Editorial

From the editors

Dear Readers,

Over the past three or four decades, there has been a steady increase in the use of lasers in biological applications. This success is partly due to the technology having become both more stable and affordable. The laser method allows energy to be delivered in a confined form, making it one of the most precise methods available thereby allowing for an elevated degree of finesse. A considerable amount of work has already been published relating to laser–tissue interactions. Many studies have dealt with the control of laser-tissue microprocessing and in particular, the secondary effects caused by the use of either continuous wave (cw) or short pulse lasers. The main concerns have been overheating and the shock waves that are the precursor to any possible laser-induced bubble expansion. The literature on laser–tissue interactions by necessity includes many studies on soft and hard tissues, as they both provide for significant opportunities for laser medical applications.

One of the more common effects during a laser–soft tissue interaction is the laser-induced cavitation phenomenon. This effect has been extensively studied in fluids and tissues by a number of acknowledged experts (A. Vogel, B. Stuart, M. H. Niemz, D. O. Lapotko, S. L. Jacques, A. A. Oraevsky, and T. Juhasz amongst others) over a period of two decades, producing excellent experimental and theoretical results. However, recently published results describe a new approach to the laser-induced cavitation phenomenon and innovative experimental developments have allowed an in-depth study of the bubbles and shock waves produced during laser-induced cavitation events. The laser-induced cavitation has been used extensively, for example, in cell lysis and ablation of the cornea.

Authors such as L. B. Da Silva, J. Kruger, and J. Neev have studied the laser ablation of hard tissue, in particular the drilling of bone or dental tissue with ultrashort laser pulses. The effects of pulse duration and repetition rate are of interest when determining the optimal parameters to ensure minimal collateral tissue damage. Additionally, both chemical transformations and thermo-mechanical damage are of concern for clinical applications in dentistry.

Another area of special interest is the microstructuring of hard tissue for use in implants.

The current availability of laser diodes, fibres and solid-state lasers offer a wide selection of cw emissions or pulse durations from microseconds (μs) to femtoseconds (fs). It is nowadays possible to conduct research on laser–tissue interactions, where the dominant physical mechanism ranges from purely thermal to a highly non-linear optical interaction. Different physical mechanisms dominating the interaction can trigger distinct effects and consequences to tissue and/or cells, and as a result the outcome of medical applications.

In the current issue of *Photonics & Lasers in Medicine*, we have contributions on three main topics: (i) laser interaction with soft and hard tissues, (ii) laser-induced cavitation, and (iii) clinical cases using typical (Nd:YAG) and novel (Tm: fibre) lasers.

Marjoribanks et al. report on ultrashort laser pulse interaction with hard and soft tissue and they discuss the ablation and thermal effects associated with the use of a pulse-train burst. Such an interaction allows for an advantageous energy delivery mode to tissue. This can be used, for example, to effect a structural transformation of dentin during ablation of a tooth.

de la Cruz Lorenzo et al. discuss the effects of laser microstructuring of dentin and enamel for the purpose of increasing adhesion properties. This is relevant for use in orthodontics and conservative dentistry. It was found that the fs laser microstructuring of dental tissue is a suitable alternative to other tissue conditioning techniques.

Padilla-Martinez et al. studied the thermocavitation phenomenon, which gives place to a novel method of transdermal drug delivery, by laser-induced thermocavitation resulting in shock waves close to the delivery site. The method discussed by the authors uses inexpensive low power cw lasers, which makes it attractive for medical applications.

Devia-Cruz et al. investigated the laser-induced cavitation effect on a pressurized fluid, in order to find a suitable method to determine small changes in the fluid pressure, through time-resolved data of the shock wave and the bubbles created during the cavitation event. They used three complementary all-optical techniques: laser shadowgraphy, a fibre optic-based interferometer acting as a hydrophone, and a novel approach of transmittance

modulated by the cavitation bubble. The advantages of using one or another technique are discussed in view of a detailed study of the laser-induced cavitation phenomenon.

Mungnirandr et al. present a therapeutic study of tattoo removal using a Nd:YAG laser. In the study the laser parameters, as well as side effects for the tattoo removal, are assessed, which range from textural changes to hyperpigmentation and hypopigmentation, to scarring.

Sroka et al. studied the feasibility of using a novel Tm: fibre laser emitting at 1940 nm to treat hyperplastic inferior turbinates. Their results demonstrate advantages such as a short time of irradiation and the low energy required to achieve sufficient tissue reduction.

In addition to these scientific contributions, you will find a short congress report from the 19th Annual Meeting of the German Society for Laser Medicine (DGLM) supplemented by the protocol of the general meeting of the DGLM, which took place on March 23rd, 2012 in Munich. Our international readers will hopefully excuse the fact that the protocol is written in German language as it specifically addresses the members of the DGLM.

As always, we would like to draw your attention to our magazine section and the congress calendar as well as to add that you have free online access to all contributions from the first volume of *Photonics & Lasers in Medicine*. For registration, please visit our website <http://www.degruyter.com/view/j/plm>.

With our very best wishes,

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