Optical Coherence Tomography (OCT) Applications in Clinical Dermatology

Florian Bazant-Hegemark, Daniel Woods, Michelson Diagnostics Ltd., 11A Grays Farm Road, Orpington, Kent, BR5 3BD

Optical Coherence Tomography (OCT) is a novel, non-invasive, real-time imaging tool to study tissue with high resolution (Figure 1).
It is particularly suitable for dermatological applications, such as the monitoring and research of novel dermal delivery systems.

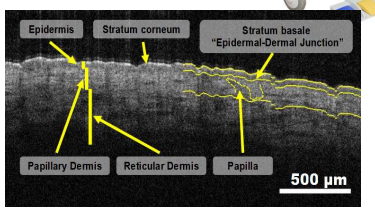
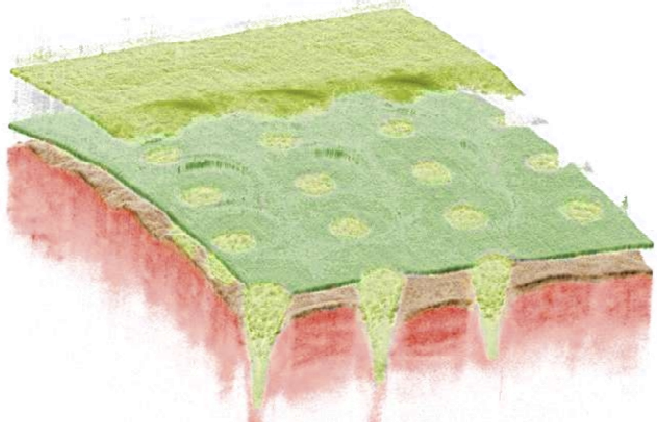


Figure 1: (Top & Left) OCT system and ergonomic probe in use. (Right) Example real-time scan of the volar forearm.

OCT has been developed over the last 20 years and is widely used in ophthalmology. Recently, the imaging performance of commercial systems has improved to give high speed and a few microns resolution over an area of 5 × 5 mm². In a pilot study, we found that the imaging depth is ideal for the study of dermal delivery systems (Figure 2).



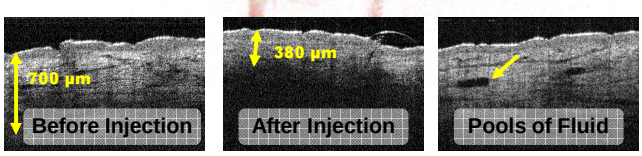


Figure 2: (Top) 3D render of a volumetric OCT scan, showing skin (red) and delivery system (green). (Bottom) Different appearance of skin scans before and after injection, and variable distribution patterns.

Skin layers can be differentiated through their different optical properties (Figure 3). OCT is a unique tool in that the sub-surface extent of features and transition zones can be determined non-invasively, in order to assist research and monitoring.

Figure 3: (Right) 3D segmentation of epidermal and dermal skin layers.

(Below) Projections and superposition of different skin layers, highlighting surface hair, subsurface hair, follicles, blood vessels, papillae, wrinkles, and other structures.

In addition to visual interpretation of the images, image processing algorithms can be used to extract numeric values and quantitative data. For example, the calculation of epidermal thickness can be automated to eliminate human bias. Similar algorithms can be used to calculate figures of merit, or scores (Figure 4).

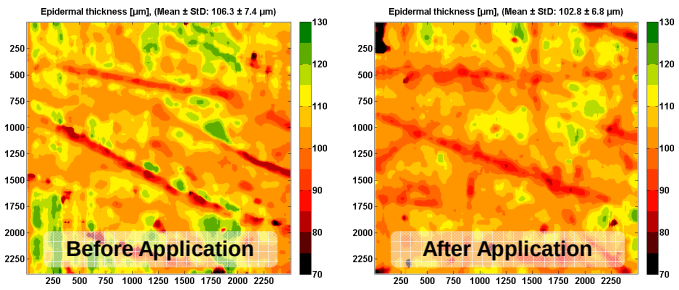


Figure 4: Microtopographic thickness map of the epidermis of the volar forearm. The results (less thickness variation) indicate a flattening of the epidermis after application of a test product [Scale: µm].