus resulting in the ablation of the tissues.[9] The Nd:YAG laser allows the dentist to perform surgery with complete haemostasis, utilising the affinity of this wavelength with haemoglobin, therefore avoiding sutures.[10] It is also employed for the periodontal pockets and root canal decontamination, for bleaching and to treat dentinal hypersensitivity.[11]

The peculiarity of FIDELIS PLUS III is given by the possibility to have pulse durations in milliseconds (15 and 25), in addition to a pulse duration in seconds, which is necessary during dental interventions. These high pulse durations can be utilised in phlebology, in the treatment of inestethisms of vascular origin, thanks to the affinity of this wavelength for haemoglobin.[12] The optic fiber delivery system is a very important advantage of this device with regard to intraoral welding, because it is very flexible and ergonomic and therefore able to penetrate into the oral cavity.


Fig. 6


Fig. 7


Fig. 8


Fig. 9

We decided to use a fiber of 900 µm in diameter, normally used for bleaching and biostimulation. Initially, a handpiece with a 2 mm spot (Fotona R 30), normally used in dermatology, was chosen and, by reducing the working distance, a spot of 1 mm was obtained. We asked the manufacturer to construct an experimental hand piece capable of generating a 0.6 mm spot. The aim was to increase fluence (J/cm^2), which is the most important parameter determining the quantity of energy delivered to a surface, by a factor of 10, while also utilising the device's maximum energy output (9.90 J).

_"*In vitro*" tests

The first *in vitro* test was conducted by irradiating CrCoMo plates with various combinations of welding parameters. The spot's configuration was analysed by an interferometric technique. Interferometry is a non-contact, optical technique for measuring surface height and shape with great speed and accuracy. Interferometry makes it possible to precisely measure the shape and size of the laser's crater in the metal surface in three dimensions, and allowed us to choose laser parameters that welded well, but minimised collateral damage to the surrounding area (Fig. 2). In these preliminary tests, the best parameters found were: output power = 9.90 W, frequency = 1 Hz, pulse duration= 15 ms, working distance = 30 mm, energy = 9.90 J, fluence = 3,300 J/cm^2.

The subsequent tests were performed on CrCoMo plates and steel orthodontic wires to compare the welding by dental laser (Fidelis, Fotona) to this obtained by the use of a device normally utilised in dental laboratories (Rofin, Germany).[14] In addition, metal fillers were used. Different techniques (Fig. 3) were employed to analyse the results: SEM (Scanning Electron Microscope), EDS (Energy Dispersive Spectroscopy) and DMA (Dynamic Mechanical Analysis). The results of the two sample groups were similar with regard to microstructure, elemental distribution on the welding fillets, strength off the joints and elastic modules.

In order to obtain a device able to weld every kind of metal and alloy, including titanium, we added an argon gas cylinder connected to a pipe to the appliance, spreading the gas to the laser impact beam by means of an additional pedal. The titanium samples welded under this shielding atmosphere did not show any trace of oxidation.

_"*Ex vivo*" tests

In order to define the thermal increase in the biological structures close to the zones which are thermally affected by the welding process (sulcus, pulp chamber, bone and root), an *ex vivo* study was performed.[15,16]

Two fresh calf jaws were kept at room temperature and holes were made in the disto-labial area in six molars of each jaw by micro motor drill. Then, four k-type thermocouples were connected to each tooth and fixed with thermoplastic paste (Impression Compound Red Sticks, Kerr) in the pulp chamber, sulcus, bone and root.

The thermocouples were then connected to a PC-integrated four-channel thermometer (LUTRON TM-946) in order to record and save the data. Twenty-four metallic CrCoMo plaques were curved to hemispherical shape (15 mm ray) and a couple of them were placed on every previously prepared tooth. Since the first examination was performed by an IR thermal camera, limited in that it only provides the surface evaluation of the jaw, it was decided to use the four-thermocouples system which, although its application is more difficult and will take longer, allows checking the internal temperature of the structures. A rise in temperature was recorded in the pulp chamber. However, for all the twelve samples tested, the maximum temperature rise was lower than 5.5 °C, which is considered a critical value for pulp vitality.

A similar test was then performed on pork jaws by welding a titanium bar to implants previously inserted into the bone under argon gas atmosphere (Fig. 4). The values recorded by thermocouples placed closely to the implants showed a thermal elevation much lower than those considered dangerous for bone necrosis (5 to 7° = protein coagulation). After these *in vitro* and *ex vivo* experiments, it was decided to apply this technique to *in vivo* clinical situations.

_Clinical cases

Case 1

A 59-year-old male patient presented with implant-prosthetic treatment which consisted in the apposition of a fixed prosthetics placed in to the upper arch with two crowns and five endosseous implants (Fig. 5). After crown preparation and impression taking, the dental technician constructed the metallic structure of the bridge in two sections to assure its fit and, to avoid the risk of inaccuracies in the impression, it was decided to connect them by intraoral laser welding.

In order to protect the soft tissues from the ejection of warm metal splinters, we utilised the silicon mass normally used to take prosthetic impressions with a little hole corresponding to the contact of the two portions of prosthesis (Fig. 6). The entire process had a duration of seven minutes, the effective weld-


Fig. 10


Fig. 11


Fig. 12


Fig. 13

ing time was 150 seconds, the parameters used were the same as described before and it was utilised a filler metal. After removing the bridge from the mouth, it was sent to the laboratory to complete its realisation (Fig. 7). During and after the welding process, the patient said the he did not felt any discomfort. After four weeks we could seal the bridge and finish the rehabilitation of the patient (Fig. 8).

Case 2

A 14-year-old female patient, in orthodontic treatment with a fixed appliance (modified "VELTRI" distaliser) for the insertion of the first premolars into the upper arch, came to our clinics for a check and we noticed that an arm of the appliance was broken (Fig. 9). We evaluated that the removal of the appliance was full of risks, in particular the impossibility to reinsert it after the repairing due to space closure. Therefore, it was decided to laser-weld the arm intraorally. In order to protect the soft tissues from the ejection


Fig. 14


Fig. 15


Fig. 16


Fig. 17


Fig. 18

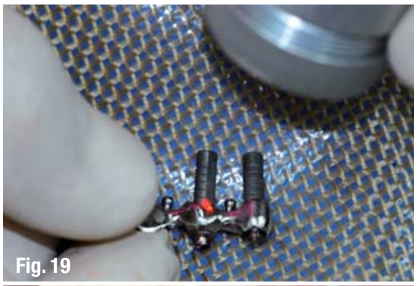
Fig. 19


Fig. 20


Fig. 21

of metal pieces during irradiation, we used a silicon sheet (Fig. 10). After repairing the arm (Fig. 11), the appliance was reactivated by turning the screw, until the space required to insert the premolar was reached (Fig. 12). During the laser welding process, which had a total duration of 2 min and a time of irradiation of 20 sec, the patient didn't feel pain or discomfort and the vitality of the teeth and the periodontal and gingival health was not damaged, even months and years later.

Case 3

A 45-year-old male patient came to our office for a fixed prosthetic rehabilitation of the lower arch. In the upper arch, he had a gold-resin fixed prosthesis which was broken in the middle, between the two central incisors (Fig. 13). Therefore, we decided to use the intraoral laser-welding technique to repair the bridge intraorally. We removed a little portion of resin by the two incisors with a bur and welded by Fidelis III with a metal apposition. In this case, the protection of soft tissues was achieved by a plastic cylinder (Fig. 14). After welding, we put a layer of composite resin to complete the restoration aesthetically (Fig. 15). During the welding process, which had a duration of seven minutes with an irradiation time of 130 seconds, the patient did not felt any discomfort. Subsequent checks, made after one month, two, six, twelve and eighteen months, evidenced no problems.

Case 4

A 67-year-old male came to our clinic for an examination. At the clinical observation, the man appeared edentulous on the upper arch where he wore removable full dentures. His problem was that the device was not stable and he had a great discomfort in speaking and eating. Due to his economic condition, it was decided to stabilise his appliance by the insertion of four implants in the maxillary bone. The medical history did not reveal any aspects of concern and the patient confirmed he did not take any kind of medication.

An impression of the upper arch was taken in order to construct a template for correctly positioning the implants. The insertion of the four implants 4.5 × 11 mm (AoN, Vicenza, Italy) was performed flapless and with the aid of the template (Fig. 16). After the surgical procedure, four abutments were screwed to the implants. Then, a bar previously constructed by the dental technician previewing the position of the implants by the maxillary arch impression was inserted in the four abutments (Fig. 17). The bar was welded intraorally by dental Nd:YAG laser in order to fix the position. The whole intraoral welding procedure had a duration of 47 sec, during which the patient confirmed he did not experience any pain or discomfort (Fig. 18).

The bar was removed from the mouth with the abutments and the welding procedure was completed extraorally with the device previously used (Fig. 19). The abutments were cut and polished, and then they were reapplied to the mouth (Fig. 20). The prosthesis was then connected to the bar with four silicon OT Cap (Rhein 83, Italy), fixed by acrylic (Fig. 21). The patient was checked after two, seven, and fifteen days, then monthly for six months. During this period, no problems were reported by the patient who has thus regained his comfort.

_Conclusion

Intraoral Laser welding (ILW), even if it is only at its beginning, is a procedure which is both promising and relevant for the restoration of a damaged prosthesis. It can be done without the risks related to prosthesis removal as well as during prosthesis construction in order to eliminate the accuracies related to the impression. The most interesting application of this technique regards the possibility to weld a bar on endosseous implants intraorally in order to immediately charge them. Further studies will find other applications for this new approach._

_contact laser

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Perfect soft tissue management in the oral use

Author_Hans J. Koort, Germany

_The use of alternating electric current for bloodless interventions in the oral soft tissues has been established for nearly a century, first in the form of the electric knife, then later in the form of radio frequency devices. Laser devices have been introduced in the 1980s as new, additional tools and have become significantly more important until today.

Both of the two technologies are based on the local, rapid heating of the cells in the tissue, and they can be used for cutting and for coagulating.

With the introduction of the laser, however, an almost antagonistic "argy-bargy" was common in marketing. For decades, the manufacturers of lasers and radio frequency devices argued about who can provide the better method for oral soft tissue treatment: "Laser is better than radio frequency"—"Radio frequency is better than laser"—"But with laser you get better results if the power is high enough"—"But if the power is too high, a laser is hardly to control"—"But with special pulse techniques, the thermal damage can be controlled"—"The cutting speed with a laser is already limited, it is much slower than radio frequency. And with pulse technique, it will then slow down again".

Fig. 1_The combination of a diode laser and radio frequency technology offers a wide range of applications.

	Laser	High Frequency	L + HF
Oral surgery	🟡	🟢	🟢
Periodontics	🟢	🟡	🟢
Implantology	🟢	🟡	🟢
Endodontics	🟢	🔴	🟢
Bleaching	🟢	🔴	🟢
PDT	🟢	🔴	🟢
LLLT	🟢	🔴	🟢

However, combining a diode laser with a modern radio frequency generator will make competition obsolete, but you will then have a useful and perfect tool for the soft tissue management. With a laser, the relatively thin and complicated oral tissue can be treated selectively and shows successful results in periodontics, endodontics and implant surgery. The radio frequency technology, on the other hand, simply because of the much higher cutting speed and perfect coagulation, brings about benefits for oral surgery. Photodynamic therapy (PDT), low level laser therapy (LLLT) and the use of the laser for tooth bleaching open additional new treatment options (Fig. 1).

_Why is this approach so promising?

Lasers have been and still are often understood and advertised as general purpose devices. However, there are many applications that cannot be carried out satisfactorily with these devices. Of the many lasers that have been "tried out" in the oral soft tissues for decades, such as the CO_2 laser, the Nd:YAG laser and diode lasers, essentially only the latter can prevail in the market because of their broad spectrum of treatment and their relatively inexpensive equipment designs.

Its strength lies in its applications in periodontics, endodontics and the removal of the superficial soft tissues such as overgrown implants.

A significant disadvantage, however, can be observed in surgical applications. The oral tissue is very thin, delicate and has complicated structures. In addition, it is often in close proximity to jaw bone and tooth structure. While laser radiation is absorbed in the tissue and converted into heat, it will also be partly transmitted through the tissue. It can thus cause unpredictable and undesired side effects in adjacent healthy areas. The cutting speed of the laser beam is limited by the fact that the tissue can be removed only in layers. Neither increasing the laser power nor using laser pulses can eliminate this problem.

However, in radio frequency technology, the tissue will be heated and cut simultaneously, homogeneously and rapidly in the entire length of the inserted metal electrode. Damages to adjacent healthy areas are unlikely and if they do occur, they are predictable and can be planned.

The relatively low frequencies (200 to 400 kHz) in high frequency devices used in human medicine usually generate distinct thermal necrosis with extended healing times, increased swelling and tissue retractions as sequelae. They have been used in dentistry for many years, but they have been replaced by modern radio frequency technologies with working frequencies of 2 to 4 MHz.

_Which are the similarities between diode laser and the radio frequency and what makes them different?

Similarities

Both the laser light from the diode unit as well as the electric current from the radio frequency device are transformed in the tissue to heat. The cells in the tissue will be heated in a fraction of a second, this results in a cut or in a coagulation. While in the laser the power is passed through an optical fiber to the site and the light energy emitts from the fiber tip, in the radio frequency the high-frequency current is directed through a metal electrode into the tissue.

The main difference

A laser fiber a priori can not be inserted deeply into the tissue to produce a cut. The laser radiation emitts from the front end of a fiber and heats only the uppermost layer of the tissue and ablates it. To get into the depth therefore, the tissue must be removed layer by layer (Fig. 2).

In contrast, the metal electrode at the high frequency can be introduced into the tissue in a desired depth. The RF field heats the area simultaneously and uniformly to the entire physical length (Fig. 3). The cutting speed of the RF electrode therefore is much faster than with a diode laser. Also, in the intraoral use of radio frequency technology it is very positively accepted that the local increase in temperature is less than 60 to 80 °C. Using a laser or an electric knife, however, a temperature increase of more than 400 °C must be considered.

In a leukoplakic, exophytic growing alteration at the left border of the tongue, the histology after the use of radio frequency at 2.2 MHz shows just little thermal damage in the striated muscle (Fig. 4). The thermal reaction layer in the stroma is minimal, vacuoles are invisible.

Figure 5 shows a histological comparison of the thermal reaction zone in an excidate, which was removed using a 980 nm laser. Recognisable is the much wider and partially merged reaction zone as a result of the significant thermal effect.

_The situation in dentistry

The estimated more than 20 providers of diode lasers use mostly marketing arguments such as laser wavelength, performance and the possibility of using pulses. A jour, wavelengths of 810 nm and 980 nm are advertised, although there are only very small differences. Thus, for example, 980 nm shows a higher absorbance in water, which promises a better coupling to aqueous environments and thus a better cutting behaviour. The laser of 810 nm shows

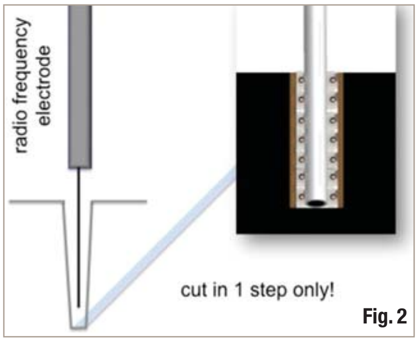

Fig. 2

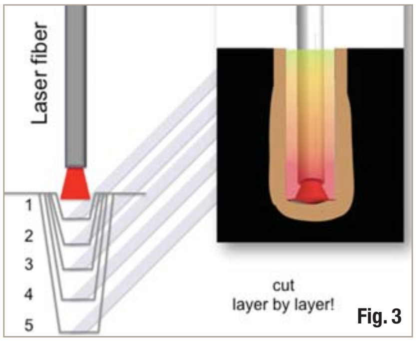

Fig. 3

Fig. 2_Cutting in tissue with a diode laser. The tissue cut is removed layer-by-layer. The deeper the cut, the greater is the heat damage at the base of the lesion. The emitted laser radiation also heats the fiber end, thus the tissue is exposed to additional stress.

Fig. 3_Cutting of tissue with radio frequency: The tissue is removed by only one precise, uniform section in the entire length of the inserted electrode. The metal electrode remains cold at 2.2 MHz.

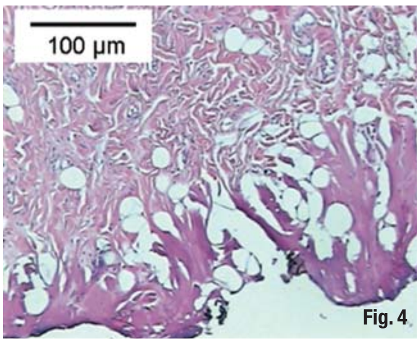

Fig. 4

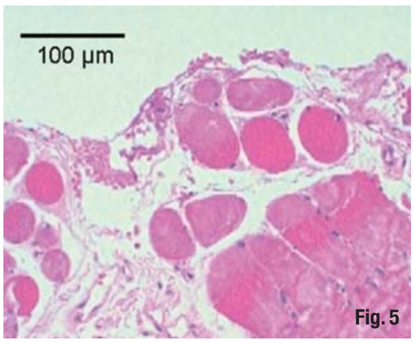

Fig. 5

Fig. 4_Histology of tongue specimen, radio frequency (2.2 MHz).

Fig. 5_Histology of tongue specimen, diode laser (980 nm).

Fig. 6_LaserHF – Combination of diode laser and radio frequency.

a lower water absorption and a higher absorption haemoglobin, which promises a good coagulation. The differences, however, are actually rather low. And there is a historical explanation: Laser diodes with 810 nm were introduced to the market long before laser diodes with 980 nm. In addition, 980 nm laser diodes are now mainly used for many industrial applications.

High laser power and shorter pulse durations are propagated by the providers. The pulsed application, in fact, has advantages, especially if very short pulses of a few µs are used. The thermal influence is significantly lower. However, it also means that the already low working speed is further reduced. Moreover, with any increase of laser power, the risk of damage to adjacent healthy tissue may become greater than the desired therapeutic effect.

The advantage of the laser, however, can be seen particularly in superficial applications, for example for killing of bacteria in periodontic and endodontic applications, to expose overgrown implants or for trimming the gingiva. The use of photodynamic therapy, in laser therapy (soft laser) and tooth bleaching, are additional and can be attained only with lasers. In oral surgical applications, such as the removal of fibroma and haemangioma and performing frenectomy and in larger invasive applications, the radio frequency provides clear advantages because of a faster and more precise interaction.

Using very thin, flexible electrodes made of special metal alloys, the electro-magnetic waves are passed into the tissue. This approach allows fast, precise, pressure-free and nearly athermal cutting. In addition, bleeding is controlled effectively by the adjustable coagulation.

Compared to laser, radio frequency provides—because of the rigid metal electrodes, which are available in various forms for specific indications—a better tactile feeling than does glass fiber. This results from the predetermined length of the electrode as well an exact depth of penetration. The high speed is advantageous for larger and deeper cuts.

Requests for higher laser output power or for constructing appropriate pulse technology will affect the price of the devices, which will become more expensive. Additional costs of the supplies, especially the often in surgical operations at high power damaged glass fibers must be considered as a considerable part.

For hygienic points of view and also taking into account the necessary quality assurance system in a dental practice, the consideration is to use sterile fiber tips instead of repeatedly preparing laser fibres.

The radio frequency technology, however, can be realized relatively inexpensively in the device design. Compared to optical fibres, the metal electrodes can be prepared relatively simply and sterilised many times.

Figure 6 shows the combination device LaserHF (Hager & Werken, Germany). It consists of a 975 nm laser with a power of 6 W, combined with a 2.2 MHz radio frequency generator with a power of 50 W and with a 660 nm laser with a power of 100 mW as a therapy supplement for photodynamic and low level laser therapy.

_Conclusion

With regard to its potential applications, the combination of a diode laser with a radio frequency device meets the desire for a perfect system for complete soft tissue management._

_contact laser

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Post-cure irradiation of pit and fissure sealant by diode laser

Part II

Authors_Nermin M.Yussif, MSc, Ali M. Saafan & Samah S. Mehani, Egypt

_Introduction

Due to its peculiar anatomical shape, the occlusal surface is highly susceptible to carious lesions.[1] Several methods of prevention have been tried to reduce its prevalence.[2] A widely used technique affecting the caries incidence is fissure sealing[3], in which the fissure systems are sealed with a material. This material is retained on the enamel surface either by the acid etch technique (resin sealants) or through chemical bonding (GIC sealants).[4] The preventive benefits of such treatment rely directly upon the sealant's ability to thoroughly fill pits, fissures, and/or anatomical defects, as well as to remain completely intact and bonded to enamel surfaces without marginal micro leakage at the resin-tooth interface and consequent development of a carious process underneath the sealant material.[5,6]

The majority of resin materials utilised in restorative dentistry today consists of a methacrylated resin matrix (i.e. usually a blend of several resins) that is mixed with various glass filler particles. Bis-GMA continues to be the most used monomer for manufacturing present day composites; whether alone or in conjunction with other resin matrices. As a general rule, the lower the mean molecular weight of the monomer or monomer combination, the greater the percentage of shrinkage. Because Bis-GMA is highly viscous, in order to facilitate the manufacturing process and clinical handling it is diluted with less viscous monomers (low molecular weight) which are considered viscosity controllers, such as ethylene glycol dimethacrylate (EGDMA), triethylene glycol dimethacrylate (TEGDMA), or urethane dimethacrylate (UDMA).[7,8]

The chemical composition affects mainly the material behaviour during exposure to different oral conditions such as temperature, pH, stress, pressure, and humidity. The total amount of shrinkage, the rate of shrinkage, and the elastic modulus (i.e., stiffness) of the composite are just some of the factors that influence the degree of stress and strain (i.e., deformation) induced at the adhesive interface during composite polymerisation which result in shrinkage.[9] Shrinkage depends solely on the organic matrix and on the number of reactions that take place. It rises with the degree of conversion and falls with increasing monomer molecular weight.[10]

The filler particles are added to the organic phase to improve the physical and mechanical properties of the organic matrix, so incorporating a percentage of the filler as high as possible is a fundamental aim. The filler reduces the thermal expansion coefficient and overall curing shrinkage, provides radio-opacity, improves handling and improves the aesthetic results.[11] Improving the fluidity of composite resins is an important issue, so there are various options: lowering the viscosity of the monomeric component[12], adjusting the filler components, or improving the surface treatment of the filler.[13] The findings of clinical trials indicate that unfilled sealant performs better than filled sealants. In some cases, the manufacturers have added fillers to resin sealants

Table 1_Grouping.

Groups	Group 1 control	Group 2	Group 3	Group 4
Treatment	Artificial caries	Laser+ artificial caries	Fissure sealant +artificial caries	Fissure sealant +diode laser +artificial caries

as fluoride. In general, variation in the filler content heavily affects thermal expansion, thermal conductivity, polymerisation shrinkage, and mechanical strength of the sealant material.[14] Decreasing the filler loading eventually weakens the physical properties of resins, such as microhardness and wear resistance.[15]

Nowadays, the vast majorities of resin-based materials cure or polymerise by initiating free radical generation with a visible light curing device.[16] The manufacturers tried to develop light sources that will give the greatest conversion with the least curing stress, as this helps to improve the functional and aesthetic results of composite materials. Four types of polymerisation sources have been developed and applied: quartz tungsten halogen (QTH) lamps, light emitting diodes (LED) units, plasma-arc lamps and argon-ion lasers.[17]

LED's use a combination of two different doped semiconductors instead of a hot filament.[17] The spectral output of blue LED conveniently falls within the absorption spectrum of camphoroquinone.[18] Therefore, they do not require filters to produce blue light and they convert electricity into light more efficiently.[19] They produce less heat so no cooling fan is required and they can be smaller and cordless.[20]

The depth of cure is dependent on different cofactors such as filler particle size and distribution, colour and optical translucency of the composite, and refractive index ratio of the single components being used.[21, 22] Curing light is absorbed and scattered by composite resins, resulting in higher light intensity at the top than the bottom surface.[23] For this reason, Bayindir and Yildiz found significantly different top and bottom surface hardness values, whereby those of the top surface were consistently higher than those of the bottom surface.[24]

Full polymerisation of the material is determined by the degree of conversion of monomers into polymers, indicating the number of methacrylated groups that have reacted with each other during the conversion process.[25] The application of heat, as an additional polymerisation method, increases the conversion rate of monomers, reflecting in improvement of surface hardness, compressive, modulus of elasticity and flexural strength. Composites submitted to heat might present internal stress relief, especially at the interface between organic matrix and inorganic particles.

This would increase the adhesion between both of the two phases and the cross linking between the methacrylate groups.[26] In the past, the most commonly used method as a secondary treatment is heating in a furnace as a means to improve the degree of conversion.[27] The used ovens and stoves must have temperatures ranging from 60 to 170 °C, and a heating time varying from seven minutes to one hour.[28]

Also, laser was used as an additional curing method to potentiate the material properties as CO_2 laser as its effect mainly consists of heat action.[29] Diode lasers are in the category of devices that emit light from semiconductor materials.[30] They are portable, compact surgical units with efficient reliable benefits. Diode lasers have a wavelength between 805 and 980 nm. They can be used in the continuous as well as pulsed mode.[31]

The current study was conducted as a morphological and microhardness evaluation of the effect of the post curing application of diode laser (980 nm) on specific fissure sealing material in caries prevention.

_Materials and method

Sample preparation

Forty extracted caries-free permanent molars (wisdoms) and premolars were used in the current study. Extraction had been done for orthodontics treatment. Selected teeth were cut into two halves bucco-lingually with a low speed diamond disc, which were divided into groups (Tab. 1).

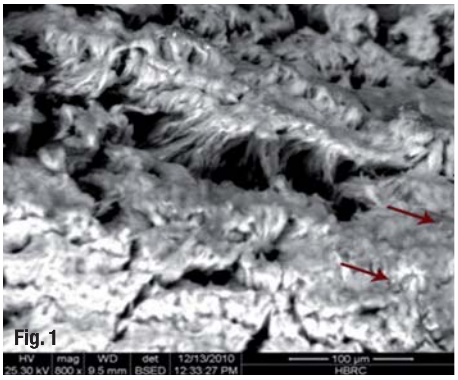
_Surface treatment

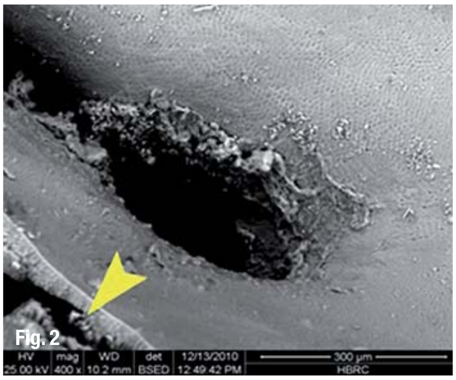
Artificial caries

The specimens of all groups were individually submitted to the process of the caries induction using artificial caries media (6 % hydroxyethyl cellulose to a 50 m mole lactic acid solution) of 4.5 pH for seven days.[32] The specimens were then washed and kept in distilled water.

Laser irradiation

In groups 2 (sound enamel) and 4 (fissure sealing material), occlusal depressions of the experimental





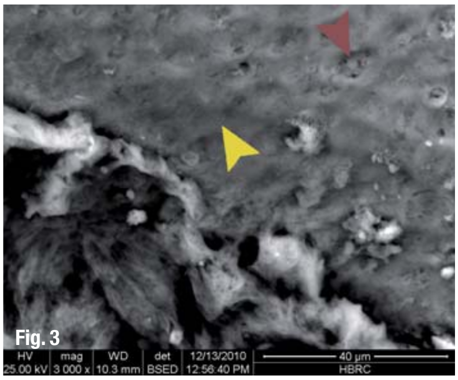


Fig. 1_ESEM image of group 1 showed carious enamel surface with aggregated granules (red arrows) (BSED) x800.
Fig. 2_ESEM image of group 2 shows pitted surface and destructed unlased part (arrowhead) x400.
Fig. 3_ESEM image of group 2 showed the nearby enamel with typical keyhole appearance (arrowheads) (BSED) x3,000.

samples were irradiated using diode laser irradiation of 980 nm wave length, 2 W power for 15 sec, in contact mode (Quanta system, Italy) and optic fiber transmission system. The fiber tip was positioned perpendicularly to the occlusal pit and fissure areas. Laser irradiation was performed by hand, screening the enamel surface in a uniform motion.[33]

Sealant material

Groups 3 and 4 were treated with Clinpro pit and fissure sealing material, unfilled and fluoride releasing type (3M ESPE, USA).

Curing process

A DEMI LED was used to photocure the resin sealant. These curing lights have a light intensity of approximately 1,100 mV/ cm^2 and emit light in the wavelength range of 450–470 nm (sds Kerr, USA). The curing time is up to 20 seconds.

Environmental scanning electron microscope analysis

The specimens were examined occlusally and proximally using an ESEM (Inspect S ESEM, FEI).

Microhardness detection

Surface hardness was measured using Vickers microhardness tester (HMV-2 Shimadzu, Columbia, US). Measurements were done proximally at the depth of the fissure and at the lateral sides of the fissure depth. Indentations were made with the long axis of the Knoop diamond perpendicular on the inner enamel surface laterally and at the depth of the fissures. Each group underwent a load of 19.61 N, applied for 20 sec in order to evaluate the variations of surface hardness eventually caused by laser treatment in comparison with unlased enamel. The hardness values were calculated automatically by a computerised machine.

Statistical analysis

The data were gathered and analysed using ANOVA (Analysis Variance) test. Statistical results were processed by SPSS software (17.0, SPSS Inc., Chicago, USA).

_Results

Environmental scanning electron microscope analysis

Disappearance of the normal architecture of the enamel structure was detected clearly. Few enamel crystalline aggregations reprecipitated on the decayed surface indicating the massive demineralisation of enamel. Rods and interrod regions in group 1 were detected at the wall of the fissure due to loss of the surface rodless enamel (Fig.1).

Contrarily, melted irregular areas of the irradiated occlusal grooves were detected in specimens of group 2 (Fig. 2). However the high pH of the artificial caries media used, preservation of the surface integrity was observed clearly in most of the examined specimens (Fig. 3).

As in group 1, loss of the enamel integrity was detected in group 3. The sealant surface revealed widely distributed voids and cracks with variable sizes (Fig. 4). Multiple aggregations of enamel crystals which reprecipitated on the sealant surface indicated a massive demineralising effect of the artificial caries media. Intimate contact between the enamel and the sealant was noticed, barring few cracks extended from the sealant to the adjacent enamel (Fig. 5). The lateral wall of that enamel exhibited atypical enamel rods and interrod regions (Fig. 6). The lateral borders of the sealant material did not show a normal separation, but erosion was observed at its border which may be due to the fluoride-releasing effect of the sealant material.

Finally, group 4 revealed intact tooth and restoration integrity related to the lased part (Figs. 7 & 8). Contrarily to group 3, where the sealant surface and enamel were destructed totally, the sealant revealed slightly irregular surface with few small voids and cracks in group 4. The bond between the sealant and the enamel seemed to be intact and revealed a neglected effect of acid on the restoration. Sporadic areas of melted sealant were clear at the interface, masking some of the enamel rod ends (Fig. 9). The lased enamel also showed intermittent melted areas which appeared as a homogenous layer that masked the enamel rod ends (Fig. 10). Destruction of the unlased part of the enamel surface was detected near the intact lased part, but there was also clear and intact smooth sealant surface free of voids and cracks. Contrarily to group 3, the difference of the sealant surface reflected the laser effect as even the inherent defects of the sealant surface can be detected easily.

Statistical analysis

Statistical analysis of the microhardness data was made using the ANOVA test in order to compare the resulted data from the examined groups. Results were presented as mean ± standard deviations and a p-value of less than 0.05 was considered as statistically significant (Tab. 2). The degree of demineralisation and the ability of each group to resist caries were reflected as changes in the microhardness measurements. The comparison of the groups showed highly significant differences ($p = 0.0001$). As a result, the Post-Hoc test and the Pairwise test were done as multiple comparisons in order to determine the most significant mean in reference to the measured control group scores. Also, comparing all the groups with reference to the artificial caries group, group 4 showed a highly significant difference ($p = 0.0001$). No significant difference was detected between group 1, group 2 and group 3. The opposite was found when comparing all groups and group 4 ($p > 0.05$) which means that the main positive effect was owing to laser only.

_Discussion

Caries is a pathologic process of external origin involving softening of the hard tissues and proceeding to the formation of a cavity.[35] Microscopically, caries begins with the integration of enamel prisms after decalcification of the interprismatic substances, events which lead to the accumulation of debris and microorganisms. When the process reaches the dentino-enamel junction, it spreads laterally and also penetrates the dentin along the dentinal tubules.[3]

Table 2_Vickers microhardness tests results.

Group	Mean ± standard deviation S.D.
1	79.250 ± 33.9894
2	191.890 ± 22.7996
3	77.360 ± 11.4723
4	1069.30 ± 486.693*

** Statistically significant value*

Unfortunately, incipient lesions in tooth pits and fissures respond less favourably to fluoride therapy than lesions isolated to smooth surfaces. Today, there is a wide choice of different sealing materials used clinically. In 1990, Jensen demonstrated that fluoride releasing sealants had a slightly higher retention rate after one year than the sealant without fluoride.[35] In this study, the 3M™ ESPE™ Clinpro fissure sealant was used (light-cured, nearly unfilled, and of low viscosity with a colour-change feature). Also, it contains a patented soluble organic fluoride source. BIS-GMA/TEGDMA resins are the main components.[36]

Clinpro fissure sealant contains only 6 % fillers which are mainly fluoride. The effect of this fluoride is clinically beneficial because it exerts a protective action on the tooth along the tooth restoration interface.[37] The fluoride is released as long as the gel layer exists. Consequently, the protective action is effective until there is the gel layer around the filler particle. The dissolution of the gel layer produces loss of the filler particle and then cavity formation[38] which strongly affects the integrity and the main structure of the restoration. In this study, ESEM micrographs of group 3 reflected the later negative effect of fluoride releasing on the material surface that showed in voids, cracks and loss of bonding at the sealant enamel interface. Massive destruction of the enamel surface and the lowest surface hardness was also detected in this group, which reflected the inability of the sealant material to provide enough protection to the sealed enamel.

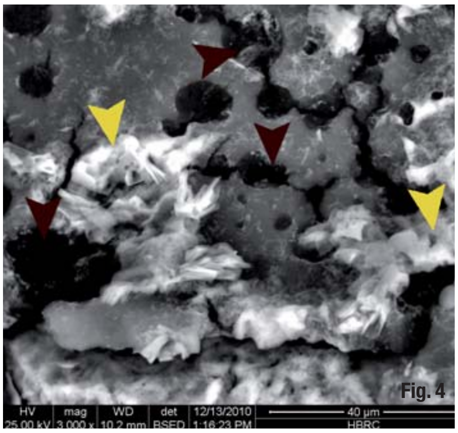


Fig. 4_ESEM image of group 3 showed multiple voids on the sealant surface (red arrows) and reprecipitated enamel crystals (yellow arrows) (BSED) x3,000.

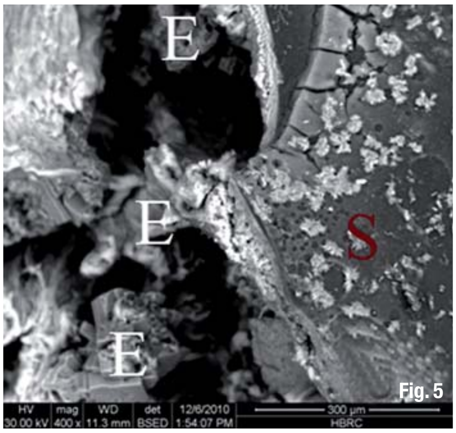


Fig. 5_ESEM image of group 3 showed destructed enamel (E) and sealant (S) (BSED) x400.

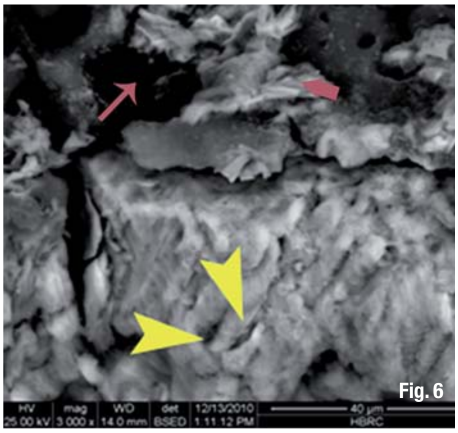
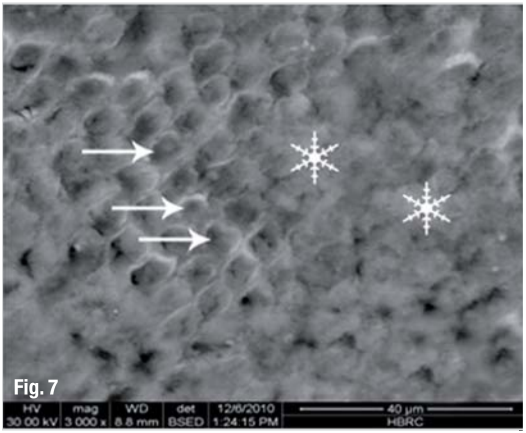


Fig. 6_ESEM image of group 3 showed atypical rods and interred region (yellow arrowheads) at the interface, voids on the sealant surface (red arrow) and reprecipitated enamel crystals (red arrow head) (BSED) x3,000.



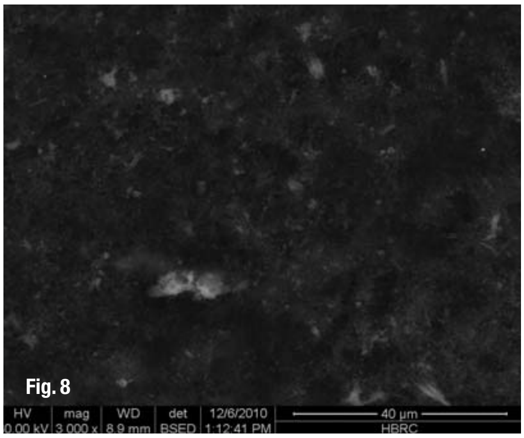


Fig. 7_ESEM image of group 4 showed the lased enamel with homogenous melted areas (asterisks) intermingled with the rod ends (arrows) (BSED) x3,000.

Fig. 8_ESEM image of group 4 showed smooth, clear sealant surface with minimal cracks or surface defects (BSED) x3,000.

The curing process is affected by the composition of cured material and curing light. LED was used in this experiment in order to achieve a very narrow range of blue light which is more likely to be absorbed by chomphorquinone (450–500 and a peak at 465 nm). As a result, there is no overheating of the restoration. In order to achieve a maximum conversion rate, some authors recommended curing at lower intensities (< 500 mW/cm^2) within extended polymerisation intervals.[39] But with LED units providing output levels consistently between 1,500 to 2,000 mW/cm^2, polymerisation time can be reduced to 20 seconds.[40]

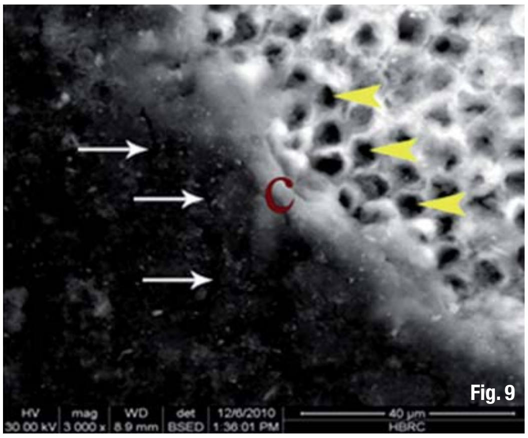
There are many factors that control the success of the sealing process, some of which depend on the tooth and the other depend on the material itself and the environment of the application. In this study, we used the traditional way of application mentioned in the sealant pamphlet. In single-paste visible light-cured materials, it has been supposed that the porosities are air introduced as the unpolymerised material is extruded through the nozzle of the syringe. The cured materials are characterised by different concentrations, dimensions and distribution of porosity. Often, dimensions and concentration of porosity decrease in light-cured materials when the unpolymerised paste is extruded through a needle. The smaller the needle's inner diameter, the more extensive is its effect. This rule, however, shows exceptions. In some cases, the extrusion through a small tip results in the decrease of large porosities and in an increase of small porosities. This is due to the fragmentation of large porosities.[41]

The small nozzle available with Clinpro™ sealant aiming to provide better introduction of the material into the fissure system caused an inherent defect in its application technique. Probably it is impossible to remove all porosities as the unpolymerised pastes contain 0.05–1.4 % porosities by volume. The stress induced by the polymerisation contraction also affects the success of the sealing process. Polymerisation contraction seems to be the cause of the cracks that were detected in group 3. Those cracks originated from both bubbles and the filler-resin interface as they are considered weak points. The filler does not shrink during the setting reaction, thus producing additional stress at the filler-matrix interface.[42]

Massive destruction of the enamel surface and the lowest surface hardness was detected as well as in group 1. This massive destruction was obvious due to the low pH of the used artificial caries media that reached 4.5. However, by using diode laser, the lased areas were not affected by this media (group 2). Also, increased microhardness levels that were detected in this group provide protection of these areas even with pH decay, especially with uncontrolled diseased patients, who are for example handicapped, have a high caries index or young permanent teeth. Patients prior to radiation therapy are also included.

According to the fissure system morphology, complete penetration of the etchant material into the fissure system is an essential step in the sealing retention. Converting the enamel surface into a hydrophilic highly reactive one, the etching process needs a highly penetrating etchant.[43] The most commonly used etchant is phosphoric acid; there have been reports on the insufficient penetration on the phosphoric acid etchant into the fissure system.[44] Also, failure to achieve a satisfactory bond for fissure sealants may be due to the lack of tag formation following etching due to the prismless structure of the fissure walls which had been demonstrated microscopically by Hoh et al.[45]

Wavelengths in the near infrared and red region of the visible spectrum are poorly absorbed by dental mineral, but they are optimally transmitted and scattered through the sound enamel. This holds true for diode lasers and Nd:YAG laser.[46,47] Laser and fluoride varnish showed 43 % inhibition of pits and fissure lesions and 80 % inhibition of smooth surface lesions compared to the untreated groups.[48]



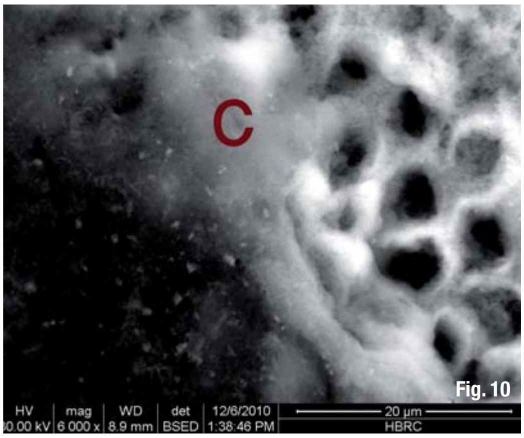


Fig. 9_ESEM image of group 4 showed few cracks on the sealant (arrows) and enamel ends (arrowheads) at the interface (C) (BSED) x3,000.

Fig. 10_Higher magnification of the previous figure showed sporadic areas of melted sealant material at the interface (C) (BSED) x6,000.

In this study, a 980 nm diode laser was used in order to assess its ability to provide partial to complete closure of the occlusal depressions as an alternative method to pit and fissure sealants.

Some reports have shown that the low power red laser can induce caries prevention and as it does not promote heating, the mechanism of action must be different.[49,50] ESEM micrographs revealed a great difference between lased and unlased ones. So far, no published data are available concerning the effect of a 980 nm high-power diode laser on enamel microhardness.[51] The resulting amorphous and heterogeneous tissues might be due to enamel melting and resolidification.[52] The low absorption coefficient of diode laser wavelength in enamel[53] showed a great benefit as it caused rapid elevation of the surface energy during exposure and rapid decay of temperature once stopped. As a result, the action needed is carried out, but in the same time it did not penetrate deeply so it did not affect the pulp or the underling structures.

The detected surface temperature also provides sterilisation of the fissure depth as streptococcus bacteria die at 60 °C. Group 2 also revealed irregular lateral walls of the pits that might be due to the presence of areas of melted enamel intermingled with carious enamel. In group 4, combination between laser and fissure sealant material was used. The use of different polymerisation methods as the application of heat for additional curing time after polymerisation increases the compressive, flexural strength, hardness, tensile strength and wears resistance.[26] This secondary curing procedure caused increase in the chain vibration amplitude, allowing free radicals and methacrylate groups to collide and establish covalent links, increasing the degree of conversion.[54]

Light cured materials have disadvantages such as limited depth of cure and poor distribution of degree of conversion (DC) in cured resin.[55] The high DC of the used sealant in this research could result from a light attenuation of the thinner sealant which is less than that seen in 2 mm composite increment. Another factor causing this higher DC might be a lower viscosity as fissure sealants have less filler content to penetrate into pits and fissures. This great DC of the used sealant was reflected into greater curing shrinkage and consequently, poor marginal adaptation.[36]

To overcome this shrinkage probability of the sealant, laser was applied to the sealant enamel interface areas to melt the enamel and the sealant material found at the interface as well as get rid of the possible gap formation by melting and recrystallisation of enamel layer at this interface. These findings were in accordance with Yoshiharu et al. who proved that the Knoop hardness at the surface of composite was increased with CO_2 laser super pulse irradiation 10 sec with 1 W after light curing.[29]

The fluoride content of the sealant may also increase the caries resistance due to the formation of flour apatite in order to overcome the failure of sealant enamel interface. Thus, the recorded microhardness in group 4 that was the greatest between the groups was explained by flour apatite crystals as well as the presence of melted enamel that caused the rod and interrod region._

Editorial note: A list of references is available from the publisher.

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Diode lasers for periodontal treatment

The story continues

Authors_Drs Fay Goldstep & George Freedman, Canada

_Introduction

Lasers have been a part of the dental scene for over 25 years. Unfortunately, they used to be perceived as large, unwieldy, difficult-to-use, expensive machines and thus they were largely ignored. Affordable, effective, user-friendly diode lasers seem to have arrived on the scene only recently. In fact, the diode laser has proven itself to be the ideal soft-tissue handpiece in a considerably short time.

The diode laser functions as the essential handpiece for all soft-tissue procedures just as the dental handpiece is essential for all hard-tissue procedures. The advantages of the diode laser for soft-tissue applications include surgical precision, bloodless surgery, sterilisation of the surgical site, minimal swelling and scarring, minimal suturing, and virtually no pain during and after surgery.

What about using the diode laser for the treatment of periodontal disease (laser-assisted periodontal treatment)? An early version of the diode laser was used effectively in the treatment of periodontal pockets in 1998.[1] Since there is still so much confusion and controversy regarding the use of lasers in the treatment of periodontal disease today, clarification and simplicity seem to be needed.

First, as the term "laser-assisted periodontal therapy" implies, the laser is only one part of the treatment equation. Therefore, the laser should not be viewed as a stand-alone treatment for periodontal disease. Second, the laser may not be of any help in advanced cases of periodontal disease because these cases may require a surgical approach. Third, when discussing the benefits of laser-assisted periodontal therapy, we must specify the particular type of laser used. Several categories of lasers have shown positive results. For the sake of clarity and simplicity, the following discussion will deal exclusively with the diode laser, since its ease of use and its affordability have made it the predominant laser in dentistry.

Fig. 1

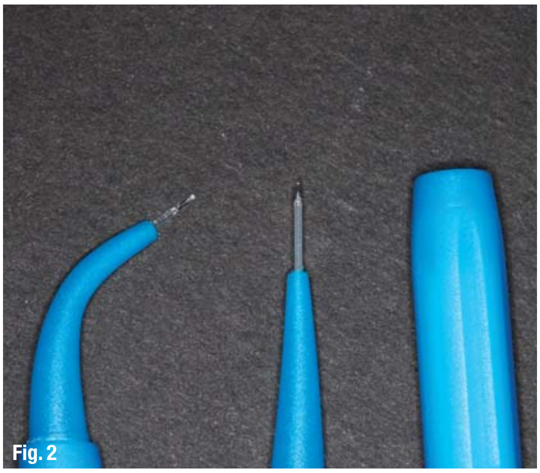

Fig. 2

Fig. 1_Picasso diode laser.
Fig. 2_Picasso high energy tip (left and middle). Biostimulation tip (right).

_Diode lasers for periodontal treatment

Two types of diode lasers have been studied for their effects in laser-assisted periodontal therapy: (a) the diode laser, which emits high levels of light energy; and (b) the low-level diode laser, which emits low-intensity light energy.

There is very compelling evidence in the dental literature that the addition of diode laser treatment to scaling and root planing will produce significantly improved and longer-lasting results.[2] Scaling and root planing is the gold standard in non-surgical periodontal treatment.

Low-level lasers have been used for biostimulation in medicine since the 1980s. The therapeutic effect is non-cutting and of low intensity, and covers a much wider area than the traditional laser. Low-level laser therapy is a treatment in which the light energy emitted by the laser elicits beneficial cellular and biological responses. At a cellular level, the metabolism is increased, stimulating the production of adenosine triphosphate, the fuel that powers the cell. This increase in energy is available to normalise cell function and promote tissue healing.[3, 4]

The functions of the diode and low-level diode laser have remained separate until recently. With the introduction of the biostimulation delivery tip, the diode laser is able to provide both cutting and therapeutic effects. When the low-level tip is used, the laser energy is delivered over a wider area, decreasing the energy level and producing the therapeutic effect of the low-level diode laser. Two laser companies have made these auxiliary tips available (Figs. 1–4).

Used together, these two laser treatment modalities provide benefits that help to heal the chronic inflammatory response in the periodontal pocket. This works well in treating mild to moderate periodontitis.

Patients can be treated in a minimally invasive way, without surgery and in the general practice.

_The periodontal pocket

Periodontal disease is a chronic inflammatory disease caused by bacterial infection. The inflammation is the body's response, seeking to destroy, dilute or wall off the injurious agent.[5] If the situation remains chronic, this self-protective mechanism becomes destructive to the tissue. In periodontal disease, the periodontal pocket contains several substances that contribute to the continuation of the unhealthy condition (Fig. 5):

1. calculus and plaque on the tooth surface;
2. pathogenic bacteria; and
3. an ulcerated, epithelial lining with granulation tissue and bacterial by-products.

Fig. 3_Picasso biostimulation tip.

Fig. 4_Ezlase biostimulation tip.

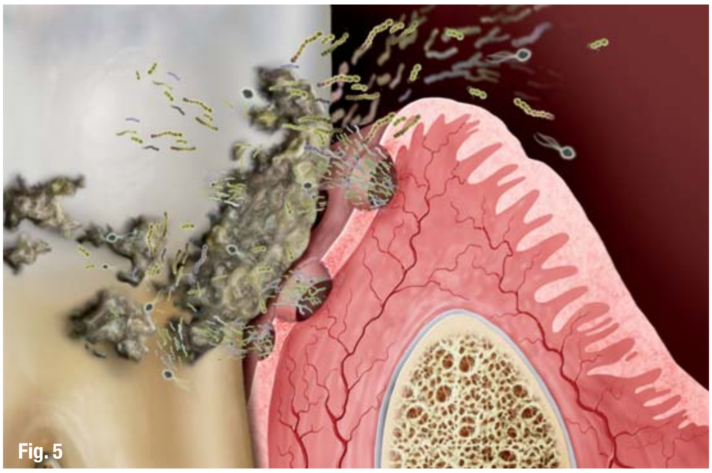

Fig. 5_The periodontal pocket containing calculus, bacteria and granulation tissue.

What do we need for healing of the pocket?

1. scaling and root planing to eliminate calculus, plaque and other debris on the tooth to create a completely clean surface;
2. decontamination to eliminate any pathogenic bacteria dispersed through the pocket;
3. curettage to eliminate granulation tissue, bacterial products, and ulcerated areas to create a clean, even epithelial lining without tissue tags (epithelial remnants); and
4. biostimulation to kick-start the healing process.

The following is a sequence to demonstrate how this can be easily accomplished in a minimally invasive, non-surgical way:

1. Calculus is removed with scaling and root planing. This procedure has been well documented throughout the dental literature as the gold standard of care for non-surgical periodontal treatment. The diode laser and the low-level diode laser are ideal for the remaining steps.
2. Since a bacterial infection is the initiator of the chronic inflammatory response of periodontitis, the bactericidal and detoxifying effect of laser treatment is advantageous.[6] The diode laser's bactericidal efficacy, particularly against specific perio-pathogens, has been well documented.[7–10] Moreover, there is a significant suppression of *Aggregatibacter actinomycetemcomitans*, an invasive bacterium that is not easily treated with conventional scaling and root planing. This bacterium is present on the diseased root surface and invades the adjacent soft tissue, making it virtually impossible to remove with mechanical means alone.[11–13] The diode laser energy is able to penetrate the soft tissue to eliminate this pathogen.
3. The diode laser is an instrument well suited to dealing with diseased soft tissue. Its energy is well absorbed by melanin, haemoglobin and other chromophores present in periodontal disease.[14] The 2002 American Academy of Periodontology statement regarding gingival curettage proposes that "gingival curettage, by whatever method performed, should be considered as a procedure that has no additional benefit to scaling and root planing alone in the treatment of chronic periodontitis".[15] However, the diode specifically targets unhealthy gingival tissue, performing an effective curettage that produces a clean, even epithelial lining without tissue tags. It is also stated that all the methods devised for curettage (including lasers) "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".[15] This was the state of the art in 2002. To date, this statement has not been updated. Studies have demonstrated that instrumentation of the soft tissue in the diseased periodontal pocket with the diode laser leads to complete epithelial removal, while conventional instrumentation with curettes leaves significant epithelial remnants.[16] Thus, in fact, the diode laser does have a clinical advantage over mechanical instrumentation with a curette.
4. This step requires the low-level laser tip. Studies have demonstrated that low-level laser light affects damaged and not healthy tissue. Laser biostimulation normalises cell function and promotes healing and repair.[17] Secondary effects include increased lymphatic flow, production of endorphins, increased microcirculation, increased collagen formation and stimulation of fibroblasts, osteoblasts and odontoblasts. This stimulates immune response, pain relief and wound healing.[4]

Fig. 6_Scaling and root planing is performed first.
Fig. 7_The diode laser tip is placed into the pocket.
Fig. 8_Laser energy is applied to the pocket to decontaminate and coagulate the soft tissue.

Fig. 6

Fig. 7

Fig. 8


Fig. 9


Fig. 10

Fig. 9_The biostimulation tip is applied at right angles to the external surface of the pocket.

Fig. 10_Pocket depth is measured pretreatment and three months post-treatment.

Studies have demonstrated that low-level laser therapy performed in conjunction with scaling and root planing on patients with both mild periodontitis[18] and chronic advanced periodontitis[19] can significantly improve treatment outcomes and the long-term stability of periodontal health parameters. The above four steps create an ideal environment in the periodontal pocket for healing. Lasers are an adjunct to scaling and root planing, not a stand-alone procedure. Scaling and root planing too is not a stand-alone procedure. We need all the pieces of the puzzle to create health.

_The protocol so far

The protocol must incorporate the four steps discussed above to establish the ideal environment for periodontal healing: a clean, calculus-free hard-tissue surface; no pathogenic bacteria; a smooth, clean soft-tissue surface; and biostimulation. Biostimulation tips, which help prepare the final step, are at present only available for two diode lasers, the Picasso (AMD LASERS) and EZLASE (BIOLASE). Individual parameters vary, depending on the clinician and the particular diode laser used. However, most protocols follow a simple formula:

1. The hard-tissue side of the pocket is debrided with ultrasonic scalers and hand instruments (Fig. 6).
2. This is followed by laser bacterial reduction and coagulation of the soft-tissue side of the pocket (Figs. 7 & 8).[14] The laser fibre is measured to a distance of 1 mm short of the depth of the pocket. The fibre is used in light contact with a sweeping motion that covers the entire epithelial lining, starting from the base of the pocket and moving upward.[20] The fibre tip is cleaned frequently with damp gauze to prevent debris build-up.
3. The low-level laser tip is applied at right angles and with direct contact to the external surface of the pocket for biostimulation (Fig. 9).
4. Reprobing of the treated sites should be performed no earlier than three months after treatment to allow for adequate healing (Fig. 10), as the tissue remains fragile for this period.

The power settings and duration are determined by the particular laser used. The manufacturers should be consulted in order to apply the proper parameters to achieve the best results. With experience, the user will feel comfortable enough to adapt the protocol to his or her particular practice. This protocol may be performed by the dentist and/or hygienist as determined by the regulatory organisation in the geographic location of the dental practice.

_Conclusion: The implication is clear

Many of our patients have periodontal disease, but they want to be treated in a minimally invasive way. They are not rushing out to the periodontist to have surgery. We need to treat their disease before it spirals out of control, especially when considering the periodontal health or the systemic health link. There is significant proof that the addition of laser-assisted periodontal therapy to scaling and root planing improves outcomes in cases of mild to moderate periodontitis, thus contributing to general health. The treatment is comfortable and not invasive. We now have the tools and protocol to treat our periodontal patients with an effective procedure that they are ready to accept. What are we waiting for?_

_contact laser

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Photodynamic therapy with the new active ingredient Perio Green

Author_Dr Ralf Borchers, MSc, Bünde

_Introduction

Indocyanine green combats pathogenic bacteria simply, effectively and without side effects.

Until now, systematic periodontal treatments have often required the additional use of systemic antibiotic medication as well as the normal manual treatment involving cleaning, curettage and after-care in order to eliminate treatment-resistant pathogens more effectively and to achieve a long-lasting therapeutic effect.

However, the administration of antibiotics is always associated with side effects which unfortunately cannot be avoided with classic therapy. In the following article, a case study will therefore be used to illustrate a new, gentle method of bacterial reduction in gingival pockets: minimally invasive photodynamic therapy (PDT) with indocyanine green (Perio Green, elexxion AG) which works without antibiotics and causes no systemic side effects or unsightly discolouration.

Fig. 1_Gingival redness with signs of inflammation.

In periodontology, the laser is frequently used as adjuvant therapy because of its bactericidal mode of action. Various studies using laser light to decontaminate gingival pockets have delivered promising results. Diode lasers (810 to 980 nm) with output levels of 1 to 2 watts are mostly used for this purpose. Depending on the practitioner's manual dexterity and experience, this laser adjuvant therapy can be performed without anaesthetic.

_Pain-free periodontal therapy without cytotoxic effects

Photodynamic therapy is a new and promising approach to eliminating periodontal pathogens and bacteria. Unlike laser application on its own, a photodynamic active ingredient (photosensitiser) is absolutely essential to this technique. This dye adheres to matrix proteins in the bacterial membrane and, when exposed to laser light of the corresponding wavelength, reacts with the release of free oxygen radicals. This singlet oxygen alters the plasma proteins so that they are unable to continue metabolising and hence die.

Correct use of the defined laser light source in combination with the photosensitiser is essential in this process. This means that the dye must be specifically coordinated with the wavelength used. If not, no absorption of the laser light takes place in the active ingredient. The energy settings employed lie within milliwatt range (mainly 100 mW) so that pain-free treatment is possible for patients.

A systemic effect (as with antibiotic administration) can be prevented completely by choosing the right photodynamic sensitiser. As the photosensitiser only docks onto the bacterial membrane, no side effects such as cytotoxic effects occur in endogenous cells. In addition, no heating of the tissue ensues and there is no evaporation of tissue or bacterial residues; anaesthesia is usually unnecessary.

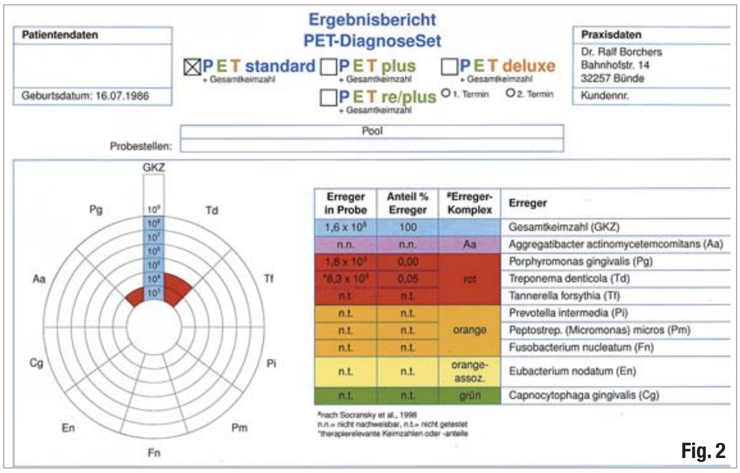
_Green photosensitiser leaves no dye residues

While blue PDT dyes such as methylene or toluidine blue were mainly used until recently, green photosensitisers such as indocyanine green are now available. As the green dye is used with diode lasers with 810 nm wavelength, it is not necessary to purchase a special laser for PDT—compared with blue dyes this is an economic advantage to dental practices that should not be underestimated.

Indocyanine green is a "true" photosensitiser which only reacts when the appropriate laser light is supplied but otherwise displays no therapeutic effect —neither negative nor positive. By contrast, the blue PDT active ingredients have a bacteriostatic or bactericidal action even without the supply of light; strictly speaking, therefore, they are not true photosensitisers.

Another disadvantage of methylene and toluidine blue: particularly in the anterior area, they continually cause prolonged blue discolouration of the tissue and/or teeth, which patients find extremely unsightly. Indocyanine green deals with this problem because the sensitiser as a unique laser-activatable ingredient has the property of coupling selectively to bacterial cells while at the same time it is far easier to rinse off with water than the "blue products" found on the market.

The indocyanine green that is used as the raw material for the new Perio Green is identical to the dye that


Ergebnisbericht
PET-DiagnoseSet

Patientendaten
Geburtsdatum: 16.07.1986

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Dr. Ralf Borchers
Bahnhofstr. 14
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Probestellen: Pool

Erreger in Probe	Anteil % Erreger	#Erreger-Komplex	Erreger
1,6 x 10⁸	100		Gesamtkeimzahl (GKZ)
n.n.	n.n.	Aa	Aggregatibacter actinomycetemcomitans (Aa)
1,6 x 10³	0,00	rot	Porphyromonas gingivalis (Pg)
*8,3 x 10⁴	0,05		Treponema denticola (Td)
n.t.	n.t.		Tannerella forsythia (Tf)
n.t.	n.t.	orange	Prevotella intermedia (Pi)
n.t.	n.t.		Peptostrep. (Micromonas) micros (Pm)
n.t.	n.t.		Fusobacterium nucleatum (Fn)
n.t.	n.t.	orange-assoz.	Eubacterium nodatum (En)
n.t.	n.t.	grün	Capnocytophaga gingivalis (Cg)

#nach Socransky et al., 1998
n.n.= nicht nachweisbar, n.t.= nicht getestet
*therapierelevante Keimzahlen oder -anteile

Fig. 2

Fig. 2_The microbiological test shows the bacterial spectrum in the reddened area.

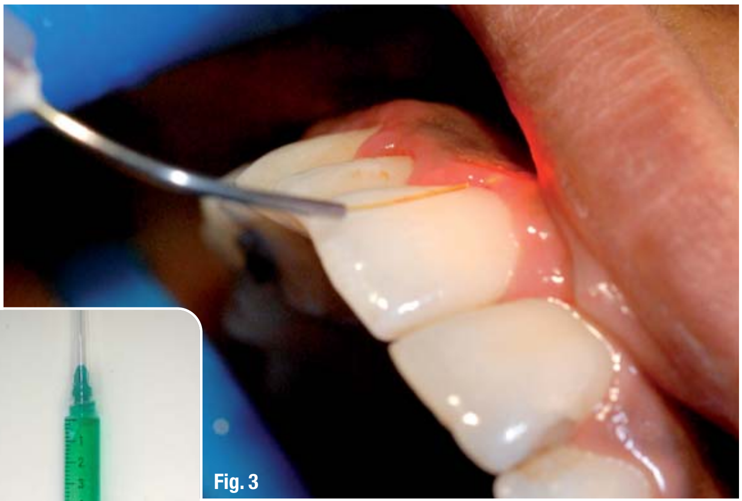


Fig. 3

Fig. 4

Fig. 3_Drawing up the resulting laser-activatable dye solution into a disposable syringe.

Fig. 4_Pulsed light activation with the elexxion laser.

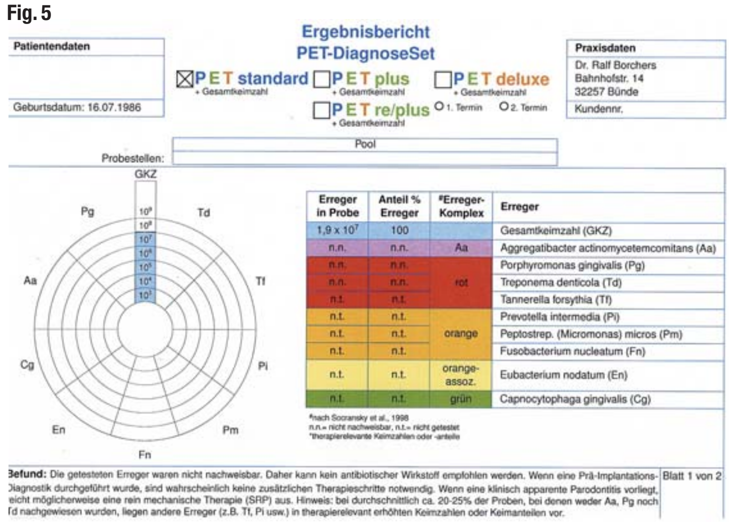
Fig. 5_The microbiological germ identification after PDT shows that the micro-flora was eliminated effectively.

has been used successfully in medical diagnostics for many years and is licensed worldwide. In other words, the photosensitiser by elexxion is clinically safe and furthermore is a certified class IIa medical device. The use of Perio Green in combination with a diode laser of a wavelength of 810 and variable pulsing (claros, elexxion) is presented below.

_Initial situation

The patient was treated by me for severe periodontal disease (pocket depths from 5 to 7 mm) and had already received conservative treatment (professional tooth-cleaning, education and motivation, debridement and curettage of pockets plus ultrasonic rinsing). Nevertheless, clearly visible gingival redness with signs of inflammation persisted (Fig. 1). Microbiological testing revealed a remaining bacterial spectrum in the reddened area (Fig. 2). Such refractory cases inevitably lend themselves to treatment with antibiotics. After a detailed discussion with the patient, however, we opted for an alternative that would be freer of side effects: photodynamic therapy.

Fig. 5



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Erreger in Probe	Anteil % Erreger	#Erreger-Komplex	Erreger
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n.t.	n.t.	orange-assoz.	Eubacterium nodatum (En)
n.t.	n.t.	grün	Capnocytophaga gingivalis (Cg)

#nach Socransky et al., 1998
n.n.= nicht nachweisbar, n.t.= nicht getestet
*therapierelevante Keimzahlen oder -anteile

Befund: Die getesteten Erreger waren nicht nachweisbar. Daher kann kein antibiotischer Wirkstoff empfohlen werden. Wenn eine Prä-Implantations-Diagnostik durchgeführt wurde, sind wahrscheinlich keine zusätzlichen Therapieschritte notwendig. Wenn eine klinisch apparente Parodontitis vorliegt, reicht möglicherweise eine rein mechanische Therapie (SRP) aus. Hinweis: bei durchschnittlich ca. 20-25% der Proben, bei denen weder Aa, Pg noch Td nachgewiesen wurden, liegen andere Erreger (z.B. Tf, Pi usw.) in therapierelevant erhöhten Keimzahlen oder Keimanteilen vor.

Blatt 1 von 2

_Photodynamic therapy

As the photosensitiser mixed into Perio Green is only effective for about two hours, the tablet was dissolved in sterile water only shortly before treatment was carried out. The resulting laser-activatable dye solution was drawn up into a disposable syringe (Fig. 3), then spread into the gingival pockets by a thin, blunt application tip. Owing to the low viscosity of the active ingredient, penetration down to the floor of the pocket is guaranteed. After two minutes' exposure to the solution and subsequently rinsing of the mouth, pulsed light activation was performed with the elexxion laser. To do this, a laser fibre 200 to 300 µm in diameter was inserted into the pocket and the active ingredient was irradiated for 30 seconds (Fig. 4).

_After-care

The patient came back a week later for recall when another Perio Green treatment was carried out. Microbiological testing to identify germs was repeated under the same conditions as the first test in order to monitor the success of the treatment. The results of the test (Fig. 5) suggest that the new active ingredient Perio Green in combination with the specific laser light of the elexxion laser is a suitable tool for effective elimination of micro-flora.

_Conclusion

The photodynamic therapy with indocyanine green presented here is not only effective at combatting bacteria in the oral cavity, but it is also free of side effects, offers uncomplicated handling for practitioner and patient and involves minimal treatment time (approx. 45 minutes for a complete UJ/LJ treatment). Other patient treatments performed in my practice as well as current clinical trials with Perio Green also confirm the success of this minimally invasive form of therapy. Thus the positive aspects of indocyanine green treatment were presented in detail by several speakers during the DGL (German Association for Laser Dentistry) and LEC congress (Laser Beginners Congress) held last year in early September in Leipzig, Germany._

_contact laser

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Er:YAG laser etching of hypoplastic enamel

Authors_Prof. Dr Georgi Tomov, Dr Ana Minovska, Birute Rakauskaite & Laura Navasaityte

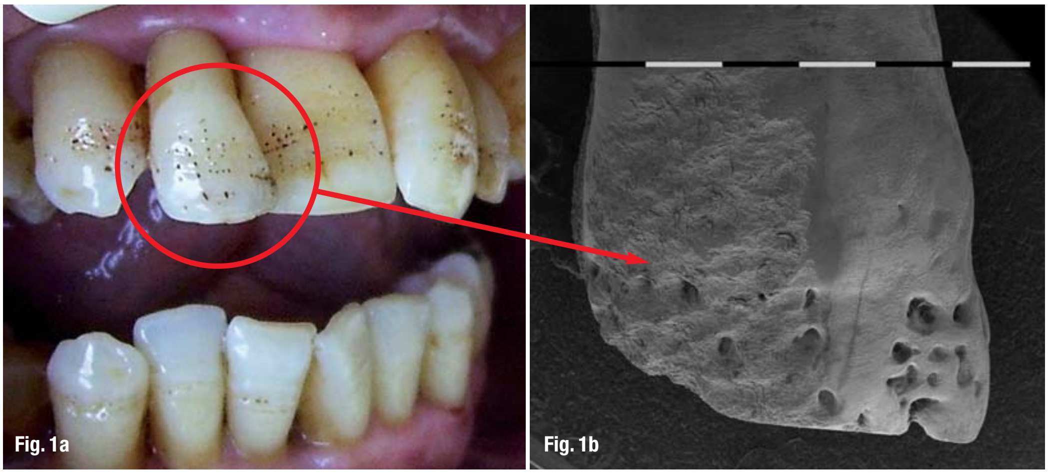
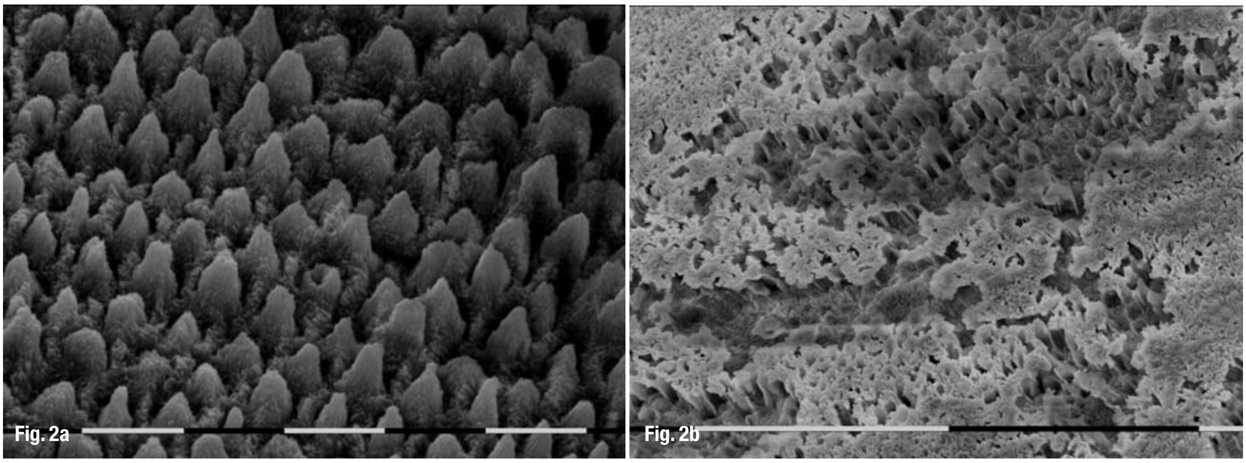


Fig. 1_Dentition represents a pitted hypoplastic variant of EH **(a)**. The extracted tooth is treated with 37% phosphoric acid for 600 sec. (right side) and irradiated by Er:YAG radiation (LiteTouch 200 mJ/355 Hz, left side) and then examined under SEM **(b)**.

_Introduction

Enamel hypoplasia is the most common abnormality of development and mineralisation of human teeth. The lesion is characterised by a quantitative defect in enamel tissue resulting from an undetermined metabolic injury to the formative cells—the ameloblasts.[1] Clinically, enamel hypoplasia is seen as a roughened surface with discreet pitting or circumferential band-like irregularities which posteruptively acquire a yellow brown stain.[1] Enamel hypoplasia is endemic in many countries of the world and is commonly reported in association with disease of childhood. The hypoplastic enamel has differences in structure and composition that may affect it's etching patterns.[2] Enamel etch by the acid can be additionally complicated by variability of penetration depth, and strong washing and drying affecting the bond strength.[3] Er:YAG lasers are discussed as an alternative of acid etching, but there are no scientific evidences to support this hypothesis.

Fig. 2_Type 2 etching pattern in normal enamel: prism peripheries are preferentially removed **(a)**. Acid etching of hypoplastic enamel showed a patchy loss of surface tooth structure without evidence of etching patterns **(b)**.



_Aim

This *in vitro* study compares the etching effects of acid etchant and Er:YAG laser on hypoplastic enamel (HE) and normal enamel (NE) of extracted human teeth.

_Material and methods

Teeth extracted due to advanced periodontal diseases were collected by patients. All the HE patients had been previously diagnosed by G. Tomov and G. Nikolova using clinical and radiographic criteria.[1]

Clinically, all HE teeth have showed many round, pin head-sized pits, which were concentrated mainly on the buccal and lingual surfaces. The teeth had been kept in saline until the time of study. The buccal surface of each tooth (10 HE and 10 NE, all frontal teeth) was divided and the right side was treated with 37 % phosphoric acid for 60 sec. while the left side was irradiated by Er:YAG radiation (LiteTouch 200 mJ/35 Hz for 10 sec., Figs. 1 a and b). The treated surfaces were evaluated using a scanning electron microscope (SEM), Phillips 505 scanning electron microscope (Phillips Electronic Eindhoven, Netherlands). For SEM analysis, the samples were fixed (2.5 % glutaraldehyde, 12 h, 4 °C), dehydrated (25–100 % ethanol), dried, and sputter-coated with gold and examined under different magnifications. The observed changes were photographed and analysed.

_Results

Normal enamel (NE) after acid etching

After treatment with 37 % phosphoric acid for 60 sec., the etched area generally showed a type 1 pattern with the prism cores preferentially removed. However, in small, isolated areas, the etching pattern was similar to that of type 2, i.e., prism peripheries were preferentially removed (Fig. 2a). A type 3 etching pattern (general removal of tooth structure without exposing prism structure) was also observed in other isolated areas.

Hypoplastic enamel (HE) after acid etching

The acid etched HE do not exhibit the typical etching pattern seen in control enamel. In the areas where intact surface enamel was presented (without pits), 37 % phosphoric acid etching for 60 sec. leads to irregular and patchy loss of surface tooth structure without evidence of uniform etching patterns (Fig. 2b). After etching, no uniform removal of hypoplastic (and hypomineralised) enamel is evident.

Normal enamel (NE) and hypoplastic enamel (HE) after laser conditioning

A comparison of the laser-treated surfaces showed that laser radiation caused a uniform roughness of the enamel for both HE and NE teeth. The morphology patterns were similar without melted or damaged surfaces (Figs. 3a and b).

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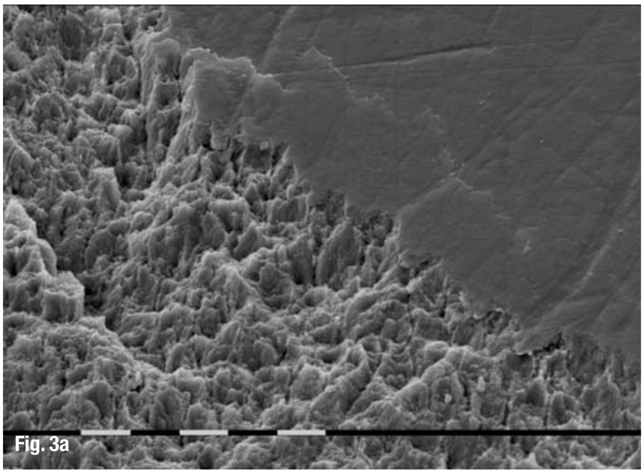

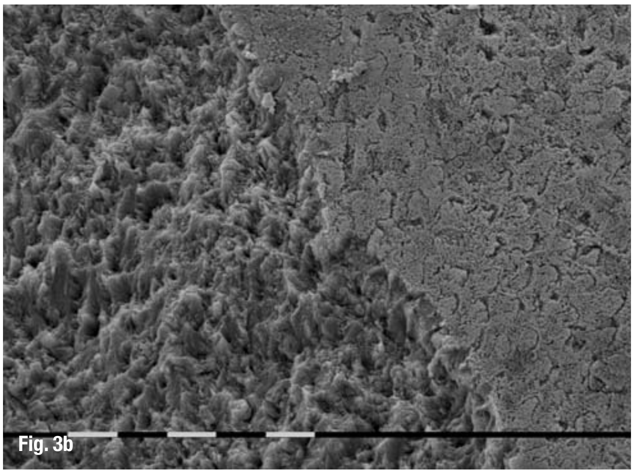

Fig. 3_The laser-treated surfaces showed that laser radiation caused a desired and uniform roughness of the enamel for both HE **(a)** and NE **(b)** teeth.

_Discussion

As the failure rates of adhesive restorations in HE teeth may be high, the question often arises as to whether this type of dental enamel may be successfully etched.[3] The present study addresses this important clinical issue in one clinical variant of Amelogenesis imperfecta, namely, pitted hypoplastic type, using extracted permanent teeth. The common features of normal enamel, as well as the abnormal HE, have been described in previous publications.[4–6] However, there have been no previous studies comparing the effects of acid etching and Er:YAG laser conditioning on hypoplastic enamel. Our study shows that the three classical acid-etching patterns found in normal enamel cannot be reproduced in the HE type. In the case of the pitted hypoplastic variant, the etching pattern was similar to that of type 1, in which the prism cores were preferentially removed. The pattern of prism dissolution was irregular and did not appear to be related to prism structure. Additionally, it is also likely that, because of smaller or weaker prisms, the length of time of the acid etch or the concentration of etchant may not be optimal to produce the classical etch patterns. These hypotheses are based on findings of previous studies which found abnormalities of prism structure, as well as reduction in enamel thickness by more than half compared to normal enamel.6 The acid etching of a less organised hypoplastic enamel structure may result in a pattern that is not the classic etched pattern, which may have a detrimental effect on bonding between the adhesive materials and the affected enamel.

The Er:YAG laser etching seems to be an alternative approach for adhesive treatment of hypoplastic enamel defects. LiteTouch Er:YAG laser used in this study (Syneron, Israel) emits a beam with a 2,940 nm wavelength which is absorbed mostly by water. The mechanism of ablation is based on interaction between laser energy and hydroxyapatite incorporated water which results in microexplosions. It is believed that this process is the mechanism of ablating particles from dental tissues without overheating and without smear layer formation. The program "hard tissue mode" removes enamel, dentin and dental caries effectively and without visible carbonisation or disturbance of the dental microstructure. Evaluated under SEM, the dental tissues treated with LiteTouch Er: YAG laser showed rough and irregular surface without presence of smear layer.[7] Treated enamel shows preserved prismatic structure, but also strong retentions.[7] These results suggested Er:YAG lasers to be effective in the treatment of hypoplastic enamel in order to avoid acid etching. From a clinical point of view, the presence of typical and uniform morphological changes after Er:YAG laser treatment in both normal and hypoplastic enamel suggests that bonding of composite resins may be feasible in most patients with HE. However, the possible advantages of Er:YAG laser conditioning of HE needs further clinical investigation to be approved.

_Conclusions

1. In the pitted hypoplastic type of EH, classical etching patterns after treatment with 37 % phosphoric acid like those seen in normal enamel, are generally not observed.
2. Er:YAG laser conditioning produces similar morphological changes in both normal and hypoplastic enamel.

Editorial note: A list of references is available from the publisher.

_contact | laser

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SEM analysis of the laser activation of final irrigants for smear layer removal

Authors_Dr Vivek Hegde, Dr Naresh Thukral, Dr Sucheta Sathe, Dr Shachi Goenka & Dr Paresh Jain, India

_Introduction

The complete restoration of the root canal space with an inert filling material and the creation of a fluid tight seal are the goals of successful endodontic therapy.[1] In order to create a fluid tight seal, it is imperative that the endodontic filling material closely adapts or bonds to the tooth structure. This, however, is impaired by the presence of a smear layer, which invariably forms after endodontic instrumentation.[2,3] The smear layer contains organic material, odontoblastic processes, bacteria and blood cells.

Various materials and techniques have been reported with wide variations in their efficacy regarding the removal of the intra-canal smear layer.[2,4] The most widely used chemical for the purpose is EDTA, used in different formulations.[5] They have been reported to consistently produce canals with patent dentinal tubules.[6] However, it has been found to be less efficient in narrow portions of the canal[7], it requires a long application time for optimum results[8] and can seriously damage the dentin, if used in excess.[9]

Clinically, endodontic procedures use both mechanical instrumentation and chemical irrigants in the attempt to three dimensionally debride, clean and decontaminate the endodontic system.[10,11]

Even after doing this meticulously, we still fall short of successfully removing all of the infective microorganisms and debris. This is because of the complex root canal anatomy and the inability of common irrigants to penetrate into the lateral canals and the apical ramifications. It seems, therefore, appropriate to search for new materials, techniques and technologies that can improve the cleaning and decontamination of these anatomical areas.[12]

Some of these mechanically activated irrigation techniques include manual irrigation with needles, K-file, Master cone GP points, Irrisafe, ultrasonics, Endo-activator, Rotobrush, Roeko-

Table 1_Subgroups depending on the final irrigant used.

GROUPS / SUB-GROUPS	GROUP I (Hand Activation)	GROUP II (Er:YAG with PIPS)
Sub Group A (5.25 % NaOCl)	n = 10	n = 10
Sub Group B (17 % EDTA)	n = 10	n = 10

Fig. 1_Access opening.

Fig. 2_Stainless steel 10# no. K-file for patency.

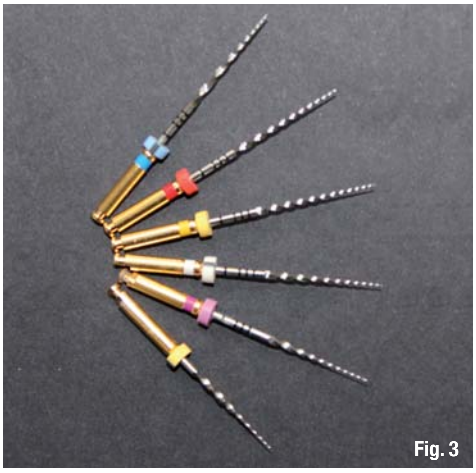


Fig. 3

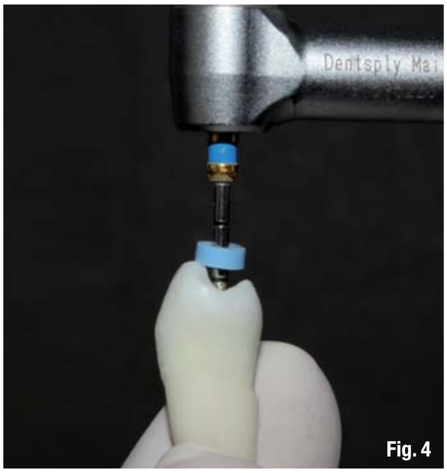


Fig. 4

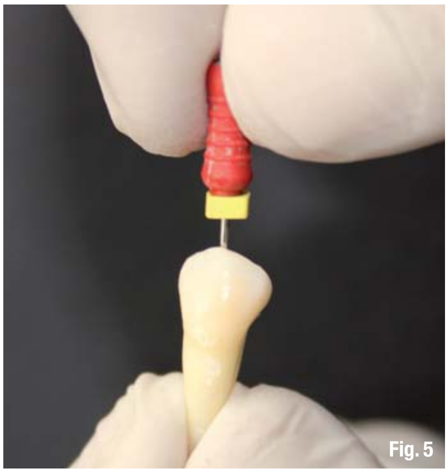


Fig. 5

brush, etc. The newest of the lot is PIPS, i.e Photon-Induced Photoacoustic Streaming via laser. Hence it was chosen for the study.

_Material and methods

Forty single-rooted, extracted human teeth were used in the study. Teeth with fractures, cracks or any other defects were excluded. Subsequently, they were scaled with ultrasonics for the removal of calculus or any soft-tissue debris, washed with distilled water and then stored in normal saline. Standard endodontic access cavity preparations were performed and then a stainless-steel #10 K-file (Mani K-File) was inserted into the canal until the tip was just visible at the apical foramen to check for patency. Chemo-mechanical preparation was done up to F3 using rotary protapers (DENTSPLY Maillefer) along with EDTA gel (Glyde – DENTSPLY Maillefer) for all the samples.

Irrigation of all the samples during preparation was accomplished using 5 ml of 5.25 % sodium hypochlorite between each file. Samples were then divided randomly into two groups, depending upon the method of activation of the final irrigant used.

These groups were further divided into two subgroups, depending upon the final irrigant used (Tab. 1):

– Subgroup A: 5.25 % NaOCl (n = 10)
– Subgroup B: 17 % EDTA (n = 10)

Activation of the irrigant for group I was done mechanically by agitating a stainless steel #25 K-file (2 % taper) in the canal when it was filled with the final irrigant solution.

An Er:YAG laser with a wavelength of 2,940 nm (Fotona) was used to irradiate the root canals in Group II with a newly designed 12 mm long, 400 µm quartz tip. The tip was tapered and had 3 mm of the polyamide sheath stripped away from its end. The laser operating parameters used for all the samples (using the free-running emission mode) were as follows: 40 mJ per pulse, 20 Hz, at very short pulse (MSP) mode, which provides the same 400 W of peak pulse power as the parameters recommended by Olivi (20 mJ, 15 Hz, SSP). The coaxial water spray feature of the handpiece was set to 'off' while air settings were kept at 2. The tip was placed into the coronal access opening of the chamber just above the orifice, and was kept stationary. During the laser irradiation cycles, the root canals were continuously irrigated with the final irrigant to maintain hydration levels using a hand syringe with a 25 gauge needle positioned above the laser tip in the coronal aspect of the access opening, according to the above protocol.

After preparation, the root canal walls were dried using paper points. Longitudinal grooves

Figs. 3 and 4_Chemo-mechanical preparation up to F3.
Fig. 5_Group I – Hand activation using stainless steel #25 K-file (n = 20).

Figs. 6a & b and 7_Group II – Er:YAG activation using Photon-Induced Photoacoustic Streaming tip (n = 20).

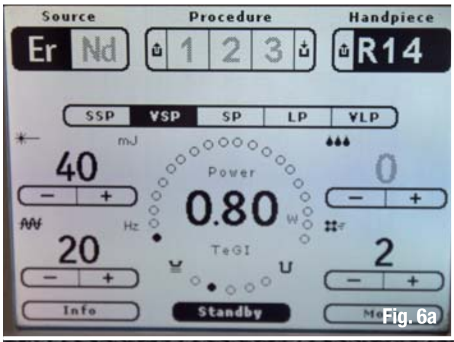


Fig. 6a

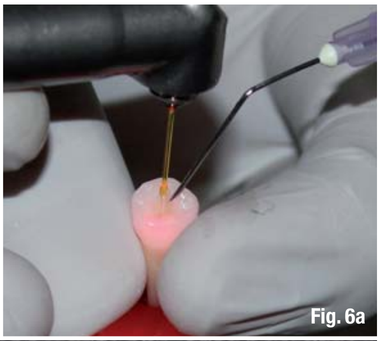
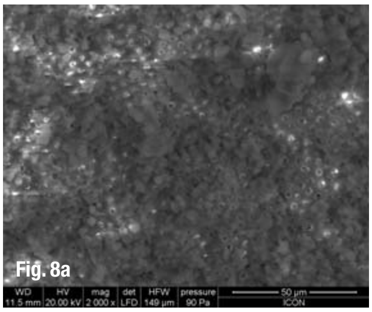
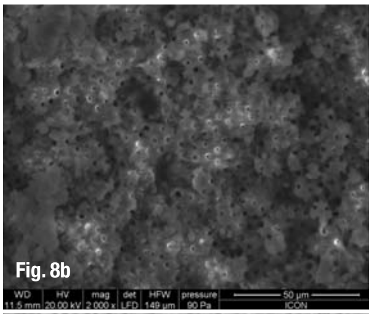
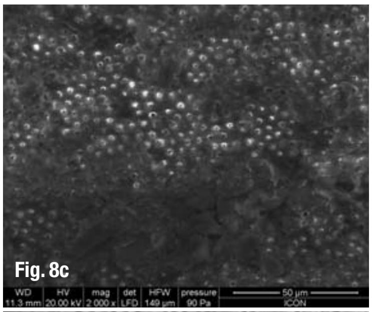


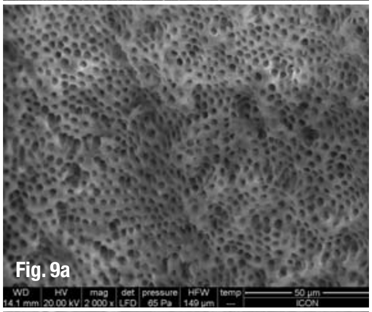
Fig. 6a

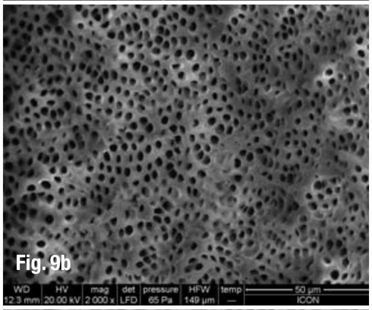

Fig. 7

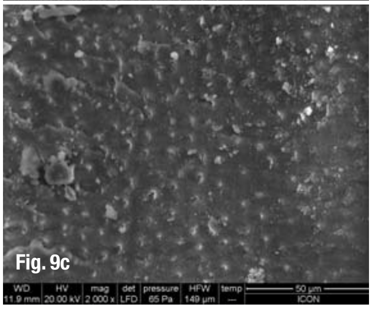


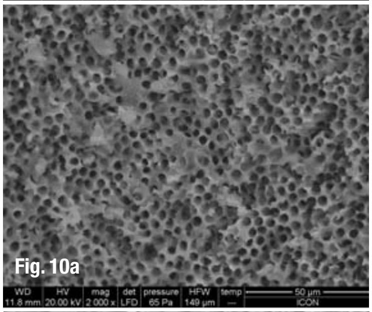


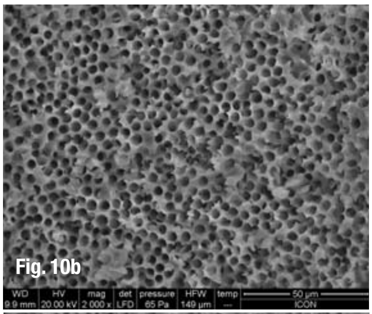


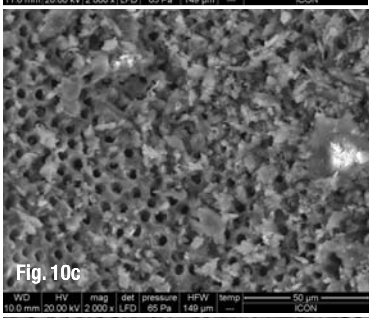


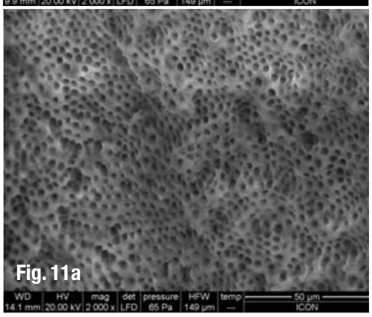


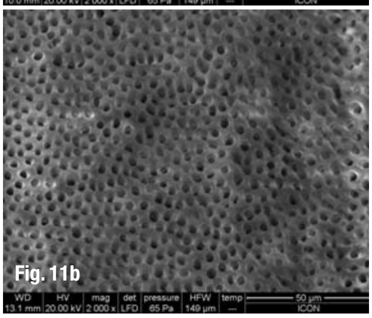


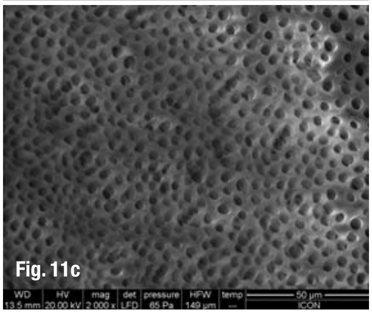












were made on the distal and mesial root surfaces, preserving the inner shelf of the dentin surrounding the canal. Roots were then sectioned with the help of a chisel and mallet. Samples were then subjected to SEM to visualize the surface characteristics.

_Results

Group I specimens (hand activation) consistently exhibited a thick smear layer with NaOCl (subgroup A, Figs. 8a–c) while comparatively less smear layer was observed with EDTA (subgroup B, Figs. 9a–c). SEM examination demonstrated that when NaOCl irrigation was applied, a noticeable smear layer and occluded dentinal tubules remained on the treated surface. Debris, defined as dentin chips and pulp remnants loosely attached to the internal surface of the root canals, was present in the specimens in subgroup A (Group I). In the specimens of EDTA, mostly open dentinal tubules were observed in the coronal and the middle third while in the apical third of all specimens occluded tubules were observed.

Group II specimens treated with the Er:YAG laser with PIPS showed the most effective removal of the smear layer from the root canal walls compared to Group I (hand activation) specimens. At higher magnifications (1,000x–2,000x) subgroup B (17 % EDTA) showed better results with exposed and intact collagen fibers and open dentinal tubules, even in the apical third (Figs.11a–c), when compared with subgroup A (5.25 % NaOCl), where open dentinal tubules along with scattered dentinal chips were observed (Figs. 10a–c). None of the SEM images indicated signs of dentin melting.

_Discussion

Current instrumentation techniques using rotary instruments and chemical irrigation still fall short of successfully removing the smear layer from inside the root canal system. Mechanical activation of the chemical irrigant plays an important role in removing the smear layer. Fiber-guided lasers have also been used hoping to achieve some

Fig. 8_Group I—Hand Activation (5.25 % NaOCl—Subgroup A): coronal third **(a)**, middle third **(b)**, apical third **(c)**.

Fig. 9_Group I—Hand Activation (17 % EDTA—Subgroup B): coronal third **(a)**, middle third **(b)**, apical third **(c)**.

Fig. 10_Group II—Er:YAG with PIPS (5.25 % NaOCl—Subgroup A): coronal third **(a)**, middle third **(b)**, apical third **(c)**.

Fig. 11_Group II—Er:YAG with PIPS (17 % EDTA—Subgroup B): coronal third **(a)**, middle third **(b)**, apical third **(c)**.

degree of success, however, there is limited availability of literature regarding this topic.

The concept of laser-activated irrigation is based on cavitation. Because of the high absorption of water by the mid-infrared wavelength of lasers, the cavitation process generates vapor-containing bubbles, which explode and implode in a liquid environment.[13] This subsequently initiates pressure/shock waves by inducing shear force on the dentinal wall. In a water-filled root canal, the shock waves could potentially detach the smear layer and disrupt bacterial biofilms. To efficiently activate irrigant and generate shock waves in the root canal, lasers with wavelengths from 940–2,940 nm have been used.[14–22]

5.25 % sodium hypochlorite was used in Group I because the majority of practitioners still use only sodium hypochlorite as the irrigant along with hand instruments. Hence sodium hypochlorite was used in Group I. To remove inorganic debris of the smear layer, use of aqueous EDTA had been recommended. But prolonged use of EDTA can cause dentinal erosion of the root canal by decalcifying the peritubular dentin. The recommended time in endodontic literature is only 1–2 minutes. Hence, 17 % aqueous EDTA was used for one minute in Group II to minimise time and damage.

The results of this study indicate that NaOCl subgroups could remove the smear layer in the coronal third; however, it did not remove the smear layer from the middle and apical third of the canal wall. EDTA is efficient in removing the smear layer, which is evident in this study for both groups. The effects of EDTA were limited to the coronal and middle third in Group I (hand activation) while it was effective even in the apical third for Group II (Er:YAG-PIPS). Ciucchi et al. stated that there was a definite decline in the efficiency of irrigating solutions along the apical part of the canals.[23] This can probably be explained by the fact that dentin in the apical third is much more sclerosed and there are fewer dentinal tubules present there.[24] Also apical reach, canal configuration, and smooth transition are a few of the anatomical key factors. Hence root canal success is dependent on apical third anatomy.

The Er:YAG laser used in this investigation proved to be more effective than the conventional technique in removing the smear layer. This finding can be attributed to the photomechanical effect seen when light energy is pulsed in liquid.[25-27] When activated in a limited volume of fluid, the high absorption of the Er:YAG wavelength in water, combined with the high peak power derived from the short pulse duration that was used for five seconds (three cycles), resulted in a photomechanical phenomenon. A profound "shockwave-like" effect is observed when a radial and stripped tip is submerged in a coronal chamber above the orifice. As a result of the very small volume, this effect may remove the smear layer and residual tissue tags and potentially decrease the bacterial load within the tubules and lateral canals.[28-30] By using lower sub-ablative energy (40 mJ) and restricting the placement of the tip to within the coronal portion of the tooth only, the undesired effects of the thermal energy, as previously described in the literature, was avoided.[31-45] In the current study, the smear layer and debris were not removed by thermal vaporisation, but probably by photomechanical streaming of the liquids, which were laser activated in the coronal part of the tooth.

Giovani Olivi and Enrico DiVito have described this light energy phenomenon as photon-induced photoacoustic streaming (PIPS). The effect of irradiation with the Er:YAG laser equipped with a tip of novel design at sub-ablative power settings (20 mJ, 15 Hz, SSP, 400 W peak power) is synergistically enhanced by the presence of EDTA. This leads to a significantly better debridement of the root canal, contributing to an improvement in treatment efficacy. Hence, the PIPS technique resulted in pronounced smear layer removal when used together with EDTA and at the settings outlined.

_Conclusion

Within the limitations of this study, the Er:YAG laser with PIPS showed significantly better smear layer removal than the hand-activation group. At the energy levels and with the operating parameters used, no thermal effects or damage to the dentin surface was observed. With the described settings, the Er:YAG laser produced a photomechanical effect, demonstrating its potential as an improved alternative method for debriding the root canal system in a minimally invasive manner._

Editorial note: A list of references is available from the publisher.

_contact laser

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Manufacturer News

BIOLASE

Royalty agreement with Lambda

In April, international dental laser manufacturer BIOLASE announced that it has entered into an agreement with Lambda, an Italian laser company. The agreement involves payment from Lambda for past royalties and established royalty rates for future sales involving BIOLASE's technology. The royalties from Lambda relate to intellectual property that BIOLASE owns in connection with Er:YAG lasers and does not involve the company's patented WaterLase technology, which uses Er,Cr:YSGG lasers, or its delivery systems, including handpieces and consumables. Federico Pignatelli, Chairman and CEO of BIOLASE, said that the company is very pleased about the agreement.

"We have invested heavily in our intellectual property for laser dentistry, as well as other medical fields. Currently, we have over 340 US and international patents and patents pending. We will not tolerate what we believe to be any infringement of these patents and will continue to protect our rights," he stated.

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Fotona

X-Runner™ Automated Handpiece Technology

Fotona's new X-Runner™ digitally controlled laser handpiece is the industry's first dental handpiece to offer instantly adjustable spot size and shape. Designed for the award-winning LightWalker AT dental laser, the X-Runner™ handpiece enables routine hand movements to be fully automated, making it an ideal tool whenever deep, wide or precise cuts are required.

Dental laser professionals at IDS were impressed by X-Runner's performance and were amazed by the completely new treatment possibilities that an automated handpiece enables. With X-Runner, the shape and size of an ablation area can be selected in advance to facilitate a wide range of hard- and soft-tissue treatments, from standard cavity and veneer preparations to high-precision surgical and implantology procedures.

Practitioners can also switch instantly between the new automated mode and the classical, single-spot mode without need to swap handpieces, thus maximizing convenience and efficiency.

The X-Runner handpiece can be installed with only a simple software upgrade and is compatible with all standard Fotona handpiece parameters. Visit www.Fotona.com for more information.

Fotona d.d.
Stegne 7
1000 Ljubljana, Slovenia

www.fotona.com
www.lightwalkerlaser.com

Syneron Dental Lasers

Bronze Winner at the A'Design Award

Syneron Dental Lasers has been selected the Bronze winner of the A'Design Award in Scientific Instruments, Medical Devices and Research Equipment Design Category. The international A'Design Award recognises the best designs, design concepts and design-oriented products & services. The A'Design Award was born out of the desire to underline the best designs and well-designed products.

LiteTouch™, highlighted at the A'Design Award Exhibition 2013, Ex-Chiesa di San Francesco Museum, Como, Italy.

Mr Ira Prigat, president & CEO of Syneron Dental Lasers, accepted the Bronze Award on Sunday, April 14, 2013, at a stunning Gala Night held at the Villa Gallia in the Lake Como area in Italy. The award-winning products and designs are highlighted at the international public via the A'Design Award exhibition at the MOOD: Museum of Outstanding Design (www.museumofdesign.com/exhibitions.php). Syneron Dental Lasers participated at the A'Design Award Exhibition 2013 and exhibited its winning LiteTouch™ design at the Ex-Chiesa di San Francesco between 15 and 27 April, 2013.

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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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Henry Schein

MoonWalk© London to raise awareness of Breast Cancer

Henry's Angels, a group of volunteers from Henry Schein UK, based in Gillingham, Kent, supported the MoonWalk© London on Saturday, 11 May 2013. The MoonWalk© is organised by breast cancer grant making charity walkthewalk© which has to date raised over £84 million for vital breast cancer care and cancer research causes. The MoonWalk© London is already in its 16th year.

Henry's Angels in front of Battersea Power Station to support the MoonWalk© London to raise awareness of Breast Cancer.

Led by Henry's Angels, a total of 54 volunteers—the largest number of volunteers that walkthewalk© have ever had join them from one company—made their way to Battersea Power Station to take on the massive task of organising the Baggage Tent as volunteer Crew. Travelling from Henry Schein's Gillingham location for the 6.00 pm to Midnight shift, the volunteers made up mainly of Henry Schein team members from Gillingham and Maidstone but also including some of their family members and a supplier partners (Diverse Catering) helped to look after the 17,000 bra-clad walkers who were raising money for this important cause. Apart from the responsibility of safekeeping the thousands of bags, and ensuring the weary walkers didn't have a long wait when they returned, walkthewalk© was looking to Henry's Angels for their special brand of enthusiasm to cheer and spur on the walkers throughout the evening.

Henry Schein UK
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Gillingham ME8 0SB, England

www.henryschein.co.uk

Master of Science in Lasers in Dentistry

Professional education programme

_**Patients are increasingly seeking** alternative therapies, expecting their dentist to be well informed and to provide information regarding more gentle treatments. Through the use of laser technology, dentists can meet these expectations and provide patients with added benefits compared to more traditional methods.

The master programme, MSc in Lasers in Dentistry, has been developed in order to enable dentists to specialize in the full range of dental laser therapies. Building upon a first higher education degree in dentistry, this two-year modular master's course enables practicing dentists to specialize in dental laser applications by providing both theoretical and practical training.

Approximately 150 dentists, from all over the world, have successfully graduated from our MSc programme and, together with graduates from our mastership and fellowship courses, we are pleased to have a globally active alumni network.

_Course objectives

The course balances the teaching of the medical aspects with extensive practical skill training on the dental application of laser systems. The close interdisciplinary cooperation between dentistry and physics is of significant importance in this field. In addition to teaching the latest research results, proactive problem solving to improve dental laser therapies is addressed.

After extending participants' basic knowledge in this subject area, the study goals focus on the transfer of specialist knowledge that is at the forefront of laser dentistry. Treatment methods, the planning and preparation of treatments, the systematic organisation of scientific and clinical findings, as well as independent, responsible conduct, are of central importance.

_What to expect

During the course you can expect the following:

- Use of different laser systems from leading manufacturers, covering all available wavelengths, during skill training sessions and practical exercises
- Live operations on patients or via direct monitor broadcasting
- Provision of all necessary organic materials and safety glasses for individual practice with lasers

dgl. Deutsche Gesellschaft für laser Zahnheilkunde e.V.

Call for papers

DGL | German Society for Laser Dentistry
22nd International Annual Congress

15 - 16 November 2013 in Berlin, Germany

Titel

Author(s)

Institute(s)

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Abstract

Session:
(1) Scientific Session
(2) Case Presentation

Presentation:
(1) Lecture
(2) Poster Presentation
(3) Video Presentation

Abstract:
Please arrange the text in the order of:
- Purpose: Give a brief overview of the topic and in this context state the main objective of the study.
- Material and Methods: Describe the basic design, subjects and scientific methods.
- Results: Give main results of the study including confidence intervals and exact level of statistical significance, whenever appropriate.
- Conclusion: State only those conclusions supported by the data obtained and whenever appropriate, the direct clinical application of the findings (avoid speculations)

Authors:
The name of the person presenting the paper should be marked by an asterisk
Please include a copy on CD!

Presentation:
Only via computer/beamer

Adress:
Prof. Dr Norbert Gutknecht, Universitätsklinikum Aachen,
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– Meticulously compiled course documentation and additional specialist literature which serve as a future work of reference
– Encouragement to participate actively in international scientific congresses and to publish in scientific journals
– Independent access to a modern e-learning environment, supported by scientific staff.

This master programme is aimed at dental practitioners who want to train as specialists in laser dentistry and who wish to qualify with a highly recognised degree, while continuing with their career.

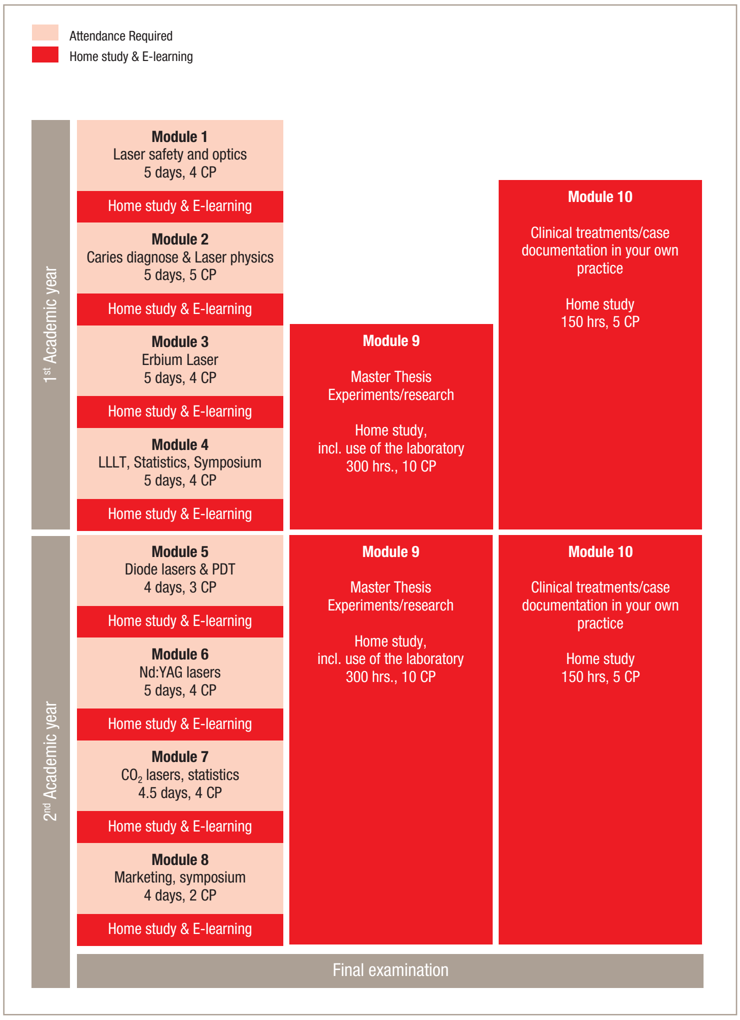
Participants must be approbated dentists with a minimum of two years of experience in a clinic or dental practice. Candidates who are not native speakers of English must provide appropriate proof of language qualification.

This career-accompanying course requires dentists to attend ten modules (38 days) over two years. These attendance modules are supplemented by e-learning enabling contact with the lecturers throughout the duration of the course. This mix of learning methods allows dental practitioners to balance their studies with their professional commitments.

Graduates are awarded the academic title "Master of Science" and, as such, are recognized as specialists in the field of laser therapy in dentistry. The awarding body is the RWTH Aachen University. Successful participants receive a total of 60 credit points in accordance with the European Credit Transfer and Accumulation System (ECTS). Graduates receive master diplomas in English and in German. An EU-recognised diploma supplement is also provided.

For each module that is successfully completed training points for the German Federal Dental Association (Bundeszahnärztekammer) are awarded. A total of 466 training points are awarded during the two year programme. Furthermore, on completion of the appropriate training module, participants receive Laser Safety Officer (LSO) certification.

The MSc in Lasers in Dentistry has been accredited by the accreditation agency, ASIIN e.V. It is the first of its kind in Germany and the first worldwide accredited master programme in the field of laser dentistry. It is recognized in the EU, all countries of the Washington Accord and the Bologna-Reform as a national and internationally valid academic degree. Lectures as well as skill training sessions are held in the modern facilities of the Aachen Dental



Laser Center and the University Hospital Aachen. Course participants have access to scientific staff of world-class experts in their specialised fields. The course attracts dentists from across the globe and participants are encouraged to network with their fellow students during numerous social events, additional networking opportunities at international scientific conferences and through the alumni network, WALED._

_contact laser

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IDS 2013 sets new records

Source_Koelnmesse

_The 35th International Dental Show (IDS) posted record-setting results when it closed on Saturday, 16 March 2013, after five days in Cologne. The world's leading dental trade fair attracted 125,000 trade visitors from 149 countries. That figure represents an increase of six per cent compared to the previous event. Records were also set in terms of the number of exhibitors and the occupied exhibition area. This year 2,058 companies (+5.3 per cent) from 56 countries presented a wide range of innovations, products and services on 150,000 square metres of exhibition area (+3.4 per cent). With 68 per cent of the exhibitors and 48 per cent of the visitors coming from abroad, the fair was also more international than ever before. "The degree to which IDS's global attraction increases from one event to the next is impressive," said Dr Martin Rickert, Chairman of the Executive Board of the Association of German Dental Manufacturers (VDDI). "Thanks especially to the trade visitors' high level of internationality and decision-making authority, we expect the positive effects of the fair to continue for the rest of the business year. We're also expecting sustained growth in the German and international healthcare markets." Katharina C. Hamma, Chief Operating Officer of Koelnmesse, added, "IDS has good reason to consider itself the world's leading dental trade fair. It provides the perfect conditions for sharing information, communicating and doing global business. The exhibitors were delighted with the large number of excellent business contacts they were able to make, and the visitors were excited by the comprehensive product range, as well as the numerous innovations that were presented."

_Highly satisfied visitors

The visitor survey revealed that 74 per cent of visitors said they were (very) satisfied with IDS. What's more, the fair's comprehensive spectrum of products and numerous innovations caused 79 per cent of the visitors to rate the product range as either good or very good. In terms of reaching their trade fair goals, 74 per cent of the visitors surveyed said that they were satisfied or very satisfied. Overall, 95 per cent of the visitors surveyed would recommend a visit to IDS to their business partners.


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_Tremendous interest in innovations

Individuals from the specialist trade as well as end users were especially interested in innovative products and technologies. Nowadays it is almost taken for granted that developers will come up with functional enhancements, more rational digital workflows and software updates for existing CAD/CAM systems. Even so, many participants were still impressed by the large number of new materials for computer-controlled processing. In addition to the always popular areas of CAD/CAM, there have also been advancements in the details of various specialist disciplines—for example, in prophylactic care, the preservation of teeth and implantology.

_Positive conclusions reached by BZÄK and VDZI

"IDS is the top event for the dental market. In 2013, it again drew the attention of the international dental world," concluded Dr Peter Engel, President of the German Dental Association (BZÄK).

"Demographic developments will make continuous updates of healthcare structures necessary, and they will be dependent on technical advances and innovative therapies. At the trade fair, the industry has impressively demonstrated its ability to meet this challenge. But brainstorming for a (dentally) healthy future isn't required within the dental sector alone. It also has to come from public policymakers. Germany is at an excellent international level technically and scientifically, as was demonstrated by this year's IDS. However, austerity regulations are making it more difficult for innovations to make their way to the dentists' practices." At the end of IDS 2013, Uwe Breuer, President of the Association of German Dental Technicians' Guilds (VDZI), said in summary, "IDS has proven itself as the meeting place for specialists from dental technology laboratories and dental practices. At this leading global trade fair, both of these groups were once again able to get a comprehensive picture of the new developments and product refinements in the dental industry and make their evaluations together. From the point of view of the VDZI, it is becoming increasingly clear that master dental technicians and dentists, each group with its own specialised expertise, will have to work together even more closely in the future. A clear indication of this collaboration was given at IDS when the VDZI and the German Association for Oral Implantology (DGOI) presented the programme for the annual DGOI convention which will take place in September."

IDS—the International Dental Show is held in Cologne every two years. The event is organized by the Gesellschaft zur Förderung der Dental-Industrie mbH (Society for the Promotion of the Dental Industry, GFDI), which is the commercial enterprise of the Association of German Dental Manufacturers (VDDI). The trade fair is staged by Koelnmesse GmbH, Cologne.

_IDS 2013 in figures

At IDS 2013 a total of 2,058 companies from 56 countries (2011: 1,954 companies from 58 countries) occupied a gross exhibition space of 150,000 m^2 (2011: 145,000 m^2). Among the participants were 643 exhibitors and 12 additionally represented companies from Germany (2011: 654 exhibitors and 17 additionally represented companies) and 1,347 exhibitors and 56 additionally represented companies from abroad (2011: 1,250 exhibitors and 33 additionally represented companies). The proportion of visitors from abroad was 68 per cent (2011: 66 per cent). Including the estimates for the last day of the fair, around 125,000 trade visitors from 149 countries came to IDS (2011: 117,697 trade visitors from 149 countries); 48 per cent (2011: 42 per cent) of them came from abroad.*

The next IDS—36th International Dental Show will take place from 10 to 14 March 2015._

*The figures concerning visitors, exhibitors and stand space for this trade fair were determined and certified according to the standardized definitions used by the Society for Voluntary Control of Fair and Exhibition Statistics (FKM).

Why use laser if you can do without?

Invitation to the 22nd Annual Congress of DGL

Dear Colleagues,

Our 22nd International Annual Congress, which takes place in Berlin from 15 to 16 November, 2013, has the provocative title "Why use laser if you can do without?". On the one hand, this choice of title implies critical questions by dentists who have not yet included laser to their repertoire. On the other hand, scientific evidence will be presented which states that professional and purposeful application of laser technology can entail decisive advantages for both patient and dentist in various indications.

For this reason, speakers from German universities and experienced specialists from various international universities will contribute to the scientific lectures. Simultaneous interpretation from English to German will ensure that our German participants will be able to follow all abstracts easily. In order to make theoretical statements and scientific research "come to live", colleagues with a more practical background and from universities will introduce clinical cases and their treatment. In addition, DGL workshops will be offered, in which treatment concepts for various indications can be presented and discussed.

We invite all our colleagues to send in their speeches, case presentations and posters until 31 May, 2013. Furthermore, we would like to inform our more science-oriented colleagues that congress abstracts will be printed in the renowned specialist magazine "Laser in Medical Science" (LIMS), and are thus acknowledged as a valid scientific effort.

Take part in the 22nd International Annual Congress of DGL and contribute to its scientific success! For any questions or requests, please contact our headquarters (Ms Speck).

Best wishes from Aachen, Germany!

Prof. Dr Norbert Gutknecht
– DGL President –

Invitation DGL General Meeting

Deutsche Gesellschaft für Laser Zahnheilkunde e.V.

Friday, 15 November 2013
Hotel Maritim, Berlin
2 to 3 p.m.

TOP 1	Approval of the agenda
TOP 2	Report of the DGL executive board
TOP 3	Auditor Report
TOP 4	Ratification of the current members of the board
TOP 5	Election of the DGL executive board
TOP 6	Accounting/GOZ
TOP 7	Direct debit authorisations (SEPA)
TOP 8	DGL Congress 2014
TOP 9	Requests for the general meeting
TOP 10	Various

[PICTURE: ©JOSE AS REYES]

Herbal lollipops may

Fight periodontal pathogens

Researchers from the US have found new evidence that glycyrrhizol A from the Chinese herb Glycyrrhiza uralensis, more commonly known as licorice root, in lollipops improves oral health. In a recent study, they found that the herbal compound reduced the activity of the main agents of periodontal disease and tooth decay.

In the *in vitro* study, researchers from the University of Iowa inoculated agar plates with a number of pathogens, including agents associated with periodontal disease, such as *Porphyromonas gingivalis, Prevotella intermedia, Tannerella forsythia* and *Streptococcus mutans*, which causes dental caries.

"The results suggest that the sugar-free herbal lollipops may play a role in decreasing the levels of certain periodontal pathogens in the oral cavity," the researchers concluded. "More research, including clinical research, is needed to assess the efficacy of glycyrrhizol A in reducing periodontal pathogens," they added.

Glycyrrhizol A is isolated from the Chinese plant Glycyrrhiza uralensis. Another study, published in the *Journal of Natural Products* in 2011, also found that the substance has antibacterial properties. The researchers reported that it killed the main bacteria responsible for tooth decay and gum disease. The findings were presented at the International Association for Dental Research's annual meeting last month.

Emotional intelligence affects

Dentist–patient relationship

Educators at Case Western Reserve University wondered why some high-performing students did not fare as well in the clinic. The researchers thus examined whether EI was a determining factor.

The study involved 100 third- and fourth-year students from the university's School of Dental Medicine, who completed a questionnaire about self-awareness, self-management, social awareness and relationship management. Their overall clinical performance, including diagnosis, treatment planning skills, organisation and patient management, was assessed by two preceptors.

After a thorough analysis, the researchers found a correlation between high EI scores and high clinical performance. They said that EI skills in self-management, which involves self-control, initiative, trustworthiness and adaptability, were significant predictors of clinical

[PICTURE: ©LUCKY BUSINESS]

grades. However, no such correlation with self- and social awareness was found. In addition, the researchers found the EI scores regarding relationship management difficult to determine owing to the transient nature of the interaction between student and patient during the two-year training. The study, titled "What is the Relationship Between Emotional Intelligence and Dental School Clinical Performance?" was published in the April issue of the Journal of *Dental Research.*

Launch of

Israeli society of laser dentistry

Recently, the Israel Association of Laser Dentistry (ISLD) was launched at an event sponsored by international dental laser technology provider Syneron Dental Lasers in collaboration with Oral-B. Many Israeli practitioners from all over the country joined the event at the Dan Tel Aviv Hotel. The society aims to advance laser dentistry in Israel.

ISLD is the result of the joint vision of and intensive collaboration between Prof. Adam Stabholz, the Dean of the Hadassah School of Dental Medicine at the Hebrew University of Jerusalem, and Ira Prigat, President and CEO of Syneron Dental Lasers. The founders hope that it will help promote awareness of the important role of dental lasers in oral treatment in Israel by encouraging research and other activities to advance the field of laser dentistry among Israeli dentists. Prigat said that country's dental market and citizens will benefit from the initiative.

[PICTURE: ©YURI ARCURS]

"The idea was to launch the ISLD as a forum for sharing and exchange among scientists, clinicians and the industry's dental laser companies that are providing the technology and making it available at dental clinics. The ISLD will establish hands-on practice seminars, education, training and regular meetings to study the various laser technology solutions," Stabholz said.

Fear of tooth loss greater than

Fear of root-canal treatment


[PICTURE: ©ARTFAMILY]

Although it is generally believed that root-canal treatment is considered one of the most unpleasant medical procedures by the majority of patients, a recent survey has revealed that most people are more afraid of losing their permanent teeth than undergoing root-canal treatment or getting the flu—despite the particularly high flu activity this season. The survey was conducted at the beginning of the year by members of the American Association of Endodontics. Among other findings, they found that 74 per cent of survey participants hoped to avoid losing a permanent tooth, while 73 per cent said that they wanted to avoid the flu. In addition, 70 per cent of the participants said that they would avoid undergoing root-canal treatment and 60 per cent were more anxious about root-canal treatment than getting a tooth pulled (57 per cent) or receiving a dental implant (54 per cent). According to the association, an estimated 15.1 million root-canal treatments were performed in 2005 and 2006, of which 10.9 million (72 per cent) were performed by general dentists and 4.2 million (28 per cent) by endodontists.

The survey was conducted in preparation for the seventh annual Root Canal Awareness Week taking place in the US from March 17 to 23. The aim of the program is to encourage collaboration between general dentists and endodontists in order to preserve patients' natural teeth and to help anxious patients. Several documents about the subject can be downloaded free from the association's website.


[PICTURE: ©URFIN]

US adults delay dental care

Due to uncertain economy

A survey of more than 1,000 US adults has revealed that 36 per cent have delayed or would delay dental treatments owing to their current financial situation. Although more than 80 per cent knew about the long-term financial implications of neglecting oral health, many people seemed to put dental care off until they experienced significant pain or had a dental emergency, the investigators said. The survey involved 501 men and 504 women aged 18 and older. It was conducted as a telephone survey by market research agency ORC International on behalf of Aspen Dental, one of the largest networks of dental care providers in the US, between Feb. 28 and March 3. Overall, the results were in line with other studies that found a general decline in health care spending. More than 30 per cent of the people surveyed reported that their net salary was lower this year than in 2012. Moreover, 44 per cent had no dental insurance. The number was especially high among those with an annual income below $35,000 (61 per cent), the investigators said. They also found that only 1 in 10 agreed that routine dental visits were critical to their overall well-being.

“The survey is a stark reminder of the need to improve public understanding about the importance of dental care to overall health, as well as create a better understanding about the long-term effects of ignoring dental visits, including the link between gum disease and other serious conditions such as diabetes and stroke,” said Dr Nathan Laughrey, who runs a number of Aspen Dental practices.

Parents' saliva (on pacifiers) reduces

Allergy risk in infants

Researchers from Sweden have suggested that parental saliva stimulates a baby’s immune system owing to the altered oral flora and thus reduces the risk of allergy development. In a study of almost 200 infants, they found that children whose parents sucked their pacifiers to clean them during the first six months of life had a significantly reduced risk of eczema and asthma.


[PICTURE: ©WAVEBREAKMEDIA]

The study involved 184 children whose mothers were recruited between 1998 and 2003 from a larger European allergy study at the Mölndal Hospital in Gothenburg, Sweden, when they were still pregnant.

Overall, the study suggested that parental pacifier sucking could be a simple and safe method to reduce allergy development in infants and young children. However, further studies are needed to confirm the findings.

According to the researchers, parental cleaning of the pacifier by sucking was associated with a decreased risk of allergy development. The incidence of both eczema and asthma was greatly reduced in children whose parents sucked their pacifier. In addition, the analysis found that parents of vaginally delivered infants were more likely to have this habit than parents of infants delivered by caesarean section were.

The study, titled “Pacifier cleaning practices and the risk of allergy development”, was published online on 6 May in the *Pediatrics Journal* ahead of print.

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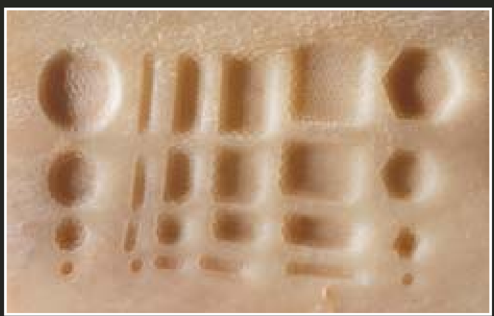

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