The expert defines laser dentistry 2011

An interview with Prof Dr Norbert Gutknecht



_In the meantime another five years have elapsed since the book „Evidence Based Laser Dentistry" was published in 2006. A great deal has also happened in laser dentistry in this period. Prof Norbert Gutknecht, President of Deutsche Gesellschaft für Laserzahnheilkunde (DGL—German Society for Laser Dentistry), Executive Director of World Federation for Laser Dentistry (WFLD) and editor of the book „Proceedings of the 1st International Workshop of Evidence Based Dentistry on Lasers in Dentistry", gives answers to the most important questions on laser-assisted therapy in the various fields of treatment in the following interview.

_The criteria to select a laser are important for the newcomer. For which indications is the use of the laser particularly recommendable and which significant advantages result from this for the dentist and his/her patient?

Prof Gutknecht: There is no such thing as THE laser and THE field of application but there are different wavelengths with different fields of application. A clear advantage can be achieved for the dentist and the patient in the respective special fields of application with regard to the wavelength.

_Are the large devices superior to the compact laser systems in terms of efficiency and range of applications?

Prof Gutknecht: "Large" laser devices, i.e. in this case in particular erbium lasers or combination lasers, offer a broad field of applications. The erbium wavelength hereby provides above all the possibility to treat hard tissue. This is the classic "laser drill" the patient imagines when thinking of a laser. These indications are not covered by any other commercially available wavelength.

_Can we say: an erbium laser is an erbium laser? And what about the other wavelengths, for example diode lasers, Nd:YAG lasers, etc? Where are the relevant differences?

Prof Gutknecht: Of course, we cannot say, for example "Er:YAG is an Er:YAG". That would be like saying "a car is a car". This also applies to diode and Nd:YAG lasers, the same applies here that one motorbike is not the same as the next motorbike. The relevant differences lie in the technical configuration of the laser systems.

_Different criteria are relevant when purchasing a laser system. Which are the most important for you and what should we bear in mind when purchasing the system?

Prof Gutknecht: If you wish to choose a laser system, you have to have decided beforehand in which indication field this laser is to be used. If this question has been clarified, you should then compare along with the technical data also the quality, maintenance service and training possibilities for the respective system. As well as pre-programmed protocols, which are good for the beginner, a modern laser device should also have a variable adjustment of its laser parameters in order to give the well trained dentist the possibility to be able to adapt his/her treatment to the needs of his/her respective patients. The dentist can obtain expert advice through Deutsche Gesellschaft für Laserzahnheilkunde (DGL) or from our institute as well—Aachen Dental Laser Center (AALZ).

_Which wavelengths would you choose for starting up in laser dentistry if you have a limited budget?

Prof Gutknecht: To start off, there is the diode laser if the amount you are able to invest plays an essential role. In the meantime, these compact devices can be purchased at reasonable prices and offer a solid, if not comprehensive treatment spectrum. Therefore it is appropriate to purchase other wavelengths in the practice at a later date in order to further extend the treatment spectrum for the joint use of patient and dentist.

_In the meantime there are three wavelengths available in the field of diode lasers. In your opinion is there a wavelength here that can be applied most effectively for use in daily practice?

Prof Gutknecht: The 810 nm diode laser has the greatest all-round features and has been scientifically researched to the greatest extent.

_Are the systems working with the help of a battery safe in terms of energy performance and efficiency during the treatment?

Prof Gutknecht: We are not aware of any problems in this respect.

_How can it be guaranteed that the energy parameters adjusted on the system are also actually reached at the end of the work? Can any guarantee be given here that the performance is correct and that this can be verifiably documented?

Prof Gutknecht: Although the efficiency of the lasers are checked annually in the framework of the safety check, we recommend that the user buys his/her own power measurement device in order to be able to guarantee the optimum parameters. Some lasers have internal power measurement devices that constantly monitor the laser performance during operations; however, the power is measured here in front of the fibre resp. in front of the articulated arm. Unfortunately, no defects on these transmission systems can be detected in this way. Other lasers have their own power measurement devices included in the scope of delivery. Along with the pure measurement, however, careful handling and maintenance of the optical elements is indispensable. Deserving a special mention here are the fibre tips or coupling-out windows which should also be kept clean as far as possible during the treatment. Along with the longer lifespan of these consumables, the user also guarantees in so doing that the measured, power not only leaves the hand piece but also reaches the tissue. There is often a disregarded source of error particularly with newcomers. Such errors can be avoided if the newcomer has completed the right training before using the laser for the first time.

_Let's move on the most well-known indication field in laser therapy: endodontics. What are the advantages of laser assisted endodontics? Are there any additional advantages for the persons giving the treatment, who carry out intensive preparations, through using a laser?

Prof Gutknecht: The advantages of laser-assisted endodontics can be particularly recognised in areas where there is a highly infected root canal system, combined with periapical ostitis, periapical granula or periapical cyst. Moreover, the morphological features of an endodontic system present a problem in attempting to achieve a germ reduction in the main and lateral dentinal tubules as well as the accessory canals and ramifications. The advantages of laser-assisted treatment are based on a very effective removal of the smear layer and the organic components from the main canal when additionally using an Er:YAG resp. an Er,Cr:YSGG laser with relevant fibre attachment. A significant difference in the germ reduction can be achieved by using a Nd:YAG laser or a 810 nm diode laser. The extremely high transmission of the Nd:YAG laser through dentine and its good absorption in the pigmented bacteria (96 % of the germs) leads to a germ reduction not existent up to now in the lateral dentinal tubules up to depths of 2,000 – 3,000 µm. The germ reduction is still over 80 % with 1,000 µm in the lateral dentinal tubules. Compared to this we have a measurable germ reduction in the lateral dentinal tubules up to 100 µm in depth with a conventional mechanical-chemical treatment of the root canal system.

_Is the invoicing a problem? How is the laser treatment to be settled and can this also be used, for example, in the field of endodontics or periodontology?

Prof Gutknecht: Invoicing the laser treatment is not a problem if the patient has been informed beforehand about the additional treatment steps and he/she has given his/her consent in writing that this treatment not covered by the health insurance companies is to be paid privately. This approach is the method recommended and supported by Deutsche Gesellschaft für Laserheilkunde (DGL) in endodontics as well as in periodontology.

"The removal of the biofilm on the root surface is possible just as with adequate power settings."

_Could you give a ranking list of the wavelengths in endodontics if there are different wavelengths available?

Prof Gutknecht: Of course,

1. pulsed Nd:YAG laser
2. 810 nm diode laser
3. 940 nm diode laser
4. 980 nm diode laser

_Let's get on to the subject of periodontology and in particular closed curettage. How effective is the use of the erbium laser in connection with the new side-fire-tips in the field of periodontology?

Prof Gutknecht: In my opinion making a definitive statement on this question is still too early since there are still too few clinical studies dealing with this question. However, what is clear from the stud-

ies and case presentations already carried out is that there is a reduction in the germs in the pocket bottom and a superficial erosion of the granulation tissue from the sulcus wall. The removal of the biofilm on the root surface is possible just as with adequate power settings like the micro retentive surface resulting from this, which has a very positive effect on a re-attachment.

_Which advantages will the person performing the treatment and the patient have when using a laser within this indication field?

Prof Gutknecht: The germ reduction also leads to an improved body immune defence, which in turn leads to the repair mechanisms and the healing process associated with this being able to be initiated more quickly.

_How can any guarantee be given that all infected areas are able to be reached and the germs killed?

Prof Gutknecht: The best way to achieve this is if the treating dentist has acquired good know-how about the mode of action and handling through a sound training. These form the prerequisites of being able to perform a correspondingly successful treatment.

_How can it be guaranteed that the sensitive root cement is not damaged by the laser?

Prof Gutknecht: Likewise, the best way to achieve this is if the treating dentist has acquired good knowledge about the mode of action and handling. Basic tools with a laser-assisted periodontal treatment are: 810 nm diode laser, pulsed Nd:YAG laser, 940 and 980 nm diode laser.

If we have the possibility of combining two wavelengths, a combination of erbium lasers and 810 nm diode or Nd:YAG laser would be a great advantage.

_The topic "closed curettage with photo sensitizer" is a major subject of debate at the moment. In the meantime there are several systems on the market that are said to bring about a germ reduction in parodontology and peri-implantitis, etc. with the aid of photo sensitizers etc. How effective is the use of these systems and can these be used alone in order to be able to achieve better results than through conventional methods?

Prof Gutknecht: The PDT therapy has its origins in medicine and is used there in the various fields with different photo sensitizers and wavelengths. The systems and areas of application already used in dentistry are proven through various clinical studies, which have shown that this supporting PDT therapy has contributed towards an improvement in treatment success, particularly in periodontal therapy. Since photo sensitizers and wavelengths are not directly comparable with each other, a correspondingly sound statement can only be made after a comparable clinical study of all three systems used in dentistry has been performed.

Due to the biochemical features and investigations already carried out in other expert fields, we can assume that when using the "Emundo" process we helped to develop, an improved efficiency of the therapy is able to be achieved.

_In which indications do these methods make sense, in which should they not be used?

Prof Gutknecht: Periodontology is primarily an indication that makes sense. Other indications fields still have to be verified.

_Are these methods suitable for the initial therapy or do they only represent a supplement to the recall treatment?

Prof Gutknecht: The Emundo method, for example, is perfectly suited for the initial therapy, particularly if it is carried out by an assistant. After the dental treatment and in the recall treatments it represents a very helpful supplement to the therapy and promotes good treatment results.

_Cavity preparation is the domain of the erbium laser group. Are the erbium lasers less damaging to the substance even with high energy settings than the rotating instrument? How great is the danger of micro defects through the high energies?

Prof Gutknecht: The erbium lasers are only less damaging to the substance if the person performing the treatment has clear ideas about the type and scope of the area to be treated. When working with performances in the range of 10 and 20 W, even healthy tooth structure will be very quickly eroded when the dentist is not trained sufficiently.

_What are the advantages of a preparation by means of laser compared to a rotating instrument along with insensitivity to pain?

Prof Gutknecht: The preparation by means of laser is a biophysical and not a purely mechanical preparation. Due to the thermo mechanical ablation, hydroxylapatite crystals are loosened from the tissue surface in an athermal way. Vibrations occurring when drilling as well as micro cracks and structural weaknesses caused by this do not occur. No smear layer is created and the cavity floor, as well as the cavity walls, is completely germ-free through this laser treatment.

_Frequently the speed of a laser preparation is assumed to be more time-consuming. Can you con-

firm this? Or are there perhaps even time advantages through using a laser?

Prof Gutknecht: The speed of the laser preparation is dependent on the material to be treated (enamel, dentine, bones, composite, glass ionomer cement, etc.) and naturally also extremely dependent on the adjustment values and adjustment combinations of the various devices. Time advantages through the laser preparation can be gained in the fields where an anaesthetic has to be given in conventional treatments; in laser treatment it is not necessary to give a surface anaesthetic or to wait for the reaction time or wait for the actual anaesthetic to take effect after the injection has been given. In addition, particularly in the approach used in preserving dentistry, not having to apply the etching gel and take the time needed for rinsing is seen to be gain in time with laser preparations.

_Is it possible to remove selective caries with a laser?

Prof Gutknecht: The erbium laser is the only tool with which caries can be selectively removed due to its biophysical features.

_Is it possible to carry out a preparation for a CAD/CAM restoration completely by means of laser or does a rotating instrument have to be used for after treatment?

Prof Gutknecht: Preparations for a CAD/CAM restoration by laser can be performed even without the additional use of rotating instruments.

_Is there the possibility to prepare onlays by means of laser?

Prof Gutknecht: Onlays can also be prepared by means of erbium lasers.

_Training and further training plays a big role in all the answers you have given. Can you specify this?

Prof Gutknecht: Undergraduate dental education does not include any information on the use of lasers in dentistry. Since the laser systems are not a further development of a currently known dental instrument but are based on very different modes of action, a sound training about the set up, function, indication and application of laser systems is an absolute must.

_Can people providing the treatment work without the relevant training with a laser system made available to them as a trial? What consequences could this have in the case of this happening anyway?

Prof Gutknecht: Even laser systems made available on loan may not be operated without proof of laser safety training due to statutory regulations. The relevant laser protection precautions also have to be on hand in the treatment rooms. A breach of these regulations is punishable with high fines and a temporary closure of the dental office.

_What does Deutsche Gesellschaft für Laserzahnheilkunde say about questions of laser safety and training?

Prof Gutknecht: There is a clear statement by DGL that lasers may only be operated after completing a recognised laser safety officer course (LSO). Moreover, an urgent recommendation has been issued that lasers may only be used on patients after completing a basic training course (two to three day workshop).

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_To what would you attach special importance in view of the training for laser use?

Prof Gutknecht: Due to the complexity of the laser application in the oral cavity I would agree with the recommendations of DGL to complete a training program which not only deals with the bare necessities regarding adjustments and actions but a training system in which dentists also have a relevant scientific background, and in which are given clinical demonstrations and practical exercises. In addition I personally would recommend the DGL mastership curriculum to each future laser user.

_In your opinion are practical demonstrations not sufficient?

On the basis of what I have said before it is clear that practical demonstrations are by far not sufficient.

I thank you for the interview._

Editorial note: The interview was led by Kristin Urban, Germany.