



DERMATOPATHOLOGY

AUTOMATED IN VIVO 3D HIGH-DEFINITION OPTICAL COHERENCE TOMOGRAPHY SKIN ANALYSIS SYSTEM

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Background: In current clinical practice, beyond clinical assessment, dermoscopy and biopsies are being performed. However, these assessments typically subjective and provide two-dimensional views. The epidermal thickness varies continuously across an area of the skin. This parameter is typically measured in biopsies, which actually do not reflect in vivo thickness and are inaccurate due to sample error. In vivo high-definition OCT (HD-OCT, Skintell, Agfa, Belgium) enables non-invasive 3-dimensional imaging of the structure of the skin.

Objective: To develop a skin analysis software system to automatically identify and quantify the epidermal thickness in HD-OCT images.

Methods: Our team developed a software system, named Automated Skin HD-OCT Image Analysis (ASHIMA), to greatly increase the diagnostic capability and usability of the HD-OCT through signal and image processing. One of its functions is to perform epidermal thickness measurements across the whole skin image volume.

For validation, HD-OCT images of healthy forearm skin (both posterior and anterior) were analysed using ASHIMA and the mean 3D epidermal thickness was compared with manual measurements. In the latter, the middle slice of the five image volumes was extracted and ImageJ was used by the investigator to manually measure the thickness at two distinctive locations.

Results:

The mean difference between manual and ASHIMA measurements is 3.81µm. The largest difference is seen when the images are least clear. In the images which the epidermis was clearer, the mean error was less than 2.4 µm. There was no apparent difference if the measurement was applied in the image centre or at other locations, suggesting that the ASHIMA system performs consistently across the images.

Conclusion:





We developed an automated software system for three-dimensional analysis of skin images in in vivo non-invasive HD-OCT imaging. Measurement of the 3D epidermal thickness using the system correlated well with the current standard of manual measurements.

