19 April 2017

In-vivo multiphoton microscopy (MPM) of laser-induced optical breakdown (LIOB) in human skin (Conference Presentation)

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Proceedings Volume 10037, Photonics in Dermatology and Plastic Surgery; 100370F (2017)
https://doi.org/10.1117/12.2253566

Event: SPIE BiOS, 2017, San Francisco, California, United States

Abstract

We use a multiphoton microscopy (MPM)-based clinical microscope (MPTflex, JenLab, Germany) to describe changes in human skin following treatment with a fractional non-ablative laser (PicoWay, Candela). The treatment was based on a fractionated picosecond Nd:YAG laser (1064 and 532nm, 3mJ and 1.5mJ (no attenuation), respectively maximum energy/pulse, 100 microbeams/6mmx6mm). Improvements in skin appearance resulting from treatment with this laser have been noted but optimizing the efficacy depends on a thorough understanding of the specific skin response to treatment. MPM is a nonlinear laser scanning microscopy technique that features sub-cellular resolution and label-free molecular contrast. MPM contrast in skin is derived from second-harmonic generation of collagen and two-photon excited fluorescence of NADH/FAD+, elastin, keratin, melanin. In this pilot study, two areas on the arm of a volunteer (skin type II) were treated with the picoWay laser (1064nm, 3mJ; 532nm, 1.5mJ; 1pass). The skin response to treatment was imaged in-vivo at 8 time points over the following 4 weeks. MPM revealed micro-injuries present in epidermis. Damaged individual cells were distinguished after 3h and 24h from treatment with both wavelengths. Pigmented cells were particularly damaged in the process, suggesting that melanin is the main absorber and the primary target for laser induced optical breakdown. At later time points, clusters of cellular necrotic debris were imaged across the treated epidermis. These results represent the groundwork for future longitudinal studies on expanded number of subjects to understand the response to treatment in different skin types at different laser parameters, critical factors in optimizing treatment outcomes.

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