Skin ablation using high intensity femtosecond laser

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Conventional laser ablation techniques have less precision and high collateral damage compared with high intensity ultrashort laser pulses. Our study was designed to investigate ablation of ex-vivo skin samples of Wistar rats. In this experiment, we use a Ti:Sapphire (830 nm) with energy per pulse varying between 5 and 150μJ, ultrashort pulses of approximately 35 fs at 4KHz. The pulses were focused by a lens (f = 50 mm) on samples resulting in maximum energy density of 34.1 μJ/cm^2. Ex-vivo skin samples were shaved with razor-blade and fixed on flatted acrylic plane, which were positioned on two axes coordinated system with micrometric accuracy, CNC programming was used to guide the sample through a pre-defined path and aligned perpendicularly to the laser beam. Skin samples were exposed to seven different conditions of energy with irradiation performed in raster line, with 25% pulses overlapping. The site of irradiation had 1mm x 2mm, and were separated by 3mm. To evaluate skin removal depth and the quality of lesions borders, the samples were analyzed using optical coherence tomography (OCT). An OCT system using SLD with central wavelength at 930 nm and about 100 nm of bandwidth was used (Thorlabs Inc.). This system provides an axial and lateral resolution in air of 6.0 μm and it can be adjusted to get up to 8 frames per second. The images were generated with 1 Mpixel (2000x512) corresponding to a lateral range of 6.0 mm and axial depth of 1.5 mm. This system is provided by a fiber optical hand probe. It was possible to remove skin reading the dermis with 50 μJ/pulse (11.4 J/cm^2) and higher fluencies, from 55$\pm$5 μm depth, measured by OCT. Acknowledgement: FAPESP CEPID (05/51689-2), Instituto Nacional de Fotônica/CNPq (573.916/2008-0), FAPEAM - Programa RH-POSGRAD.
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