

## Medical &gt; In Vivo &gt; Wound healing

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**Spatiotemporal closure of fractional laser-ablated channels imaged by optical coherence tomography and reflectance confocal microscopy.**

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**ABSTRACT**

**BACKGROUND AND OBJECTIVE:** Optical coherence tomography (OCT) and reflectance confocal microscopy (RCM) offer high-resolution optical imaging of the skin, which may provide benefit in the context of laser-assisted drug delivery. We aimed to characterize postoperative healing of ablative fractional laser (AFXL)-induced channels and dynamics in their spatiotemporal closure using in vivo OCT and RCM techniques. **STUDY DESIGN/MATERIALS AND METHODS:** The inner forearm of healthy subjects (n=6) was exposed to 10,600nm fractional CO<sub>2</sub> laser using 5 and 25% densities, 120µm beam diameter, 5, 15, and 25mJ/microbeam. Treatment sites were scanned with OCT to evaluate closure of AFXL-channels and RCM to evaluate subsequent re-epithelialization.

**RESULTS:** OCT and RCM identified laser channels in epidermis and upper dermis as black, ablated tissue defects surrounded by characteristic hyper- and hyporeflexive zones. OCT imaged individual laser channels of the entire laser grid, and RCM imaged epidermal cellular and structural changes around a single laser channel to the depth of the dermoepidermal junction (DEJ) and upper papillary dermis. OCT images visualized a heterogeneous material in the lower part of open laser channels, indicating tissue fluid. By OCT the median percentage of open channels was evaluated at several time points within the first 24 hours and laser channels were found to gradually close, depending on the used energy level. Thus, at 5mJ/microbeam, 87% (range 73-100%) of channels were open one hour after laser exposure, which declined to 27% (range 20-100%) and 20% (range 7-93%) at 12 and 24 hours after laser exposure, respectively. At 25mJ/microbeam, 100% (range 100-100%) of channels were open 1 hour after laser exposure while 53% (range 33-100%) and 40% (range 0-100%) remained open at 12 and 24 hours after exposure. Median depth and width of open channels decreased over time depending of applied energy. RCM verified initial re-epithelialization from day 2 for all energy levels used. Morphology of ablation defects by OCT and RCM corresponded to histological assessments.

**CONCLUSIONS:** OCT and RCM enabled imaging of AFXL-channels and their spatiotemporal closure. Laser channels remained open up to 24 hours post laser, which may be important for the time perspective to deliver topical substances through AFXL channels