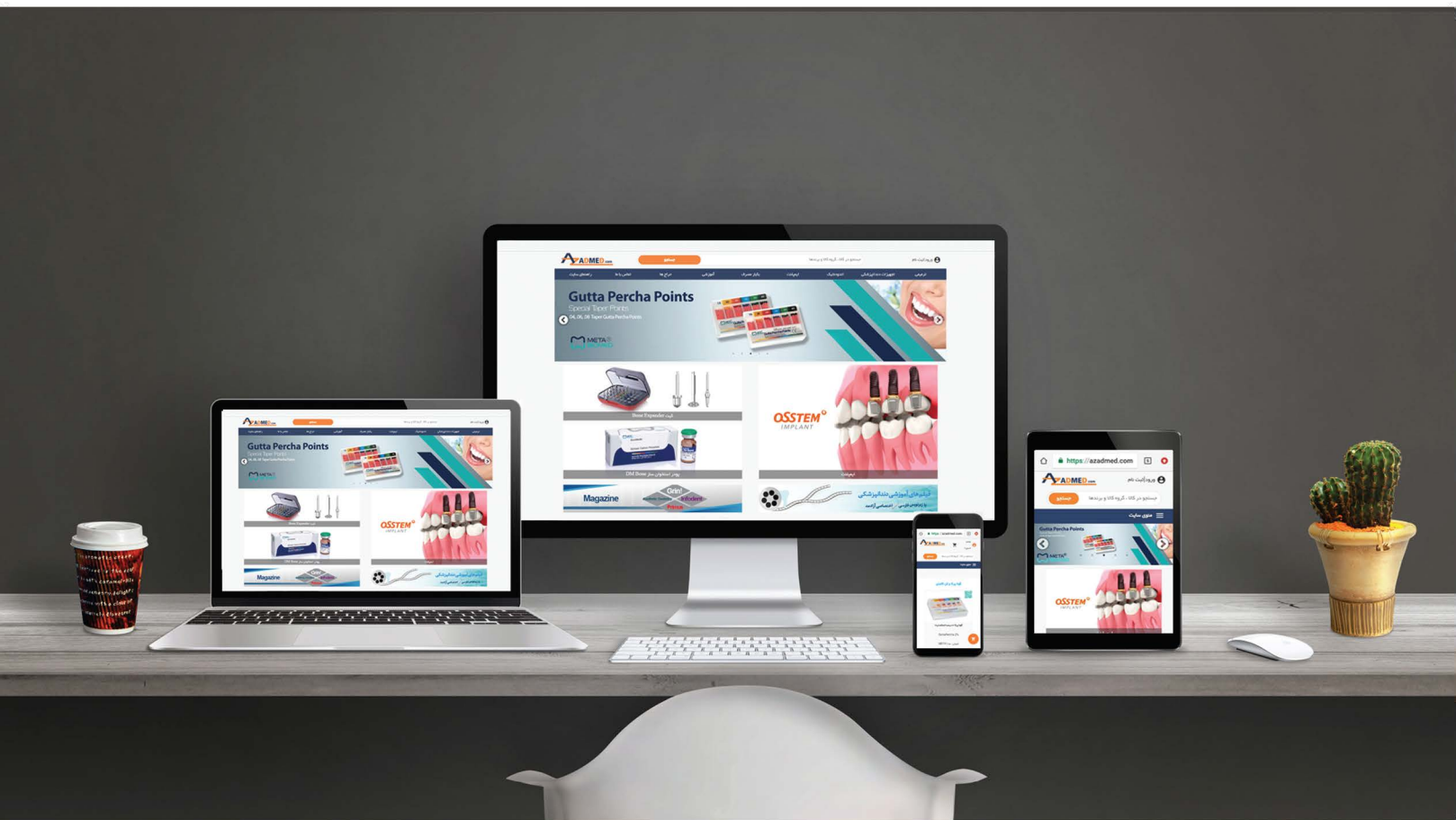







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Prof Dr Norbert Gutknecht  
WFLD President  
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# Dear **Laser** users,

\_This editorial is written under the impression of the WFLD Congress, which is just now taking place in Dubai together with the biggest dental exhibition and dental conference in the Middle East, the AEEDC® 2010.

The WFLD Congress is an integrating factor for Lasers in the different fields of dental treatment and the visitors from more than 110 countries are able to participate not only in Laser presentations but also in a number of other presentations concerned with conventional treatments.

The very positive effect out of this integration is that colleagues who have been very reserved towards this technology perceive lasers and laser treatments more objectively.

I hope that this edition is again stimulating you to dig deeper in the advantages of laser-supported treatments.

Prof Dr Norbert Gutknecht  
Editor-in-Chief

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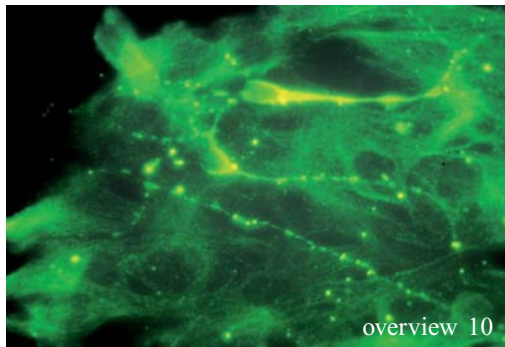
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# Surface analysis of Erbium:YAG laser etching v/s acid etched surface

## ESEM observations *in vitro* study

**Authors**\_Dr Roheet Khataavkar & Dr Vivek Hegde, India

### Summary

#### *Aim*

The aim of the present study was to compare the effect of conventional acid etching with 37 % phosphoric acid and Er:YAG laser (non-contact mode) on surface changes in enamel.

### Materials & methods

A total of 50 non-carious extracted human teeth were collected for the study. The teeth were divided into five groups; wherein one set of teeth was acid etched for 30 seconds with 37 % phosphoric acid and four groups were laser-ablated with an energy output of 50, 75, 100 and 150 mJ respectively using Er:YAG (2,940 nm wavelength) Laser in non-contact mode. Micromorphological effects were evaluated using an ESEM for change in the structure of enamel.

### Results

Following observations were made: Comparison between acid-etching & Laser treatment on the

Effects on tooth surface and smear layer for each group.

ESEM evaluation showed that increasing the energy parameters showed difference in the surface morphology of enamel from roughening to a etching-like micro-roughened pattern. Certain laser treated teeth showed better micro-retentive features as compared to acid-etching.

### Conclusion

Laser-treatment for providing a micro-retentive surface is a viable option that can be chosen. The Er:YAG Laser energy levels that provide a comparable effect to acid-etching were also noted.

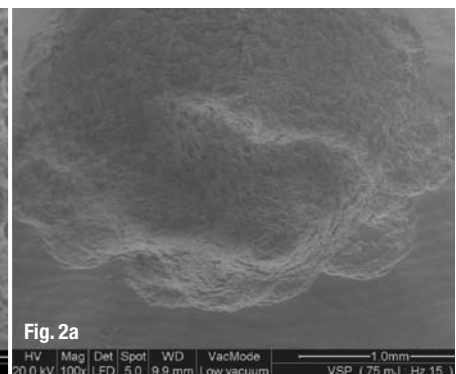
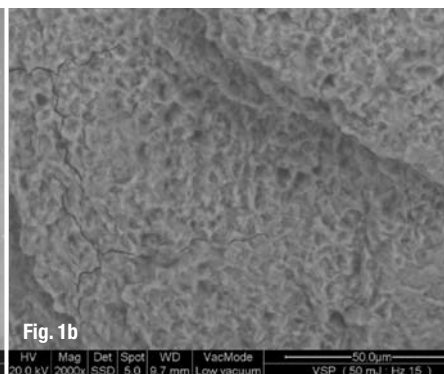
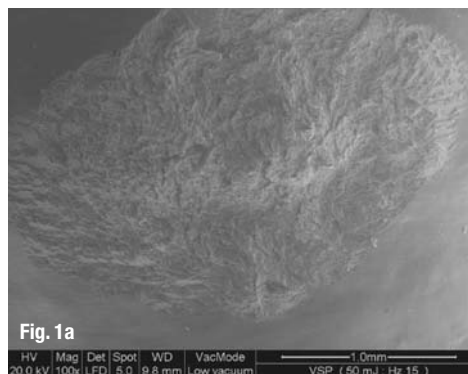
### Introduction

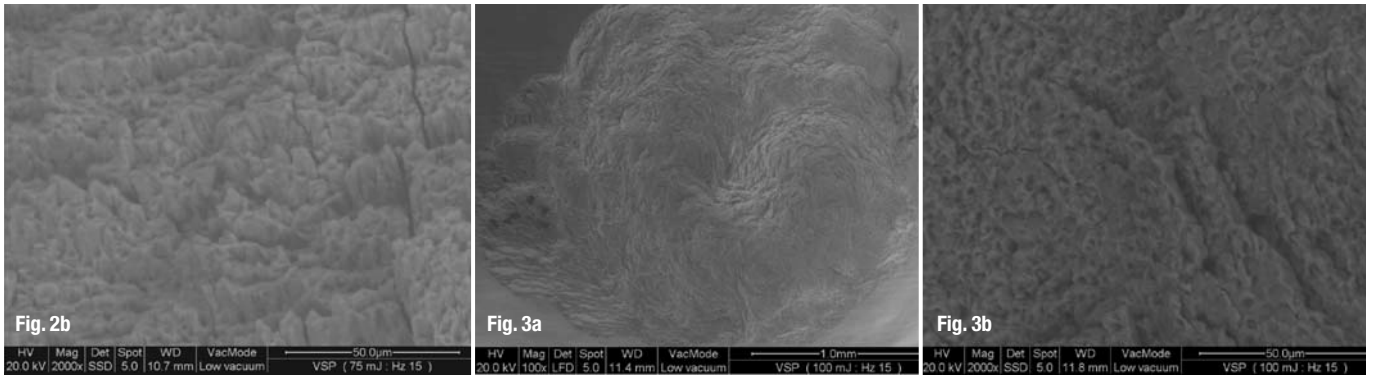
Hard tissue lasers have been introduced in dentistry since almost 20 years and a number of wavelengths have been tried and experimented upon for ablation of hard tissue including enamel, dentin, cementum and bone.<sup>1-4</sup> Lasers delivery devices today have a number of parameters that can be modified

**Fig. 1a**\_ Low power magnification (100x) image of enamel surface lased at 50 mJ and 15 Hz showing definite surface changes.

**Fig. 1b**\_ High power magnification (2000x) image showing micro-roughened surface.

**Fig. 2a**\_ Low power magnification (100x) image of enamel surface lased at 75 mJ and 15 Hz showing circular path followed by the laser beam.





by the clinician to obtain the desired results; these include minor variables like water and air; and major variables like Pulse mode, Frequency & Energy output.

With respect to pulse duration i.e. duration of a pulse there are five options available namely Very Long Pulse (1,000  $\mu$ s), Long Pulse (600  $\mu$ s), Short Pulse (300  $\mu$ s), Very Short Pulse (100  $\mu$ s), Super Short Pulse (50  $\mu$ s). Also frequency (i.e. number of pulses per second) can be modified. Energy output can also be varied depending upon a requirement of high or low energy levels. The Power; which is a product of the energy output and frequency changes accordingly. It has been shown through a number of studies that the Er:YAG laser is an effective tool in cavity preparation etching and removal of caries from enamel and dentin.<sup>5-9</sup>

In the numerous hard tissue applications that lasers have been used for, lasers have been suggested to cause a surface etching effect which has been comparable to conventional acid etching. This study aimed to analyze the changes in the ultrastructure of human enamel resulting from simulated cavity preparation by an Er:YAG Laser, and to investigate the optimal parameters of that laser for ablating enamel for etching; with a VSP (Very Short Pulse); variable energy outputs (EO) but Repetition Rates (RPR) kept constant and compare it with the surface characteristic of an acid-etched surface.

## Materials and methods

### *Selection of Samples*

A total of fifty non-carious extracted maxillary human premolars were collected for the study. The teeth were washed in normal saline and gross calculus was removed using an ultrasonic scaler. The teeth were stored in normal saline at room temperature until treated.

### *Preparation of samples*

The cervical 3<sup>rd</sup> of buccal surface of each tooth was subjected to 15 seconds with an Er:YAG (Fotona

Fidelis III Plus, Fotona d.d., Slovenia, EU) of 2,940 nm wavelength. A circular area of 2 mm diameter ( $\pm$  0.25 mm) was prepared using the laser in non-contact mode at a distance of approximately 7mm from the tooth surface; set at different energy parameters. Keeping the Frequency constant at 15 Hz; the energy output was varied at 50 mJ, 75 mJ, 100 mJ and 150 mJ respectively. The Power reading on the Laser Device also increased accordingly. The water and air were kept constant at a value of six each. Ten Samples were also etched with the conventional method of 37% phosphoric acid (3M ESPE, USA) etching for a period of 15 seconds. Following preparation of the samples with the prescribed parameters (Table1) the teeth were subjected to ESEM analysis.

### *ESEM evaluation*

Micromorphological effects were evaluated on enamel using an Environment Scanning Electron Microscope (ESEM) at a magnification of 100x and 2,000x; wherein we noted the Effects of the laser on Enamel Surface and Smear Layer for each setting.

Comparison amongst the difference in laser etched and 37% phosphoric acid etched samples and the ideal parameters for laser etching as compared to conventional acid etching.

The advantage of the ESEM over the Scanning Electron Microscope (SEM) being that the sample does not have to go through any processing; it can directly be placed into the Microscope; thereby avoiding drying of the specimens during processing.

## Results

The effects of the laser application on the enamel as observed with the ESEM were as follows.

### *50 mJ*

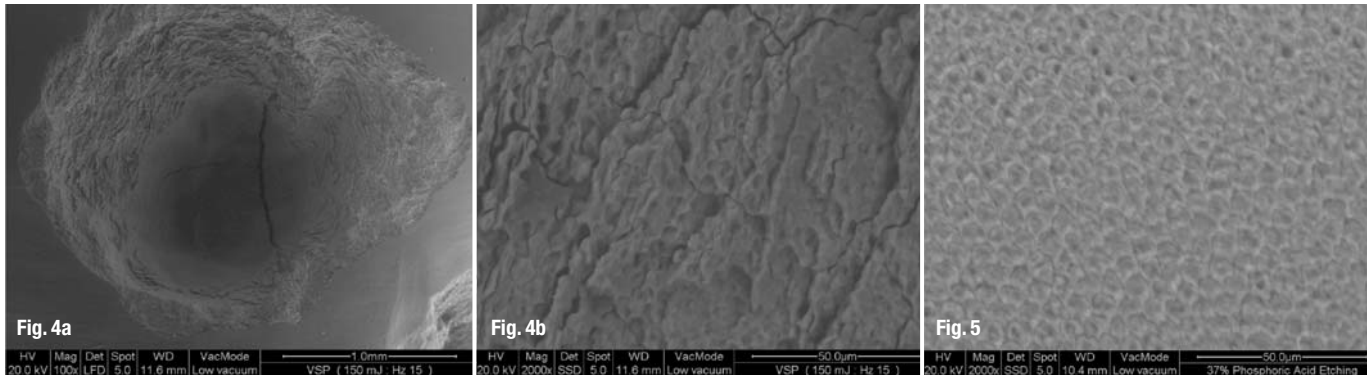
A definite change in the surface of the enamel was noted at low power magnification (100x) as compared to the adjacent sound enamel. However, at a higher power magnification the circular laser treated area showed only a superficial roughness without

**Fig. 2b**\_High power magnification (2,000x) image showing micro-retentive surface.

**Fig. 3a**\_Low power magnification (100x) image of enamel surface lased at 100 mJ and 15 Hz showing surface melting.

**Fig. 3b**\_High power magnification (2,000x) image showing melting and partial recrystallization of the enamel prisms.





**Fig. 4 a** Low power magnification (100x) image of enamel surface lased at 150 mJ and 15 Hz showing saucer-like cavitation.  
**Fig 4 b** High power magnification (2,000x) image showing partially coalesced structure and presence of microcracks.  
**Fig. 5** High power magnification (2,000x) image of 37 % phosphoric acid etched surface showing type III etching pattern.

the presence of a micro-retentive surface. (Fig.1)

*75 mJ*

The circular path followed by the laser beam is clearly visible on the 100x magnification. Slot-type pattern of enamel ablation is seen in the 2,000x magnification indicating selective ablation of the enamel prisms occurring over the lased surface. The lased surface shows a definite micro-retentive surface with presence of elevations and depressions (Fig. 2).

*100 mJ*

Lower magnification shows the superficial layer of enamel that has melted and flowed in the direction of the laser beam Higher magnification reveals the melting & partial recrystallization of the enamel prisms (Fig. 3).

*150 mJ*

When lased at 150 mJ there is a saucer-like cavitation seen on the surface. Higher magnification shows molten and partially coalesced structures instead of the prismatic pattern of enamel and a number of microcracks are also noted on the laser treated surface (Fig. 4).

*37% phosphoric acid etched surface*

The acid etched surface seen at a high power magnification clearly shows the presence of the key-hole pattern of enamel with a type III etching pattern.

This shows a uniform micro-retentive surface over the etched area (Fig. 5).

**\_Discussion**

An evaluation of all the laser-treated groups revealed that the lased surfaces were free of any smear layer indicating a good surface for bonding.<sup>10</sup> However, the morphology of the lased enamel showed a large variation as the energy output was increased.

Excessive energy parameters did not give the same results in all the samples, because of the presence of induced alterations resulting from the thermal effect. Higher energy values were shown to be change the structure of the enamel prisms. The changes in the inherent structure of the enamel prism followed this order—Microroughness, Micro-retentive areas, Reorganization and Recrystallization of Enamel Prisms, and Microcracks.

A micro-roughened surface was observed at a low energy output level of 50 mJ however the depth of the roughened areas seemed lesser as compared to the higher energy output of 75 mJ. The ultra-structural appearance of enamel lased at 75 mJ was similar to that of conventionally etched enamel with 37 % phosphoric acid. However, the etched surface showed a non-specific mixed-type pattern of the rods and prisms; as opposed to a uniform type III pattern seen with an acid etched surface.<sup>11,12</sup> Clinically, the advantage of laser etching over conventional bur is that a debris free, smear free and oil free surface is obtained.

The Er:YAG laser has also been shown to have anti-bacterial properties.<sup>13</sup> The taste of phosphoric acid may also not be well accepted by the patients hence laser etching would be a better option.

**\_Conclusion**

**Tab. 1** Table showing groups and parameters used for each group.

Groups (n=10)	Energy output (mJ)	Frequency (Hz)	Power (W)
I	50	15	0.75
II	75	15	1.10
III	100	15	1.50
IV	150	15	2.25
V	37% phosphoric acid etched surface		

Through this study we have concluded that lasers definitely can be used as an alternative to conventional procedures. We concluded that a correct parameter of energy level has to be chosen to get the desired result for bonding procedures. We also inferred that 75 mJ Energy output with 15 mJ frequency provided a micro-retentive surface that was comparable to a 37 % phosphoric acid etched surface.

These results are based on the surface changes that have been seen on the enamel only and may not be indicative of the bonding ability of the lased surface to composite resins. Hence, studies have to be carried out to compare the bond strengths of the lased and acid etched surfaces to validate the etching effect of the Erbium:YAG Laser.

## Acknowledgements

The authors would like to thank Mr. Dheeraj Suryawanshi for his technical assistance with the ESEM Analysis at ARAI, Pune.

## References

1. Parker S. Introduction, history of lasers and laser light production. *British Dental Journal* 2007;202(1): 21–31.
2. Featherstone JDB, Fried D. Fundamental Interactions of Lasers with Dental Hard Tissues. *Med. Laser Appl.* 2001;16: 181–194.
3. Featherstone JDB, Nelson DGA. Laser Effects on Dental Hard Tissues *Adv. Dent. Res.* 1987; 1(1): 21–26.
4. Parker S. Laser-tissue interaction *British Dental Journal* 2007;202(2): 73–81.
5. Yamada Y, Hossain M, Suzuki N, Kinoshita J, Akamura Y, Matsumoto K. Removal of Carious Dentin by Er:YAG Laser Irradiation with and without Carisolv™. *Journal of Clinical Laser Medicine & Surgery* 2001;19:3: 127–131.
6. Attrill DC, Farrar SR, King TA, Dickinson MR, Davies RM, Blinkhorn AS. Er:YAG Laser Etching of Dental Enamel as an Alternative to Acid Etching. *Lasers Med Sci* 2000;15: 154–16.
7. Cozean C, Arcoria CJ, Pelagalli J, Powell GL. Dentistry for the 21<sup>st</sup> Century?—Erbium:YAG Laser for Teeth. *JADA* 1997;128: 1080–87.
8. Ying D, Chuah GK, Hsu CYS. Effect of Er:YAG laser and organic matrix on porosity changes in human enamel. *Journal of Dentistry* 2004;32: 41–46.
9. Liu J, Liu Y, Stephen HCY. Optimal Er:YAG laser energy for preventing enamel demineralization. *Journal of Dentistry* 2006;34: 62–66.
10. Tay FR, Pashley DH. Etched Enamel Structure and Topography: Interface with Materials In: Eliades G, Watts DC, Eliades T. *Dental Hard Tissues and Bonding: Interfacial Phenomenon and related properties.* Springer Verlag Heidelberg, Germany. 2005: 6–8.
11. Silverstone L, Hicks M, Featherstone M. Oral fluid contamination of etched enamel surfaces. A SEM study. *J Am Dent Assoc* 1985; 110: 329–332.
12. Hosoya Y. The effect of acid etching times on ground primary enamel. *J Clin Pediatric Dent* 1991; 15: 188–194.
13. Araki TA, Ibraki Y, Kawakami T, Lage-Marques JL. Er:YAG Laser Irradiation of the Microbiological Apical Biofilm. *Braz Dent J* 2006;17:4: 296–299.

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# Laser phototherapy (LPT) in dentistry

Author\_Jan Tunér, Sweden

Although laser phototherapy has been practiced for more than 40 years, there is still some remaining controversy regarding its scientific standard. During recent years about 250 scientific papers are annually published on PubMed and the knowledge about the basic mechanisms and the optimal clinical parameters are gradually better known.

The effects exerted on cells and tissue are well documented and to a certain degree also in animal models. Large clinical studies are still scarce. The safety of the treatment is well documented. Some controversy remains for several indications, in spite of enthusiastic clinical observations for a great variety of conditions.

The problem of finding consensus in this area of dental laser applications is greater than for "hard laser" applications, due to the fact that so many parameters are involved. Different wavelengths, power densities, energy densities and application modes have been used and there is no current consensus about optimal standards. The reporting of the actual laser parameters and dosimetry in studies is too often substandard<sup>1</sup>

and control studies are then difficult to perform. Consequently the evaluation of the various applications becomes problematic. The optical properties and performance of commercially available lasers vary a lot, adding problems in the evaluation process.<sup>2</sup>

Surgical lasers are rather precise in their indications and the results are easier to verify by the naked eye. Therapeutic lasers work on the cellular level, enhancing the fundamental functions of the cells. This means that any pathological condition theoretically can be improved, if the suitable wavelength and energy of light is applied. This is the beauty of laser phototherapy, but also the problem: how can one single therapy be used in so many situations? There is supposedly no "take-it-all" method in the history of medicine and a sceptical attitude from dentists is basically a sound reaction.

## Two sides of the same coin

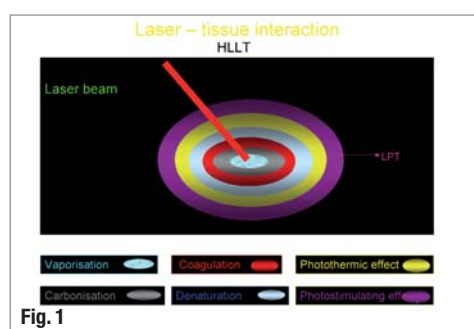
For decades efforts have been made to separate "soft" and "hard" lasers and the plethora of suggested names partly stems out of these ef-

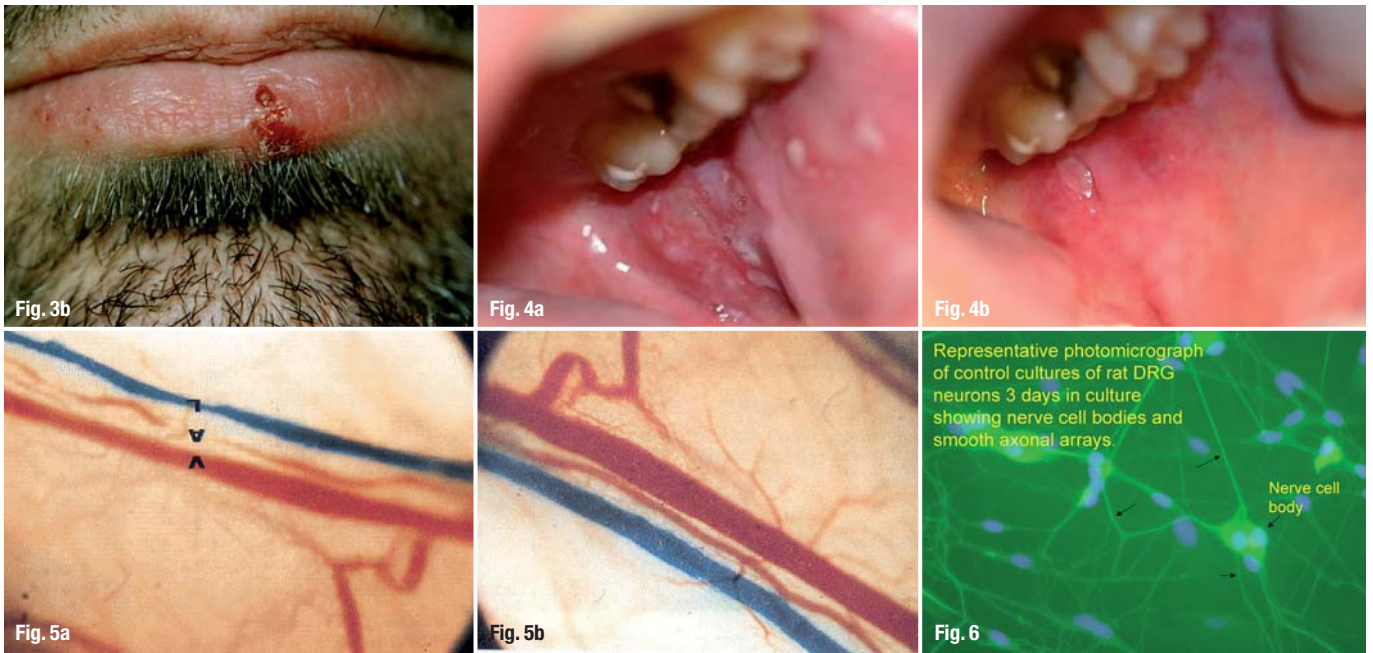
Fig. 1\_A theoretical description of the effects of a strong laser beam.

Courtesy: Edson Nagib.

Fig. 2\_Red laser light penetration through dry bone.

Figs. 3a & b\_HSV-1 blister on day 1 and 2.





forts. "Low power laser", "Low level laser, Low energy laser" are examples of this confusing nomenclature. The modern name of the tool is therapeutic laser and the therapy itself is more frequently called Laser Phototherapy (LPT). It is becoming increasingly clear that the strict division between the two types of lasers cannot be maintained. "Soft" lasers are now being used in the Watt range (although defocused), and the stimulatory effects of surgical lasers are being taken into consideration. This stimulatory effect of "surgical" laser is not new. Already in 1980 Goldman<sup>3</sup> published a report about the use of Nd:YAG laser for arthritis. The Er:YAG laser is a more recent laser and up till now only a few studies have been published using this laser for a priori laser phototherapy

### Contra indications

There are no known absolute contraindications for LPT but several relative contraindications and caveats. Areas of malignancies or suspected malignancies must be avoided due to insufficient knowledge at the present time. For the same reason irradiation of patients with coagulation disorders should be avoided. Irradiation over the thyroid has been reported as a contraindication but present knowledge does not substantiate such risk when irradiation is performed in or close to this area. However, care is recommended in cases of hyperthyroidism. Pregnancy is reported as a caveat but this would only be applicable to large doses over the abdomen. As for epilepsy there are anecdotal reports on seizure attacks triggered by pulsed

light, but it would probably have to be in the visible range and observed by the patient. Irradiation over testicles and diabetic wounds has been reported as contraindications but are rather confirmed as good indications for LPT.<sup>4-8</sup> Old literature mentions patients wearing pacemakers as a contraindication, but this is clearly a misunderstanding.

### Safety

Therapeutic lasers are considered as safe by the US Federal Drug Administration. The only known hazard is the risk of eye injuries and it is recommended that patients wear protective goggles, adapted for the wavelength used. The real risk for eye injuries is minimal even without goggles, but still recommended for legal reasons. Protective instructions for therapeutic laser were initially mimicking the safety regulations for surgical lasers but the levels of risk are certainly very different. Indeed, the use of therapeutic laser for treatment of macular degeneration has been reported.<sup>9</sup>

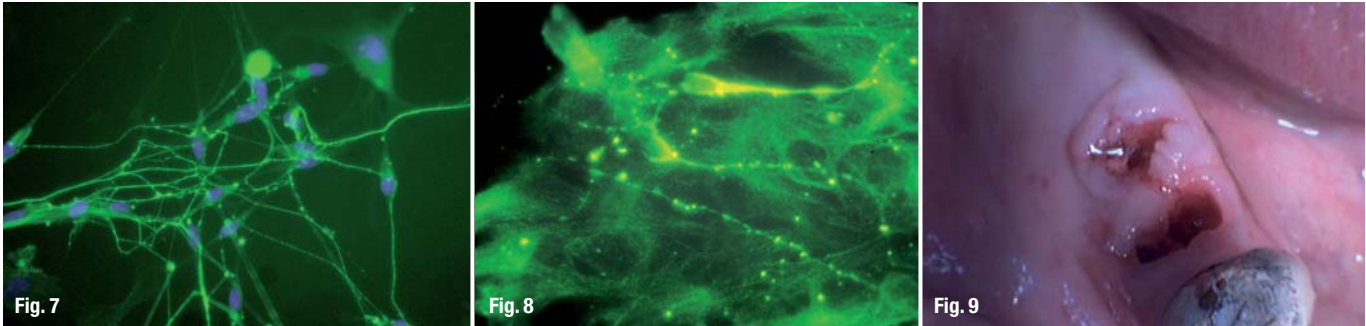
### The mechanisms

To the skeptical reader it may seem improbable that one therapy can affect so many conditions. However, the effects of LPT take place in the cells, and all cells in the body have a common architecture. Irradiation causes fundamental changes such as enhancement of ATP and cell membrane permeability. The main, but not the only photoreceptor is located in the mitochondria and is the cytochrome-c oxidase, the termi-

**Figs. 4a & b** Mucositis after 6 days of radiation started, result after 6 days. Courtesy: Alyne Simoes.

**Figs. 5a & b** Effects on artery, vein and lymph vessels of 904 nm laser. Courtesy: Pierre Lievens.

**Figs. 6 & 7** Axons in vitro before and after 830 nm laser irradiation. Courtesy: Roberta Chow. Full stop in analogy with the above.



**Fig. 8**\_The same effect from Nd:YAG irradiation. Courtesy: Ambrose Chan.

**Figs. 9 & 10**\_Extraction wound healing in 24 hrs after 660 nm irradiation. Courtesy: Talat Qadri.

nal enzyme of the Krebs's cycle. The basic irradiation changes generate a cascade of secondary and tertiary events, which are complicated and difficult to study, especially since they are more or less related to the wavelength and intensity of the light. Cells in a normal redox balance do not react much, whereas cells in a reduced redox situation react by increasing the pH situation toward normalization. The basics of LPT are extensively described by Karu in the book "Ten Lectures on Basic Science of Laser Phototherapy".<sup>10</sup>

### The wavelengths

Therapeutic lasers generally operate in the wavelength range of 630–980 nanometers (nm). Output powers can be anything from 10 to 500 mW. They are often named after the contents of the substances of the lasering medium. Thus red light lasers are often called InGaAlP lasers or "Indium lasers", infrared lasers GaAlAs ("Aluminium lasers") or GaAs ("Gallium lasers"). However, the best way is just to indicate the wavelength, since these different materials are found in a wide wavelength range.

### The tools

There is a great variety in design of the therapeutic lasers. For dentistry it is obvious that a battery based design similar to that of many curing lights is favorable. The probe can be sterilized, the unit is easy to move from one operatory to the other and there are no cables. However, the problems with battery operated gadgets remain, although batteries have been greatly improved in recent years.

### Dosage

Practitioners often find the issue of dosage complicated, since it has to be adapted to the condition of the tissue, depth of location, chronic or acute etc. To get to the dosage, the energy has to be calculated first, and that is quite uncomplicated. The energy is the power of the laser in

milliwatts x the number of seconds. For instance, a laser of 50 mW used during 20 seconds produces an energy of  $50 \times 20 = 1,000$  millijoules = 1 joule (J). Clinicians often use "energy per point" in this fashion. This is acceptable but not the whole truth. The energy is not the "dose", although we from a semantic point of view tend to look at it that way. The dose is a function of the size of the irradiated area, so in order to calculate the dose, the area also has to be taken into consideration. If the size of the probe, kept in contact with tissue, is  $0.25 \text{ cm}^2$  preferably with superscript 2, then the 1 J in the example above becomes 1 divided by  $0.25 = 4 \text{ J/cm}^2$ . If the probe is held at a short distance and the divergence of the beam makes the light cover an area of  $1 \text{ cm}^2$ , then the dose becomes 1 divided by 1, equals  $1 \text{ J/cm}^2$ . The above examples simply show that when the energy (J) is concentrated to a smaller area, the intensity increases. This is the same effect that we observe when we change our large curing light probe to a "turbo" tip with a smaller end tip. The clinical importance of understanding the difference between energy and dose must be underlined. The biological effects between applying 1 J with a fibre of  $0.5 \text{ cm}^2$  and  $0.1 \text{ cm}^2$  are quite different.

### Penetration

The depth of penetration varies with the wavelength. Red laser light has a limited penetration depth while there is an "optical window" around 800 nm in the infrared. The penetration increases with higher power, but only marginally. Oral tissues such as mucosa and teeth are quite transparent, whereas bone is less transparent and muscles even less. Therefore each wavelength has its limitations. Red is best for superficial structures such as wound healing while TMD (except for the superficial joint) is best treated with infrared. Blood is the main absorber of laser light. Therefore the penetration into muscles can be increased by using slight pressure, creating an ischemic area. It is obvious that a lot of factors influence the numbers of photons reaching the de-

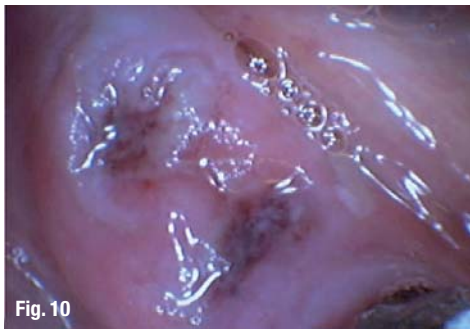


Fig. 10



Fig. 11a



Fig. 11b

sired target area and the clinician needs to understand these to obtain good results.

### Some indications for dental LPT

#### *Laser acupuncture*

Few dentists are trained in acupuncture but there are some safe points which could be used at advantage, e.g. the P6 on the wrist, useful to reducing gagging. fMRI studies have confirmed that laser and needles actually have similar, although not identical effects.<sup>11, 12</sup>

#### *Bone regeneration*

Several *in vitro* and animal studies indicate that LPT has a positive effect on bone regeneration. This has consequences for both periodontology and implantology. Repeated irradiation can activate osteoblasts and also stimulate the integration of implants. Optimally the irradiation should start during the surgery and continue during the first two weeks.<sup>13-17</sup>

#### *Caries*

A cavity or crown preparation is a burden for the pulp. LPT applied after preparation and before cementation can save a lot of postop problems and potential endodontic work.<sup>18, 19</sup>

#### *Dentinal hypersensitivity*

Several studies<sup>20-25</sup> have been published regarding the effect of laser phototherapy for dentinal hypersensitivity. While stronger lasers have the ability to seal dentinal tubuli, the therapeutic lasers do not have any such effect but will influence the odontoblasts and the pulp. The therapeutic effect of the "surgical" lasers has generally not been realized. The results from studies vary and so do the dosages, wavelengths and application techniques. All used wavelengths apparently have an effect, given the proper dosage. Irradiation has been directed towards the exposed dental necks and sometimes also over the projection of the apices. For this latter approach infrared is needed, except for the upper incisives.

#### *Herpes Simplex (HSV1)*

LPT has been reported to be a fast and very effective treatment for this indication. If treated in the prodromal stage, a great likelihood for the attack to subside till the following day is reported. Pain relief is immediate and the intermediate period between the attacks is prolonged. The effect is supposed to be similar to that of Acyclovir, but without any side effects. Interestingly enough, it has been shown that patients with recurrent herpes attacks to advantage can be treated even in the silent periods. In spite of few available clinical studies this therapy appears to be safe and effective.<sup>26-28</sup>

#### *Mucositis*

Mucositis is an inevitable follower of radiation and chemotherapy. LPT has been documented as an effective method to reduce pain and incidence of mucositis<sup>29-34</sup>, not full stops. The HeNe laser was first documented but the red and infrared laser diodes appear to be useful as well. Best results are obtained when LPT is initiated before the radiation/chemo therapy, since LPT has a radio protective effect.<sup>35</sup> Intra oral irradiation is rather time consuming and extra oral application via red LED arrays<sup>36</sup> has been proven effective and future research may look into the same concept for less staff-intensive laser applications.

#### *Nerve recovery*

There are many papers about the effect of LPT on the function and recovery of peripheral nerves. This therapeutic modality seems very attractive in oral surgery where injuries of nerves such as the IAN and the facial nerve are likely to occur in some types of surgery. LPT can be used as an immediate protective treatment<sup>37</sup> but it is reported that even long-standing aberrations can be influenced.<sup>38-42</sup>

#### *Oedema*

Oedema is a daily guest in dental operatories, either caused by pathologies or by dental interventions. LPT decreases the permeability of the lymph vessels and can also stimulate lymph ves-

**Figs. 11 & 12** Necrotic frozen fingers tips treated with red laser for five sessions.



Fig. 12



Fig. 13



Fig. 14



Fig. 15

**Figs. 12 & 13**\_ Non-healing angular cheilitis treated daily for one week.  
**Figs. 14 & 15**\_The same patient had a non healing ear wound. Also treated for one week.

sel collaterals, thus reducing the oedema.<sup>43-46</sup> Irradiation of the involved lymph nodes is recommended for all oral pathologic conditions as an adjunctive therapy to local irradiation.

### \_Orofacial pain

Reduction of pain is one of the most desired effects of LPT. This is obvious in dentistry where pain is one of the most feared situations. Pain reduction requires higher doses than general stimulation and therefore pain reduction and tissue stimulation cannot be achieved at the same time. Pain can be gradually reduced by the ability of LPT to reduce the period of inflammation, but the dose window for this is lower than that of immediate pain reduction. LPT stimulates opioid precursors and causes transient axonal vesicles which reduce neural transmission.<sup>47-51</sup> Trigeminal neuralgia<sup>52</sup> and post herpetic neuralgia<sup>53,54</sup> are two indications suitable for LPT. The neuralgia therapy is not likely to cure a trigeminal neuralgia but will facilitate a reduction of Carbamazepine intake.

### \_Orthodontics

There is some documentation for the use of LPT to reduce the pain experienced during tooth movements and also to increase the velocity of tooth movement.<sup>55-58</sup> Low dosage seems to accelerate the speed of movement whereas higher dose appear to slow down movement. In the latter case this could possibly be used for stabilization of a finished orthodontic therapy. This phenomenon is in acc. to the Arndt-Schultz law, which stipulates that for every substance, small doses stimulate, moderate doses inhibit, large doses kill. Here, the "killers" are the surgical lasers.

### \_Periodontics

While high power lasers have received much attention for their ability to reduce pocket microbes

and to remove the pocket epithelial lining, therapeutic lasers have received less attention. However, a number of studies suggest that LPT can reduce pocket inflammation and be useful in combination with SRP.<sup>59-62</sup> Irradiation in connection with SRP reduces postoperative pain and discomfort but several irradiations are needed to produce good clinical results. LPT in itself has no germicidal effect but if used in combination with a suitable dye, a PDT-like effect can be achieved.

### \_Temporomandibular joint disorders (TMD)

TMD can be either arthrogenic, myogenic or both in combinations. The effect of LPT on arthritic conditions is well investigated and there is some evidence of an effect of myogenic pain and trismus. For arthrogenic conditions low doses are required whereas myogenic conditions require infrared laser and high dosage. The pain and spasm relieving effects are fast and a condition of trismus<sup>63</sup> can be resolved or improved within minutes. Since the occipital and neck muscles are frequently involved in TMD, the laser will add benefits for the dentist and patient. Patients having stiff necks are difficult to treat and a session of LPT can soften the neck. In addition, irradiation over the joint and masseter after surgery will decrease the postoperative consequences of a long period of overstretched muscles.<sup>64-66</sup>

### \_Wound healing

The literature contains a multitude of studies on the wound healing aspect of LPT. Some of the underlying mechanisms have been documented but still there is no certain knowledge about the optimal laser parameters and dosimetry. The early studies were performed on healthy test animals and showed moderate results. Modern studies using a diabetic-rat model have proven more successful. The best clinical effects are also seen in long-standing wounds where traditional therapies have failed.<sup>67,68</sup>

## Other indications

The above mentioned indications are some of the major ones but since LPT has an effect on hardly any pathological condition, the list could be much longer. These would not only be purely "dental". The limit of TMD problems does not end with the masticatory muscles; the neck and upper trapezius are frequently involved and easily reached by the laser. The "laser dentist" has many opportunities to help patients and staff with less dental-related problems, as shown by the cases below.

## The therapeutic window

From the above it may appear to be very difficult to find the proper parameters to achieve a stimulative effect. However, like all modalities LPT follows the above mentioned Arndt-Schultz law. This means that too small a stimulation elicits no reaction and too high a stimulation elicits an inhibition. Fortunately the "therapeutic window" between these extremes is fairly wide in LPT.

## The documentation

There is an extensive literature on the biological effects of laser light. About 4,000 studies have been published since the mid 60ies; about 10 % of these are dental-related. The quality varies a lot but has improved considerably during the last decade. The question these days is no longer whether LPT works or not but rather how it works and which are the optimal parameters for the various conditions.

## Abstract

Therapeutic lasers ("Low-level lasers") are defined as "Treatment using irradiation with light at low power intensities and with wavelengths in the range 540–830 nm. The effects are thought to be mediated by a photochemical reaction that alters CELL MEMBRANE PERMEABILITY, leading to increased mRNA synthesis and CELL PROLIFERATION. The effects are not due to heat, as in LASER SURGERY. Low-level laser therapy has been used in general medicine, veterinary medicine, and dentistry for a wide variety of conditions, but most frequently for wound healing and pain control." (MeSH—Medical Subject Headings, 2009). It is apparent that these lasers are different from the Nd:YAG and Er:YAG lasers now gaining popularity in dentistry. However, the two types are actually only two sides of the same coin, since the thermal lasers also have biostimulative qualities. This article presents a general overview of the

therapeutic lasers and presents some of the mechanisms and examples of clinical indications useful in dentistry.

## References

1. Enwemeka CS. Standard Parameters in Laser Phototherapy. Editorial. Photomed Laser Surg. 26 (5): 411 (2008).
2. Guirro RR, Weis LC. Radiant power determination of low-level laser therapy equipment and characterization of its clinical use procedures. Photomed Laser Surg. 27 (4): 633–639 (2009).
3. Goldman J, Chiapella J, Bass N et al. Laser Therapy of Rheumatoid Arthritis. Lasers Surg Med. 1 (1): 93–101 (1980).
4. Zinman LH, Ngo M, Ng ET et al. Low-intensity laser therapy for painful symptoms of diabetic sensorimotor polyneuropathy: a controlled trial. Diabetes Care. 27 (4): 921–924 (2004).
5. Schindl A, Schindl M, Schön H, Knobler R, Havelec L, Schindl L. Low intensity laser irradiation improves skin circulation in patients with diabetic microangiopathy. Diabetes Care. 21 (4): 580–584 (1998).
6. Hourelid N, Abrahamse H. Effectiveness of Helium-Neon Laser Irradiation on Viability and Cytotoxicity of Diabetic-Wounded Fibroblast Cells. Photomed Laser Surg. 25 (6): 474–481 (2007).
7. Corral-Baques MI, Rigau T, Rivera M, Rodriguez JE, Rigau J. Effect of 655-nm diode laser on dog sperm motility. Lasers Med Sci. 2005; 20 (1): 28–34 (2005).
8. Ocaña-Quero JM, Gomez-Villamandos R, Moreno-Millan M, Santisteban-Valenzuela JM. Biological effects of helium-neon (He-Ne) laser irradiation on acrosome reaction in bull sperm cells. J Photochem Photobiol. B - Biol. 40 (3): 294–298 (1997).
9. Ivandic BT, Ivandic T. Low-Level Laser Therapy Improves Vision in Patients with Age-Related Macular Degeneration. Photomed Laser Surg. 2 (3): 241–245 (2008).
10. Karu TI. Ten Lectures on Basic Science of Laser Phototherapy. ISBN 978-91-976478-0-9. Prima Books, Sweden. 2007.
11. Schlager A et al. Laser stimulation of acupuncture point P6 reduces postoperative vomiting in children undergoing strabismus surgery. Br J Anaesth. 1998; 81 (4): 529–532.
12. Litscher G, Rachbauer D, Ropele S, Wang L, Schikora D, Fazekas F, Ebner F. Acupuncture using laser needles modulates brain function: first evidence from functional transcranial Doppler sonography and functional magnetic resonance imaging. Lasers Med Sci. 2004; 19 (1): 6–11.

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# Low-level laser therapy in the treatment of herpes labialis

Author\_Dr Igor Cernavin, Australia

The herpes simplex virus (HSV), both type 1 and type 2 has been identified as a pathogen in a number of infectious processes involving mucocutaneous tissues and the central nervous system.<sup>1</sup>

Recurrent herpes labialis is a significant problem, causing pain and physical discomfort as well as social embarrassment in a large proportion of the population. The clinical manifestation depends on the anatomic site of the infection, the immune status of the host and the antigenic type of the virus. HSV-1 generally affects the tissues of the orofacial region whilst HSV-2 is generally isolated from the genital region.<sup>1</sup>

Up to ninety per cent of adults have circulating neutralizing antibody and about one third of the population are subject to recurrences.

Many factors have been implicated in the reactivation of herpes labialis and these include exposure to sunlight, minor trauma (e.g. dental procedures) and severe systemic disturbances, particularly a fever.<sup>2</sup> It is most common amongst adolescents and adults and symptoms can range from mild discomfort to severe pain.<sup>16</sup>

The typical clinical manifestations are an initial swelling and soreness of the lip, followed by a crop of vesicles on the lip adjacent to the mucocutaneous junction. These vesicles break down to weep, serum and crust, with final healing occurring in ten to fourteen days.<sup>2</sup>

During the prodromal stage many patients experience an itching, tingling or discomfort in the area of the lesion.<sup>1</sup>

Treatment has been haphazard and ad hoc, with a variety of over-the-counter and home remedies being used by both physicians and patients. These have included chemical agents such as alcohol, phenol, tannic acid and camphor but no well controlled clinical studies support the belief that these agents promote healing.<sup>1</sup>

Wright three reported that the use of lysine was an effective prophylactic and a moderately effective treatment. Lysine is a naturally occurring amino acid which is required for the human diet and is essential for the synthesis of certain enzymes, hormones and proteins and it is postulated that it inhibits replication of HSV (herpes simplex virus) by limiting the availability of cellular arginine which is required in the replication of HSV.<sup>3</sup>

Wright found that lysine treatment limited the size of the lesion, and decreased the normal duration of HSV by 25 to 50 per cent.<sup>3</sup> Low energy laser therapy has been advocated as a successful form of treatment for herpes labialis and recurrent aphthous ulcers.<sup>4,8</sup>

Polioxidonium was reported to be effective when used in combination with HeNe laser for treatment of recurrent herpetic stomatitis in children with allergic

**Fig. 1** A typical HSV-1 lesion on the lip of a patient which has been present for about two days and the vesicles have not yet burst.

**Fig. 2** The same lesion as reviewed on the day following treatment. The lesion is dry and the patient reports no discomfort. If left to its natural course this stage would have been reached in about ten days.



diseases and also increased the efficacy of the treatment of the allergic diseases themselves.<sup>13</sup> Low energy laser therapy takes place at intensities so low that any biological effects that occur are due to direct effects of radiation and not as a result of heating.<sup>5</sup> The resulting effect is referred to as biostimulation which assumes that the energy of laser light can be incorporated into the natural process in much the same way that photons are incorporated into the chain of photosynthetic reactions of plants.

Velz-Gonzalez et al.<sup>17</sup> found that low-level lasers had an effect similar to Ayclovir on labial and facial areas as well as on genital areas.

Schindl and Neumann<sup>18</sup> in a randomized double blind study found that patients in the laser group had a median recurrence free interval of 37.5 weeks as compared with three weeks for the placebo group which was exposed to sham irradiation.

Low-level laser therapy or biostimulation has aroused considerable controversy in the literature but many clinicians report positive clinical responses albeit of an anecdotal nature.

Anne Coulter<sup>6</sup> sums up current thinking in the following passage. "The biological reasons for the laser's effectiveness have not been made clear, the information is conflicting and the research has not been well standardized. Much of the earlier work was published without parameters making it impossible to reproduce."

Walsh<sup>7</sup>, writing in 1997 states that it is clear that LLLT can influence the behavior of many cell types, and that multiple effects can occur simultaneously. He then goes on to list a variety of conditions for which treatment benefits have been established and others for which there is no benefit. He lists HSV under the no benefit column.

Researchers are currently striving to reveal the biological process behind the observed successes, including the effect of laser irradiation on the oxidation metabolism of cells.<sup>9</sup>

Webb<sup>10</sup> and her co-authors found that LLLT had a significant effect on cell counts of two human fibroblast lines in the first few days.<sup>1-4</sup> Sroka et al.<sup>11</sup> in examining the effects on the mitosis of normal and tumor cells induced by light treatment using different wavelengths concluded that low level laser irradiation by means of coherent and non-coherent light results in a biostimulation of cellular activities in a wavelength dependent manner and that the photo-induced processes are just one aspect of the more general phenomenon of photo-signaling, which is getting more



and more acknowledgment. Sommer et al.<sup>12</sup> concluded that the threshold parameters of energy density and intensity were biologically independent from each other and that this independence was of practical significance for the medical application of photobiological effects achieved at the low energy density levels. This work supports the author's clinical observation that effectiveness of treatment in herpes labialis is dose dependent.

Reports can be found in the literature pointing out that if applied in the prodromal stage, the blister is likely to disappear in two to three days. It also reduces the frequency, recurrence rate, and according to these authors, post herpetic neuralgia and zoster may also be treated.<sup>14, 15</sup>

The author has been using LLT successfully for treatment of HSV-1, and has found that treatment appears to be dose dependent and also appears to increase the time interval between recurrent attacks. Treatment is significantly more effective if the lesion is irradiated before the vesicles burst, i.e. on about the second day of its appearance. Under such circumstances, most lesions will progress to the dry stage overnight, thus eliminating the discomfort associated with its normal progression of 10-14 days, and in at least one case, the lesion disappeared within six hours.

Figures one and two below, show typical results obtained by the author in approximately 80 per cent of cases treated, as long as they are treated before the vesicles burst, usually within the first two days of their appearance.

Figures three, four and five show a more aggressive case which required more than one treatment. Figure three shows the patient at presentation, Figure four shows considerable improvement by the following day when additional irradiation was carried out, and Figure five shows the patient at day four by which time all discomfort and most of the swelling had subsided.

*Editorial note: The literature list can be requested from the editorial office.*

**Fig. 3** Patient at presentation showing swelling. The patient was in considerable discomfort.  
**Fig. 4** The patient on the following day showing reduction in swelling. The patient reported a significant improvement in discomfort.  
**Fig. 5** The patient on day four by which time most of the swelling and symptoms had subsided.

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# Laser-assisted frenectomy in pediatric dentistry

Author\_Dr Gabriele Schindler-Hultzsch, Germany

## Abstract

The greatest challenge in pediatric dentistry is the child's fear of pain, fear of dental treatment, fear of noise and fear of something they do not know. This is the reason why dental surgery in pediatric dentistry is a special challenge for the child, the parents and the dentist.

Dental fear, anxiety and dental behavior management problems often go together with a perceived lack of control. This leads to a lack of compliance and a high percentage of untreated and unhealed children (Klingberg 2008; Butz, Goebel 2006). Laser-assisted frenectomy offers a treatment alternative for children, providing a more convenient therapy.

## Introduction

Labial frenectomy is the surgical procedure of removing the frenulum. A labial frenulum is the tissue attached to the upper lip and extends into the gums between the two upper front teeth. The labial frenulum may sometimes extend and intrude into the inner, palatal side of the upper front teeth. A labial frenulum also appears at the lower teeth between the two lower

central incisors or as lingual frenulum attached to the tongue and the inner, lingual side of the two lower central incisors.

Indications for frenectomy are a diastema of the upper or lower central incisors, retraction of the gingiva, pain during tooth brushing or orthodontic problems.

Often no treatment is necessary because most of these "abnormal" frenula and diastema disappear as the permanent incisors and canines erupt (Koch, Poulsen 2009). The best time for frenectomy is shortly after the beginning of the eruption of the permanent canines.

Frenectomy can be performed conventionally by scalpel or laser-assisted with either diode lasers at wavelengths of 810 nm, 940 nm, 980 nm, Nd:YAG (1,064 nm), CO<sub>2</sub> lasers (10,600 nm) or lasers of the Erbium-group (Er:YAG 2,940 nm or Er,Cr:YSGG: 2,780 nm), (Gutknecht 2007).

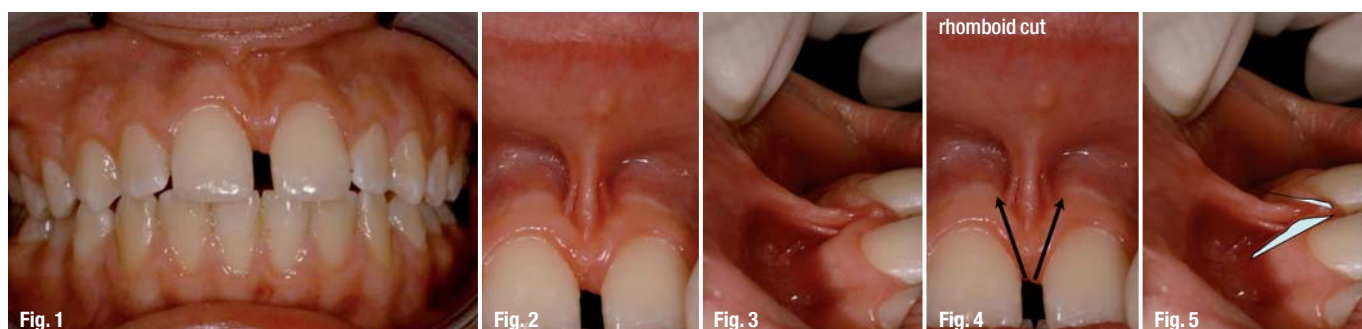
## Clinical Procedure

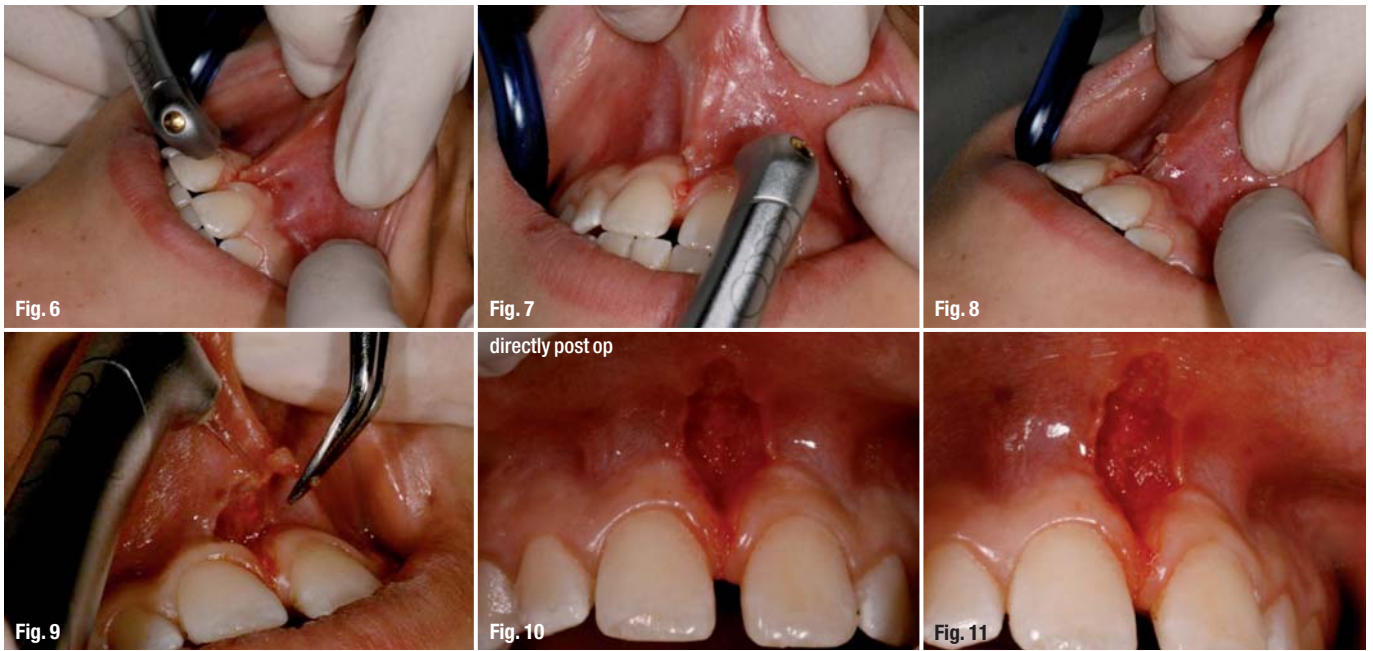
In this article laser-assisted frenectomy will be presented with the clinical procedure of the

Fig. 1 Initial status – persisting diastema between the two upper central incisors.

Figs. 2 & 3 Initial status front side: strong, three way labial frenulum.

Figs. 4 & 5 Cutting technique.





**Figs. 6–9\_** Treatment procedure.  
**Figs. 10 & 11\_** Post-operative follow-up.

Laserkids® concept. The Laserkids® concept (Schindler 2008) is a comprehensive guideline for laser-assisted pediatric dentistry including aspects of dental anxiety, behavioral management, desensitizing, special laser parameters and treatment procedures for pediatric dentistry from the first visit to lifetime care (Schindler, Gutknecht 2009).

In this case the general medical and dental anamnesis shows a healthy 12 year old boy who was very anxious and did not want to have surgery because of previous bad experiences. He was referred from the orthodontist for frenectomy because of the persistent gap between the two upper central incisors. The referral for frenectomy was late because canines were fully erupted. Further orthodontic treatment was considered.

The clinical findings were a strong, three way labial frenulum extending to the gap between the two upper central incisors leading to a diastema mediale with an incisal spacing of 5 mm and a cervical spacing of 4 mm. The patient showed an Angle Class I denticulation with a slight protrusion of the front teeth, a convex profile and a swallowing dysfunction.

The diagnosis was a diastema mediale between the two upper central incisors with spacing of the upper central incisors. The treatment plan was laser-assisted frenectomy because of the boy's fear of surgical treatment. The clinical procedure followed the Laserkids® concept.

The treatment procedure for the upper labial frenectomy took 8 minutes. In this case topical and

local anesthesia was used because of the strong and deep, three way frenulum. In many cases only topical anesthesia is necessary. After applying Cherry GINGICAIN® GEL (Belpoort Co., Inc. Camarillo, CA, USA) and waiting for 30 seconds, 1,0 ml local anesthesia Ultracain® D-S forte 1:100,000 Epinephrine (Sanofi-Aventis Deutschland GmbH, Germany) was applied buccally on the left and right side of the frenulum.

Safety goggles were put on the patient, mother, assistant and dentist while waiting for the anesthetic to work. The time was used to desensitize the child and to get acquainted. A tell-show-show-do technique was used to explain the laser beam, its function and the procedure. The laser beam was shown first on a puppet and then on the finger of the child, following the Laserkids® concept. The surgical procedure started when the child felt comfortable. The frenectomy was completed within 4:30 minutes.

For this frenectomy the Er,Cr:YSGG laser with a wavelength of 2,780 nm was used. The procedure was performed with a MC3 tip, 1,5–2 W, 30 Hz, pulse duration 700 µs, 7 % water and 11 % air, in contact mode.

The first cut was placed incisally in V-form from the right side at an angle. The second cut followed from the left at an angle with the tissue under tension to allow the edges of the fibres to be seen. The next step was an extension to a rhomboid shape, cutting fibres at depth to avoid later relapse and retraction of the tissue. The fibres and excessive tissue were removed. Almost no bleeding occurred during



**Fig. 12–15**\_Post-operative follow-up.

surgery, enabling a clear view for the surgeon and making the procedure fast. No further coagulation was necessary. No sutures were required. A swab was placed for 30 seconds at the end of the laser treatment. The compliance of the patient during treatment was very good.

No painkillers and no antibiotics were prescribed. The patient's post-operative instructions were to take no milk products, no alcohol, no smoking, no caffeine and no theine for the day, and not to participate in sports that day. The lip should be left down and cooled. The teeth should be brushed as always. Repeat visits after one day, six days and four months.

Post-operative findings after one day showed no complications. No bleeding, no pain and no swelling appeared. The healing process was very fast, showing fibrine coating after one day and good vascularisation. There was slight scarring after 4 months. The spacing reduced by about 1,5 mm incisally. The patient was referred back to the orthodontist.

**\_Conclusion**

Laser-assisted dental surgery has benefits compared to conventional treatment methods: selective, minimally invasive, less traumatic, and less pain. There was almost no bleeding and therefore a good, clear view for the surgeon during the treatment. The bactericidal and biostimulating effect of the laser resulted in very good and rapid healing.

The advantages for this patient were obvious—less post operative pain, no swelling. In addition, no sutures were necessary and a further appointment for suture removal was not needed. The compliance and acceptance of the child was high. Laser-assisted frenectomy in pediatric dentistry following the Laserkids® clinical procedure is a gentle treatment option.

**\_References**

1. Butz CL, Goebel C. 2006. Die Inhalationssedierung mit Sauerstoff und Stickoxidul in der Kinderzahnheilkunde. Quintessenz 57, 959–963.
2. Gutknecht N. 2007. Proceedings of the 1<sup>st</sup> International Workshop of Evidence Based Dentistry on Lasers in Dentistry. Quintessence Publishing Co. Ltd.
3. Klingberg G. 2008. Dental anxiety and behavior management problems in pediatric dentistry—a review of the prevalence, measurement and aetiology. Eur Arch Paediatr Dent. Feb; 9 Suppl 1: 11–5.
4. Koch G., Poulsen, S. 2009. Pediatric Dentistry: a clinical approach. 2<sup>nd</sup> edition. Blackwell Publishing Ltd. 306–307.
5. Schindler G. 2008. The Laserkids® Concept—Treatment Concept for laser-assisted pediatric dentistry. Master s thesis RWTH Aachen University.
6. Schindler G., Gutknecht N. 2009. The Laserkids® Concept—Treatment Concept for laser-assisted pediatric dentistry. Lasers Med Sci 24:496–497.



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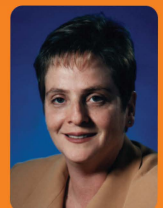
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# Technology-enhanced caries detection and treatment options

Authors\_Michele Baffi Diniz/Brazil<sup>1</sup>, Dr Jonas Almeida Rodrigues<sup>2</sup>, Dr Adrian Lussi/Switzerland<sup>3</sup>

## \_Abstract

Here we present a case report illustrating technology-enhanced caries detection and treatment systems on occlusal surfaces during a 26 month follow-up. The use of ozone therapy and a laser-induced fluorescence device on incipient occlusal caries lesions in a 25-year-old woman is described. The utilisation of the ozone therapy monitored by the laser-induced fluorescence device enabled an alternative and comfortable treatment for incipient caries lesions on occlusal surfaces. Thus, technology-enhanced caries detection and treatment systems are helpful tools during clinical practice.

**Figs. 1a-c**\_Baseline clinical aspect of the incipient caries lesions on tooth 16 (Fig. 1a), tooth 26 (Fig. 1b) and tooth 46 (Fig. 1c).

Note that all teeth presented brown and white opacities on the fissures.

**Fig. 2a**\_Laser-induced fluorescence device (DIAGNOdent).

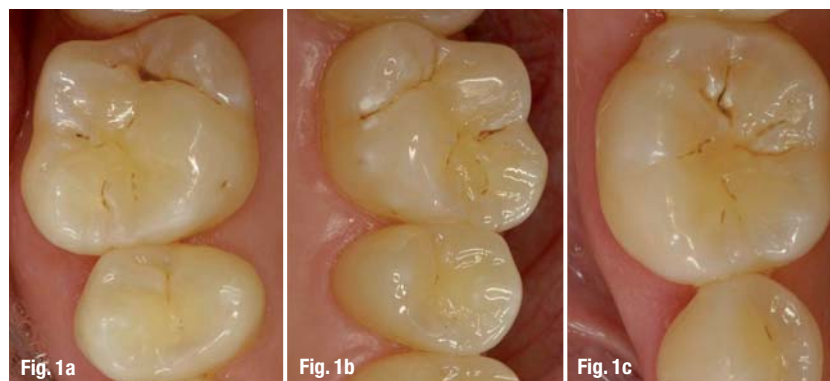
**Fig. 2b**\_LF reading using tip A for occlusal surfaces.

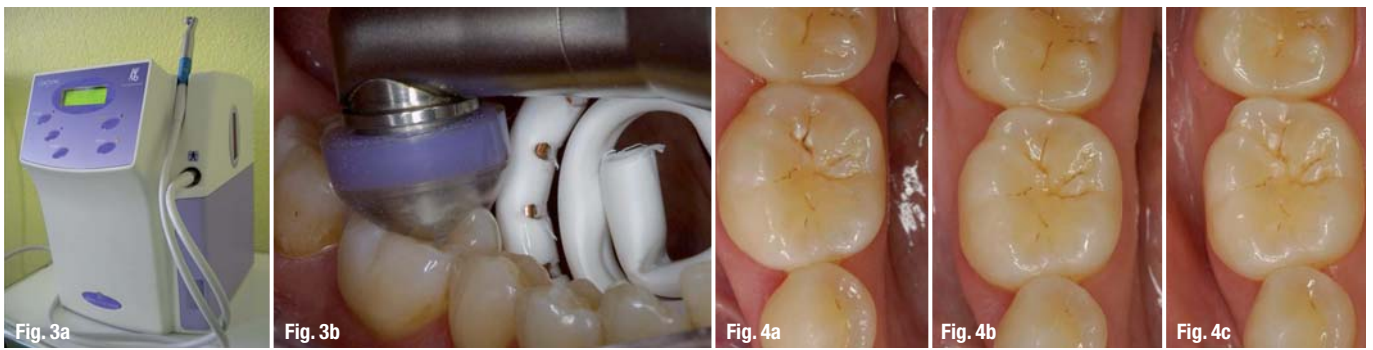
## \_Introduction

Although the prevalence of dental caries in children has declined in the past several decades, there has been a continuing increase in occlusal caries. This fact may be explained by the changes in caries pattern and progression. Additionally, this may be due to the increased use of fluoride and its superficial remineralisation, which seems to delay the cavitation (Strassler & Sensi 2008). In this way, incipient occlusal caries have become more difficult to detect.

The difficulty in diagnosing incipient caries has stimulated the development of new detection methods. Recently, new methods have become available as adjuncts to traditional methods, such as the fluorescence-based devices. These are based on the phenomenon that caries lesions fluoresce more strongly than sound tissues when stimulated by light at specific excitation wavelengths (Hibst et al. 2001, Bader & Sugars 2004). The most common laser-induced fluorescence device for caries detection used in dentistry is the DIAGNOdent (LF, DIAGNOdent 2095, KaVo, Biberach, Germany). This device emits a red light at 655

nm and quantifies the fluorescence from bacterial porphyrins and other chromophores present in caries lesions (Hibst et al. 2001). The changes in the fluorescence intensity are numerically quantified and translated in to values ranging from 0 to 99,





according to the lesion's depth. This can be used to help clinicians decide whether a tooth should be restored (Young 2002). The device has been used as an auxiliary to detect and quantify mineral loss in caries lesions on smooth and occlusal surfaces, presenting good reproducibility and accuracy (Lussi et al. 1999, Lussi et al. 2001, Mendes et al. 2006, Rodrigues et al. 2008, Diniz et al. 2009).

It is important to point out that the management of dental caries is based on appropriate detection of pathological changes and, consequently, on the correct diagnosis to provide the best treatment for each patient (Tranaeus et al. 2005).

Recently, a novel concept for the treatment of dental caries using ozone gas as a potent microbicide has been introduced (Baysan et al. 2000, Baysan & Lynch 2004, Dähnhardt et al. 2006, Baysan & Beighton 2007). Ozone is a gas that quickly kills microorganisms by oxidative degradation of the unsaturated fatty acids in the cell wall (Dähnhardt et al. 2006). The device delivers ozone, through a hand piece, directly to the carious lesion in a concentration of 2,100 ppm with a changeover of 300 times per second. A silicon cup is able to tightly seal the covered area (Baysan et al. 2000). Previous reports have assessed the effect of ozone gas on occlusal caries, non-cavitated occlusal caries and primary root caries, showing significant reductions in the number of microorganisms (Baysan et al. 2000, Brazzelli et al. 2006, Baysan & Beighton 2007). However, the inhibitory effect of ozone in the caries process is discussed and controversial (Hauser-Gerspach et al., 2009; Kronenberg et al., 2009).

To date, there are some clinical studies evaluating improvements in the clinical status of non-cavitated occlusal caries and root caries after ozone therapy monitored by the laser-induced fluorescence device (Huth et al. 2005, Baysan & Lynch 2007). This clinical report illustrates that the application of ozone therapy (and monitoring using the

laser-induced fluorescence device) on incipient caries on occlusal surfaces in a young woman during a 26-month follow-up.

### Case Report

A 25-year-old Caucasian woman was referred to the clinic of the Preventive, Restorative and Pediatric Dentistry department of the Dental School of Bern, Switzerland, presenting incipient caries lesions.

During the clinical interview, the patient reported that she presented a normal systemic status. The caries risk assessment indicated that she was at low risk.

Visual examination was performed by direct visualisation of the teeth with the aid of a light reflector and a 3-in-1 air syringe. The patient presented incipient caries lesions on the distal fossae upper right first molar (16), on the distal fossae upper left first molar (26) and on the central fossae lower right first molar (46) (Fig. 1). The visual and tactile characteristics observed were the presence of brown and white opacities and roughness on the fissures, indicating caries activity.

Bitewing radiographs were taken and then analysed using an X-ray viewer. No radiolucency was observed in the occlusal surfaces.

Based on clinical and radiographic observations, and considering anamnesis data, the treatment proposed was ozone therapy application (to reduce the microflora in the lesion) monitored by laser-induced fluorescence readings. The patient was instructed with respect to the maintenance of her oral hygiene. An informed consent contract was signed by the patient agreeing with the treatment.

The laser-induced fluorescence device used was the LF (DIAGNOdent 2095; KaVo, Biberach, Germany). The occlusal surfaces were measured ac-

**Fig. 3a**\_Ozone device (HealOzone)  
**Fig. 3a**\_Ozone gas application after carefully drying the occlusal surface. Note that the silicon cup tightly seals the covered area.

**Fig. 4a**\_Clinical aspect of the incipient caries lesion on tooth 46 at baseline.

**Fig. 4b**\_After 2 months.

**Fig. 4c**\_After 26 months of follow-up. Note that the lesion's characteristics and severity changed over time, indicating that the treatment is effective.





**Fig. 5a** Clinical aspect of the incipient caries lesion on tooth 26 at baseline.  
**Fig. 5b** After 26 months of follow-up. Note that the lesion's characteristics, such as smoothness and brightness, indicate caries inactivity.

According to the manufacturer's instructions (Fig. 2). The device was first calibrated using a ceramic standard and then calibrated on the buccal surface of the right permanent central incisor. For measurements, tip A for occlusal surfaces was used. The device was moved through the entire occlusal surface until the highest value was obtained (peak value).

The ozone device used was the HealOzone delivery system (Oz; KaVo, Biberach, Germany). Ozone was applied on each tooth at room temperature according to the manufacturer's instructions (Fig. 3).

In each session, the occlusal surface of each tooth was cleaned for 10 s with a water-powder jet cleaner (PROPHYflex II, KaVo, Biberach, Germany) and sodium hydrogen carbonate powder. Then the caries status was measured by the LF device, and ozone was used after carefully drying the occlusal surface. The visual characteristics of the lesions were evaluated and considered as gold standards during the monitoring. The 26 month follow-up was performed according to Tab. 1. The LF device was checked and calibrated before each session. The ozone device was also checked on a regular basis. During the first recall visit, it was observed that the laser-induced fluorescence readings were lower than the baseline readings, indicating that 40 s of ozone therapy in each tooth was effective. However, after 10 months of follow up, the laser-

fluorescence readings were higher than the baseline readings. In view of this fact, the time of the ozone therapy was increased to 80 s. After 26 months of follow up, a good response to the treatment was observed by the changes in clinical severity and in the LF readings (Figs. 4 & 5).

## Discussion

Ozone therapy was introduced as a conservative alternative in the treatment of primary caries, resulting in the *in vivo* reduction of the number of microorganisms present in lesions by 99% (Baysan & Lynch 2005, Baysan & Lynch 2006). The purpose of ozone therapy is to reduce the microflora in the lesion, to increase its pH and to oxidise pyruvic acid to acetate and CO<sub>2</sub>, which opens up "channels" within the dentin to allow the penetration of calcium, phosphate and fluoride ions. This makes remineralisation of the demineralised hard tissue possible (Dähnhardt et al. 2006, Hodson & Dunne 2007).

A significant reduction in the clinical status of small and non-cavitated occlusal caries lesions after ozone therapy has been reported (Huth et al. 2005). In the present case, we clinically observed that the incipient lesions arrested after 26 months of follow-up, indicating that ozone therapy remineralised lesions over time. However, the treatment adopted in this case was better achieved when the ozone therapy was applied for 80 s on each tooth compared to 40 s. Polydorou et al. (2006) evaluated the antibacterial activity of 40- and 80-s HealOzone application. The authors concluded that the 80 s ozone application is a very promising therapy for eliminating residual microorganisms in deep cavities.

This case report shows it is possible to treat incipient caries lesions using an ozone-delivering device monitored by laser-induced fluorescence. The treated caries showed lower readings com-

**Tab. 1** Laser-induced fluorescence (LF) readings and ozone therapy (Oz) application time for each session during a 26 month follow-up.

Tooth	Baseline		2 months		4 months		10 months		12 months	
	LF	Oz	LF	Oz	LF	Oz	LF	Oz	LF	Oz
16	17	40 s	18	40 s	11	40 s	19	80 s	-	80 s
26	30	40 s	18	40 s	22	40 s	38	80 s	-	40 s
46	19	40 s	12	40 s	20	40 s	19	80 s	-	40 s
Tooth	15 months		17 months		20 months		24 months		26 months	
	LF	Oz	LF	Oz	LF	Oz	LF	Oz	LF	Oz
16	15	80 s	-	80 s	20	80 s	20	80 s	4	-
26	17	80 s	-	80 s	38	80 s	23	80 s	4	-
46	16	80 s	-	80 s	16	80 s	14	80 s	10	-

pared to the baseline, indicating that the ozone therapy was successful. At the first recall visit, the LF readings were substantially reduced for tooth 26 and 46. This is in accordance with Dähnhardt et al. (2006), who observed that the use of ozone gas results in an average reduction of 13 % of the laser fluorescence values immediately after ozone therapy.

In the present case, the clinical characteristics and severity of the carious lesions changed over time, indicating that the treatment was effective. Recently, an in vivo study compared the performance of the LF device to visual and radiographic examination (Diniz et al. 2009). The authors concluded that the LF device may be a useful complement to visual examination, and its diagnostic performance seems to be superior for dentin caries detection. The same result was also observed by a systematic review (Bader & Shugars 2004) that showed laser-induced fluorescence tended to be more sensitive than the visual method in detecting occlusal caries in dentin and less sensitive in detecting enamel caries. The case presented in this paper was monitored by laser-induced fluorescence as an adjunct to visual examination because the LF device is supposed to be an auxiliary method for occlusal caries detection.

It is also important to consider that confounding factors might contribute to false-positive laser-induced fluorescence readings in clinical practice, such as the presence of stains, calculus, hypoplasia, polishing pastes and filling materials (Neuhaus et al. 2009). For this reason, a prophylaxis procedure was done on the occlusal surface of each tooth in each session to avoid possible false-positive readings.

While in this case report it was possible to monitor the caries status after ozone therapy by laser-induced fluorescence, there are some important aspects that clinicians should consider regarding this procedure. For instance, ozone has not been proven superior to other clinical approaches in caries management, such as fluoride or chlorhexidine, sealants, and stepwise excavation (Hodson & Dunne 2007). It may work better than these approaches, work well in combination with these approaches, or may prove to be entirely unnecessary (Hodson & Dunne 2007). In a systematic review of the literature by Rickard et al. (2004), there was no reliable evidence that the application of ozone gas to the surface of decayed teeth stops or reverses the decay process. The authors emphasised the need for more evidence of appropriate strictness and quality before the use of ozone can be accepted into primary dental care or can be considered a viable alternative to current methods for the

management and treatment of dental caries. Additionally, the laser-induced fluorescence device should be considered as a second opinion because, to date, there is no method available that is completely reliable.

## Conclusions

The utilisation of ozone therapy monitored by laser-induced fluorescence enabled an alternative and comfortable treatment for incipient caries lesions on occlusal surfaces. However, the ozone therapy parameters and cost effectiveness is unknown. It should be recommended to increase the exposure time during the ozone therapy to achieve a better outcome. In addition, the laser-induced fluorescence device cannot be considered a standard diagnostic tool by itself. It should be used as an adjunct to the traditional methods, especially considering important patient factors, such as caries risk, caries activity, oral hygiene, diet and fluoride supplements.

## References

1. Bader JD, Shugars DA: A systematic review of the performance of a laser fluorescence device for detecting caries. *J Am Dent Assoc* 135: 1414–1426 (2004).
2. Baysan A, Beighton D: Assessment of the ozone-mediated killing of bacteria in infected dentine associated with non-cavitated occlusal caries lesions. *Caries Res* 41: 337–341 (2007).
3. Baysan A, Lynch E: Clinical reversal of root caries using ozone: 6-month results. *Am J Dent* 20: 203–208 (2007).

*Editorial note: The whole reference list can be requested from the editorial office.*

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# Endodontic treatment of periapical chronic periodontitis

## A Laser Assisted Technique

**Authors\_** Prof Umberto Romeo, Dr Gaspare Palaia, Dr Roly Kornblit, Dr Gianluca Tenore, Dr Alessandro Del Vecchio,

### \_Abstract

Nowadays, the bactericidal effect of laser irradiation is well known in endodontic therapy. Many studies showed that, in combination with an appropriate shaping and cleaning of root canal system, laser irradiation, inside the root canal, could increase the percentage of bactericidal effect in endodontic treatment. Three clinical cases of teeth with periapical chronic periodontitis are presented. In two cases, teeth were treated by one-visit laser-assisted therapy, using Nd:YAG 1,064 nm, the other case was treated following a standardized protocol for diode laser 808 nm. In all the cases a complete long term clinical and radiographic healing was observed. We suggest that "single visit treatment Laser assisted" could be useful in the endodontic treatment of periapical lesions, because it's safe and could be indicated for patient's time constraints.

### \_Introduction

Root canal disinfection of necrotic teeth may be achieved through proper shaping and cleaning techniques, with the aid of instruments that, combined with irrigant solutions, remove the pulp and infected dentine. Specifically, it is possible to remove necrotic pulp tissues and one layer of 1–2  $\mu\text{m}$  of organic and inorganic materials, adhering to the root canal wall, formed during the mechanical instrumentation, which is the so-called "smear layer".

Cleaning is usually performed by chemical irrigant solutions. The most used irrigant solution is sodium hypochlorite (NaOCl), that is able to dissolve organic substances, especially on necrotic tissue fragments that have lost their blood supply, while it is powerless on live tissues.<sup>1,2</sup>

No solutions alone are effective against organic and inorganic components, so chelating agents

**Fig. 1\_** Periapical X-ray of the 4.1.

Note the large periapical radiolucency compatible with apical periodontitis and the presence of two canals.

**Fig. 2\_** Periapical X-ray control at 6 months, note an important reduction of the radiolucency.

**Fig. 3\_** Insertion of a Nd:YAG laser's fiber after the cleaning and shaping of the two canals.

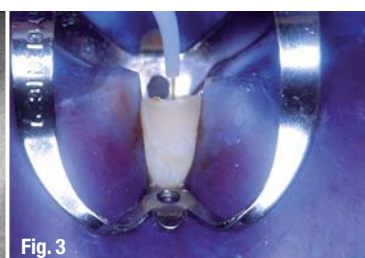
**Fig. 4\_** Periapical X-ray of the 4.6 with a large periapical lesion.



**Fig. 1**



**Fig. 2**



**Fig. 3**



**Fig. 4**

have been proposed as root canal irrigants too. These substances can chemically bind to calcium ions, removing the salts of calcium from the internal walls of root canals and going, therefore, to soften the dentin during preparation. The most used chelating agents are ethylene diamine tetracetic acid (EDTA) and citric acid.

To obtain a good disinfection, endodontic solutions, acting through direct contact with target bacteria, must penetrate the entire root canal system, including various side canals and dentinal tubules, that would otherwise constitute an important source for potential bacterial re-infection.

Experimental studies showed that different bacterial species can invade and traverse the dentinal tubules even up to significant extensions. Perez et al.<sup>3</sup> reported an average depth of penetration of *S. sanguis* to 458.8 µm along the dentinal tubules, with a maximum of 792 µm. Berkiten et al.<sup>4</sup> showed that the *S. sanguis* could penetrate up to 382.3 µm. According to Gutierrez et al.<sup>5</sup>, however, the depth of penetration of bacteria is about 250 µm. So, if bacterial colonization occurs at these depths, these portions of canal would be inaccessible to conventional irrigation procedures, especially in the apical third.

Moreover, it is difficult to get a complete disinfection at the apical third because of several factors: the thin diameter of this portion of the root canal, the high surface tension of solutions irrigants (sodium hypochlorite, hydrogen peroxide, EDTA, Chlorhexidine, cetrimide), the small diameters of the dentinal tubules and, finally, the distance from the point of introduction of the solution. These factors impede the solution flowing and reduce the wet ability of root canal walls, thus resulting an insufficient depth of penetration of bactericidal solutions, which cannot reach the microorganisms in the deeper layers of dentin.

In recent years, numerous experimental studies have been conducted to demonstrate the effective penetration of endodontic irrigants. For example, Berutti et al.<sup>6</sup> have shown that NaOCl can penetrate along the dentinal tubules up to a maximum depth of 130 µm, which could not be enough to attack the bacteria that penetrated through the tubules in the deeper layers of dentin. This difference between the depth of penetration of microorganisms and irrigants is often responsible for cases of failure of conventional endodontic treatments.

Furthermore, Nair<sup>7</sup> in 2005 concluded his microbiological experience saying that "it is very unlikely that an absolutely microorganism-free canal system can be achieved by any of the contempo-

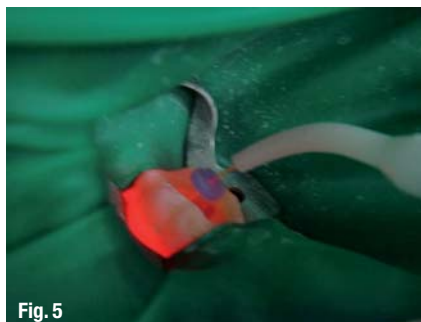


Fig. 5



Fig. 6

rary root canal preparation, cleaning, and root-filling procedures".

Nowadays, the potential bactericidal effect of laser irradiation<sup>8-10</sup> is well known. Used in combination with shaping and cleaning of root canal system, it can significantly increase the percentage of long-term success of endodontic treatment. The basic concept of endodontic laser therapy is that no technique can effectively disinfect the apical third since the impossibility, by solution of achieving this area. Nd:YAG and diode laser, with the optical fibre of 200 µm (as a K-file 20 diameter), may help to solve this problem.

Klinke et al.<sup>11</sup> showed a significant bacterial reduction produced by an Nd:YAG laser within the first 300 µm of dentin tubules and bactericidal action, although weaker, to depths of 1,000 µm. Other studies<sup>12,13</sup> showed the bactericidal effect of diode laser. Also our group<sup>10,14</sup>, in the past through in vitro experiences, showed the antimicrobial activity of Nd:YAG and diode laser, confirming literature data.

Considering the activity of Nd:YAG and diode laser against bacteria, the treatment of necrotic teeth with apical chronic periodontitis through a one visit laser-assisted treatment is evaluated in this study.

## Clinical Cases

Three clinical cases with periapical chronic periodontitis of endodontic origin, were treated in the Department of Odontostomatological Science in Sapienza University of Rome. The teeth showed no symptoms and signs of clinical acute process (absence of swelling) and radiographically a variously extended lucency.

For the treatment of these clinical cases a standardized protocol was used. After the application of a rubber dam, a conventional endodontic therapy was performed, with the use of mechanical Ni-Ti instrumentation (Profile, Maillefer, USA) and irrigant

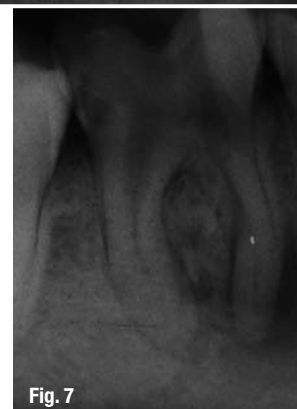
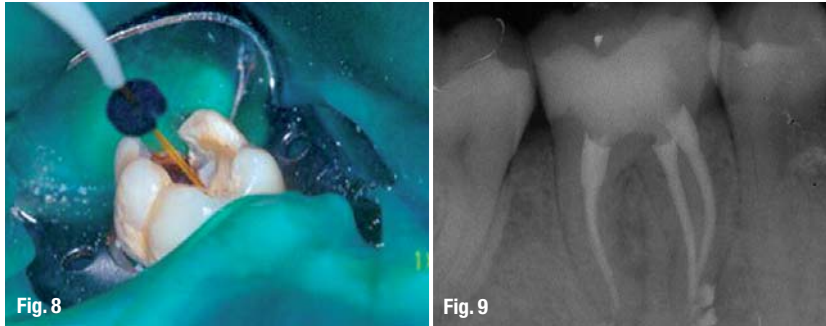


Fig. 7

**Fig. 5**\_Diode laser irradiation of the canals after mechanical instrumentation and irrigation with NaOCl.

**Fig. 6**\_X-Ray after 6 months shows the healing of the periapical lesion.

**Fig. 7**\_Periapical lesion involving the 4.6.



**Fig. 8** Nd:YAG laser irradiation.

**Fig. 9** X-ray after 6 months shows the healing of the periapical lesion.

solutions (NaOCl 5 % and EDTA 17 %). At the end of this phase, in a wet canal with NaOCl, laser irradiations were applied.

Two cases were lased with Nd:YAG 1,064 nm (Pulse Master 600 IQ, ADT, USA) and one case with diode laser 808 nm (Laser Innovation, Italy). The parameters varied according to the wavelengths (1,5 Watt, 15 Hz, 100 mJ, 318 J/cm<sup>2</sup> for Nd:YAG; 2,5 Watt, Ton 35 ms, Toff 35 ms, 278 J/cm<sup>2</sup> for diode).

The following steps were used for all cases: placing the 200 µm fibre up to 1 mm to the working length and making a movement from apical to crown touching the canal walls.

According to the literature<sup>15,16</sup>, four irradiations of 5" each were performed with Nd:YAG laser and five irradiation of 5" each with the diode laser. Every irradiation had a rest period of 5" to avoid the temperature increase above the threshold of 7 °C.

After the irradiation, root canal obturation using vertical condensation technique with gutta-percha was performed. Then, a radiographic and clinical follow up at 3 and 6 months was made.

### Case 1

The Patient I.P., 36 years old female, was referred to our Department. During assessment, the patient reported recurrent mandibular abscesses. Clinical examination revealed a fracture of the incisal edge of the first right mandibular incisor consequent to a trauma that she had six months before. The periapical radiographic examination revealed the presence of two root canals and a large periapical radiolucency compatible with apical periodontitis (Fig. 1). The final diagnosis of periapical chronic periodontitis was made; so a conventional endodontic treatment and a final Nd:YAG laser irradiation into the root canal (Fig. 2) were performed before root canal obturation. The control at six months showed an important reduction of the radiolucency of the periapical area of the tooth (Fig. 3).

### Case 2

The patient B.G., female, 20 years old, came to our observation. The clinical examination revealed an extensive composite resin restoration of the right first mandibular molar; the pulp test was negative and the radiography revealed, in the same tooth, a periapical radiolucency area involving the furcation too (Fig. 4). A final diagnosis of periapical chronic periodontitis was made. In this case, a diode laser 808 nm was used to complete the conventional endodontic therapy (Fig. 5). The X-ray control at six months showed the new bone apposition and the complete recovery of the lesion (Fig. 6).

### Case 3

The patient M.G., male, 39 years old, was referred to our Department one week after an endodontic emergency in another Dental Hospital. Clinically, a cutaneous sinus tract was evident; intraorally a big hole was revealed in the lower right first molar. The X-ray revealed an extensive region of demineralization of the enamel and dentin crown and a periapical radiolucency compatible with apical periodontitis especially on mesial root (Fig. 7). After cleaning and shaping the canals, four Nd:YAG laser irradiations were performed (Fig. 8), then the canal obturation was carried out. In the control at seven days the extraoral fistula disappeared and a radiographic recovery was obtained after six months (Fig. 9).

### Discussion and Conclusions

Since the ruby laser was developed by Maiman in 1960, researchers investigated laser applications in dentistry. In particular, in Endodontics many studies demonstrated the antimicrobial activity of various wavelength towards Gram positive and negative pathogens, both *in vitro* and *in vivo*.<sup>8-13, 15, 16</sup> Clinically, this unmistakable property can be helpful in the treatment of serious endodontic infections caused by bacteria resistant to conventional therapies. Moritz et al.<sup>17</sup> showed that there is a strong correlation between antibacterial effect of Nd:YAG and structure of target bacterial cells. In fact, if few radiations can kill Gram negative bacteria, Gram positive bacteria appear to be more resistant and require repeated exposures.

The bactericidal action of the laser irradiation is due to the heat transmitted from fibre in the root canal system and is directly correlated to the amount of radiation and its energy level and power output. At the same time Levy et al.<sup>18</sup> demonstrated that Nd:YAG laser irradiation induced pressure waves, with different characteristics from waves induced by freely vibrating sonic and ultrasonic endodontic instruments when applied to water-filled root canals.

This concept can explain the reason of bactericidal laser activity when used in a wet canal.

However, it is reasonable to say that laser disinfection must be preceded by conventional endodontic techniques (cleaning and shaping of root canal).

The resolution of apical chronic periodontitis occurred in all three cases presented, confirms that laser disinfection, using controlled parameters, can be considered a safe therapy, without adverse effect on both periodontal and dental tissues. Moreover, the opportunity to improve the antibacterial result of the endodontic treatment through the laser decontamination is an advantage that might lead clinicians to prefer single-visit treatment to the multiple visits (approached by repeated intracanal medications i.e. calcium hydroxide) for the treatment of apical chronic periodontitis. In conclusion, since three cases are not sufficient to confirm the hypothesis that all cases of apical chronic periodontitis could be resolved with one visit treatment laser assisted, our next goal is to reach a statistically significant number of cases, to report the real efficacy of the single-visit endodontic laser treatment versus conventional treatment for the resolution of chronic apical periodontitis of endodontic origin.

## References

1. Castellucci A. Endodonzia. Bologna: Martina Ed, 1996.
2. Goracci G, Cantatore G. La medicazione endocanalare. Stammer Ed.
3. Perez F, Rochd T, Lodter JP, Calas P, Michel G. In vitro study of the penetration of three bacterial strains into root dentine. Oral Surg Oral Med Oral Pathol 1993; 76: 97–103.
4. Berkiten M, Okar I, Berkiten R. In vitro study of the penetration of Streptococcus sanguis and Prevotella intermedia strains into human dentinal tubules. Journal of Endodontics 2000 apr 26(4):236–9.
5. Gutierrez JH, Jofre A, Villena F. Scanning electron microscope study on the action of endodontics irrigants on bacteria invading the dentinal tubules. Oral Surg Oral Med Oral Pathol 1990; 69: 491–501.
6. Berutti E, Marini R, Angeretti A. Penetration ability of different irrigants into dentinal tubules. J of Endodontics 1997; 23(12):725–7.
7. Nair P et al.: Microbial status of apical root canal system of human mandibular first molars with primary apical periodontitis after “one-visit” endodontic treatment. Oral Surg Oral Med Oral Pathol 2005;99:231–5.
8. Kreisler M, Kohnen W, Beck M, Gotz H, Jansen B, d’Hoedt B. Efficacy of NaOCl/H<sub>2</sub>O<sub>2</sub> irrigation and GaAlAs laser in decontamination of root canals In vitro. Lasers Surg Med 2003,32(3):189–96.
9. Moritz A, Gutknecht N, Goharkhay K, Schoop U, Wernisch J, Sperr W. In vitro irradiation of infected root canals with a diode laser: Results of microbiologic, infrared spectrometric, and stain penetration examinations. Quintessence International 1997; 28(3):205–9.
10. Romeo U, Palaia G, Pacifici L, Ripari F, Gambarini G, Moroni C, Tarsitani G, Petti. Antimicrobial activity of Nd:YAG laser in endodontics. J Dent Res 82 (Spec. Iss.B)2003, 184, n1378.
11. Klinke T, Klimm W, Gutknecht N. Antibacterial effect of Nd:YAG laser irradiation within root canal dentin. J Clin Laser Med Surg 1997 feb;15(1):29–31.
12. Benedicenti S, Cassanelli C, Signore A, Ravera G, Angiero F. Decontamination of root canals with the gallium-aluminum-arsenide laser: an in vitro study. Photomed Laser Surg. 2008 Aug;26(4):367–70.
13. Gutknecht N, Franzen R, Schippers M, Lampert F. Bactericidal effect of a 980nm diode laser in the root canal wall dentin of bovine teeth. J Clin Laser Med Surg. 2004 Feb;22(1):9–13.
14. Romeo U, Palaia G, Furnari A, Berlutti F, Maggiore C. Antibacterial activity of a diode laser 808nm associate with iodopovidone: a preliminary in vitro study. Doctor Laser 2007 Mag-Ago;1(2):9–16.
15. Gutknecht N, Franzen R, Meister J, Vanweersch L, Mazian M. Temperature evolution on human teeth root surface after diode laser assisted endodontic treatment. Lasers in Medical Science 2005;20:99–103
16. Bergmans L, Moisiadis P, Teughels W, Van Meerbeek B, Quirynen M, Lambrechts P: Bactericidal effect of Nd:YAG laser irradiation on some endodontic pathogens ex vivo. Intern. Endod. Journal 2006,39:547–557
17. Moritz A, Jakolisch S, Goharkhay K, Schoop U, Kluger W, Mellinger R, Sperr W, Georgopoulos A. Morphologic changes correlating to different sensitivities of Escherichia Coli and Enterococcus Faecalis to Nd:YAG laser irradiation through dentin. Lasers in Surgery and Medicine 2000 ; 26 ( 3 ) : 250–61.
18. Levy G et al.: Pressure waves in root canals induced by Nd:YAG laser. J Endod. 1996 Feb;22(2): 81–4.

_contact	laser
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# Using lasers to tackle periodontitis

Author\_Stefan Gottschalk, Germany

**\_Periodontal diseases** are advancing. Above all adults and elderly patients are affected. In many cases their condition is chronic. Recurrent inflammations of the periodontium pose a significant challenge. On top of the effective therapy the intensive cooperation of the patient is necessary in order to achieve a stable long-term situation. With reference to a specific case dentist Stefan Gottschalk (Bensberg, Germany) describes how he treated a female patient suffering from progressive periodontitis with the aid of laser therapy and intensive preventive care.

When we set up our dental practice in Bensberg in 2005 we decided to concentrate on preventive care and periodontics in addition to restorative dentistry. During our time at university we had established, on the one hand that a growing number of patients suffer from gingivitis and periodontitis. On the other hand, there is a shortage of specially trained dentists to treat such patients. For this reason we acquired detailed knowledge of the periodontium and developed this knowledge during our university studies and clinical training. In 2006 we obtained a specialist qualification in periodontics

under Professor Kleinfelder. Today we can say that an estimated 90 per cent of our patients suffer from gingival and periodontal disease. This condition frequently remains undetected for a long period; many cases show a correspondingly advanced progression. In spite of difficult initial situations we achieve a 90 per cent success rate now. This is due, firstly, to our effective array of instruments—we use a combination of laser and ultrasound devices—and, secondly, it is also a result of the intensive collaboration with patients in the area of preventive care and oral hygiene. Unfortunately, patients today have to pay themselves most of the costs of periodontal treatment and follow-up in Germany. For this reason intensive counselling must be provided in order to ensure their compliance. We give top priority to this in our dental practice. Good collaboration is a prerequisite not only for the reimbursement of therapy costs by the German health insurance funds, but also for the sustained success of periodontal therapy.

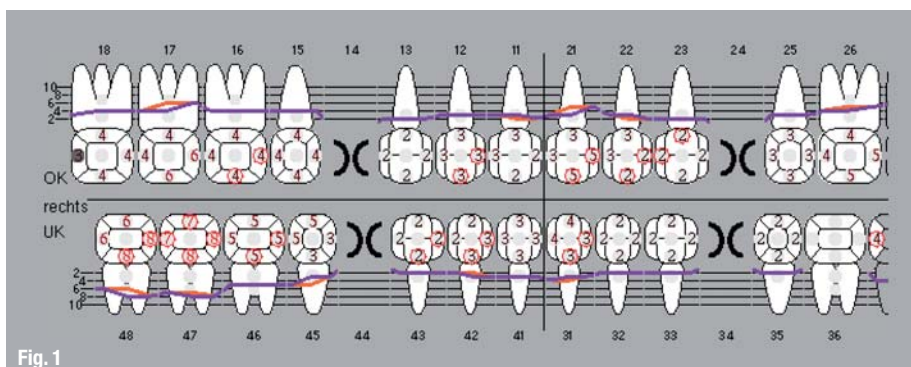
## **\_Applying high-tech in the gum pockets**

From a medical viewpoint the effective treatment of periodontitis requires great caution. We use



Fig. 1 \_Initial diagnosis on September 3, 2009.

Fig. 2 \_X-ray of the initial situation.



two high-tech devices made by the dental equipment manufacturer Sirona: the SIROLaser Advance and the PerioScan. In combination with each other these devices facilitate atraumatic and effective treatment. We started working with lasers during our clinical training. The potential of this technology was so convincing that we integrated laser therapy into our practice concept from the outset. Instead of a scalpel, we use the laser for the excision of inflamed tissue, as well as for effective and long-term bacteria management in the gum pockets. The 'smart' PerioScan ultrasonic system is used for root planning and scaling. In contrast to mechanical instruments the PerioScan can detect and remove calculus.

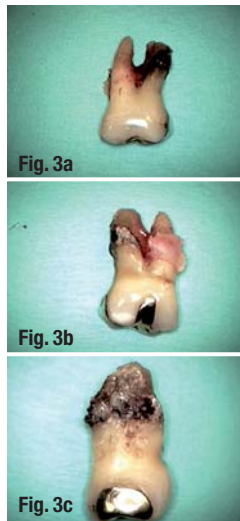
For the past five years we have deployed the SIROLaser and its successor SIROLaser Advance (diode laser devices designed to treat soft tissue) for periodontal therapy purposes. Its features convince us again and again as this laser allows us to remove diseased tissue gently and thoroughly without having to surgically open the treatment site. In addition, we are able to combat existing infections and prevent new infections. Handling the laser is very simple. The user inserts the tip into the gum pocket and vaporizes the dark-pigmented inflamed tissue—gently and with only minimal discomfort and bleeding. The light-coloured healthy tissue absorbs the laser radiation only to a very limited extent and hence remains unaffected. The laser technology is so 'smart' that the user can work precisely and effectively even without a direct view of the treatment site. With a certain amount of practice the user knows exactly how to move the laser in the gum pocket for a perfect result and when the pocket is practically free of infected tissue. At the beginning infected tissue adheres to the laser tip. After two or three passes the intensity of vaporization decreases significantly. Correspondingly less tissue

adheres to the tip. If the tip is clean when withdrawn from the gum pocket it is safe to assume that the infected tissue has been completely removed. A further advantage is that all four quadrants can be treated during a single appointment. This is not possible in the case of surgical procedures due to their invasive nature and the resultant stress on the patient. So typically only one quadrant is treated per treatment session. By contrast, laser therapy is quicker, less invasive and less painful. This benefits older patients in particular who frequently suffer from chronic diseases.

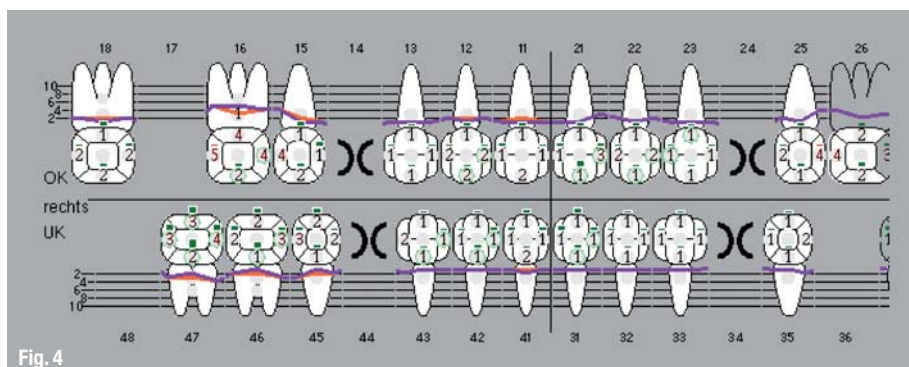
### \_Case study

In the following case we used the SIROLaser Advance to treat progressive periodontitis in a 40 year old female patient. She visited our practice in September 2009 suffering from severe periodontitis. The patient stated that she had been undergoing periodontal treatment for ten years—but without success. During the first treatment session we diagnosed that eight teeth displayed pocket depths of five to eight millimetres. A further 11 teeth had an attachment loss of three to four millimetres. Due to the severity of the periodontitis we were unable to save teeth 17, 36 and 48; they were extracted a week later. During two subsequent appointments at an interval of one week we removed all the supragingival calculus and instructed the patient in the use of interdental brushes and dental floss. Thanks to the patient's cooperation, she was free of supragingival calculus and infection after three weeks.

In the middle of October we then performed a complete periodontal procedure on the upper and lower jaws during a single appointment. In addition to curettes and scalers we used the SIROLaser Advance and PerioScan. After administering an



**Figs. 3a–c** \_Extracted tooth 36 showing strong calculus deposits.



**Fig. 4** \_Diagnosis on 4 January 2010.  
**Fig. 5** \_X-ray after periodontal treatment.





anaesthetic we deployed the laser device to reduce bacteria and germs in the pockets, remove inflamed tissue and dry out the root surface. In our experience lasered calculus are easier to be removed with the aid of curettes and the PerioScan than concretions that are not lasered. A further reason for deploying the laser first is to minimize the number of pathogens that enter the patient's bloodstream. This is of particular benefit to cardiac patients and allows the dentist to dispense with prophylactic antibiotic coverage. The patient in our case study was not impaired by surgical incisions or sutures. After a brief follow-up examination the following day she was able to return to work.

One week later we once again lasered all the periodontal tissues in order to remove any remaining bacteria. This procedure was painless due to the fact that all the infected tissue had been removed. The patient did not require an anaesthetic. In January 2010 the patient was recalled for a checkup.

**Figs. 6a & b** Clinical status after the last laser treatment procedure and professional tooth cleaning (January 2010).



Fig. 6a



Fig. 6b

The laser was once again deployed to remove bacteria. This was followed by professional tooth cleaning (PTC). The gum pockets showed a significant improvement. Isolated bleeding from tooth 16 (distal) and 47 (mesial) was curetted under local anaesthetic and then treated with the aid of the laser.

The overall periodontal status of the patient has significantly improved. There are very good chances that her situation will continue to improve and then remain stable in the long term. The patient responded very positively to our counselling efforts, the atraumatic treatment method and the measurably good results.

### Conclusion

The laser plays an indispensable role in periodontal treatment. It makes the therapy process easier, faster and more efficient. From the patient's viewpoint laser therapy is gentler, less painful and much less stressful. Elderly patients benefit from this in particular since many of them suffer from various chronic health issues. Thanks to its intuitive user-friendly features, the SIROLaser Advance is easy to learn. The SIROLaser Advance in our dental practice is in constant use and has more than paid for itself. \_

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- \* Periodontics - Non surgical periodontal management, Periodontal surgery
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# From theory to the first working laser

## Laser history—Part I







Author\_Ingmar Ingeneeren, Germany

The principle of both maser (microwave amplification by stimulated emission of radiation) and laser (light amplification by stimulated emission of radiation) were first described in 1917 by Albert Einstein (Fig.1) in "Zur Quantentheorie der Strahlung", as the so called 'stimulated emission', based on Niels Bohr's quantum theory, postulated in 1913, which explains the actions of electrons inside atoms. Einstein (born in Germany, 14 March 1879–18 April 1955) received the Nobel Prize for physics in 1921, and Bohr (born in Denmark, 7 October 1885–18 November 1962) in 1922.

In 1947 Dennis Gábor (born in Hungarian, 5 June 1900–8 February 1972) developed the theory of holography, which requires laser light for its realization. 1963 the first successful holographic trials were done by Emmet N. Leith (born in the USA, 12 March 1927–23 December 2005, National Medal of Science Award among others) and Juris Upatnieks (born in Lithuania, 7 May 1936–today,

19 US patents) using a ruby laser. Both were nominated for the Nobel Prize. Gábor received the 1971 Nobel Prize in Physics for the invention and development of the holographic method. To a friend he wrote that he was ashamed to get this prize for such a simple invention. He was the owner of more than a hundred patents.

In 1954 at the Columbia University in New York, Charles Townes (born in the USA, 28 July 1915–today, Fig. 2) and Arthur Schawlow (born in the USA, 5 Mai 1921–28 April 1999, Fig. 3) invented the maser, using ammonia gas and microwaves which led to the granting of a patent on March 24, 1959. The maser was used to amplify radio signals and as an ultra sensitive detector for space research. The two scientists also theorized and published papers about a visible maser, an invention that would use infrared and/or visible spectrum light. However, they did not proceed with any further research at the time. Townes was awarded with the Nobel Prize

-  **1913** Niels Bohr (born in Denmark, 7 October 1885–18 November 1962) explains along his quantum theory how electrons could act in the atom model. Nobel Prize in 1922.
-  **1917** Albert Einstein (born in Germany, 14 March 1879–18 April 1955) postulates first description of stimulated emission in his work "Zur Quantentheorie der Strahlung", based on Bohr's atom model. Nobel Prize in 1921.
-  **1947** Dennis Gábor (born in Hungary, 5 June 1900–8 February 1972) develops the theory of holography, which requires laser light for its realization. Nobel Prize 1971.
-  **1954** Charles Townes (born in the USA, 28 July 1915–today) and Arthur Schawlow (born in the USA, 5 Mai 1921–28 April 1999) develop a device that stimulates the emission of microwaves. Nobel Prizes in 1964 and 1981.
-  **1957** Gordon Gould (born in the USA, 17 July 1920–16 September 2005) is the first to use the acronym laser in his work "Some rough calculations on the feasibility of a LASER".
-  **1960** Theodore Maiman (born in the USA, 27 July 1927–5 May 2007) builds the first working laser with his assistant Charles Asawa.

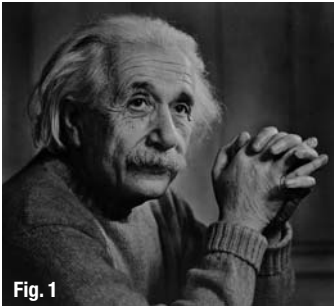


Fig. 1

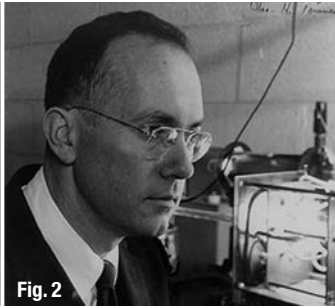


Fig. 2

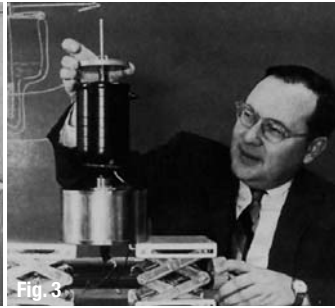


Fig. 3



Fig. 4

in Physics in 1964 (together with Bassow and Prokhorov) and Schawlow in 1981 together with Nicolaas Bloembergen (born in the Netherlands, 11 March 1920–today) and Kai Siegbahn (born in Sweden, 20 April 1918–20 July 2007) for their contribution to the development of laser spectrography.

In 1957 Gordon Gould (born in the USA, 17 July 1920–16 September 2005), came up with important concepts, as well as the word laser. He patented optically pumped and discharge excited laser amplifiers, laser uses and optic communications. He idolized Edison and his ambition from childhood was to be an inventor. In 1957 his first ideas for the laser came to him one night "in a flash" and he wrote „some rough calculations on the feasibility of a LASER". That was the first use of this acronym. Due to a misunderstanding with his attorney, he did not file for a patent until 1959, after other laser researchers already filed. Since his original patent application contained a number of different inventions, it was put through a series of five separate interferences by the Patent Office, resulting in issuing Gould's first basic laser patents in 1977. In 1991 he was inducted in the National Inventors Hall of Fame.

50 years ago, on 16 May 1960, at Hughes Aircraft Company, Theodore H. Maiman (born in the USA, 27 July 1927–5 May 2007) let the worlds first monochromatic, collimated, coherent, pulsed (red) light beam shine with a wavelength of approximately 694 nanometres. He succeeded in building the first operable laser, small enough to fit in his hand, based on a synthetic ruby rod which served as the active medium, which worked on the first try. The idea of using a photographic flash for illuminating the ruby crystal came from his assistant Charles Asawa.

Theodore H. Maiman was inspired by the article of Townes and Schawlow which appeared in the Physics Review in 1958 with the title: "Infrared and Optical Masers". One year later the race to build the first laser started and was won by Maiman who said his favourable academic background, the quest for

simplicity, a maverick spirit and unconventional thinking helped him achieving this goal. Although several other scientists had already discounted its suitability for such a task, Maiman persisted that ruby would work as an active medium, along his calculations of the fluorescence quantum efficiency. His first paper was rejected by the Physical Review Letters and a shorter version was published in the journal Nature in the United Kingdom in August of 1960. In 2000 Maiman published the story of his discovery of the laser in "The Laser Odyssey" and described the laser as "a solution seeking a problem".

Maiman was nominated twice for the Nobel Prize. He received the Fannie and John Herz Science Award, the 1984 Wolf prize and the 1987 Japan Prize (equivalent to the Nobel Prize). After he was introduced into the National Inventors Hall of Fame in 1984, he met his second wife Kathleen on the flight home. Mrs. Kathleen Maiman attended the 16<sup>th</sup> Congress of the ALD in April 2008 in San Diego, California. She received the ALD T.H. Maiman Award as post hum honour for her late husbands breaking work and contribution to science. Mrs. Maiman brought along a model of the ruby laser for the congress delegates to see and to hold (Fig. 4).

## \_Sources

123people.com, AIP, Answers.com, Azerbaijan International, books.google.de, biography.com, China Times, Inventors Hall of Fame, Jeff Hecht, New York Times, Wikipedia.org, and other internet sites and links.

\_contact

laser

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# Official Awarding Ceremony EMDOLA

Author\_Dajana Klöckner, Germany

All successful graduates of the programme „Lasers in Dentistry“ received their certificates European Master Degree of Oral Laser Application (EMDOLA) in a joint ceremony on Thursday, 26 November 2009, at the Medical Faculty of RWTH Aachen University, Germany. This was the first and a unique European bestowal in Dentistry and was another highlight in the professional carrier as well as an extraordinary appreciation of the performance of all Master Alumni from RWTH Aachen University and from the Universities of Nice and Liège.

Since 2004 more than 100 dentists have already achieved this outstanding degree in Aachen only. For the first time, three European Universities concluded a cooperation contract in the field of laser dentistry on the basis of the accredited study programme „Master of Science—Lasers in Dentistry“, at the RWTH Aachen University. The Universities: RWTH Aachen University, Germany, University of Liège, Belgium, and University of Nice, France, offer the European master programme for laser dentistry, a top-class theoretical, clinical and research oriented education. The programme does not only impact dentistry. This European education model is path breaking and was awarded with the Bronze Award of the European

Union for “Lifelong learning Programmes”. It is based on the idea to offer a common European study programme that is conform to the criteria of the Bologna Process (European Credit Transfer System). The aim is to provide an education that is adapted for practical dentists who would like to continue and deepen their studies of laser dentistry.

Thereby, the students at the RWTH Aachen University are awarded with the title „Master of Science“ (MSc) in Lasers in Dentistry after their two years post graduate study programme. The graduates of the Nice University receive the „diplôme universitaire“: At Liège University the „Certificat Universitaire de compétence“ is bestowed.

The programme of this extraordinary day started with the welcome speech of the initiator of the first Master programme in dentistry, the scientific director from the Aachen Master of Science Professor Dr Norbert Gutknecht. Afterwards the more than 140 guests listened to eight chosen graduates who presented their theses in the scientific symposium:

*Dr Iris Brader, MSc:* “The influence of different factors on the treatment of recurrent aphthous ulcers



with the Nd:YAG laser—a first clinical investigation" (RWTH Aachen University)

*Dr Jacques Berrebi:* "Clinical treatment by means of CO<sub>2</sub> laser of exposed pulp by Direct Capping/Pulpotomy on primary and permanent immature teeth" (Université de Liège)

*Dr Elisabetta Merigo:* "Effects of Low Level Laser Therapy performed with KTP laser on proliferation and differentiation of murine bone marrow cells" (Université Nice)

*Dr Peter Kleemann, MSc:* "Bactericidal Effect of the Pulsed Nd:YAG Laser on *Prevotella intermedia* and *Actinobacillus actinomycetemcomitans*. A Dose-metric in vitro study" (RWTH Aachen University)

*Dr Ryan Seto, MSc:* "Predictability of using Er:YAG laser to prepare bone for dental implant placement—A preliminary study" (RWTH Aachen University)

*Dr Paolo Vescovi:* "Nd:YAG Laser, quantum molecular resonance (QMR) scalpel, and traditional lancet: A clinical and histomorphometric analysis of the surgical treatment of oral benign fibromatous lesions" (Université Nice)

*Dr Marc Tielemans:* "Comparison of microleakages of photo-cured composites using 3 different light sources: Halogen lamp, LED and Argon laser: An in vitro study" (Université de Liège)

*Dr Gabriele Schindler-Hultsch, MSc:* "The Laserkids" concept—Treatment concept for laser-assisted pediatric dentistry" (RWTH Aachen University)

After this scientific session all attendees were welcomed by the rectors and deans of all universities. Before Prof Dr Norbert Gutknecht, Prof Dr Samir Nammour (Liège) and Prof Dr Jean-Paul Rocca (Nice) personally presented their successful graduates with the certificates, they gave entertaining and fascinating insights and aspects of the history and development of the master programme „Lasers in Dentistry".

The solemnly ceremony with accompanying family and friends was continued with a festive Gala Dinner at the Aachen City Palais in the evening. The graduates, who have not seen each other for several years and arrive to Aachen just for this ceremony celebrated and share their experience the whole night.

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# Successful with a Master Degree

## “MSc in Lasers in Dentistry”

On 24 February 2010, a further group of international dentists graduated from the RWTH Aachen University with a Master of Science in “Lasers in Dentistry” and are now able to use the laser-assisted dentistry therapeutically, correctly, and successfully in their daily practices.

It takes a lot of courage, discipline and perseverance to study for two years whilst practising dentistry and caring for patients. But for dentists who would like to offer innovative treatment to their patients, the success of applying new technologies cannot be denied. Two years ago, this was also in the minds of the now successful graduates who earned the title Master of Science “MSc in Lasers in Dentistry.”

Since 2004, more than 90 dentists have successfully passed this accredited master programme. Including the current graduates, the programme now has over 100 alumni from all over the world, hailing from the European Union, Canada, China, Japan, India, Iran, Iraq, Pakistan, Saudi Arabia, Turkey, and many other countries.

All participating dentists recognize that dental laser systems have become more and more important: Well-informed and discerning patients increasingly inquire about alternative treatments and expect their dentist to be able to inform them about new medical and technological developments. Hence, the laser has become one of the most important medical instruments of today and forms a foundation of successful and state-of-the-art dental clinics.

In standard academic studies in dentistry, students never have the opportunity to learn about dental laser technology and treatment concepts. Building on a university degree in dentistry, this two-year extra-occupational Master course teaches the necessary professional knowledge for laser applications in dental practice at the highest academic level in both theoretical and practical modules. All important theories and application options pertaining to laser use in dentistry are covered. “A postgraduate education offered by the best professors in the fields of physics, medicine and dentistry is in my opinion of



an ideal situation. The organisation and realisation of this master programme is very professional. For all dentists who want the best clinical and scientific background, I see no alternative option to this programme," attests Dr Dimitris Strakas from Greece.

Participants obtain sound theoretical knowledge in lectures and seminars led by renowned, competent and experienced international scientists and practitioners. Skill training sessions, exercises, practical applications, live operations and workshops with intensive assistance from scientific associates with doctorates guide participants towards using lasers successfully and professionally in their own practices.

During the ten modules, students remain in steady contact with the RWTH Aachen University and lecturers between attendance days via the e-learning system. This kind of segmentation allows established dentists to remain active in their practices while continuing to earn their Master degree. Additionally, candidates are able to always stay in touch with their professors, and the continuous contact between candidates helps establish new networks and professional relationships. The excellent combination of live lectures and e-learning makes it easily possible for dentists to manage this programme alongside their daily practice. Additionally, for every module a participant passes, he or she receives a certificate. "In my opinion the laser will become one of the most important instruments in the dental office. A participant of this master programme will therefore create the fundamentals for a successful future, both for his patients and for



himself by becoming a specialist in this field," confirms Dr Andreas Adamzik from Germany, one of the first master candidates.

A final exam and a master thesis at the end of the programme are part of the requirements of the Master in Lasers in Dentistry degree. The "Lasers in Dentistry" master programme is the first accredited dentistry laser master program in Germany and indeed the world that is recognized in the EU and all countries of the Washington Accord (USA and Anglo-American nations) as well as by the Bologna Reform as an internationally valid academic degree. The European Commission has awarded it the bronze medal for lifelong learning.

On 8 September 2010, the 12<sup>th</sup> instalment of this study programme begins at the RWTH Aachen University. For more information, including regarding applications, [\\_](#)

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It is planned that a group will fly from Frankfurt on **Tuesday, April 13, 2010** at 21:55 with Lufthansa, returning to Frankfurt/Main on **Sunday, April 18, 2010** at 05:30.

The trip includes 3 nights in the \*\*\*\*\*Conrad Hilton Hotel, opposite the Convention Centre, where the trade fair will take place. (Due to the time difference, the stay in Singapore will be from April 14–17, 2010).

This entire **package** can be booked via NMT München for only **€ 1,499.00**. The cost for an accompanying person is **€ 1,199.00**.

You do, of course, have the option of extending your stay and changing your return flight to a later date. In this case the alteration fee will be € 125.00 per person.

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It is planned that there will be a maximum of 10 participants in this group. Please register via:  
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# International events

## 2010

### ALD The Academy of Laser Dentistry & 17th Annual Conference and Exhibition

Where: Miami, USA  
Date: 14–17 April 2010  
Website: [www.laserdentistry.org](http://www.laserdentistry.org)

### IDEM International Dental Exhibition and Meeting

Where: Singapore  
Date: 15–18 April 2010  
Website: [www.idem-singapore.com](http://www.idem-singapore.com)

### 32<sup>nd</sup> Asia Pacific Dental Congress

Where: Colombo, Sri Lanka  
Date: 12–16 May 2010  
Website: [www.apdc2010.com](http://www.apdc2010.com)

### IADR 88<sup>th</sup> General Session & Exhibition

Where: Barcelona, Spain  
Date: 14–17 July 2010  
E-mail: [sherren@iadr.org](mailto:sherren@iadr.org)  
Website: [www.iadr.org](http://www.iadr.org)

### FDI Annual World Dental Congress

Where: Salvador da Bahia, Brazil  
Date: 02–05 September 2010  
Website: [www.fdiworldental.org](http://www.fdiworldental.org)

### 40<sup>th</sup> International Congress of DGZI

Where: Berlin, Germany  
Date: 01–02 October 2010  
Website: [www.dgzi.de](http://www.dgzi.de)

### 19<sup>th</sup> Annual Scientific Meeting of EAO

Where: Glasgow, Scotland  
Date: 06–09 October 2010  
Website: [www.eao.org](http://www.eao.org)

### Annual Congress of DGL

Where: Berlin, Germany  
Date: 29 & 30 October 2010  
Website: [www.dgl-online.de](http://www.dgl-online.de)

### LASER START UP 2010

Where: Berlin, Germany  
Date: 29 & 30 October 2010  
Website: [www.startup-laser.de](http://www.startup-laser.de)

### Greater New York Dental Meeting

Where: New York, NY, USA  
Date: 26 November–01 December 2010  
Website: [www.gnydm.org](http://www.gnydm.org)

## 2011

### 34<sup>th</sup> International Dental Show

Where: Cologne, Germany  
Date: 22–26 March 2011  
E-mail: [ids@koelnmesse.de](mailto:ids@koelnmesse.de)  
Website: [www.ids-cologne.de](http://www.ids-cologne.de)

### 3<sup>rd</sup> European Congress World Federation for Laser Dentistry (WFLD)

Where: Rome, Italy  
Date: 10 & 11 June 2011  
Website: [www.wfld-org.info](http://www.wfld-org.info)



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# 13<sup>th</sup> Laser-Beginners-Congress “LASER START UP” and 18<sup>th</sup> Annual Conference of DGL

Beginners and experts—together in one big event! The two days were filled with theoretical and practical aspects of laser dentistry. Both events had been very successful in the last years.

For the first time, the two biggest German Laser Dentistry Events had been partnered together. More than 300 dentists took this opportunity to first experience the use of laser light or expand their knowledge in this specialized field of dentistry. This combination of “Beginners and Experts” was a big plus and will be held again this year due its success. Professor Dr Norbert Gutknecht stood as President of the DGL as well as Professor Dr Herbert Deppe and Dr Georg Bach as Congress Chairs of the 13<sup>th</sup> LEC. The aim of the 13<sup>th</sup> Laser-Beginners-Congress “LASER START UP” (LEC) and the 18<sup>th</sup> Annual Conference of the German Federation for Laser Dentistry (DGL) was not only to provide information about improvements in fields surrounding dental laser therapy, but also to introduce new therapy concepts and new aspects of accounting during lectures, seminars and workshops.

In their opening lectures, the conference chairs of the LEC highlighted four main aspects:

- Explanation of basic knowledge of laser light and physics
- Introduction to all major components in laser dentistry
- Presentation of suitable laser wavelengths in dentistry
- Demonstration of legal aspects and billing of laser treatment

The title of the DGL conference was on “Lasers in Implantology and Surgery.”

“Please talk about laser-supported endodontics and not about laser endodontics.” With this clarification, Prof Dr Norbert Gutknecht started his lecture and defined laser light as an ideal instrument and aid for antibacterial treatment. Photodynamic Therapy, Diagnostics, cavity preparation, bleaching and laser supported Peri-implantitis therapy were the main lecture topics on the first day. One highlight was the live patient demonstration “Laser in Surgery.”

The main conference topics on the second day were laser-supported Endodontics, Physics and Basic Research, Laser in Periodontology and Integration of





Lasers into the daily clinic. A very interesting lecture was the "First worldwide laser implant site preparation without any anaesthesia using a drilling template after 3-D planning." Additionally, the programme of the second day was reserved for workshops, as well as the deepening and consolidation of all learnt topics.

The common panel discussion for both events (LEC/Laser Start Up and DGL Annual Conference) was led by the honorary president of the DGL, Professor Dr Friedrich Lampert (Aachen), the chairman of the scientific advisory board of the DGL, Professor Dr Herbert Deppe and practical dentists Dr Thorsten Kuypers, MSc and Dr Thorsten Kleinert.

The topic "Laser—a Philosophy or an economical factor" led to a lively but controversial discussion and concluded that both assessments do not wholly apply.

Laser dentistry cannot and should not be seen only under the lens of either the economy or philosophy. Rather, it is a unique instrument to be used by specialists.

Prof Dr Matthias Frentzen, Dr Pascal Black and Dr Georg Bach were the experts at the scientific panel discussion. Most questions centred about the topic "Which wavelength is the most appropriate to use?" The clear answer from all perspectives was: The only parameter for or against the use of a certain wavelength depends on the type of activities and objectives

of the laser user. Only the dentist him/herself could decide which wavelength is suitable.

Other similarly geared events were targeted at such groups as hygiene representatives. Other topics included "Smile aesthetics" with minimal invasive treatments from bleaching to veneer preparations, "Perfect Smile," a concept for perfect anterior tooth aesthetics, a Symposium about the oro-facial syndrome with live patient demonstrations, as well as a seminar about injection techniques for wrinkle reduction.

Several laser manufacturers and distribution companies not only presented their whole product range, but also illustrated and pointed out their laser devices and philosophies. Participants gladly took advantage of the companies' presence and visited the exhibition, as well as the two generous workshop sessions offered.

A social flair to the event was also not missed. All interested participants met in one of the oldest beer breweries at the Rhine site and enjoyed a "Kölsche Abend" (Cologne evening) with traditional dishes and, naturally, lots of beer.

In 2010, two anniversaries will be celebrated: 50 years of the implementation of lasers by Maiman and 20 years of DGL in November. There certainly exist plenty of reasons to celebrate and come together to discuss the development of laser dentistry!\_



# Traducción

Author\_Dr Josep Arnabat and Dr Simeon Dragov Kutnjak, Spain



The past days 12 and 13 February was held, with notable success, the X<sup>th</sup> Congress of the Spanish Society of Laser in Dentistry SELO in Santiago de Compostela. In the main auditorium of the Faculty of Medicine Santiago over 180 dentists and 109 dental hygienists and assistants gathered in the town of Compostela which this year celebrates the Holy Year Compostela, Xacobeo 2010.

Those attending the congress could hear during the two days of congress Lecturer of both national and international prestige. During the Pre-congress different papers relating to the subject of bisfosfonates and their impact on dentistry have been presented and discussed. The national speakers were Dr Jose Vicente Bagan (Professor at the University of Valencia and current elected president of the European Association of Oral Medicine), Dr Miguel Angel Macias (Chef of Service Risk Assessment, Division of Farmacoepidemiology

and Farmacovigilance, Spanish Agency of Medicines and Spanish representative in the European working group Farmacovigilance in the European Medicines Agency), Dr Javier Junquera (Professor of Oral and Maxillofacial Surgery, University of Oviedo) and Dr Paolo Vescovi (Professor of the Oral Surgery Department, University of Parma, Italy) which is also the coordinator of the study of osteonecrosis bisfosfonates-Hospital University of Parma since 2005. All were moderated by Prof Dr Juan Seoane, Faculty of Medicine and Dentistry, University of Santiago de Compostela.

The different applications of lasers in dentistry were exposed by Spanish Lecturers among whom were Dr Antonio Spain Tost, Prof Cosme Gay Escoda, Prof Juan Ramón Boj, Dr Manuel Serra. We also had the pleasure to talk with professionals from Portugal through the cooperation of Dr Tony Rolo who represented the Ordem dos Médicos dentists in Portugal.



Dr Mario Trelles which is the current president of the Spanish Society of Medical-Surgical Laser presented us with a fantastic presentation of the applications of lasers in facial aesthetics.

The international speakers who provided a high level scientific meeting came from different countries such as Germany, Turkey, Israel and Italy. Prof Dr Norbert Gutknecht, Director of the Master of Laser Dentistry, University of Aachen (Germany) and current president of the World Federation of Dental Laser WFLD, discussed the scientific evidence on laser dentistry. We also had the opportunity to listen to Prof Dr Adam Stabholz who is an eminent scientist on issues related to laser treatment in endodontics and is currently the dean of the Hadassah University in Jerusalem, Israel. Dr Sevil Gurgan who is the head of the Department of Conservative Dentistry of Hacettepe

University in Ankara, Turkey, and Dr Carlo Fornaini Masters Coordinator EMDOLA Laser Dentistry, University of Parma, Italy, presented lectures on laser applications in Conservative Dentistry and the new KTP laser. Dr Francesco Saverio Martelli of Italy presented his studies on applications of lasers in periodontics, and Dr Frilander talking about the advantages of laser applications on a daily clinical basis.

Also on Saturday morning was developed with a large influx of attending the Fourth Meeting of SELO for dental hygienists. Over 100 attendees at this meeting confirmed the great interest that these kind of new technologies have in the field of dental hygiene.

In short, a wide range of speakers who kept the attention of all present and as in previous meet-

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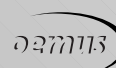
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ings of SELO have succeeded in increasing the knowledge level of everyone attending the conference. The Organizing Committee with its President Dr Gonzalo Lopez de Castro succeeded in making this SELO meeting the one with the greatest participation of all that have been celebrated until today. His work has been widely recognized by all the attendees who have shown great appreciation for all aspects of the conference, both scientifically and socially.

The participation of the industry on the other hand has been very important because we could count on most commercial houses both Spanish and international that are related to the field of laser applications in dentistry. There were also some new trading houses involved that joined our conference. All of them had a large influx of attendees because all breaks and lunch took place on the same area of the exhibition.

Social events prepared by the organization had a large influx of participants. During Friday night held the feast of the industry in which all participants could enjoy the best traditional Galician cuisine, pastries, Pulpo a feira Caldeiro meat or ending the event with a queimada which was accompanied

with a "Conxuro" as witches. The whole evening was enlivened by a group of Galician folk music. One of the most important events was held Saturday afternoon at the Cathedral of St. James, where there was held a Jubilee Mass with Botafumeiro. During the Masses Congress President Dr Gonzalo Lopez de Castro read the offering of all members of SELO to the Apostle Santiago. At the end of the event all attendees were able to attend the exhibition of one of the best known and most popular symbols of the Cathedral of Santiago de Compostela, the Botafumeiro that only happens in the Eucharist of the pilgrim and most solemn Masses.

The Congress ended with the gala dinner held at the Hotel San Francisco in the refectory of the convent dating back to 1726. In this majestic frame the participants were able to taste the best dishes of the local seas, ending the act with the delivery of plaques of appreciation by the presidents of previous SELO congresses: Dr Marcela Bisheimer (Madrid 2006), Dr Luz Aguilo (Valencia 2007), Dr Maria Perez (Salamanca 2008).

Finally all participants before they parted were reminded that the next Congress of SELO will be held in Seville on February 2011. \_



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Please note that all the textual components of your submission must be combined into one MS Word document. Please do not submit multiple files for each of these items:

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- \_ all the image (tables, charts, photographs, etc.) captions;
- \_ the complete list of sources consulted; and
- \_ the author or contact information (biographical sketch, mailing address, e-mail address, etc.).

In addition, images must not be embedded into the MS Word document. All images must be submitted separately, and details about such submission follow below under image requirements.

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Article lengths can vary greatly—from 1,500 to 5,500 words—depending on the subject matter. Our approach is that if you need more or less words to do the topic justice, then please make the article as long or as short as necessary.

We can run an unusually long article in multiple parts, but this usually entails a topic for which each part can stand alone because it contains so much information.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

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Please use single spacing and make sure that the text is left justified. Please do not centre text on the page. Do not indent paragraphs, rather place a blank line between paragraphs. Please do not add tab stops.

Should you require a special layout, please let the word processing programme you are using help you do this formatting automatically. Similarly, should you need to make a list, or add footnotes or endnotes, please let the word processing programme do it for you automatically. There are menus in every programme that will enable you to do so. The fact is that no matter how carefully done, errors can creep in when you try to number footnotes yourself.

Any formatting contrary to stated above will require us to remove such formatting before layout, which is very time-consuming. Please consider this when formatting your document.

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### Questions?

Eva Kretzschmann  
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# Manufacturer News

IC Medical

## New standard in aseptic keyboard technology

More and more working steps make the computer indispensable. Even in medicine. The stronger health rules cause a well known problem, because to keep a PC-keyboard hygienically clean was previously impossible. Tools, like a silicone cover, are only a temporary solution, because they do not last long enough. The surface of the keyboard is glass, a special transparent glass. The keyboard layout is printed backside and the key areas are sensitive and respond to touch, whose strength is adjustable in three stages. So the keyboard is easy to use even with gloves. A "TrackPad" replaces the mouse. There is also no need to keep a standard mouse hygienically clean—you need no mouse! CleanKeys hygiene keyboards work with any computer that has an USB port. There is no need for additional software. Compatible with Windows, Mac OS X, and Unix. A subtly translucent light shows you when the Caps Lock key is pressed and an adjustable click sound makes every keystroke audible. This makes it easy to write fast. CleanKeys are proofed against humidity, splash-proof and can be cleaned with all commercially available surface disinfectants to protect against viruses and bacteria. With a simple button-touch the keyboard can be switched off for cleaning. The CleanKeys keyboard is ideal for use in medical technology. The CleanKeys PC keyboard is splash-proof to IP65 and is therefore easy and quick to clean. The absolutely flat surface and the capacitive mouse pad guarantee easy operation—with and without protective gloves. This makes the CleanKeys PC keyboard interesting for clean room work stations, which has to



be absolutely hygienic and dust-free. Cleankeys uses touch-capacitive technology, similar to what you might be familiar with on touch-sensitive appliances such as a microwave oven or Ceran top stove. A small electric field is created above each key, which is affected by the presence of a human finger (try using the end of a pencil and you'll see it won't work). The sensors are working even when you're wearing gloves.

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Fotona

## Another Study Confirms Er:YAG Laser's Hard Tissue Ablation Superiority

Fotona's AT Fidelis—the All Tissue laser dentistry platform—features in a study report on heat deposition of Erbium lasers in hard dental tissues, published in the Journal of Oral Laser Applications (winter 2009 issue). In a comparative study between Er:YAG and Er,Cr:YSGG lasers it was found that less total absorbed laser energy remained in the tooth in the form of heat in teeth treated with the AT Fidelis'

Er:YAG laser. The authors conclude that this, at least partially, explains the observed higher ablation efficacy of Er:YAG lasers compared to Er,Cr:YSGG lasers. This report follows previous studies, one which was also published in the Journal of Oral Laser Applications and another published by the Laser and Health Academy ([www.laserandhealth.com](http://www.laserandhealth.com)). Both investigated the use of laser profilometry for the characterization of craters produced in hard dental tissue by Er:YAG and Er,Cr:YSGG, which gave insights into accurately



measuring laser drilling speeds. The latter study revealed that the AT Fidelis' Er:YAG laser's ablation rates, which determines drilling speed in volume per second, to be 3.7 times higher in dentine and 5 times higher enamel compared to the Er,Cr:YSGG laser.

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## Biolase

### **iLase™—Questions and answers**

#### **What is the iLase?**

The iLase from BIOLASE is the world's first personal laser for dentists or hygienists\* to perform a full range of minimally invasive soft-tissue and hygiene procedures. A single, independent handpiece with no external connections provides intuitive finger-control of up to 5 Watts of peak laser power, and up to 3 Watts of continuous wave laser power. No extra foot pedal, and no extra cords are added to the operatory!

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\* Where local law allows.

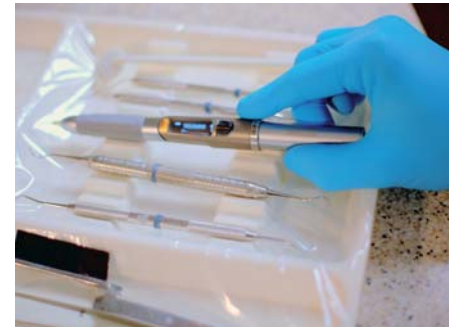
#### **What is a "personal" laser? Isn't that the same thing as a portable laser?**

The "personal" laser advances portability to a whole new level. You can carry all the components of a personal laser in one hand—or in a tray, right next to the other dental tools—and you don't have to plug it in to a power outlet. Only the iLase lets you do this! Other portable lasers either require you to carry and place a foot pedal, or plug the device in to a power outlet, or carry the component(s) with two hands, or any combination of these.

Every clinician in the dental office can have their own, personal iLase handpiece to take with them to use throughout the day. And when leaving the office, up to four integrated handpieces can be stored in a single iLase charging station, while the batteries recharge.

#### **What procedures can the iLase perform?**

The iLase can perform the same, comprehensive set of 24 FDA cleared soft-tissue and hygiene proce-



dures as the popular ezLase™. For the most common, everyday soft-tissue and hygiene procedures—such as gingivectomy, troughing for crown preparations, and sulcular debridement—the iLase is the perfect tool for every clinician.

#### **Biolase Technology, Inc.**

4 Cromwell

Irvine, CA 92618

Web: [www.biolase.com](http://www.biolase.com)

## elexxion

### **Two wavelengths and 50 W pulse output in one machine**

Among the products they presented at the IDS 2009, elexxion AG, based in Radolfzell (Germany), included their internationally-patented combination laser elexxion delos. The elexxion delos combines two of the most frequently studied and scientifically recognised wavelengths (810 nm and 2,940 nm) in one machine so that both hard and soft tissue can be treated with one single machine. At present, according to elexxion, most applications can be reasonably treated with this combination system. For example, the elexxion delos can be used for the removal of concretions, decontamination, cavity preparation, root resection and bone ablation.



Over 100 digitally stored indications can be accessed on a large touch screen and activated at a "touch". Output modifications can be easily and individually fine-tuned. The practitioner saves time, the dosage accuracy is guaranteed. Especially for peri-implantitis therapy and the treatment of biofilm, elexxion has cooperated with the University of Dusseldorf on the development of special sapphire tips.

These feature the ability to direct 90% of the laser's power lateral to the surface of the implant. Further advantages of the elexxion delos for soft-tissue applications are: Together with the ultra-short pulse durations of as little as 9 µs, the modern diode technology with its 50 W pulse output enables a gentle,

efficient soft-tissue surgery at a speed which, according to elexxion, was previously unattainable. A flexible fibre guide is an additional relief for the dentist during treatment. At the same time, the newly developed fibre increases the output density thanks to an optimized beam profile. This means higher removal speed, for example in the tooth enamel. The machine can be connected comfortably to the internal compressed-air supply or to an external compressed-air supply. The external connection permits the water spray to be precisely adjusted and, thus, improves the removal performance. The elexxion delos combination laser can be purchased in Germany from the specialized distributor Pluradent.

#### **elexxion AG**

Schützenstraße 84

78315 Radolfzell, Germany

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## AMD Lasers

### **AMD updates its laser for soft-tissue surgery**

The US-based manufacturer AMD LASERS recently launched the Picasso Lite in dental markets worldwide.

As a first in the industry, this new soft-tissue dental laser will be able to use convenient disposable tips or a low-cost strippable fibre for a wide range of applications, the company said in a press release in January. Picasso Lite is aimed at dental hygienists

and dentists who have no or little experience with dental lasers. Dentists can use Picasso Lite for various kinds of soft-tissue surgery, including gingivectomies, frenectomies, troughing, exposing implants/teeth/orthodontic brackets, and treating aphthous ulcers and herpetic lesions. According to the company, it cuts



and coagulates tissue with reduced trauma, bleeding and necrosis of tissue. Picasso Lite, which is priced at US\$2,495, comes with a set-up DVD, online laser certification, accessories and a world power adapter. AMD offers a two-year warranty on all its products.

#### **AMD LASERS™, LLC.**

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# laser

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