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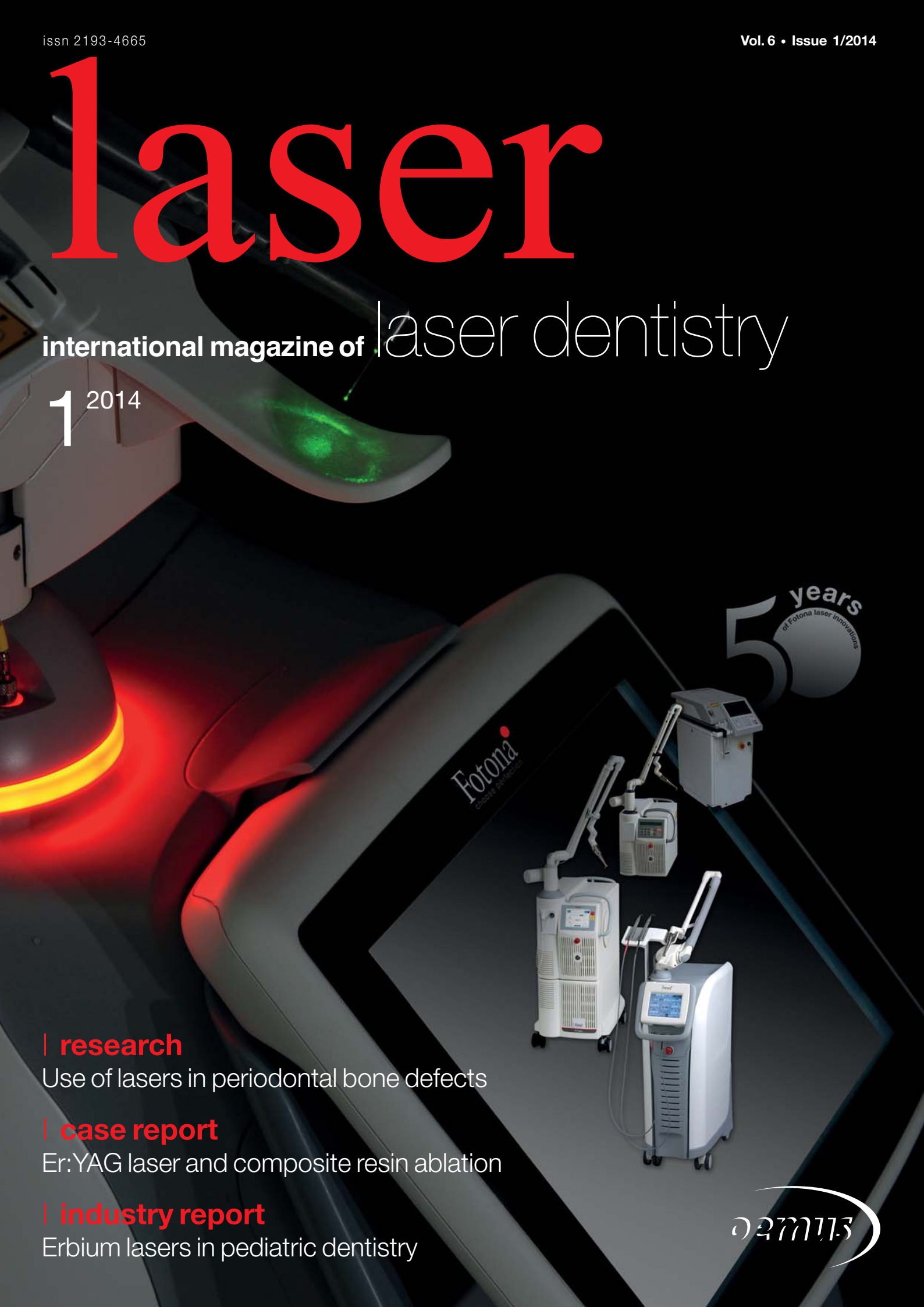

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Prof. Dr Norbert Gutknecht
Editor-in-Chief

Welcome to Paris 2014

Dear reader,

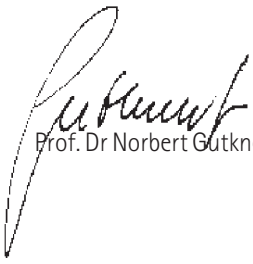
First of all, I would like to wish all our friends and DGL members a happy, healthy and successful 2014! I am sure many of you already have fixed dates and venues on their schedules, which are hopefully both obligatory and relaxing. I assume that you, being an active reader of laser **international magazine of** laser dentistry, are not only interested in new technologies and application concepts, but you also wish to participate in direct discussions with speakers and users at our WFLD (World Federation for Laser Dentistry) Congress on 2–4 July in Paris.

Scientists, practitioners and postgraduate students from all parts of the world will meet in Paris to exchange their latest findings and opinions as well as controversial problems. It will be your decision whether you let yourselves be charmed by either the various wavelengths or Paris' irresistible flair.

It is my special pleasure to welcome you all in the name of the WFLD board and the Paris organizational team to this year's most exclusive laser event.

Looking forward to meeting you in Paris

You're sincerely,



Prof. Dr Norbert Gutknecht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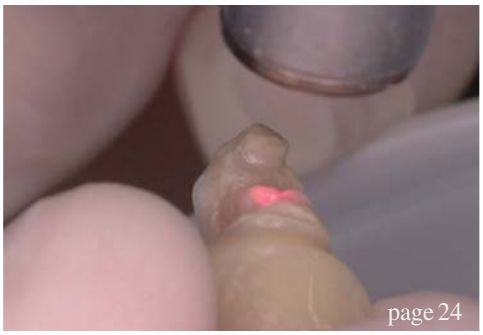
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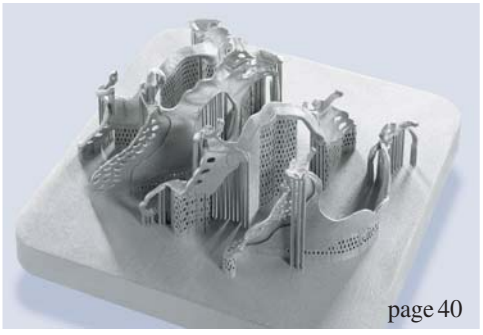
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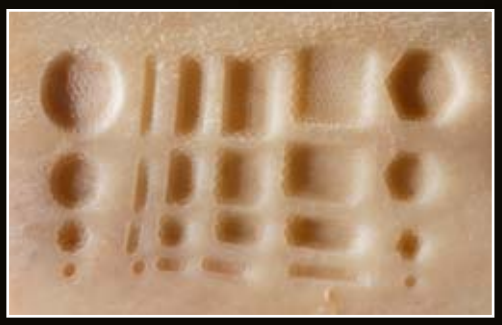

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Use of lasers in periodontal bone defects

A case report with six years follow-up

Authors_Prof. Dr Aslan Ya ar Gokbuget & Necla Aslı Kocak, Turkey

_Introduction

The use of lasers in periodontal treatment has been well documented over the past ten years. Lasers can be used for initial periodontal therapy and surgical procedures. When used in deep periodontal pockets with associated bone defects, not only does laser remove the diseased granulation tissue and associated bacteria, but it also promotes osteoclast and osteoblast activity, often resulting in bone regrowth. This usage becomes more complicated because the periodontium consists of both hard and soft tissues. The many lasers available, such as CO_2, Nd:YAG and diode lasers, can be used in periodontics because of their excellent ablation and haemostatic characteristics.

Chronic periodontitis is initiated by microbial plaque, which accumulates on the tooth surface at the gingival margin and induces an inflammatory reaction. The inflammatory response in patients with chronic periodontitis results in destruction of the periodontal tissues. With a constant bacterial challenge, the periodontal tissues are continuously exposed to specific bacterial components that have the ability to alter many local cell functions. The function of the inflammatory process is to protect the host and limit the effect of the biofilm. Some tissue destruction occurs as part of this process. Extent and severity of damage vary among individuals and over time, and may involve attachment loss. This variation in disease expression is the result of the interaction of host genetics and environmental and microbial factors.

A major goal of periodontal therapy is to achieve a biocompatible root surface through the removal of bacterial biofilms and smear layer. Ultrasonic scalers and hand instrumentation are the most commonly used procedures for root debridement in periodontal therapy. To achieve more efficient subgingival instrumentation at deeper probing depths (PDs), the tips of scalers have evolved to smaller diameters and longer working lengths. Clinical studies reported similar results when comparing ultrasonic scalers and manual instrumentation for root debridement, even though manual instrumentation requires more time and physical effort. Mechanical root debridement results in a smear layer containing bacteria, bacterial endotoxins, and contami-

Fig. 1_Bone defect.
Fig. 2_First radiographic examination.
Fig. 3_Probing.


Fig. 1


Fig. 2


Fig. 3

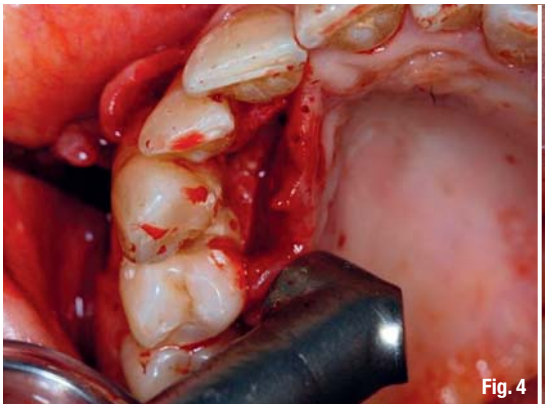
Fig. 4

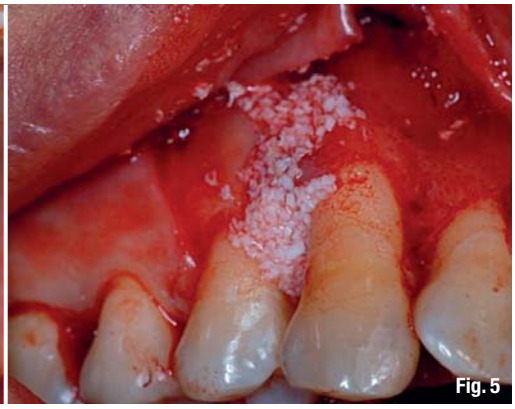
Fig. 5

Fig. 4_Surgery.
Fig. 5_Augmentation.

nated root cementum. Furthermore, it does not remove plaque and calculus completely from interradicular septa or root concavities. Individually or collectively, these factors are likely to hamper the periodontal healing process. A significant disadvantage of ultrasonic scalers, for the patient and the clinician, is the formation of a contaminated aerosol. Dentistry has changed tremendously over the past decade to the benefit of both the clinician and the patient. One technology that has become increasingly utilized in clinical dentistry is that of the laser. Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Laser is a device that utilizes the natural oscillations of atoms or molecules between energy levels for generating coherent electromagnetic radiation usually in the ultraviolet, visible, or infrared regions of the spectrum. It is a device that produces high intensity of a single wavelength and can be focused into a small spot. Initially introduced as an alternative to the traditional halogen curing light, the laser now has become the instrument of choice, in many applications, for both periodontal and restorative care. Because of their many advantages, lasers are indicated for a wide variety of procedures.

Presently, various laser systems have been used and in recent years, laser radiation has been suggested as an alternative instrumentation modality for the treatment of chronic periodontitis. *In vitro* studies reported effective results for Nd:YAG laser root debridement. When used at low-energy densities with a water-spray surface coolant, the Nd:YAG laser provides a homogeneous and smooth root surface topography. In addition, laser is effective at removing dental calculus and smear layer and exhibits bactericidal effects without inflicting any significant thermal damage to the root surface. Several clinical studies compared traditional instrumentation to the Nd:YAG laser for treatment of periodontal disease. However, laser usage for such purposes remains controversial, probably because of insufficient evidence that any specific wavelength of laser is superior to traditional instrumentation. The lack of evidence supporting laser usage results from poorly designed studies and the lack of continuity of design between studies, e.g., wide variations in laser parameters, energy densities, experimental designs, and the lack of proper controls in many studies.

_Advantages and disadvantages

Advantages of laser treatment are greater haemostasis, bactericidal effect, and minimal wound contraction. Compared with the use of a conventional scalpel, lasers can cut, ablate and reshape the oral soft tissue more easily, with no or minimal bleeding and little pain as well as no or only a few sutures. The use of lasers also has disadvantages that require precautions to be taken during clinical application. Laser irradiation can interact with tissues even in the noncontact mode, which means that laser beams may reach the patients eyes and other tissues surrounding the target in the oral cavity. Clinicians should be careful to prevent inadvertent irradiation to these tissues, especially to the eyes. Protective eyewear specific for the wavelength of the laser in use must be worn by the patient, operator, and assistant. Laser beams can be reflected by shiny surfaces of metal dental instruments, causing irradiation to other tissues, which should be avoided by using wet gauze packs over the area surrounding the target. However, previous laser systems have strong thermal side effects, leading to melting, cracking, and carbonization of hard tissues.

_Clinical presentation and case management

A 44-year-old female patient presented at our private clinic PGG for treatment of the periodontal problems at the right maxillar molar site (Fig. 1). Upon review of her medical history she was otherwise healthy. She had previously been treated for chronic periodontitis with a non-surgical approach. Then radiographic examination was made (Fig. 2). It revealed a combined marginal and vertical radiolucency. On clinical examination, deep probing depths


Fig. 6


Fig. 7


Fig. 8

Fig. 6_Suturing.
Fig. 7_ Six years after radiation.
Fig. 8_Radiograph six years after radiation.

were isolated (Fig. 3). No clinically detectable mobility of the teeth was present. One day prior to surgery, the patient was given 2,000 mg of amoxicillin and following surgery put on a regimen of amoxicillin (1,000 mg tid) for five days post-op. A crestal incision is scalloped around the teeth necks to eliminate the internal epithelium and granulation tissue from the pocket (Fig. 4). A mucoperiostal flap is rised to expose the teeth, and bone tissue and granulation tissue are eliminated from the bone defect with Nd:YAG laser with 300 µm tip, VSP, 1.5 Hz, 10 W power setting was used and Er:YAG laser with power settings of VSP, 120 mJ, 10 Hz with water and air flushing was used for teeth surface detoxification. Due to defect morphology we used a combined technique with enamel matrix derivative (Emdogain). Then, xenogenous bone grafts (Bio-Oss®) were compacted into the defect (Fig. 5). A Bio-Gide® barrier was placed over the defect and was extended both buccally and lingually.

The buccal and lingual flaps were released and tension-free primary closure was achieved with 4-0 silk sutures (Fig. 6). The patient was instructed to continue antibiotics as prescribed and to rinse with the 0.12 % chlorhexidine gluconate bid for 30 sec twice a day. Finally, a strict maintenance and oral hygiene protocol were established. The area healed uneventfully after six months. Periapical radiographs were taken throughout the healing process to evaluate the mineralization of the graft over time, bone formation within the bony defect was evident. Radiographically it appeared that there was increased mineralization of the bone surrounding the teeth.The patient was again examined every year. Six years after treatment (Fig. 7), a new radiograph (Fig. 8) was taken which demonstrated complete resolution of the bony defect surrounding the teeth.

_Discussion

As technology advances into dentistry, whether it is laser or another exciting venue, the options available to clinicians will continue to increase. Although the use of lasers in dentistry is relatively new, the future looks very bright. In summary, laser treatment is expected to serve as an alternative or adjunctive to conventional mechanical periodontal treatment. Currently, among the different types of lasers available, Nd:YAG, Er:YAG and Er,Cr:YSGG laser possess characteristics suitable for dental treatment, due to their dual ability to ablate soft and hard tissues with minimal damage. In addition, the bactericidal effect of laser with elimination of lipopolysaccharide, its ability to remove bacterial plaque and calculus, an irradiation effect limited to an ultra-thin layer of tissue, faster bone and soft tissue repair make it a promising tool for periodontal treatment including scaling and root surface debridement. The decision to use a laser should be based on the proven benefits of haemostasis, a dry field, reduced surgical time and the general experience of less postoperative swelling.

_Conclusion

Although no definitive conclusion can be drawn from a single case report, the guided bone regeneration combined laser technique described in this case report effectively eliminated teeth associated three-wall bony defect and deep pocket. Under the conditions of the present case, it may be concluded that the Nd:YAG and Er:YAG laser combination can be safely and effectively utilized for degranulation and implant surface debridement in the surgical treatment of periodontal infection._

_contact laser

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Mucocele of the lip treated by using 980 nm diode laser

Authors_Dr Merita Bardhoshi, Prof. Dr Norbert Gutknecht, Dr Esat Bardhoshi, Dr Alketa Qafmolla, Dr Edit Xhajanka & Dr Neada Hysenaj, Albania & Germany

_Introduction

Mucoceles are defined as mucus-filled cavities that can appear in the oral cavity, paranasal sinuses or lacrimal sac. They are characterised by the accumulation of liquid or mucoidmaterial, giving rise to a rounded, well circumscribed transparent and bluish-colored lesion of variable size.[1,3,5,7] The consistency is tipically soft and fluctuant in response to palpation. Mucoceles are painless and tend to relapse. Etiologically, most mucoceles are considered to be secondary to traumatic or obstructive disorders of the mainly minor salivary glands—the preferential location being the humid mucosa of the lower lip. Mucoceles are usually asymptomatic, although in some patients they can cause discomfort by interfering with speech, chewing or swallowing. They can be different in size, small and large. However, in most cases these lesions rupture spontaneously or traumatically a few hours after being formed, with the release of a characteristic viscous mucoidfluid. This may give the mistaken impression of healing, since the lesion decreases in size or disappears. However, once the small perforation allowing release of the mucocele contents has healed, the secretions accumulate again and the lesion relapses.[5,9,15] In case of repeated trauma, the lesion may become nodular and firmer in response to palpation with rupture being more difficult in this situation. Treatment may be performed by conventional surgery, cryotherapy and more recently laser surgery. Carbon dioxide laser and high-intensity diode laser both have provided satisfactory results.[8] The purpose of this study was to evaluate the effectiveness of 980 nm diode laser in the treatment of mucocele of the lower lip and also to compare the results obtained after mucocele resection with scalpel versus 980 nm diode laser.

Fig. 1_Clinical diagnosis.
Fig. 2_Laser treatment.


Fig. 1

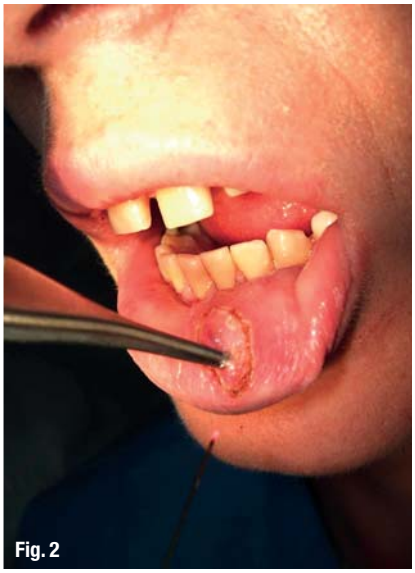
Fig. 2

_Patients and method

A total of 10 patients (six males and four females) aged 15 to 40 were treated for mucocele of the lip by a 980 nm diode laser. An initial clinical examination consisting of the past medical and dental history as well as thorough extra- and intraoral examination were performed on all patients. Complementary blood test, complete blood count and erythrocyte sedimentation rate made it possible to exclude infectious diseases. The collected data were evaluated and a clinical diagnosis for the type of lesion was established (Figs. 1). All patients were given a written and verbal information on the nature of laser treatment and signed informed consent forms were obtained prior to treatment. Treatments were con-

ducted from January 2007 to January 2011 at the Department of Oral Surgery (Dental Clinic of the University of Tirana, Albania). For all treatments, a diode laser was used (Sirona, 980 nm, cw, optical fibre 300 micrometer, 4 W). Treatments were conducted with infiltration anaesthesia of 2% lidocaine, 1 cc and excision was performed by surgical technique. The treatment area was cooled by the application of ice 2 to 5 minutes after treatment. Surgical fields were bloodless, no sutures were required and time of surgery was 2–4 minutes (Fig. 2). The specimens obtained were fixed in 10% formalin solution for posterior histological study to establish the definitive diagnosis. The resulting surgical wounds were allowed to heal by second intention (Fig. 3). After treatment, analgesic medication was prescribed to be used if necessary, but no antibiotics were prescribed. Ten clinical cases of mucoceles were treated by scalpel. An elliptic incision was made to fully enucleate the lesion along with the overlying mucosa and the affected glands. The operation proved more complicated when the lesion ruptured, since the loss of references made it more difficult to ensure complete elimination of the lesion. The wounds were finally sutured. The follow-up visits were scheduled ten days, one month, six months, one year and three years after surgery. All lesions were photographically documented at all stages of treatment and healing.

_Results

The study comprised 20 patients (twelve males & eight females), six cases presented between ten and 20 years of age, nine cases between 20 and 30 years of age, three cases between 30 and 40 years of age and two cases between 40 and 50 years of age. In most of the cases, there was no evident etiological factor. Mucoceles ranged from 1–3 cm in diameter, no pain was reported by all patients, and only seven patients referred discomfort associated with nibbling of the lesion. Immediately after the excision, all surgical fields were bloodles (Fig. 4). Histopathological examination confirmed the initial diagnosis. All patients were followed up seven days postoperatively for pain and swelling .

After four weeks, the wound healing characteristics of all clinical cases were evaluated. Patients treated with diode laser reported good, comfortable healing without complications (Fig. 4) or functional disturbances, versus ten scar formations and four relapses with scalpel. After six months to one year, no recurrence was observed in patients treated with laser versus three cases treated with scalpel. No lip paresthesias were recorded after the treatment of both of the two groups of patients.

_Statistical analysis

We have presented some of the cross tabulations using SPSS16 (Statical Package for Social Sciences). Data for patient characteristics are given as mean and standard deviation in order to obtain information and to observe the difference between the scalpel and laser procedure. For each step we have recorded pain, functional disturbance, swelling and recurrence on a standard visual analogue scale from 0 to 4. The maximum value for pain is one, showing that the response is mild pain. We recorded just one case with such kind of pain in the laser procedure. The mean is 0.625 and the standard deviation is 0.25.


Fig. 3


Fig. 4

Fig. 3_Healing by second intention.
Fig. 4_ Immediately after the excision, all surgical fields were bloodless.

We have also checked for any relationship between pain and age. A cross tabulation is presented in the case processing summary as well as a Pearson correlation for both of the two procedures. The Pearson correlation in this case shows that the correlation between pain caused in laser procedure and age is correlated negatively with the coefficient of -0.02, which is however not sufficient statistically at 5 % and 1 % (p-value is 0.943).[1] This correlation between these two variables is not genuinely significant at the rate of significance as chosen above. While the Pearson correlation between pain and age for the scalpel is also negative, suggesting that these two variables are correlated negatively and still not sufficiently statistically significant at the rate of 5 and 1 % level of significance.

_Discussion

In our study 52 % of the lesions were found in males. In all our clinical cases, mucocele growth was generally found to be slow. In the course of the anamnesis, some patients reported accidental traumatism and suction habits. Lesions vary in diameter between 0.2 mm and 2 cm without symptoms. Using the scalpel, some authors[1,3,5,8,9] propose the removal of both the affected and neighboring glands in order to prevent relapse. Special care is required to avoid damaging other glands or ducts with the suture needle, as this may become a cause of recurrence. The total treatment time with laser was 3 to 5 minutes, the same as authors state in the literature reports.[2,7,12] This was lower than the treatment time by scalpel which required sutures after the full enucleation of lesion by an elliptic incision, whereas wounds treated by laser surgery healed by secondary intention regardless of their depth. However, the size of the surgical wound is increased compared to the size of the lesion.

Laser surgery is an option of choice for pediatric and geriartric patients who have difficulties tolerating long surgical procedures. Authors recorded no postoperative bleeding or healing complications with laser surgery.[15,17,20] This was reflected in our study's postoperative period as the patients recovered without complications. We recorded no recurrence, no lip paraesthesias, no relapses after treatment of mucocele with 980 nm diode laser. Furthermore, we observed complications in the healing process of the patients treated with scalpel. These complications ranged from recurrence, scarring and relapse attributable to damage to the neighboring minor salivary glands cause by scalpel or needle upon suturing. Other advantages of the laser versus cold surgery include bloodlessness and a highly decontaminated surgical bed which allow for less swelling and pain during the postoperative period. Moreover, as is reported in literature,[14,16,17,18,19,20] these advantages also allow for the appearance of fewer myofibrobasts resulting in comparatively lesser wound contraction.[12,13] Our postoperative results of minimal pain and no or minimal swelling coincides with the observations of other authors.[1,3,5,7] No analgesics or antibiotics were needed in any of the patients treated with laser, other than all patients treated with cold scalpel.

_Conclusion

Laser surgery is a modality for the treatment of mucocele with beneficial effects and advantages. Intraoperative advantages were a good coagulation, a good visualization of the operative field and the short operating time, which made it possible to minimise fear and anxiety in the patients during the procedure. The advantages of laser surgery also include a reduction of relapses and scar formation, offering the best aesthetic outcome in comparison to the scalpel. Laser surgery is therefore an asset not only for the patient but also for the surgeon._

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

_contact laser

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Pain reduction of recurrent aphthous stomatitis

Evaluation of class 2M diode laser as a home care device

Authors_Dr Maziar Mir, MSc, Dr Masoud Mojahedi, MSc, Dr Jan Tunér DDS, Dr Hassan Adalatkhah, MSc, Dr Amir Mansour Shirani, MSc & Dr Masoud Shabani, Germany & Iran

_Introduction

Recurrent aphthous stomatitis (RAS) is a common condition, restricted to the mouth, and typically starts in childhood or adolescence as recurrent small, round or ovoid ulcers with circumscribed margins, erythematous haloes, and yellow or gray floors. RAS has three clinical types: minor, major and herpetiform ulcers. Ulcers with similar clinical features (aphthous-like ulcers) may be associated with systemic conditions such as Behçet syndrome, auto-inflammatory syndromes, gastrointestinal disease or immune defects such as HIV/AIDS.The etiology of recurrent aphthous stomatitis (RAS) is not entirely clear. A genetic basis exists for some RAS.

This is shown by a positive family history in about one third of patients with RAS, an increased frequency of HLA types A2, A11, B12, and DR2, and susceptibility to RAS which segregates in families in association with HLA haplotypes. RAS probably involves cell-mediated mechanisms but the precise immunopathogenesis remains unclear. Phagocytic and cytotoxic T cells probably aid in destruction of oral epithelium that is directed and sustained by local cytokine release. Patients with active RAS have an increased proportion of gamma-delta T cells compared with control subjects and patients with inactive RAS. Gamma-delta T cells may be involved in antibody-dependent cell-mediated cytotoxicity (ADCC). Compared with control subjects, individuals with RAS have raised serum levels of cytokines such as interleukin (IL)–6 and IL-2R, soluble intercellular adhesion modules (ICAM), vascular cell adhesion modules (VCAM), and E-selectin. However, some of these do not correlate with disease activity.[1-4]

LLLT has been reported as a useful treatment for several conditions, such as reduction of the destructive interleukins and TNF-production, improvement of the immune system function, reduction of pain and the healing time period.[5-12]

Lasers (high power and low power) have been used in some case reports and studies for pain reduction and shortening healing time of RAS.[13-32] Most of these reports focussed on office treatment, but many patients have recurrent lesions and there were no known home care devices for laser treatment of RAS. Therefore, to assist patients in using lasers at home by themselves, a class 2M low level laser was inserted in a pen-like device. This laser is called LLLAP (Low Level Laser Aphthous Pen) and it seems that it was the first time that such a device is introduced to dental professionals. Therefore, the aim of this pilot study was to evaluate the pain reduction efficiency of this particular instrument.

_Material and method

A prospective randomised trial was conducted with 30 patients. Inclusion criteria were: having at least one minor aphthous ulcer smaller than 5 mm, satisfaction and ability to take part in the study, fulfilment of the patient consent form according to the Code of Ethics and having new lesions in the first two

Fig. 1_Low Level Laser Aphthous Pen.
Fig. 2_Minor aphthous ulcer.

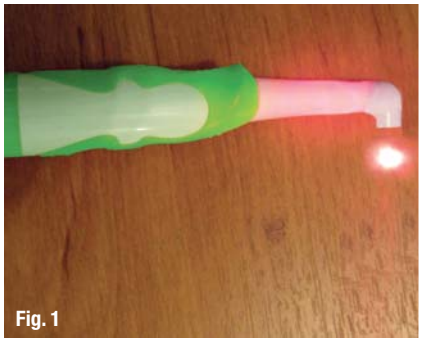
Fig. 1


Fig. 2

days. Exclusion criteria were: pregnancy, carcinoma, taking steroids or anticoagulant and anti-inflammatory agents, eye problems or mental retardation or impairment and patients with aphthous-like ulcers with signs and symptoms of systemic diseases like Behçet syndrome, auto-inflammatory syndromes, gastrointestinal disease, or immune defects such as HIV/AIDS and severe anaemia. Ethically, all these patients were treated as well but were not counted as study cases.

The samples were allocated into three groups: Group 1 received laser therapy (low-level laser aphthous pen, registration number in Iran: 72619). The device was prepared by insertion of the diode laser in the tooth brush, then it was calibrated and tested (Fig.1). Group 2 received topical triamcinolone acetonide 0.1% in orabase (gelatin, pectin, and carboxymethyl cellulose sodium in Plastibase® (Plasticized Hydrocarbon Gel), a polyethylene and mineral oil gel base, Adcortyl in orabase, Bristol-Myers Squibb Company). Group 3 received placebo (red LED light).

Laser parameters were: InGaAlP diode class 2M laser, wavelength 660 nm, continuous, 40 mW, irradiation diameter 3 mm, spot size 0.19625 cm^2, 30 seconds, 1.2 J, 6 J/cm^2 twice per day for five consecutive days, near non-contact mode and near at a perpendicular angle (Figs. 2-4). Class 2 laser was used because this laser was used at home and it is necessary to use a relatively safe laser. For this kind of laser, natural reaction of a person like shutting of the eyelid is sufficient for eye protection. But patients were educated in the application of the laser, not to stare into the beam or view it directly with optical instruments and to put it in a place which is not reachable by children. The Research Ethical Committee approval was adopted with number 01391023 for this research from Ardebil University of Medical Sciences.

The VAS scale was used for the evaluation of pain, in the range of 0 to 10 so that 0 is no pain and 10 is very severe pain. Evaluations were performed before treatment, immediately after irradiation and every day during the first five days. The data were analysed by one way ANOVA and PostHoc tests.

_Results

Thirty patients took part in the study, 16 were men and 14 were women. The location of minor RAS was the upper lip in 20 patients and the lower lip in 10 patients.

In ANOVA data analysing, there was no significant VAS difference between the groups before treatment (p=0.500). After treatment, there was significant difference between the LLLT/Adcortyl groups and the placebo group immediately after the first session and during the first five days (p=0.001).The data for Mean, Standard deviation and PostHoc test results are presented in table 1. There was no significant difference between laser and Adcortyl groups but both were significantly better than the red light pen. Chart 1 shows the pain reduction during five consecutive days among the groups.


Fig. 3

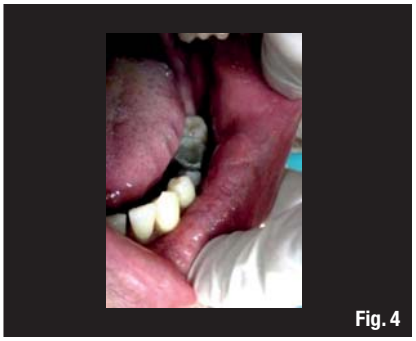
Fig. 4

Fig. 3_Laser irradiation with aphthous laser pen.
Fig. 4_Four days after treatment.

_Discussion

Many different treatments are considered for RAS. Relief of pain and reduction of ulcer duration are the main goals of therapy. Topical corticosteroids remain the mainstays of treatment.[4] Thus, in this study, one group received topical Adcortyl™ in Orabase™ for better comparison.

Different kinds of laser were successfully used in studies for treatment of RAS. The GaAlAs diode laser,[15] He-Ne laser,[16,17] argon laser,[20] InGaAlP laser,[14,21] Nd:YAG laser,[22,29] diode 830 nm,[29] GaAs (904 nm),[24] CO_2,[26,30,31] diode lase[32] were used in case reports and studies. For cases with aphthous-like lesion in Behçet syndrome, CO_2 laser[23] and GaAs (904 nm)[25] have been applied successfully. For cases with aphthous-like ulcer in AIDS (Acquired Immune Deficiency Syndrome) cases, diode 660 nm laser has been used with good result.[27]

Fig. 5_ Pain reduction during five consecutive days among intervention groups.

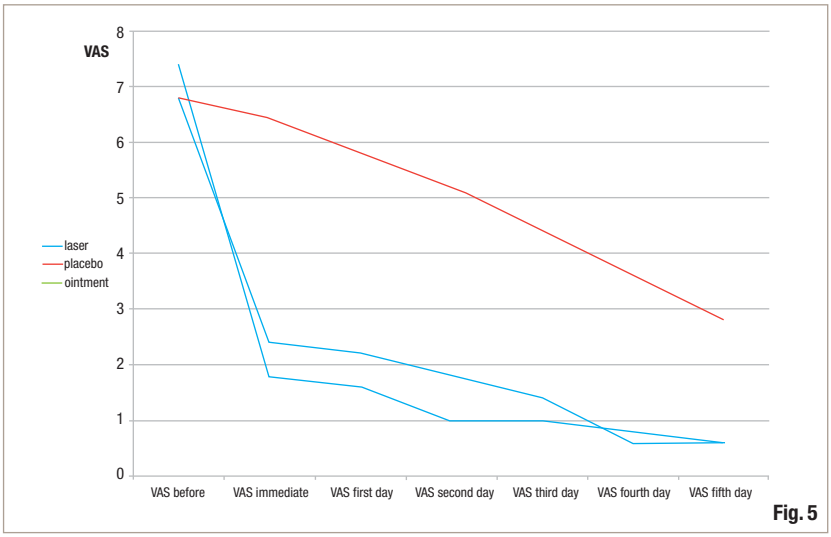

Fig. 5

Variable		N	Mean	Std.D	Groups	Sig	CI95%
VAS before treatment	Laser	10	7.4	1.07	Laser-Ointment	0.56	(-0.8)-(2.04)
	Placebo	10	6.8	1.39	Laser-Placebo	0.56	(-0.8)-(2.04)
	Ointment	10	6.8	1.39	Ointment-Placebo	1	(-1.44)-(1.44)
VAS imm. after treatment	Laser	10	1.8	0.42	Laser-Ointment	0.3	(-1.6)-(0.41)
	Placebo	10	6.4	5.8	Laser-Placebo	0	(-5.61)-(-3.95)
	Ointment	10	2.4	0.51	Ointment-Placebo	0	(-5.01)-(-2.9)
VAS 1st day after treatment	Laser	10	1.6	0.51	Laser-Ointment	0.3	(-1.6)-(0.47)
	Placebo	10	5.8	1.3	Laser-Placebo	0	(-5.2)-(-3.1)
	Ointment	10	2.2	0.78	Ointment-Placebo	0	(-4.6)-(-2.5)
VAS 2nd day after treatment	Laser	10	1	0.6	Laser-Ointment	0.19	(-1.91)-(0.31)
	Placebo	10	5.2	1.3	Laser-Placebo	0	(-5.3)-(-3.08)
	Ointment	10	1.8	0.78	Ointment-Placebo	0	(2.28)-(4.51)
VAS 3rd day after treatment	Laser	10	1	0.6	Laser-Ointment	0.74	(-1.7)-(0.96)
	Placebo	10	4.4	1.7	Laser-Placebo	0	(-4.7)-(-2.03)
	Ointment	10	1.4	1.07	Ointment-Placebo	0	(-4.3)-(-1.63)
VAS 4th day after treatment	Laser	10	0.8	0.42	Laser-Ointment	0.9	(-0.97)-(1.37)
	Placebo	10	3.6	1.71	Laser-Placebo	0	(-3.9)-(-1.6)
	Ointment	10	0.6	0.51	Ointment-Placebo	0	(1.82)-(4.17)
VAS 5th day after treatment	Laser	10	0.6	0.51	Laser-Ointment	1	(-1.01)-(1.01)
	Placebo	10	2.8	1.39	Laser-Placebo	0	(-3.2)-(-1.1)
	Ointment	10	0.6	0.51	Ointment-Placebo	0	(-3.2)-(-1.1)

Table 1_Result of PostHoc test for multiple comparisons between groups.

As the low level laser can modulate inflammatory mediators such as TNF-alpha, IL-6 and others, reduction of pain can be achived. The healing of the aphthous ulcer can be attributed to increase of the cellular activity, especially fibroblasts, keratinocytes and immune cells. Therefore, wound healing and boosting of the natural function can be achieved.

Most studies focus on in-office treatment. The low level laser therapy often requires additional treatment sessions and there is no known home care device for laser treatment of RAS. Patients with RAS have recurrent ulcers and in-office treatment for each recurrent lesion requires several visits to the dental office and consequent economic problems. Therefore, a class 2M low level laser was inserted in a pen-like device in order to assist patients to use lasers at home.

In this study, laser pen was statistically better than laser placebo in pain reduction. This was simillar to another study.[21] The laser pen statistically had an efficiency similar to topical corticosteroids (as a routine treatment) in pain reduction. This finding was consistent with other studies.[24,29] In the present study, only pain reduction was evaluated but in the Salman study[24]: the laser treatment group had a shorter healing time in comparison to Adcortyl™. Laser therapy reduced healing time in recurrent aphthous stomatitis in comparison to the control group (topical lidocaine) in some studies.[33]

As corticosteroids have several side effects, laser treatment may have some advantages for the treatment of recurrent aphthous stomatitis.

_Conclusion

In this clinical pilot study, the laser pen seems to be useful for the treatment of RAS as a home care device.

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

_contact laser

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Diclofenac, dexamethasone or laser phototherapy?

Part I

Author_Jan Tunér, Sweden

[PICTURE: ©ROBERT KNESCHKE]

_Introduction

In the May 2013 edition of Photomedicine and Laser Surgery, the editorial written by Prof. Tina Karu is titled "Is it time to consider photobiomodulation as a drug equivalent?" Well, is it? Let us have a look and see what the literature has to say about two very popular drugs:

NSAIDs (non-steroidal anti-inflammatory drugs) are the best sold pharmaceuticals ever. The short-term effects on pain and inflammation are obvious and valuable. The long-term effects, however, have been questioned and this is especially valid considering the many side effects of NSAIDs. Millions of patients are on long-term medication with NSAIDs, and even lifelong. Indeed, many persons die from their medication. So an alternative option is required. I believe it is already available: laser phototherapy! First, let us have a look at the strength of the scientific evidence for NSAIDs as such, and long term use of these in particular:

The meta-analysis by Bjordal[1] on the effect of NSAIDs on knee osteoarthritis pain appears to become important for the recognition and future development of LPT. Let us read the abstract: The research group summarises that non-steroidal anti-inflammatory drugs (NSAIDs), including cyclo-oxygenase-2 inhibitors (coxibs), reduce short-term pain associated with knee osteoarthritis only slightly better than placebo, and long-term use of these agents should be avoided. Up for analysis were 23 placebo-controlled trials involving 10,845 patients, 7,767 of whom received NSAID therapy and 3,078 placebo therapy. All in all 21 of the NSAID-studies were funded by the pharmaceutical industry, and the results of 13 of these studies were inflated by patient selection bias as previous NSAID-users were excluded if they had not previously responded favourably to NSAID. Such an exclusion criterion for non-responders has never been seen in any controlled trial of LPT or other non-pharmacological therapies of osteoarthritis. In the remaining ten unbiased NSAID-trials, the difference from placebo was only 5.9 mm on a 100 mm pain scale.

This is far less than established data on differences that are considered minimally perceptible (9 mm) or clinically relevant (12 mm) for knee osteoarthritis patients. In addition, none of the trials found any effects beyond 13 weeks. This bleak support for long term use of NSAIDs is an excellent support for non-pharmaceutical methods, such as LPT. Diclofenac is one of the best-selling NSAIDs. Several investigators have compared the effect of LPT and diclofenac.

Ramos[3] investigated the effects of LPT (810 nm) in rat-induced skeletal muscle strain. Male rats were anaesthetised with halothane prior to the induction of muscle strain. Previous studies have determined that a force equal to 130 % of the body weight corresponds to approximately 80 % of the ultimate rupture force of the muscle tendon unit. In all animals, the right leg received a controlled strain injury while the left leg served as control. A small weight corresponding to 150 % of the total body weight was attached to the right leg in an appropriate apparatus and left to induce muscle strain twice for 20 minutes with three-minute intervals. Walking index, C-reactive protein, creatine kinase, vascular extravasation and histological analysis of the tibial muscle were performed after six, twelve and 24 hours of lesion induction. LPT in an energy-dependent manner markedly or even completely reduced the Walking Index, leading to a better quality of movement. C-reactive protein production

[PICTURE: ©INESBAZDAR]

The aim of a study by Marcos[2] was to evaluate the short-term effects of LPT or sodium diclofenac treatments on biochemical markers and biomechanical properties of inflamed Achilles tendons. Wistar rats Achilles tendons (n = 6/group) were injected with saline (control) or collagenase at peritendinous area of Achilles tendons. After one hour animals were treated with two different doses of LPT (810 nm, 1 and 3 J) at the sites of the injections, or with intramuscular sodium diclofenac. Regarding biochemical analyses, LPT significantly decreased COX-2, TNF-alpha, MMP-3, MMP-9, and MMP-13 gene expression, as well as PGE2 production when compared to collagenase group. Interestingly, diclofenac treatment only decreased PGE2 levels. Biomechanical properties were preserved in the laser-treated groups when compared to collagenase and diclofenac groups.

was completely inhibited by laser treatment, even more than observed with Sodium diclofenac inhibition (positive control). Creative Kinase activity was also significantly reduced by laser irradiations. In conclusion, LPT operating in 810 nm markedly reduced inflammation and muscle damage after experimental muscle strain, leading to a highly significant enhancement of walking activity.

The aim of the study by de Almeida[4] was to analyse the effects of sodium diclofenac (topical application), cryotherapy, and LPT on pro-inflammatory cytokine levels after a controlled model of muscle injury. For such, we performed a single trauma in the tibialis anterior muscle of rats. After one hour, animals were treated with sodium diclofenac (11.6 mg/g of solution), cryotherapy (20 min), or LPT (904 nm; superpulsed; 700 Hz; 60 mW mean output power;

1.67 W/cm^2; 1, 3, 6 or 9 J; 17, 50, 100 or 150 s). Assessment of interleukin-1 and interleukin-6 (IL-1 and IL-6) and tumour necrosis factor-alpha levels was performed at six hours after trauma employing enzyme-linked immunosorbent assay method. LPT with 1 J dose significantly decreased IL-1, IL-6, and TNF-alpha levels compared to non-treated injured group as well as diclofenac and cryotherapy groups. On the other hand, treatment with diclofenac and cryotherapy does not decrease pro-inflammatory cytokine levels compared to the non-treated injured group. Therefore, the authors conclude that 904 nm LPT with 1 J dose has better effects than topical application of diclofenac or cryotherapy in acute inflammatory phase after muscle trauma.

The purpose of a study by Albertini[5] was to investigate the effect of LPT on the acute inflammatory process. Male rats were used. Paw oedema was induced by a sub-plantar injection of carrageenan, the paw volume was measured before and one, two, three and four hours after the injection, using a hydroplethysmometer. To investigate the action mechanism of the GaAlAs laser on inflammatory oedema, parallel studies were performed using adrenalectomised rats or rats treated with sodium diclofenac. Different laser irradiation protocols were employed for specific energy densities (EDs), exposure times and repetition rates. The rats were irradiated with laser for 80 s each hour. The EDs that produced an anti-inflammatory effect were 1 and 2.5 J/cm^2, reducing the oedema by 27 % and 45.4 %, respectively. The ED of 2.5 J/cm^2 produced anti-inflammatory effects similar to those produced by the cyclooxigenase inhibitor sodium diclofenac at a dose of 1 mg/kg. In adrenalectomised animals, the laser irradiation failed to inhibit the oedema. These results suggest that LPT possibly exerts its anti-inflammatory effects by stimulating the release of adrenal corticosteroid hormones.

The aim of a work by Meneguzzo[6] was to investigate the effects of infrared 810 nm on the acute inflammatory process by the irradiation of lymph nodes, using the classical model of carrageenan-induced rat paw oedema. Thirty mice were randomly divided into five groups. The inflammatory induction was performed in all groups by a sub-plantar injection of carrageenan (1 mg/paw). The paw volume was measured before and 1, 2, 3, 4 and 6 hours after the injection using a plethysmometer. Myeloperoxidase (MPO) activity was analysed as a specific marker of neutrophil accumulation at the inflammatory site. The control group did not receive any treatment (GC); GD group received sodium diclofenac (1mg/kg) 30 minutes before the carrageenan injection; GP group received laser irradiation directly on the paw (1 Joule, 100 mW, 10 sec) one and two hours after the carrageenan injection; GLY group received laser irradiation (1 Joule, 100 mW, 10 sec) on the inguinal lymph nodes; GP+LY group received laser irradiation on both paw and lymph nodes one and two hours after the carrageenan injection. MPO activity was similar in the sodium diclofenac as well as in the GP and GLY groups, but significantly lower than the GC and GP + LY groups. Paw oedema was significantly inhibited in GP and GD groups when compared to the other groups. Interestingly, the GP+LY groups presented the biggest oedema, even bigger than in the control group. LPT showed an anti-inflammatory effect when the irradiation was performed on the site of lesion or at the correlated lymph nodes, but showed a pro-inflammatory effect when both paw and lymph nodes were irradiated during the acute inflammatory process.

The aim of a study by Barretto[23] was to investigate the analgesic and anti-inflammatory activity of LPT on the nociceptive behavioural as well as histomorphological aspects induced by injection of formalin and carrageenan into the rat temporomandibular joint. The 2.5 % formalin injection (FRG group) induced behavioural responses characterized by rubbing the orofacial region and flinching the head quickly, which were quantified for 45 min. The pretreatment with systemic administration of diclofenac sodium-DFN group (10 mg/kg i.p.) or irradiation with infrared LPT (LST group, 780 nm, 70 mW, 30 s, 2.1 J, 52.5 J/cm^2), significantly reduced the formalin-induced nociceptive responses. The 1 % carrageenan injection (CRG group) induced inflammatory responses over the time-course of the study (24 h, three and seven days) characterised by the presence of intense inflammatory infiltrate rich in neutrophils, scanty areas of liquefactive necrosis and intense interstitial oedema, extensive haemorrhagic areas, and enlargement of the joint space on the region. The DFN and LST groups showed an intensity of inflammatory response that was significantly lower than in CRG group over the time-course of the study, especially in the LST group, which showed exuberant granulation tissue with intense vascularization, and deposition of newly formed collagen fibres (three and seven days).

The aim of a study by de Almeida[7] was to analyse the effects of sodium diclofenac (topical application) and LPT on morphological aspects and gene expression of biochemical inflammatory markers. The researchers performed a single trauma in the tibialis anterior muscle of rats. After one hour, animals were treated with sodium diclofenac (11.6 mg/g of solution) or LPT (810 nm; continuous mode; 100 mW; 1, 3 or 9 J; 10, 30 or 90 s). Histological analysis and quantification of gene expression (real-time polymerase chain reaction-RT-PCR) of cyclooxygenase 1 and 2 (COX-1 and COX-2) and tumour necrosis factor-alpha (TNF-alpha) were performed at six, twelve and 24 h after trauma. LPT with all doses improved morphologi-

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cal aspects of muscle tissue, showing better results than injury and diclofenac groups. All LPT doses also decreased COX-2 compared to injury group and to diclofenac group at 24 h after trauma. In addition, LPT decreased TNF-alpha compared both to injury and diclofenac groups. LPT mainly with dose of 9 J is better than topical application of diclofenac in acute inflammation after muscle trauma.

Yet another study by Marcos[8] investigated if a safer treatment such as LPT could reduce tendinitis inflammation, and whether a possible pathway could be through inhibition of either of the two-cyclooxygenase (COX) isoforms in inflammation. Wistar rats (six animals per group) were injected with saline (control) or collagenase in their Achilles tendons. Then they were treated with three different doses of IR LPT (810 nm; 100 mW; 10 s, 30 s and 60 s; 3.57 W/cm^2; 1 J, 3 J, 6 J) at the sites of the injections, or intramuscular diclofenac, a nonselective COX inhibitor/NSAID. It was found that LPT dose of 3 J significantly reduced inflammation through less COX-2-derived gene expression and PGE2 production, and less oedema formation compared to non-irradiated controls. Diclofenac controls exhibited significantly lower PGE2 cytokine levels at 6 h than collagenase control, but COX isoform 1-derived gene expression and cytokine PGE2 levels were not affected by treatments. As LPT seems to act on inflammation through a selective inhibition of the COX-2 isoform in collagenase-induced tendinitis, LPT may have the potential to become a new and safer non-drug alternative to coxibs.

The aim of the study by de Paiva Carvalho[9] was to evaluate the effect of single and combined therapies (LPT, topical application of diclofenac and intramuscular diclofenac) on functional and biochemical aspects in an experimental model of controlled muscle strain in rats. Muscle strain was induced by overloading tibialis anterior muscle of rats. Injured groups received either no treatment, or a single treatment with topical or intramuscular diclofenac (TD and ID), or LPT (3 J, 810 nm, 100 mW) 1 h after injury. Walking track analysis was the functional outcome and biochemical analyses included mRNA expression of COX-1 and COX-2 and blood levels of prostaglandin E2 (PGE2). All treatments significantly decreased COX-1 and COX-2 gene expression compared to the injury group. However, LPT showed better effects than TD and ID regarding PGE2 levels and walking track analysis. The author concludes that LPT has more efficacy than topical and intramuscular diclofenac in treatment of muscle strain injury in acute stage.

Crystalopathies are inflammatory pathologies caused by cellular reactions to the deposition of crystals in the joints. The anti-inflammatory effect of He-Ne laser and that of the non-steroidal anti-inflammatory drugs (NSAIDs) diclofenac, meloxicam, celecoxib, and rofecoxib was studied in acute and chronic arthritis produced by hydroxyapatite and calcium pyrophosphate in rats. The presence of the markers fibrinogen, L-citrulline, nitric oxide, and nitrotyrosine was determined. In the study by Rubio[10], crystals were injected into the posterior limb joints of the rats. A dose of 8 J/cm^2 of energy from a HeNe laser was applied for three days in some groups and for five days in other groups. The levels of some of the biomarkers were determined by spectrophotometry, and that of nitrotyrosine was determined by ELISA. In arthritic rats, the fibrinogen, L-citrulline, nitric oxide, and nitrotyrosine levels increased in comparison to controls and to the laser-treated arthritic groups. When comparing fibrinogen from arthritic rats with disease induced by hydroxyapatite to healthy and arthritic rats treated with NSAIDs, the He-Ne laser decreased levels to values similar to those seen in controls. Inflammatory and oxidative stress markers in experimental crystalopathy are positively modified by photobiostimulation._

Editorial note: To be continued with further studies on the effectiveness of diclofenac and LPT and conclusion in laser 2/2014. An list of references is available from the author.

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Er:YAG laser and composite resin ablation

Author_Carlo Fornaini, Italy

[PICTURE: ©STASIQUE]

_Introduction

In 1954, Buonocore[1] initiated a real revolution in dentistry by proposing the possibility of obtaining stronger adhesion between composite resin and enamel through an etching process using orthophosphoric acid. The practical application of his theory completely changed the rules of conservative dentistry, shifting from the concept of "extension for prevention"[2] to that of "minimally invasive dentistry"[3] and, subsequently it was applied, with several advantages, also in orthodontics[4] and pediatric dentistry.[5] Although such adhesive systems are largely employed in dentistry today, there are still some unsolved problems.

In fact, the etch depth is variable and not predictable[6], as well as the type of acid-etching pattern according to the Silverstone classification[7,8]; moreover, rinsing does not necessarily completely arrest the acid etching process in the depth of the exposed enamel[9] and, last but not least, there is a clinical challenge in controlling the geometry and extent of the etched enamel area.[10]

With the aim to eliminate these disadvantages, several methods were proposed over the years as an alternative to orthophosphoric acid, such air abrasion and maleic acid[11-13], but the results were not encouraging. In 1990 Hibst and Keller[14] described the possibility of using the Er:YAG laser for cavity preparation in conservative dentistry.

This wavelength (2,940 nm), being very close to the absorption peaks of water (3,000 nm) and hydroxyapatite (2,800 nm), which are largely present in enamel and dentine, causes the explosion of the intracellular water and thus the destruction of the dental tissues (15).

In recent years many advantages of using laser technology, as compared to the traditional rotating


Fig. 1


Fig. 2


Fig. 3


Fig. 4


Fig. 5


Fig. 6

Fig. 7


Fig. 8

Fig. 9

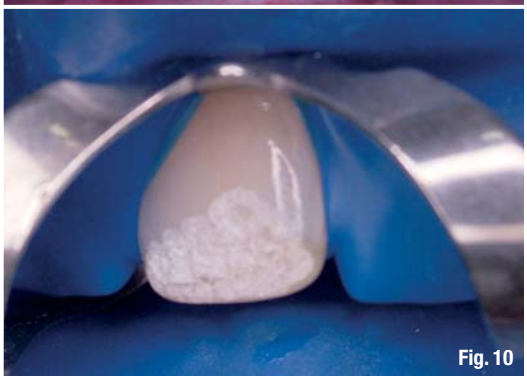


Fig. 10

Fig. 1_Case 1, initial situation.
Fig. 2_Extensive resorption of the root.
Fig. 3_After laser application.
Fig. 4_Application of orthophosphoric acid.
Figs. 5 & 6_Application of composite resin, polymerisation and polish.
Fig. 7_Case 2, initial situation.
Fig. 8_Bleaching.
Fig. 9_Post-treatment results.
Fig. 10_Laser application.

Fig. 11_Application of orthophosphoric acid.
Fig. 12_Application of composite resin, polymerisation and polish.
Fig. 13_Case 3, initial situation.
Fig. 14_Removal of amalgams, preparation of the cavities.

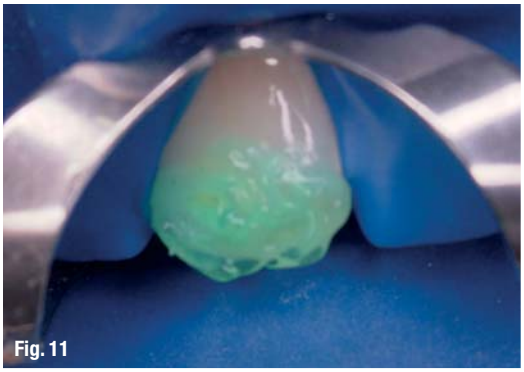


Fig. 11


Fig. 12


Fig. 13


Fig. 14

instruments, have been described and demonstrated by *in vitro, ex vivo* and *in vivo* tests.[16-19]

An interesting study, based on a questionnaire given to 100 patients, recorded the patients' satisfaction after receiving conservative dental treatments by Er:YAG laser: all the patients reported that they wished to be treated only by laser in the future, and they also wanted to suggest this opportunity to their friends.[20]

One controversial aspect regards the need to use orthophosphoric acid also after Er:YAG laser preparation. The most validated theory is that to obtain the maximum bond strength and the minimum of microleakage, it is necessary to also perform a conventional etching after laser conditioning.[21]

Recently, a great deal of importance has been given to the mode of the irradiation, in particular to the pulse duration: an interesting *in vitro* study[22] based on strength analysis by traction test and morphological analysis by SEM and Atomic Force Microscope, showed the same effects with Er:YAG irradiation alone as with acid etching. This was obtained by using the so-called "QSP" mode (Fotona, Ljubljana, Slovenia) in which each pulse is split into several shorter pulses that follow each other at an optimally fast rate. In this way, a specific surface roughness is achieved, representing a real alternative to acid etching. Water and hydroxyapatite are not the only elements with which the Er:YAG laser has a high affinity—its interactions with PMMA and Silicon Dioxide are also very interesting due to the fact that these two molecules are present in great concentrations in composite resin.

This, from a clinical point of view, makes the Er:YAG laser very effective in the removal of old composite restorations, with the result of obtaining a rough surface, able to be bonded to a new coat of resin, which is not possible to achieve with conventional rotating instruments.[23-24]

_Clinical cases

Case 1

Patient DK, a 24-year-old woman, came to our clinic to improve the aesthetic aspect of her upper left central incisor, which had been treated many years earlier with an extensive re-construction using composite resin (Fig. 1).

The patient reported that during a road accident twelve years earlier, she experienced a traumatic self-extraction of the tooth, which was re-implanted after a root-canal therapy. At the X-ray examination, extensive resorption of the root was noticed, which did not allow the preparation of a crown (Fig. 2).

The superficial coats of resin of tooth 21, and also of 11 in its distal portion, were removed by Er:YAG laser (LightWalker AT, Fotona, Slovenia) with these parameters: 250 mJ, 10 Hz, SSP mode, non-contact handpiece, air-water spray. The duration of the operation was around seven minutes. No anesthetics were used and the patient reported no pain or dis-


Fig. 15

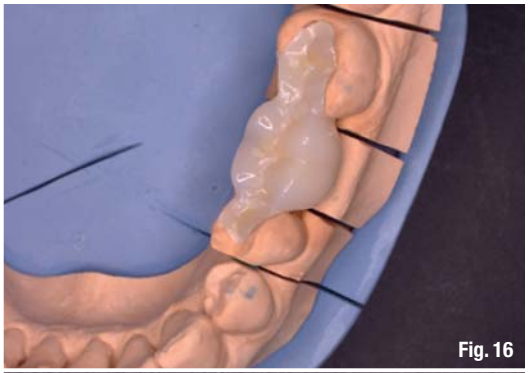


Fig. 16

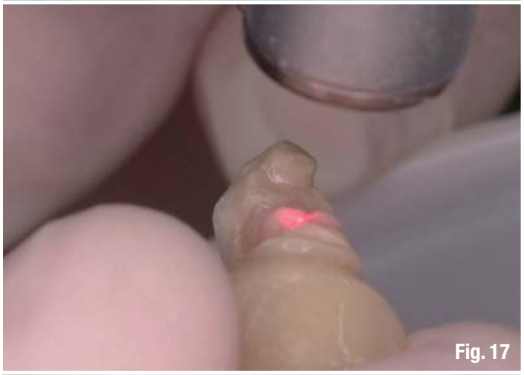
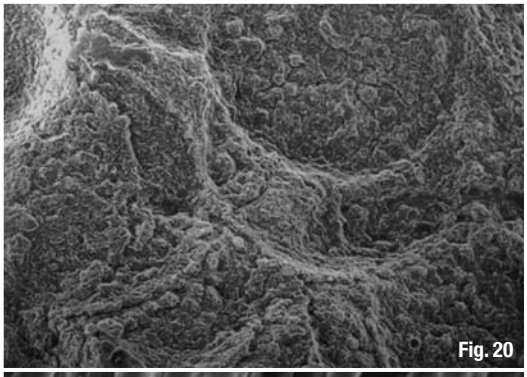


Fig. 17


Fig. 18


Fig. 19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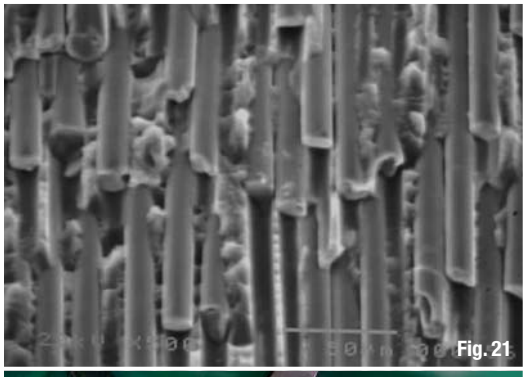
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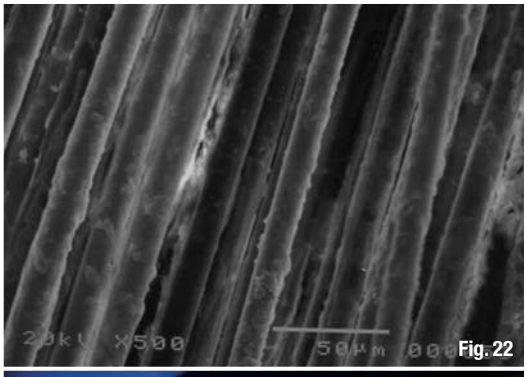
Fig. 22

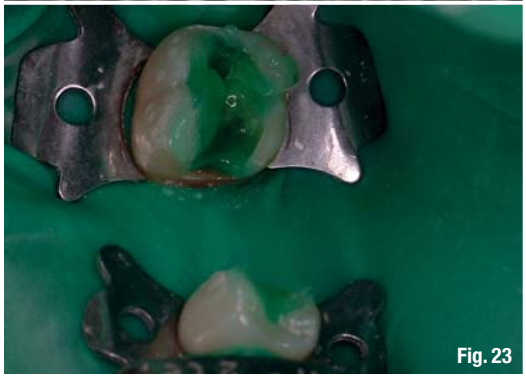
Fig. 23


Fig. 24

Fig. 15_Laser application.
Figs. 16 & 17_Same procedure on the internal surfaces of the bridge.
Figs. 18-22_Results of laser application.
Fig. 23_Application of orthophosphoric acid.
Fig. 24_Application of composite resin, positioning of the bridge, polymerisation.


Fig. 25


Fig. 26


Fig. 27


Fig. 28

Fig. 25_Application of composite resin, positioning of the bridge, polymerisation.
Fig. 26_Case 4, initial situation.
Fig. 27_Planning of a composite "Maryland bridge".
Fig. 28_Laser application.

comfort (Fig. 3). A gel of 37 % orthophosphoric acid was subsequently applied on the treated surface for 15 minutes (Fig. 4).

The area was rinsed, dried and a coat of bonding was applied and polymerized by LED lamp. Subsequently, a coat of composite resin was applied, polymerized and polished (Figs. 5–6).

Case 2

Patient PG, a 21-year-old female, came to our clinic for a bleaching treatment in the dental arches (Fig. 7). A bleaching gel containing 35 % hydrogen peroxide and a red coloring agent was used for the treatment (Fig. 8). The bleaching reaction was accelerated by Nd:YAG laser (Fidelis Plus III, Fotona, Slovenia). The patient had been previously informed that due to the fact that the bleaching agent is active only in the enamel and not in the composite, the post-treatment results would leave a chromatic difference between the two parts of the crown (Fig. 9).

To solve this problem, the superficial coat on the distal part of the upper right central incisor was ablated by Er:YAG laser (Fidelis Plus III, Fotona, Slovenia) with the following parameters: 250 mJ, 10 Hz, SSP mode, non-contact handpiece, air-water spray (Fig. 10).

The duration of the operation was around 140 sec. No anaesthetic was used and the patient reported no pain or discomfort. A gel of 37 % orthophosphoric acid was then applied to the treated surface for 15 minutes (Fig. 11).

The area was rinsed, dried and a coat of bonding was then applied and polymerized by LED lamp. Subsequently, a coat of composite resin was applied, polymerized and polished (Fig. 12).

Case 3

Patient LC, a 37-year old male, came to our clinic because of a missing first lower molar. Due to the presence of large, old amalgam restorations in the nearby teeth (45 and 47) it was decided to remove these old fillings and to apply a "California bridge" bonded with composite resin (Fig. 13).

The removal of the amalgams and the preparation of the cavities was performed by conventional rotating instruments and carbide burs (Fig. 14); then the impression was taken to construct the bridge. Before cementation, in order to enhance the adhesion, an Er:YAG laser (Fidelis Plus III, Fotona, Slovenia) was used for the enamel conditioning with the following parameters: 150 mJ, 10 Hz, SSP mode, non-contact handpiece, air-water spray (Fig. 15).

The duration of the operation was around 70 seconds. No anaesthetic was used and the patient reported no pain or discomfort. The same treatment, with the same parameters, was performed on the internal surfaces of the bridge, completed in composite resins reinforced with glass fibers (Targis-Vectris, Ivoclar Italia, Italy, Figs. 16 & 17).

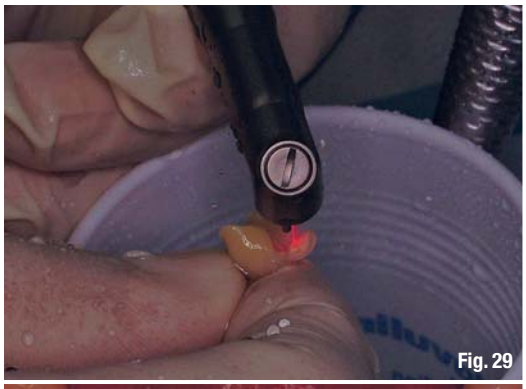
Fig. 29


Fig. 30


Fig. 31

Fig. 29_Laser application.
Figs. 30 & 31_Application of composite resin, positioning of the bridge, polymerisation.

Optical microscope observation showed that, in addition to the creation of a rough surface in the composite, the action of the laser also removed the resin around the fibers, thus allowing for penetration of the bonding agent, with a resulting stronger adhesion (Figs. 18–22). Subsequently, a 37% orthophosphoric acid gel was applied on the treated surfaces of the teeth for 15 minutes (Fig. 23). The surfaces were rinsed, dried and a coat of bonding was applied and polymerized by LED lamp. Subsequently, a coat of composite resin was applied and the bridge positioned and polymerized (Figs. 24–25).

Case 4

Patient MP, a 42-year-old female, came to our clinic for a rehabilitation of the left upper arch, where the first premolar was missing (Fig. 26). Due to financial considerations, it was decided to apply a composite "Maryland bridge" bonded to the nearby teeth (teeth 13 and 15, Fig. 27).

Before cementation, to enhance the adhesion, the surfaces of the teeth and the bridge were irradiated by Er:YAG laser (LightWalker AT, Fotona, Slovenia) with the following parameters: 150 mJ, 10 Hz, SSP mode, non-contact handpiece, air-water spray (Figs. 28–29).

The surfaces were rinsed, dried and a coat of bonding was applied and polymerized by LED lamp. Subsequently, a coat of composite resin was applied, the bridge positioned and polymerized (Figs. 30–31).

_Conclusion

Since its introduction in dentistry, the Er:YAG laser has demonstrated its ability to treat an ever wider range of clinical situations with significant advantages in term of results, patient satisfaction and comfort.

Today, thanks to its efficacy in composite resin ablation, it is also possible to apply this technology to re-make old composite restorations with sound aesthetics results, and to enhance the adhesion of non-metallic prosthetics with good results in term of bond strength._

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

_contact laser

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Erbium lasers in pediatric dentistry

Authors_Giovanni Olivi, Matteo Olivi & Maria Daniela Genovese, Italy


Fig. 1


Fig. 2

Fig. 1_Upper labial frenum with deep papillary insertion at the palatal site, in a 9-year-old child.
Fig. 2_Er:YAG laser labial frenectomy.

_Introduction

Taking care of a pediatric patient's oral health is a challenging task, but one that can be exceptionally rewarding. Providing a positive experience to children enables them to have a trusting, long-term relationship with a dental professional. Combining skill, knowledge and cutting-edge diagnostic and operative technologies help to guide children toward a lifetime of good oral health. Among the many motivational, diagnostic and operative innovations to consider, one must include lasers. Laser technology in pediatric dentistry today is a new treatment modality for children and teens; it represents an alternative instrument that sometimes complements, and at other times substitutes for traditional techniques. Laser treatment of hard and soft tissues allows for a more comfortable and minimally invasive intervention. In addition to the use of high technology, the psychological effect on the child represents an important benefit which may positively influence the acceptance of subsequent dental treatments.

Several of the factors that make laser therapy an elective procedure in pediatric dentistry are:
- Its minimally invasive nature, with more affinity for carious tissue (higher water content);
- Higher safety, because it does not use rotating instruments or blades in a small mouth (which can move unpredictably);
- It is more comfortable for the patient due to the lack of direct contact and vibration on the tissue surface;
- It is more acceptable because in many cases the use of local anaesthetics can be avoided;

Table 1

Operative Advantages:

Comfort:	non-contact—no vibration/noise
Safety:	no rotating or cutting instruments used in the mouth
Painless:	reduced need for local anaesthesia or no anaesthesia
Approach:	improved patient compliance

Clinical Advantages:

Minimally invasive:
selective for carious tissue
Decontaminating effect for deep caries
Micro-retentive surface:
a cleaned and debrided surface
Less rise in temperature in pulp and periodontal surface during irradiation
Direct pulp capping:
coagulation/bactericidal effect
Soft-tissue application:
exposure of subgingival tooth margins during cavity preparation

Table 2

Operative Advantages:

Comfort:	non-contact mode
Safety:	no cutting instruments used in the mouth
Painless:	reduced need for local anaesthesia or no anaesthesia
Approach:	improved patient compliance
Easy use:	intuitive, knowledge of the science more important than skill

Clinical Advantages:

Minimally invasive:
selective for fibrous and/or inflamed tissues
Decontaminating effect of the surgical site
Coagulating effect of near-infrared lasers
No rise in temperature in tissue for medium-infrared lasers
Soft-tissue healing:
comfortable post-operative period

Table 1_Operative and clinical advantages of lasers in restorative treatments.
Table 2_Operative and clinical advantages of lasers in soft-tissue treatments.

- It allows for easier and faster minor gingival and mucogingival surgery without scalpel or suture, and with good control of bleeding;
- Secondary intention healing and the postsurgical period are predictable and usually asymptomatic;
- The use of an innovative technology such as the laser is also well accepted by parents, who appreciate being able to offer their children the advantages of laser care. It also provides a favourable psychological impact on the child, who with his or her imagination, may see the laser as a magical tool that uses "light and water to clean teeth".

All these advantages allow laser therapy to improve patient compliance by positively influencing both the objective factors that affect the perception of pain (see the operative advantages of laser technology in Tables 1 & 2) and the subjective factors of pain, by raising the threshold of pain (analgesic effect) and the threshold of suffering (reducing the incidence of the anxiety or fear related to a negative personal or family experience when "needles, drills, scalpels, sutures, etc." are used, thus influencing the cognitive and emotional state of the patient).[1]

For these reasons the use of the laser with pediatric patients has proved to be a valid method of intervention, as noted by a number of authors who have reported good levels of patient acceptance during hard and soft tissue therapy. [1,3,4,5,6,7,8,9,10,11,12,13]

_Clinical laser applications

Various applications are possible on both hard and soft tissues using different laser wavelengths. Each wavelength has its own applications due to the spe-


Fig. 3


Fig. 4

Fig. 3_Typical secondary intention healing after one week.
Fig. 4_Complete and stable healing of the labial frenum, with new attachment on the mucogingival junction, after one year.

Table 3_Common applications of lasers in pediatric dentistry.

Table 3

Hard-Tissue Laser Applications
Preventive Dentistry: laser-assisted fissure sealing, MIH
Restorative Dentistry: carious removal and cavity preparation
Endodontics: laser-assisted pulp capping, pulpotomy and pulpectomy;
root canal debriding and decontamination

Soft-Tissue Laser Applications
Oral Pathology: gingival hyperplasia, fibrous hyperplasia, fibroma, epulis, mucocele, eruption cyst, dentigerous cyst, foreign bodies
Orthodontics: exposure of impacted teeth, distal molar operculectomy,
gingival contouring, intraoral attachment welding, ceramic bracket debonding
Periodontics: gingival contouring, labial frenotomy/frenectomy, lingual frenum release

Laser Applications for Dental Trauma
Trauma to hard tissue and pulp
Trauma to periodontal tissue

Low Level Laser Therapy
TMJ pain, orthodontic pain;
Muscular trismus and contracture;
For accelerating orthodontic movements;
Herpes, aphthous or orthodontic ulcers;
Dental trauma

cific type of biological absorption of each tissue that is targeted: visible, near, medium and far infrared lasers interact differently with different chromophores (melanin, haemoglobin, water and hydroxyapatite) contained in different target tissues (mucosa, gingiva, dental tissues) and therefore the laser choice is regulated by the optical affinity and coefficient of absorption of the tissues for each particular wavelength.

Lasers in the visible and near-infrared electromagnetic spectrum are specifically absorbed by haemoglobin and melanin and are used in the treatment of soft-tissues pathologies. On the other side, the Erbium lasers, in the medium infrared spectrum, are absorbed by water in gum and mucosa and by water surrounding the hydroxyapatite, and are therefore used on both soft and hard tissues. Among all the wavelengths used in dentistry, the Er:YAG laser (2,940 nm) is the most highly absorbed in water and has proven to be the most flexible, all-purpose laser in dentistry. In the far-infrared spectrum, the CO_2 lasers (9,300 and 10,600 nm) are also primarily absorbed by water in gum and mucosa and are used in oral surgery for the incision and vaporization of soft tissues. It is important to underline that with healthy gum and mucosa, the water chromophore is prevalent—while haemoglobin (blood) is prevalent in inflamed and in vascular tissue.

If a dentist has multiple lasers, the wavelength choice must be taken according to the type of healthy or pathologic tissue: mucosa, keratinized and non-keratinized gingival, fibrous tissue. Additional differences are dependent on location, health condition, pigmentation, vascularization, hydration and can be summarized as biotype variances.[14,15] All wavelengths absorbed by either water or haemoglobin are also used for the coagulation, vaporization or removal of the pulp tissue (vital and non-vital pulp therapy). For the application of laser energy in pediatric dentistry, the Erbium:YAG laser is considered as the most usable, all-tissue laser.

_Laser analgesia: an advantage in pediatric dentistry

Among the several advantages of lasers in dental applications, laser-induced analgesia represents a unique way to treat an infantile patient with minimal or no discomfort. Laser irradiation of the operatory site with low energy prior to any surgical or non-surgical procedure generates disruption of the NA+/K+ pump of the cell membrane of the nervous fibers, causing a temporary loss of conductance of the nervous impulse and a consequent analgesic effect in the irradiated area. Naturally, operating below the threshold of pain (by using the minimum effective energy and power) helps to avoid betraying the child's trust.[14]

_Hard and soft tissue laser

The high affinity for water, the main chromophore in carious and soft tissues, makes this laser the safest and easily used in many procedures on healthy, demineralised and carious dental tissues (enamel and dentin) as well on gingival and mucogingival tissues.

When approaching the panel setting, it is important to consider the different water content of the dif-

Fig. 5_Proximal caries in lower primary molars in a 6-year-old patient. LightWalker Er:YAG laser, treating both carious tissue and marginal gingiva for healthy tissue exposure.
Fig. 6_Cavity preparation and gingivectomy performed: note absence of bleeding and thermal damage to the soft tissue.
Fig. 7_Restoration completed.


Fig. 5


Fig. 6


Fig. 7


Fig. 8

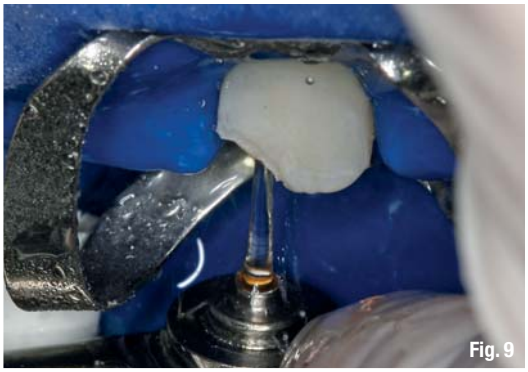
Fig. 9


Fig. 10a

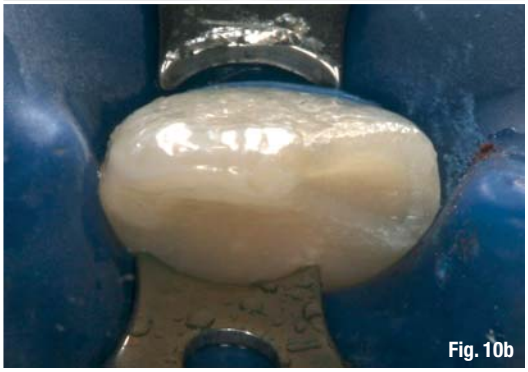
Fig. 10b

Fig. 8_Uncomplicated enamel-dentin fracture in a 10-year-old patient.
Fig. 9_LightWalker Er:YAG laser is used for cleaning, decontamination and roughening of dental structure.
Fig. 10a & b_Fractured upper central incisor cleaned and prepared with erbium laser: before (a) and after (b).

ferent tissues, such as enamel and dentin, and the different composition of the primary tooth compared to the permanent tooth (newly erupted versus aged) and adjust the parameters accordingly.[16,19] As previously reported, the pulp tissue is high in water content and is readily vaporized with the Erbium:YAG laser, and therefore care must be taken with deep cavities that are very close to pulp chamber (Figs. 8–10).[20,21] Vaporization and coagulation of the pulp is very well performed by the latest technology of the Er:YAG laser, with a very low rise in temperature in the remaining tissue, which is important for the pulp vitality during pulp coagulation or pulpotomy. The LightWalker (2,940 nm; Fotona, Ljubljana, Slovenia) at 5 or 10 mJ, 15 Hz, at 300 microseconds pulse duration, 5 to 10 seconds defocused exposure, is very effective for pulp coagulation during a pulp-capping procedure. Soft-tissue procedures are easily performed and the Erbium:YAG laser never produces tissue carbonisation even at high energy (Figs. 1–7).

The use of water spray and the possibility to modulate the duration of the pulse allows for greater or lesser thermal interaction for different procedures (the interaction is more thermal with a low ratio of water spray and less thermal when a higher water spray ratio is used). A gingivectomy or a frenectomy will be performed with a longer pulse duration (300–600 microseconds) than a cavity preparation (50–100 micros) and with different energy. When treating multiple tissues in the same intervention, for example bone and gingiva/mucosa in a labial frenectomy or impacted tooth exposure, care must be taken in varying the settings according to the different tissues.

_Conclusion

Lasers have demonstrated their effectiveness and safety for pediatric dental care. The Erbium:YAG laser, in particular, allows the clinician to perform an innovative, minimally invasive form of dentistry that is very well accepted by children.

Before starting to use a laser, it is important to understand the physical characteristics of the different laser wavelengths and their interaction with biological tissues to assure that they are used in a safe way, in order to provide the benefits of this technology to young patients. It is therefore highly recommended to invest in the appropriate training and education before applying this technology on pediatric patients._

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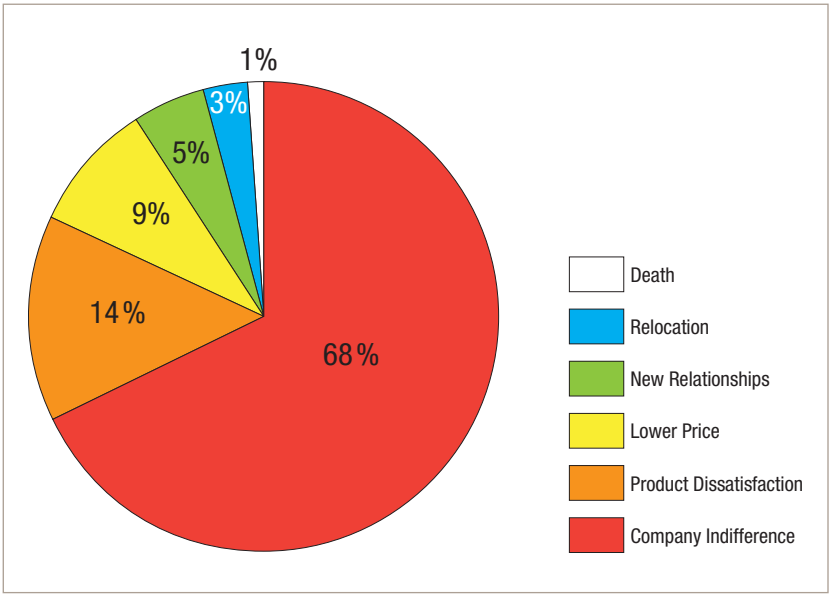
Gain power at your laser clinics!

Author_Dr Anna Maria Yiannikos, Germany & Cyprus

_During the last two issues we have discussed the importance of marketing in our clinics starting with the first element of marketing mix-service. Let's move on now to the second P of the marketing mix-Price!

First we should decide upon our pricing method. Our possible options are the following:

- Competition-Oriented Pricing: We set up the price based on ours key competitors' prices.
- Cost-Oriented Pricing: First we calculate our costs and then we add in a suitable profit margin.
- Demand-Oriented Pricing: Different prices for the service according to the type of
  a) Patients (for example, we give discounted prices to an insurance)
  b) Service version (We might charge less if we have our own CAD/CAM machine in our practice)
  c) Place (different prices for patients in a village than in a town)
  d) Time (20 years ago, an implant was very expensive in relation to others applied in recent years)



The pricing method that we choose is based upon our:

- Competitive advantage (how our patients perceive us when they compare us to our colleagues)
- Patient reaction – based on their demand
- Competitive reaction (how our colleagues react)

A very sensitive and very important issue that needs our attention is to avoid Price wars – Why?

a) Our patients' expectations are distorted
b) Price advantage is short-lived
c) Patients will become sensitive to price at the expense of value and benefits

Price is what we are going to charge for our treatments and actually represents the value of our service. Value is expressed as equal to benefits received (= tangible or emotional) over expectations (=price).

Benefits can be tangible or emotional. Tangible benefits for our patients are the larger amount of fillings that we can finish in one session due to our lasers. Emotional benefits are when they feel that they belong in an exclusive or expensive clinic.

Value = benefits/price

There are two ways that we can change the value of our services:

1. The "boring" way: We increase the benefits without changing the price or reduce the price without changing the benefits

2. The creative way: By being different! This is the way that we will be able to gain the desirable competitive advantage!

What is a competitive advantage? It is our ability to perform better than our colleagues and to maintain being different (superior longevity = remain in the market longer in superiority).

Since we are talking about performance we can achieve the highest in two ways: differentiation and cost. Being a cost leader requires offering the lowest prices in the market. This business level strategy has two main disadvantages: Firstly, a colleague will imitate us sooner or later by offering lower prices than we do. Secondly our patients will not perceive us as professionals in the long run since will not upgrade our services by investing in new technologies or in further education due to the low cost. Let us remember that research has proven that the reason that companies/clinics loose customers/patients are divided into many aspects (Fig. 1).

Clearly, the most profound cause of loosing patients is our company's lack of difference towards our colleagues. It is so obvious that the most creative strategy to attract more patients, to create value and to gain the desirable competitive advantages, is by being different, by being unique. It is by being faster than other offices (easily achieved with our lasers) or also by being more exclusive or expensive.

Why do people queue for hours and pay hundreds of Euros to buy a Louis Vuitton or a Jimmy Choo handbag? Why do you think? The real answer is: because of its emotional benefits! For these brand names and many more, people are willing to pay more than for the functional benefits in order to gain a feeling of belonging to a higher social class, a feeling of uniqueness, of their position, an item or a service that makes them feel exceptional.

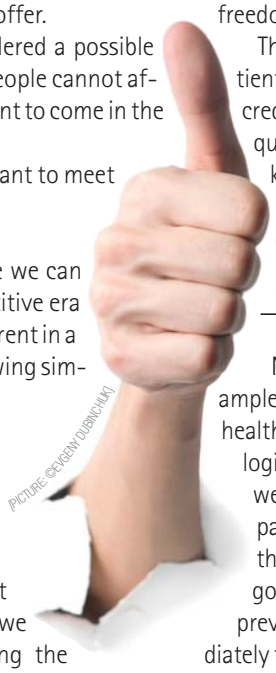
How can we create those feelings and competitive advantages for our services?

1. By promoting care and compassion. This of course cannot be achieved by words – we cannot only say to our patients that we care. People have to walk out of our office and be absolutely shocked by how much we care about them.
2. By our competitive advantage based on the number of services we offer.
3. By our level of customer service. Is our team composed by incredible people, so that when patients walk in our clinic, they are overwhelmed by the

hospitability and our team? Will our team go the extra mile for our patients and let them know how much they care?

4. Another potential competitive advantage could be our location. We need to have a location that is vibrant, growing; populated with people who can afford the dentistry we want to offer.
5. Convenience can also be considered a possible competitive advantage. Many people cannot afford to take time off and they want to come in the evening or on a weekend.
6. It is our choice of course if we want to meet their demand.

We are professionals, therefore we can increase our profits in this competitive era that we are working in and be different in a creative way by applying the following simple formula:
laser equipment + continuous education


PICTURE: ©EVGENY DUBINCHAK

This will lead to our specialization in the field of lasers, resulting in our uniqueness. To continue, let us also refer to the moments that we do not feel comfortable of telling the price—when we might be afraid that the patient might react negatively. We have high-tech clinics, we offer exclusive treatments, therefore premium services. Let us not forget to charge for them!

Now, more practically: For example, we have the patient on the chair how do we present the price? It would be better to tell the price dividing it in units—let the patient do the calculations for the whole cost of the treatment. We could also use the sandwich technique to present the price.

_The sandwich technique

This technique sandwiches the price between positive statements. For example if we are dealing with laser treatments, we say one benefit at the beginning, for example "Using a laser is a very relaxed experience since we avoid drilling" and then we add the second benefit, "You will be very satisfied because we perform the treatments without anaesthesia"— and then we add the price in the middle— "The cost of the treatment will be 400€". Then, without a break, we insert the last benefit on top— "You will also feel very comfortable since the procedure will be without the need of sutures".

Finally, remember never to argue about the price — do not forget that there is no objective price — for one patient the price can be perceived cheap and for another one extremely expensive.

Studies have shown that:

a) Consumer behavior is often based on the individual's perception and other psychological characteristics.
b) The more unique a product/service offering is perceived by the consumer, the greater is a company's freedom to set prices above those of competitors'.

Therefore, the value is affected by what the patient perceives — If our patients perceive us as a credible office, offering services based on high quality and technology, derived from our knowledge from our premium studies, then they will have a good reason to pay the requested amount for the treatments.

_The patient says Yes!

Never forget to praise them—saying for example—"Mr Smith, your decision is the best for the health of your mouth and your wellbeing". Psychological experiments have shown that whatever we say the next 25 sec. will be registered in the patient's long-term memory, meaning that they will never forget it. And when Mr Smith goes home and tries to recall what happened previously in our clinic, he will remember immediately that he made the best possible choice!

All the above topics and proposals can be elaborated further and new conclusions and ideas can be created from them. Our medical studies leave a gap where the business department of our clinics is concerned. That is why we have created DBA. DBA is the new innovative Dental Business Administration Mastership Course by AALZ. It is created exclusively from dentists for dentists, dental managers/administrators and will be launched in Aachen, Germany, on the 5 May 2014. It is all about preparing dentists to undertake their business as entrepreneurs, presenting all the business-oriented material they will need in order to be managers and directors of their own clinic and have full control and maximum utilization of resources and team. The course will be launched at 5 May 2014, immediately after the completion of the 2nd WALED Congress at AALZ — RWTH Aachen University Campus._

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International events

2014

30th AACD 2014—Annual Scientific Session American Academy of Cosmetic Dentistry
Orlando, FL, USA
30 April–3 May 2014
www.aacd.com

SIDEX 2014
Seoul, Korea
10–11 May 2014
www.sidex.or.kr

28th EAED Annual Meeting
Athens, Greece
29–31 May 2014
www.eaed2014.com

SINO-DENTAL 2014
Beijing, China
9–12 June 2014
www.sinodent.com.cn

APDC 2014—The 36th Asia Pacific Dental Congress
Dubai, UAE
17–19 June 2014
apdentalcongress.org

WFLD—5th Congress
Paris, France
3–4 July 2014
www.wfld.info

Oral Implantology World Congress
Paris, France
2–4 July 2014
www.oiwc-paris2014.com

23rd Annual DGL Congress LASER START UP
Düsseldorf, Germany
26–27 September 2014
www.oemus.com

ISMI: A new Society for Implantology

_The International Society of Metal Free Implantology (ISMI) was established in January 2014 in Constance (Germany). Founding president of the new society is Dr Karl Ulrich Volz from Constance, a resident implantologist and pioneer in the field of ceramic implants. Members of the founding group are renowned dental implantologists from Germany and abroad.

Aim of the new society is promoting metal-free implant dentistry as an innovative and particularly future-oriented direction within the field of implantology. In this context, ISMI supports its members with training and education opportunities as well as with regular expert and market information. In addition, ISMI campaigns in their public relations, i.e. in circles of experts as well as in patient communication, for a comprehensive establishment of metal-free implant treatment concepts.

ISMI | INT. SOCIETY OF METAL FREE IMPLANTOLOGY

In addition to patient advertising and public relations, ISMI offers its members a range of benefits, such as an individual homepage for every member, a specialist online archive and a chat on „Metal Free Implantology", training opportunities and a monthly newsletter.

_Metal-free implantology

For more than 40 years, titanium implants have proven to be excellent dental implants. Although the roots of implantology were metal free, the then available aluminium oxide ceramic has not worked for reasons of stability. The developer of these implants, Prof. Dr Willi Schulte, told Dr Volz shortly before his death in a personal letter that he was still convinced that the future belongs to zirconia implants.

Dr Rudelt from Hamburg has worked very successfully with zirconia implants for over 30 years. He handed on human histologies to Dr Volz, documenting a 20-year span of results. Unfortunately, his promising work could not be continued due to the economic crisis in Japan and the thus affiliated end of financial support by the main sponsor KODAK. Dr Ulrich Volz then took up the issue again in the year 2000 because the patients of his environmental medical clinic, as well as the resident doctors Dr Joachim Mutter and Dr Johannes Naumann (formerly Environmental Medicine, University of Freiburg/Breisgau) persisted on the use of metal-free implants. Over the past 13 years, Dr Volz successfully inserted more than 8,000 zirconia implants and characterised the trend towards metal free implantology.

Today, zirconia is an established material for dental implants. Stability, osseointegration and prosthetic options more and more achieve the level of conventional titanium implants. The broad use of titanium dioxide in cosmetics and medicines causes an growing number of incompatibilities. The patients' demand for highly aesthetic, tissue-friendly, anti-allergic and metal-free zirconia increases year by year. Market experts estimate that the proportion of zirconia implants is to reach at least 10 per cent, more likely 25 per cent in the next years.

For more information on metal-free implantology, visit www.ismi.me._

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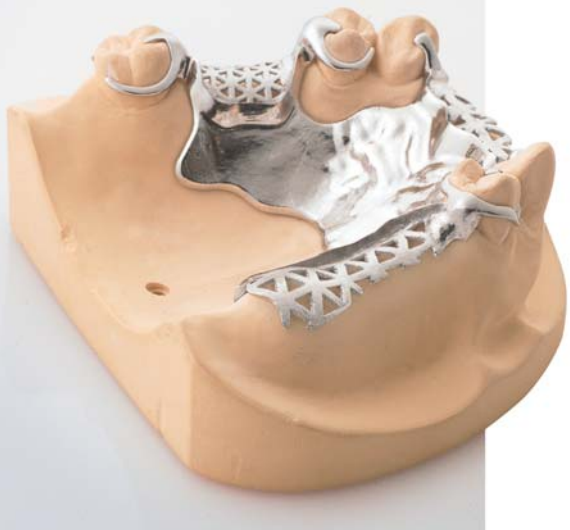

If there's one thing currently generating excitement in terms of production methods, it's 3-D printers. At all the trade fairs, 3-D printers are the big attraction in the industry. Does this signal a departure from a form-based way of thinking in favor of the geometrical freedom of components produced using additive methods? Interested parties are already finding out whether it's possible to print Lego blocks, or—more ambitiously—food items. With so much creativity out there, we wanted to explore what can be accomplished realistically using laser melting with metals in an industrial context. We spoke with Dr Florian Bechmann, Head of Development at Concept Laser, about the current state of technology, trends and options for the near future.

_You recently opened a new development center. It sounds like the industry is rapidly expanding?

That's true. The industrial applications are currently exploding, literally. Laser melting with metals exerts a strong fascination when it comes to the components of the future. As the technology leader, we must support this market process by introducing innovations. When it comes to complex systems, we must ensure a wide-ranging interplay between optics, design, control technology, software and powder material. At our new development center, my colleagues and I are hard at work on "discrete innovations" not intended for disclosure to the general public. Certain industries are quite sensitive...

_Which applications do you mean? Probably those in the automotive industry...?

Yes, but not only there. Sectors that are defining and driving the process forward include the automotive and medical technology sectors, as well as aerospace. These technology drivers not only demand high standards in terms of quality and choice of materials, but also with regard to quantitative aspects, such as increasing productivity. These customers require shorter construction times and more parts in a single-build chamber. We developed the X line 1000R, which currently has the largest build chamber, for the automotive industry. The transition from a 400 W laser to a 1,000 W laser is an important milestone for the process. It was developed in close cooperation with laser specialists from the Fraunhofer Institute. The goal was to develop quicker processes that are also more affordable. One of the applications we had in mind was time-saving development of engines for modern vehicles.

_You mentioned the aerospace sector. How does this industry use the process?

The aerospace sector is driving forward innovations. High quality solutions are in demand here, including the use of reactive materials such as titanium or aluminum-based alloys that can only be produced reliably to a high quality in a closed system. In general, users such as the following are convinced that the process will become increasingly well-established: NASA, the German Aerospace Center, Honeywell, Snecma, Aerojet/Rocketdyne and Astrium Space Transportation from the EADS Group. NASA engineers are even considering using additive manufacturing to produce components on the ISS—in orbit. The advantage of this is the ability to produce parts in

Fig. 1

space using CAD data, provided there is a sufficient stock of powder.

_Are the USA playing a leading role?

In terms of the USA, it can be said that a lot of capital and staff resources are in use. The engineers and students at universities there are fascinated by the possibilities presented by laser melting. Americans are considered to be creative and believers in progress, and to have the necessary drive. Unfortunately, we still have little contact with the aerospace industry in China. At present, we're outside that market. But that doesn't mean it has to stay that way. We Europeans can contribute our research and mechanical engineering capabilities mainly in the USA and Europe. In Europe, the EU promotes this process through projects like AMAZE due to a strong belief in the process's sustainability and high level of innovation.

_Are other sectors getting on board as well?

Of course. After all, the options are attractive. The approach is currently revolutionizing medical technology, for example: traditional process chains are being completely reconceptualised. LaserCUSING parts are in demand as implants since their porous surfaces incorporate well into the body, yet also provide the necessary elasticity. One rising application is the affordable and rapid production of dental prosthetics from biocompatible materials. These are highly adaptable, long-lasting dental solutions instead of dental prosthetics that have to be crafted manually with much effort. The process is even advantageous for retrofitting: worn-out turbine parts can be quickly and affordably regenerated. This kind of application is relevant in power plant engineering and aircraft construction. In this hybrid technique, layers of the exact same material can be applied additively to the existing part. In addition to regeneration, new whole parts are also produced for turbine technology applications. LaserCUSING also allows functionalities such as cooling channels to be integrated, which improve the performance of components. The offshore industry is considering installing laser-melting systems on drilling platforms, which would allow for independent, on-site production of certain components. The technology is not fixed to a specific location and can be operated locally.

Fig. 1_"We are constantly improving our patented Quality Management Module ('QM Module') in order to set the standard in terms of prediction quality and operability, as well as influencing the ongoing construction process."

_Environmental friendliness is one of the major issues of our time. What is the situation from an environmental perspective?

The Laser melting process is highly sustainable: on the one hand, due to the localized production options,

Fig. 2

Fig. 2_"3-D mapping can be expected in the future: this capability would increase the transparency of the process and captures the component in its structural entirety."

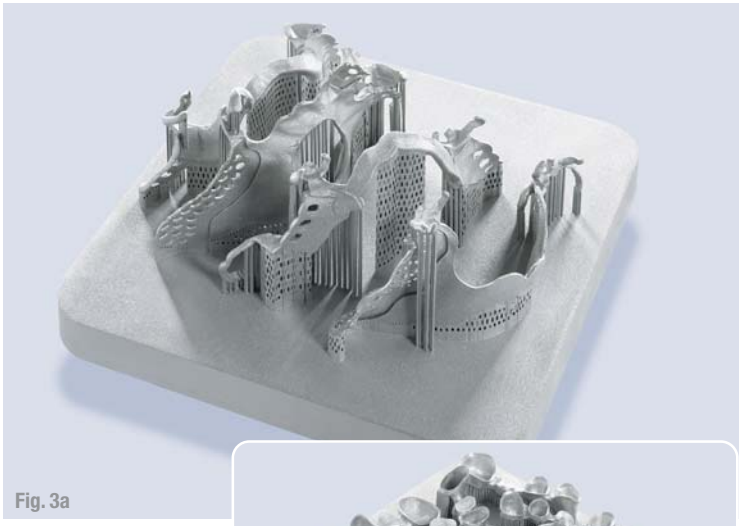
Fig. 3a


Fig. 3b

Figs. 3a & b_Sector components (application examples).

which reduce logistic complexity, and on the other, because the process reduces the quantity of material required. There aren't any oil or coolant emissions either, as is often still the case in mechanical engineering processes. Even the residual heat can be used. A 1,000 W laser produces approximately 4 kW of heat, which can be used by building systems if channeled into a cooling water circuit. There are good reasons why laser melting is considered a green technology.

_Will 3-D printers soon become a fixture on our desks, like laser printers are today?

The additive process encompasses this option. But to remain serious: we should distinguish between consumer and industrial applications. Producing LEGO blocks oneself from plastic, using 3-D printing will soon be realistic. The range of materials and scope of applications for ordinary people will remain very limited, however. Producing replacement parts for vintage cars, or cars in general, is certainly also conceivable—but these are industrial applications, once again. We always focus on purely industrial solutions with particular quality standards and material requirements, through to certification of the materials and process. Industrial solutions would be too heavy for a desk (laughs); here, we focus on current metal-processing methods in a production environment.

_If you wanted to describe what makes your system technology special, what would you mention?

Our Quality Management Modules are definitely an important distinguishing feature for us and our customers. I would also mention the separation of the build chamber and handling area, which is characteristic of our products; this offers maximum occupational safety and ergonomics. Our automated powder transport in containers is also practical. Handling materials in a closed system has many advantages. It's important for safety, but also to prevent contamination, such as by oxygen. Safety is very important to us. We comply with the ATEX Directive of the EU very conscientiously. I would also mention interfaces with the production environment, e.g., crane accessibility for building boards weighing up to 80 kg. This is convenient for the operator. Some details are interesting as well: such as filter replacement in processes using reactive materials, such as titanium. The contaminated filter is flushed with water and its contents are then safely disposed of in an environmentally-friendly manner.

_Which other impulses do you see in the future for industrial laser melting?

The scope of applications is growing, which means the range of materials is expanding as well. This requires strong consulting services, which we must provide to the market. The system must also be repeatedly adjusted to accommodate these new materials. At the same time, design requirements for components are also becoming more demanding. This ranges from lightweight construction and largely foam structures to functional integration, such as cooling technology in components. This is very exciting for us since certain developments become possible beyond the confines of one sector thanks to multiplication effects. Another aspect is the growing importance of quality among users. Customers expect active process monitoring and series production capability, i.e., reproducibility at an industrial level.

Fig. 4

Fig. 4_Discrete innovations: the largest build envelope yet for large parts in the automotive and aerospace sectors.

_What's going on in terms of quality requirements?

From the customer's perspective, this is currently the most important area. Customers are interested in geometry, density, productivity and, above all—quality. Two approaches are expedient here: active process monitoring using machine technology and developments in materials. This includes the certification of materials, such as in medical technology, or manufacturer-specific instructions, which must be complied with in the automotive and aerospace sectors.

_What does quality mean in concrete terms for mechanical engineering?

First of all, it's the interplay in the system among optics, mechanics, control technology and software that I mentioned at the outset. The key factors, however, are situated in comprehensive quality monitoring. Active QA means checking, comparing, analyzing and evaluating process data in real time. We are constantly improving our patented Quality Management Module ("QM Module") in order to set the standard in terms of prediction quality and operability, as well as influencing the ongoing construction process.

_Could you describe this QM Module more specifically?

It involves two approaches: 1. QMmeltpool and 2. QMcoating. QMmeltpool means that the system uses a camera and photo diode to record signals during the laser process. This data can then be compared to reference values. The optical system is designed coaxially. It allows the camera to record a very small area of the melting pool approx. 1x1 mm². In other words, it takes a very detailed picture. It can detect impaired laser performance due to contamination of the F-theta lens or caused by natural aging of the laser, as well as deviations in the dosing factor. The second approach is the QMcoating QM module, which ensures that the optimal powder quantity is used. Because only what's needed is used, it saves powder material—up to 25 per cent—while also reducing set-up times. QMcoating monitors the layer surface while powder is being applied. If too little or too much powder is dosed, the dosing factor is adjusted accordingly, i.e., actively counteracted. The two QM modules monitor and document the process, thereby ensuring reproducible quality.

_What developments can be expected in the future?

In the area of process signal analysis in general, also known as the "component map." 2-D maps are generated during the construction process and must ultimately be represented in 3-D models. This is comparable to the images from CT measurement, which is computer tomography, like that familiar from medical technology. This mode of imaging and capability would increase the transparency of the process and captures the component in its structural entirety. Transparency is a highly dynamic, rapid process, which operators can only master with special aids. Another point is the speed of component construction. This figures high on customers' wish lists. There are two methods: on one hand, higher laser output, such as in the X line 1000R (i.e., the jump from a 400 W to a 1,000 W laser) and on the other, using multiple lasers. Multiple laser sources will be able to significantly increase the build rate in the future, though the advantage of employing familiar process parameters has to be weighed against the increasing complexity of the optical arrangement. These concepts involve multiplication not only of the lasers themselves, but also of most of the other optical components as well._

Thank you for this conversation.

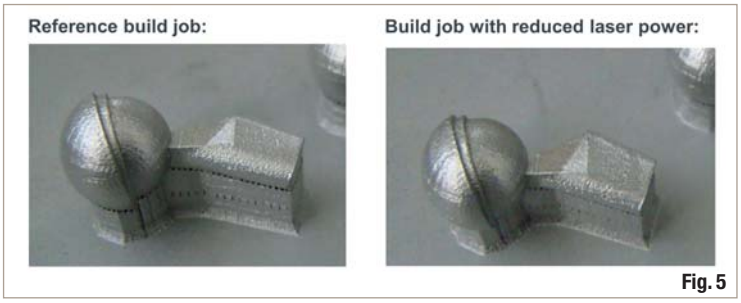

Fig. 5

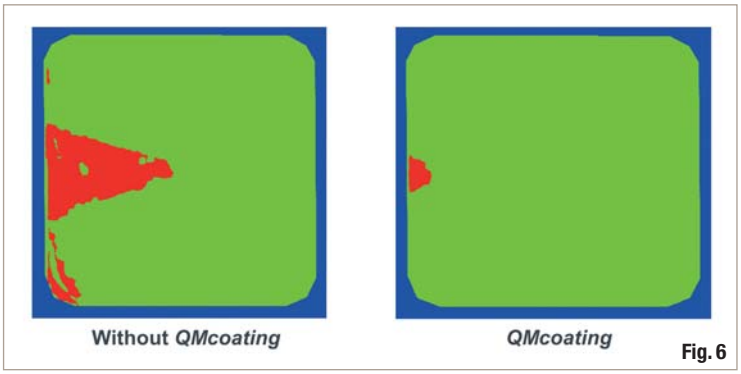

Fig. 6

Fig. 5_Active quality assurance using QMmeltpool: although the human eye is incapable of detecting defects, QMmeltpool nevertheless identifies deviations in component quality.
Fig. 6_QMcoating: without QMcoating, the layer may be insufficiently coated (the red areas indicate a lack of powder material); with the QMcoating approach, however, the powder dosing factor is adjusted within the tolerance range.

_contact laser

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"Technology has allowed my work to evolve enormously"

An interview with Dr Carlo Fornaini, president-elect of the World Federation for Laser Dentistry

Author_Nathalie Schüller

Pr. Carlo Fornaini is teacher at the University of Parma(Italy) and Researcher at the university of Nice (France). He is also Coordinator of EMDOLA Master in these two Universities. He published more than 100 papers , mainly on the use of laser in dentistry. He is President-elect of the World Federation for Laser Dentistry (WFLD).

Dr Carlo Fornaini

_Dr Fornaini, congratulations on your election as the next president of WFLD. I understand you will assume your post during the next congress in Paris, in July 2014. Are you already able to discuss your goals for your two-year tenure?

First of all, I would like to say that the governance of our federation entails teamwork and results are achieved with the contributions of all the executive committee members. This is the reason for the nomination of the president-elect two years before his or her effective start as president: in this way, he or she has the opportunity to work with the other members of the executive committee, including the past president. That said, it is normal that each president will have his or her own way of leading the federation, and I too have my own vision, which is concentrated on three main related points.

I think it is now necessary for a renewal of the federation's leadership including the divisions, there are several colleagues who served since many years the Association and are now able to actively participate to its leadership. This is related to the second point of my vision, the need to promote young members by encouraging them to participate in the association's activities and in congresses.

Then, my goal is to expand the federation to new countries and thereby disseminate information on the use of laser technology to people who are still not using lasers, through the organisation of courses and events in these countries.

But I must say that the organising and scientific committees for the Paris congress pre-empted me by choosing to invite many new young speakers, and this makes me very happy.

_Could you tell us more about the European Master Degree in Oral Laser Applications (EMDOLA)? What do you think makes it stand out from other programmes? It seems to be an important part of WFLD congresses. Do all students have to defend a master's thesis in front of the international jury during the congress?

The EMDOLA is one of the most important post-graduate opportunities for comprehensive education on the use of laser in dentistry and it is unique in that all five universities involved in it (the University of Parma and Sapienza University of Rome in Italy, Nice Sophia Antipolis University in France, University of Liège in Belgium and University of Barcelona in Spain)

offer the same programme in eight modules. A student may thus choose to attend a module at any one of these universities.

I think it is important to distinguish between universities and scientific societies and, while in some cases EMDOLA graduation ceremonies have been held during WFLD congresses, the difference between these two entities must be pointed out: the EMDOLA is offered at the universities and all the academic activities, including the master's thesis defence, take place at the universities.

That said, I think that EMDOLA is a great resource for WFLD and in recent years I have seen many of its graduates start participating in WFLD congresses, giving lectures and publishing in journals.

So, EMDOLA can be considered to bring new blood to WFLD to avoid its ageing, and WFLD can be considered to represent the new ground where little plants of the EMDOLA may grow into large trees.

_You had a lecture on laser welding at the IMAGINA Dental congress in February in Monaco. Would you tell our readers why this topic is important? Since you co-authored the book Laser Welding, published three years ago, has much changed in this area?

IMAGINA Dental is a very interesting event on new technologies in dentistry and this was the second edition to which I have been invited. I am very eager to be participating for two main reasons. The first is that the laser session will be combined with the congress of the EMDOLA ACADEMY, of which I am president. The second is that laser welding is a topic about which I am passionate: I spent several years of my life discovering a way to weld intra-orally and, once I had achieved this and published my papers, many people from different countries congratulated me.

The invitation to contribute a chapter to the book Laser Welding was most satisfying for me, giving me the opportunity to collaborate with engineers and physicists, each of us describing in our chapter our study.

I think intra-oral laser welding is still today a field of dentistry full of potential applications in orthodontics, prosthetics and implantology.

_The use of laser treatment in the dental practice appears to be very limited still. What are the reasons in your opinion, and do you feel this will change in the future?

Even if the percentage of laser users among dentists is still not high, in recent years, there has been a dramatic increase in publications, courses and the establishment of scientific societies concerned with this topic. The course I give on laser to the undergraduate students at the dental school at my university serves as an example of the extent to which laser is given consideration today at university.

In any case, the number of laser users in dentistry is growing and this is probably due to the reduced prices of the devices and the increased number of treatments possible today. If I think back to the first appliance I used, with their great dimensions, high costs and poor ergonomics, I think I was really a pioneer!

Fortunately, technological expertise is increasing rapidly and I am often surprised when visiting countries where, some years ago, I had helped my colleagues to start using laser in their practice to find that they have become expert laser dentists.

_As with any medical field, the industry is constantly changing. The integration of CAD/CAM dentistry is constantly being promoted and it will become increasingly easier to integrate it into a dental practice. Is the situation the same for lasers, and how has this affected your curriculum or the way you teach your students?

When I recall when I started to work as a dentist (around the Middle Ages!), it is evident that technology has allowed my work to evolve enormously. I am happy to have had the opportunity to live in a time of such great technological progress. I think that laser is able to integrate with every dental technology device, in particular CAD/CAM devices. When I began my last study on a laser scanning handpiece, which led to the realisation of X-Runner (Fotona), I had in mind the possibility of fully assisted prosthetics: the inlay preparation programmed in advance and performed with a laser scanning handpiece, optical impression taking and fabrication with a CAD/CAM device. The result? Perfection!

_What are the advantages and/or limitations of using laser in dental practice?

I think that the main aspect that in the past damaged the image of laser in dentistry was that it was presented as being something almost magical that was able to produce the best results possible in the hands of anybody. Evidently, it is not so and we must be honest and realise its limits and the importance of knowledge of all aspects of this technology, physics and laser–tissue interactions included.

Only with comprehensive theoretical and practical training is it possible to use laser in every clinical situation to advantage and without risk to patients.

I always say to my students, "Laser is not the magic wand that transforms the worst of dentists into stars!".

Thank you very much for the interview.

NEWS

World Oral Health Day

Calls attention to high risk of oral diseases

The figures are stark: the average density of dentists to head of population in Africa is 1 to 150,000; in industrialized countries, the average is 1 to 5,000. In Ethiopia, the lack of access is even more dramatic with a density of only 1 dentist per 1 million people. This information derives from the Oral Health Atlas developed by FDI World Dental Federation, which provides a clear picture of dental health around the world.[1] Even in countries with fast growing populations of dentists, unequal access to dental care is a major obstacle to optimal oral health.

"Developing countries face great challenges in their quest for optimal oral care", stated Dr Tin Chun Wong, FDI President. "Oral health is integral to general health and a basic human right, and we must ensure cost-effective solutions become available to all. Promoting better research and obtaining valid data will help us achieve this objective."

The damage to oral health due to poor access to care is exacerbated by the fact that many developing countries are disproportionally affected by a number of oral diseases. The combination of high risk of oral disease and low access to care, results in many patients not getting adequate treatment in time.

World Oral Health Day
20th March

World Oral Health Day is celebrated every year on 20th March. The theme of World Oral Health Day 2014 was 'Celebrating Healthy Smiles'. It reflects the major contribution oral health makes to our lives. Around the world, FDI member dental associations, schools, companies and other groups will celebrate the day with events organized under this single, unifying and simple message. For more information, visit: www.worldoralhealthday.org

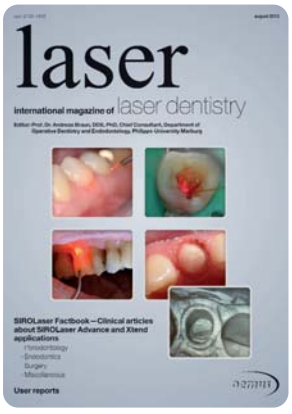
1 Beaglehole, R., Benzian, H., Crail, J., and Mackay, J. (2009) The Oral Health Atlas. Mapping a neglected global health issue. FDI World Dental Federation. Cointrin, Switzerland.

SIROLaser Factbook

Comprehensive information on diode lasers

Sirona reports on the wide range of applications of diode lasers in a special edition of the English-language laser international magazine of laser dentistry. The "SIROLaser Factbook—Clinical articles about SIROLaser Advance and Xtend applications" includes research by well-known experts as well as informative field reports from experienced users of laser technology.

Compact and informative: Sixty pages full of solid expertise and practical applications await the readers of English texts collected by Sirona in "SIROLaser Factbook—Clinical articles about SIROLaser Advance and Xtend applications." Academic articles and real-life user reports by well-known experts provide information on the many uses and treatment options of diode lasers with a wavelength of 970 nm. Interesting facts and figures, study results, documented case studies with descriptive pictures, and recommendations for further reading complete the compendium.



"Anyone with an interest in laser dentistry should read the SIROLaser Factbook," says Ingo Höver, product manager at Sirona. The book is especially meant for beginners, says the laser specialist. "However, experienced users will also find it worth reading. I am sure that they will be surprised to learn the many possibilities of diode lasers and the range of applications that are open to them with models like the SIROLaser Advance or SIROLaser Xtend."

Scientists discover that

Microorganism prevents mouth infection

A U.S. research project has shown that Pichia, a beneficial fungal yeast, inhibits growth of the harmful fungal yeast Candida, which also causes oral thrush. The researchers hope that the findings will contribute to the development of a therapeutic agent to fight the painful mouth infection, as well as other fungal infections.

The study involved testing the mouths of twelve healthy individuals and twelve patients diagnosed with HIV for the presence of fungi and bacteria. HIV-infected participants were selected for comparison because oral candidiasis is the most common oral complication in these patients, the researchers explained. Using DNA analysis, the researchers observed no differences with regard to bacteria between the two study groups. "However, what changed significantly was the composition of the fungal community," said senior author Dr Mahmoud A. Ghannoum. "We found that when Candida is present, Pichia is not, and when Pichia is present, Candida is not, indicating Pichia plays an important role in treating thrush."


[PICTURE: ©JEZPER]

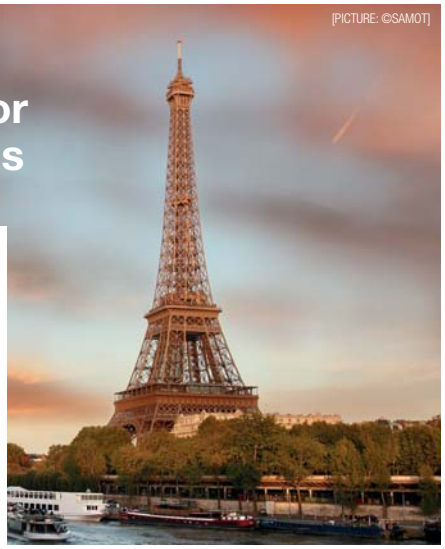
In the second phase of the study, the researchers conducted laboratory experiments on the fungi. When they grew Candida in test tubes in the presence of Pichia, there was a striking reduction in Candida growth.

"One day, not only could this lead to topical treatment for thrush, but it could also lead to a formulation of therapeutics for systemic fungal infections in all immunecomprised patients," Ghannoum said. "In addition to patients with HIV, this would benefit very young patients and patients with cancer or diabetes."

The study, titled "Oral Mycobiome Analysis of HIV-Infected Patients: Identification of Pichia as an Antagonist of Opportunistic Fungi," was published online on March 13 in the *PLOS Pathogens journal*. It was conducted by Case Western Reserve University and the University Hospitals Case Medical Center.

WFLD will hold

14th World Congress for Laser Dentistry in Paris


[PICTURE: ©SAMOT]

This event will gather dental specialists for all around the world and the scientific program has been designed with different speakers trying to cover all the different fields regarding laser use in dentistry and the appliance if laser in implantology. The combination of scientific studies, substantiating the scientific evidence of treatments performed with laser, as well as the clinical experiences of recognized professionals are a huge attraction and a not-to-miss congress.

Nowadays WFLD is present on five continents, in almost 50 countries with the mission of propagating science with no economic interest. The WFLD World Congress and Paris, as a city, come together to make a great scientific event. Do not miss what may be one of the best congress in laser dentistry from 2 to 4 July in Paris. Submit your abstract and register already on the congress website www.wfld-paris2014.com.

Congress President :
Ass. Prof. Dr Frederick Gaultier
Chairman of the scientific committee :
Prof. Dr Jean-Paul Rocca
Chairman European Divison of WFLD :
Prof. Josep Arnabat
WFLD Chairman of International and legal affairs :
Prof. S. Nammour

Prolonged breastfeeding may increase

Risk of cavities in primary teeth


[PICTURE: ©VIETROV DMYTRO]

In order to establish an association between breastfeeding and severe early childhood caries, researchers examined the oral health status of 715 infants from low-income families in Porto Alegre.

They found that the prevalence of caries was highest in children who were breastfed at 24 months or beyond compared with babies who had been breastfed until twelve months or younger. In addition, they observed that high-frequency breastfeeding increased the association between long-duration breastfeeding and caries.

Exclusive breastfeeding up to six months of age is recommended by the World Health Organization. However, the organization also recommends continuing breastfeeding along with appropriate complementary foods up to two years of age, even though several case studies have linked prolonged on-demand and nocturnal breastfeeding to early childhood caries, primarily because breast milk is considered a critical source of energy and nutrients.

The study, titled "Association of Long-Duration Breastfeeding and Dental Caries Estimated With Marginal Structural Models", was published online on Feb. 19 in the *Annals of Epidemiology*. It was conducted by scientists at the University of California, San Francisco, in collaboration with the Universidade Luterana do Brasil and Universidade Federal de Ciências da Saúde de Porto Alegre.

New studies link BPA to

Breast and prostate cancer

Bisphenol A (BPA) is a widely used chemical in plastics, such as food containers, and is also found in dental composites and sealants. Now, two recently published studies have suggested that BPA may play a crucial role in cellular transformation and disease progression in prostate cancer patients, and may promote breast cancer growth.

The first study, titled "Exposure to Bisphenol A Correlates with Early-Onset Prostate Cancer and Promotes Centrosome Amplification and Anchorage-Independent Growth In Vitro," was conducted at the Cincinnati Cancer Center and included 60 urology patients. Overall, they found higher levels of BPA in prostate cancer patients compared with study participants without the disease. The difference was even more significant in patients under the age of 65, the researchers reported. In addition, they observed that exposure to low doses of BPA increased the percentage of cells with centrosome amplification two- to eightfold, said Dr. Shuk-mei Ho, principle investigator and director of the cancer center. The study was published online on March 3 in the *PLOS ONE journal*.

In the second study, researchers at the University of Texas at Arlington found abnormal amounts of HOTAIR expression in breast cancer cells and mammary gland cells exposed to BPA. HOTAIR is a molecule that can suppress genes that would normally slow tumor growth or cause cancer-cell death. The findings suggest that BPA disrupts the normal function in such molecules and is linked to tumor growth in breast cancer patients. The study, titled "Bisphenol-A and Diethylstilbestrol Exposure Induces the Expression of Breast Cancer Associated Long Noncoding RNA HOTAIR In Vitro and In Vivo," will be published in the May issue of the *Journal of Steroid Biochemistry and Molecular Biology*.

Could chewing gum prevent

Implant failure in the future?


[PICTURE: ©OLLYY]

About 6 to 15 per cent of patients suffer from peri-implantitis, inflammation that destroys soft and hard tissue surrounding the implant after placement. It is known that the concentration of matrix metalloproteinase-8, an enzyme that is also responsible for periodontitis, increases significantly when inflammation around the dental implant arises. Prof. Lorenz Meinel from the Institute of Pharmacy and Food Chemistry at the University of Würzburg explained that this increase could be identified through a special chewing gum using a small peptide chain that is bound to a bitter-tasting compound. Once enzyme concentrations in a patient's saliva exceed a certain level owing to complications with the implant, the peptide chain will snap, releasing the bitter compound. In the future, special chewing gum could be part of post-operative care in addition to routine check-ups. Patients would have to contact their dentist upon recognising the bitter taste.

In addition to the development of the chewing gum, the researchers are considering developing a coating that uses the peptide chain system and can be applied to the implant directly.

The project will be carried out in collaboration with Swiss dental implant manufacturer Thommen Medical and various other European companies and scientific institutions. The research has received funding of € 1 million for two years from the European Union.

Mothers' oral bacteria may predict

Likelihood of early childhood caries

In their study, researchers at the University of California collected dental and salivary bacterial samples at three- to six-month intervals from low-income Hispanic mothers and their children from pregnancy through 36 months postpartum to calculate the child caries incidence. In total, the study included 243 mother–child dyads.

Over the course of the study, the researchers found that salivary levels of mutans streptococci and lactobacilli were greater among mothers of caries-affected children compared with caries-free children. Overall, they observed that the incidence of caries was twice as high in children with mothers who had higher levels of bacteria.

According to the American Dental Association, cariogenic bacteria, and mutans streptococci in particular, are transmitted soon after the first teeth erupt. The association thus recommends that parents, including expectant parents, visit a dentist to decrease the mother's mutans levels to decrease the child's risk of developing early childhood caries.


[PICTURE: ©BOTAZSOLTI]

The study, titled "Maternal Oral Bacterial Levels Predict Early Childhood Caries Development", was published online in Dec. 19, 2013, in the *Journal of Dental Research* ahead of print.

Crucial role of schools in

Promoting oral health

Although dental caries rates among children have declined in several high-income countries over the last decades, the opposite trend has been noted for low-income countries. A survey conducted at the University of Copenhagen has shown, however, that school programmes can contribute significantly to a gradual reduction of inequalities in dental health.

Through analysis of data from the World Health Organization's Global School Health Initiative, a programme that was launched in 1995 in 61 countries to improve the health of students and other members of the community through schools, the researchers observed that about 60 per cent of the countries give formalised instruction on how to bush teeth. However, not all countries have access to clean water and the necessary sanitary conditions, which constitutes a major challenge for the health and school authorities in Asia, Latin America and Africa in particular. Dental health inequalities may also arise in high-income countries.


[PICTURE: ©AN NGUYEN]

Overall, the survey showed that schools have a central role in promoting health and preventing diseases because healthy school environments that offer children education on dental health are generally well placed to set children on a path to a healthy lifestyle throughout their lives, Petersen explained. The study, titled "Promoting oral health of children through schools—Results from a WHO global survey 2012", was published in the December issue of the *Community Dental Health* journal.

Saliva may indicate

Susceptibility to depression in boys


[PICTURE: ©SUZANNE TUCKER]

For the first time, researchers at the University of Cambridge have identified a biomarker for major or clinical depression in human saliva. An examination of saliva samples of hundreds of teenagers revealed that boys especially may be at the greatest risk of depression.

Following a group of boys and girls over 12 to 36 months by measuring levels of cortisol in their saliva, as well as collecting self-reported information on symptoms of depression, the researchers found that boys with depressive symptoms and elevated morning cortisol were 14 times more likely to develop clinical depression compared to boys with neither.

However, the connection was not as distinctive in female participants. Girls with high cortisol and depressive symptoms were four times more likely to develop depression, suggesting differences between the sexes in how depression develops.

The study, titled "Elevated morning cortisol is a stratified population-level biomarker for major depression in boys only with high depressive symptoms", was published on 18 February in the Proceedings of the National Academy of *Sciences of the United States of America* journal.

Calculating risk of infection

In mere minutes from a droplet of blood

Neutrophils are a vital part of the body's immune system. Recognized as the most abundant type of white blood cell present in human blood, neutrophils function primarily as the body's first line of defence against infection and inflammation. Within minutes of stimulation, neutrophils migrate from the blood to tissue where they accumulate at sites of infection. One of the most common lab tests ordered on a regular basis is the counting of neutrophils in the blood (absolute neutrophil count).


[PICTURE: ©DMITRY LOBANOV]

"However, simply counting the neutrophils may not be enough in many cases. If neutrophils do not migrate well and cannot reach inside the tissues, this situation could have the same consequences as a low neutrophil count," says Dr Daniel Irimia, Assistant Professor at the BioMEMS Resource Center at Massachusetts General Hospital. The team recently designed miniaturized silicon-based devices that can be used to measure neutrophils' migration patterns from just a finger prick of blood in a few minutes. He also says, "The device was designed such that probing neutrophil mobility becomes extremely easy to perform."

By being able to measure the risk for infections that a particular patient has at a particular time from just a droplet of blood in a matter of minutes is a significant improvement and one that will improve current treatment. For more information on this research, refer to: www.worldscientific.com/doi/pdf/10.1142/S2339547813500040.

Gingival implant supports

Reduction of cluster headache

Cluster headache is one of the most severe forms of headache. It is usually unilateral and occurs mostly around the eye or in the temple. Attacks last up to several hours. In many people, cluster headache leads to a significant loss of quality of life. A new type of cluster headache treatment is the stimulation of the sphenopalatine ganglion (SPG). The ATI Neurostimulation System stimulates the SPG in order to break the pain cycle. The neurostimulator, which is the size of an almond, is inserted through a small incision in the gingiva and programmed by the physician. As cluster headache occurs unilaterally, the implant is inserted on the relevant side. The surgery is performed under general anaesthetic and takes about an hour.


[PICTURE: ©OLLYY]

The patient can control his or her therapy independently via a remote control. When a cluster attack occurs, he or she holds the device against the cheek to activate the implant. This stimulates the SPG and abates the attack. In many patients, the frequency of attacks decreases permanently.

The effectiveness of the ATI Neurostimulation System has been clinically proven in the most comprehensive medical study on cluster headache. With the ATI neurostimulator, 82 per cent of all attacks—even medium to severe—can be treated effectively, the manufacturer, Autonomic Technologies, stated. In 46 per cent of patients, the attack frequency was reduced significantly—from an average of 14 down to two attacks per week. The ATI Neurostimulation System has been introduced at nine clinics in Germany and is in use in Belgium.

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