Skin lesion imaging with line-field confocal optical coherence tomography

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100-word text summary

An original OCT technique called line-field confocal OCT (LC-OCT) is presented. Combining the principles of time-domain OCT and confocal microscopy with line illumination and detection, LC-OCT acquires multiple A-scans in parallel with dynamic focusing. With a quasi isotropic resolution of ~ 1 µm, the LC-OCT images reveal a comprehensive structural mapping of skin, in vivo, at the cellular level down to a depth of ~ 500 µm. LC-OCT images of various skin lesions, including carcinomas and melanomas, are found to strongly correlate with histopathological images. LC-OCT could significantly improve clinical diagnostic accuracy, while reducing the number of biopsies of benign lesions.

250-word text abstract

The use of non-invasive imaging techniques in dermatology has been reported to improve the diagnostic accuracy and the practice of biopsies, and at the same time to reduce the need for tissue excision. However, the current clinically-available imaging techniques do not yet entirely meet the need for early and accurate, non-invasive detection of all skin cancers. An optical technique called Line-field Confocal Optical Coherence Tomography (LC-OCT) is introduced for high-resolution, non-invasive imaging of human skin in vivo. LC-OCT delivers tomographic images of skin in real-time (10 frames/s) with a quasi isotropic spatial resolution of ~ 1 µm, revealing a comprehensive morphological mapping of tissues at a cellular level, down to a depth of ~ 500 µm. LC-OCT has been applied to the in vivo imaging of various skin lesions, including carcinomas and melanomas. Surgical excisions of the lesions have then been performed followed by tissue processing to realize H&E-stained histopathological images. The spatial resolution, orientation, and imaging contrast mechanism of the LC-OCT images allowed for a high level of similarity with the conventional histopathological images. LC-OCT was able to show most of the histopathological elements that allow for medical diagnosis. With its unprecedented performance, LC-OCT will push the limits of in vivo exploration of skin. Using LC-OCT as an adjunct tool in dermatology could help improve clinical diagnostic accuracy, allowing for the early detection of malignant skin tumors - including melanoma - and a reduction in the number of surgical excisions of benign lesions.