Fascination of Laser Dentistry

From 28 October until 29 October 2011 both the 20th annual congress of the German Association of Laser Dentistry (DGL) as well as the congress for laser beginners, LASER START UP, were held in Düsseldorf, Germany. Over the two congress days we welcomed up to 200 participants from all over Germany, Europe and Middle East. Here you can read the abstracts of some lectures given during the congresses.

Laser-supported reduction of specific microorganisms in the periodontal pocket with the aid of an Er,Cr:YSGG laser: A pilot study

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Aim of the study: This study evaluates the capability of the Er,Cr:YSGG laser with a wavelength of 2,780 nm and the new 360° firing elastic Radial Firing Perio Tip (RFPT; 14 mm length, 500 m diameter; BIOLASE) to reduce pathogenic microorganisms in the periodontal pocket and to eliminate the biofilm and the diseased gingiva as a non-surgical conservative periodontal treatment that offers effectiveness for the dentist and comfort for the patient.

Material and method: Twelve patients with chronic or aggressive periodontitis were examined and treated. In the second dental hygienist session, a microbial smear as a pool probe from the deepest pocket in each quadrant was taken and the pocket depth of all teeth were measured. Following, a conservative periodontal treatment with ultrasonic devices and hand instruments followed in all quadrants within 24 hours. Afterwards, two randomly chosen quadrants were lased three times in a seven-day period using the Waterlase (BIOLASE) and the RFPT (output power of 1.5 W, 30 Hz, 11 % air, 20 % water and a pulse duration of 140 µs). After the last lasing session, another microbial smear was taken from the lased sites. This was repeated after three and six months. After six months, the pocket depths were also measured again.

Results: The number of all bacteria in the pockets was reduced to -88.72 % after six months. All bacteria, *Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Prevotella intermedia, T.f., Treponema denticola* and *Fusobacterium nucleatum*, were reduced continuously throughout the whole examination period. The pocket depth showed a slightly higher reduction in the lased quadrants than in the non-lased ones. These results were found to be consistent and in some cases improved after six months post-treatment.

Conclusion: The results demonstrate that the use of the Er,Cr:YSGG laser with the new 360° RFPT in periodontal treatment is able to reduce pathogenic microorganisms in periodontal pockets significantly.

Basics of laser-assisted diagnostic procedures

Authors_Priv.-Doz. Dr J. Meister, Dipl.-Phys. F. Schelle, Dr O. Brede, Priv.-Doz. Dr A. Braun, Prof Dr M. Frentzen/Germany

Diagnosis, in the broadest sense, describes the assignment of findings to a term of illness, in which the discovery methods are grouped under the term "diagnosis". In dentistry and in oral and maxillo-facial surgery, numerous optical methods of assessment are used. These primarily include visual examination and imaging techniques such as X-rays or MRI scans. With the help of more modern LED and laser technologies, the field of optical diagnosis has been expanded. The selective excitation of fluorophores through monochromatic light and the consequent detection of carious lesions, for example, have made these technologies an integral part of the dental practice. A brief functional description is given and the current state of fluorescence technology is discussed.

The development of ultrashort-pulse laser (USPL) systems has opened another diagnostic window. For a variety of detection procedures, very specific properties of the USPL are exploited, e.g. its short coherence length or its very high intensities. The resulting technologies, for example, are optical coherence tomography and terahertz imaging. They allow not only superficial, but also deeper tissue layers to be analysed. Their function and practicality are discussed in this article.

In the future, the combination of therapy and diagnosis (theragnostics) could be of particular importance. This is explained using USPL and OCT as examples.

Possibility of calculus removal with an ultrashort-pulse laser system

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The selective and careful removal of biofilm and mineral deposits in periodontal therapy is a clinical challenge. As an alternative to conventional techniques, laser technologies hold significant potential regarding the selective removal of calculus and disinfection of the root surface. In the present study, the potential of ultrashort-pulse laser technology was investigated in this therapeutic field.

The aim was to determine the ablation thresholds of calculus and cementum. The ability to remove calculus selectively and the side-effects of this were assessed. The root surface of freshly extracted teeth with and without calculus deposits were treated with an Nd:YVO4 laser (1,064 nm, pulse energy of 6–8 µJ, pulse duration of 8 ps, repetition rate of 500 kHz, focus Ø: 30 µm, scan parameter: line spacing 12.5 µm with a scanning speed of 2 m/s).

The study's results demonstrate that biofilm and calculus can be safely removed at 4 W average output power without damaging the dental hard tissue. The result is a smooth surface area. The results are the basis for further development of a clinical application system.

Material processing with ultrashort-pulse laser technology

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Ultrashort-pulse lasers (USPL) are a well-known and proven radiation source for industrial material processing. The benefits of this technology include its high precision, versatility and efficiency of processing. The aim of this study was to determine how these properties can be transferred to application in dentistry. In particular, ablation thresholds and ablation rates for oral hard and soft tissue, and restorative materials were determined.

A 1,064 nm Nd:YVO4 laser (with a pulse duration of 8 ps, emitting at a repetition rate of 500 kHz) served as beam source. The experiments were performed on dentine, enamel, cortical bone, bone marrow, trabecular bone, titanium, amalgam, composites and ceramics. The resulting cavities were measured with an optical profilometer. All materials investigated could be ablated. Ablation rates and thresholds were determined for all materials. Selectivity of material removal could be assessed from the data obtained. Promising results regarding selectivity of removal were obtained with composite materials, which have the highest ablation rate, as well as a remarkably low ablation threshold.

Regarding material processing properties, the use of USPL in dentistry appears promising. However, no realistic treatment situations could be simulated with the laboratory system utilised. Further studies are needed to examine and assess possible side-effects and risks for patients.

Evaluation of the efficiency of the diode laser for the treatment of pyogenic granuloma

Author_Dr Merita Bardhoshi/Albania

I report my experience in the treatment of two clinical cases of pyogenic granuloma with a 980 nm diode laser in the University Hospital, Department of Oral Surgery, Tirane, Albania. You will be treated as an outpatient under infiltration anesthesia lidocaine 2% 1cc, laser parameters: 6 W, continuous wave, optical fiber 300 micrometer after surgery no sutures were required.

Patients are following up after one week, four weeks, six months and one year after surgery to evaluate the early and long-term results. No analgesics and antibiotics were prescribed. The diagnosis was confirmed by biopsy. The laser surgery is well accepted by patients.

Patient reported no pain, swelling or bleeding a week after the operation. Four weeks after surgery, the wound was completely healed without complications. No scarring occurred and lips were normal in consistency. Aesthetic result was perfect. One year after surgery no recurrence occurred. The patients were satisfied with the result.

Laser surgery is a good modality for treatment of Granuloma pyogene. It is easy to perform, well accepted by the patients and the wounds were healed without complication. The big advantage is the lack of scars and a perfect aesthetic result. The application of 980 nm diode laser for the treatment of pyogenic granuloma seems to be with good benefice.