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In vivo confocal imaging of epidermal cell migration and dermal changes post nonablative fractional resurfacing: study of the wound healing process with corroborated histopathologic evidence.

Stumpp OF, Bedi VP, Wyatt D, Lac D, Rahman Z, Chan KF.; J Biomed Opt. 2009 Mar-Apr;14(2) DOI: 10.1117/1.3103316.2009: 24018

ABSTRACT

In vivo wound healing response post nonablative fractional laser treatment is evaluated. Seven healthy subjects receive treatments with a Fraxel re:store laser system on the forearm with pulse energies ranging from 10 to 70 mJ. The treatment sites are imaged at 1-h increments up to 40 h using confocal microscope z-stacks using 10- μm -depth spacing. At least five individual microscopic treatment zones are imaged per subject, time point, and treatment energy. Images are analyzed for tissue structure and morphology to classify each lesion as healed or not healed, depending on epidermal re-epithelialization at each time point and treatment energy. Probit analysis is used to statistically determine the ED(50) and ED(84) probabilities for a positive dose response (healed lesion) as a function of treatment energy. Confocal observations reveal epidermal keratinocyte migration patterns confirmed with histological analysis using hematoxylin and eosin (HE) and lactate dehydrogenase (LDH) staining at 10 mJ at 0, 7, 16, and 24-h post-treatment. Results indicate that more time is required to conclude re-epithelialization with larger lesion sizes (all less than 500 μm) corresponding to higher treatment energies. For the entire pulse energy range tested, epidermal re-epithelialization concludes between 10 to 22-h post-treatment for ED(50) and 13 to 28 h for ED(84).