

Commentary on “OCT image atlas of healthy skin on sun-exposed areas”

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Optical Coherence Tomography (OCT) is a non-invasive imaging modality that was first introduced clinically in 1988 to measure eye length [1] and is utilized extensively in ophthalmology [2]. More recently, non-ophthalmic OCT has been used in cardiac imaging and cancer surveillance of the gastrointestinal tract, bladder, oral cavity, and skin [3]. OCT was initially described in dermatology in 1997 [4], and has been increasingly utilized to diagnose, monitor treatment response, and plan excisions of skin cancers and non-cancerous skin diseases [5].

OCT is based on low coherence interferometry and uses light like how ultrasound uses sound to generate cross-sectional (vertical) images and en face (horizontal) images of the skin [6]. OCT can image down to the reticular dermis, at a depth of about 2mm, allowing for visualization of the overlying skin layers, blood vessels, and skin appendages [7].

To use OCT in detection, diagnosis, and treatment monitoring of skin diseases, clinicians must first understand how healthy and normally aging skin appear on OCT. O’leary et al. recently analyzed OCT images of normal skin in 19 predominately sun-exposed areas of a 23-year-old man and his 89-year-old paternal grandfather [7]. They observed variability between imaging sites but demonstrated several consistent findings: the 23-year-old man had a thicker and undulating epidermis, an undulating pattern across the Dermal-epidermal Junction (DEJ), and a hyperreflective papillary dermis, the last of which provided contrast and improved visualization of the DEJ and papillary dermal structures [7]. The hypo reflective and diffuse papillary dermis of the 89 year-old man is consistent with solar elastosis, which is characterized by the accumulation of abnormal elastic tissue that distorts the normal layering of collagen [7].

OCT has previously been studied in photoaged and photodamaged skin, as well as in assessing the efficacy of topical anti-aging products [8]. Mamalis et al. assigned OCT imaging as a Grade C recommendation for assessing photoaged and photodamaged skin [8]. O’leary et al. have provided further evidence of detecting photoaging on OCT imaging, and future clinical trials may incorporate OCT in the assessment of novel anti-aging therapies.

O’leary et al. chose to image sun-exposed skin regions that are most prone to various skin cancers: melanoma, squamous cell carcinoma, and basal cell carcinoma. OCT has been studied extensively in Non-melanoma Skin Cancers (NMSC) [9]. Although NMSC are the most common skin cancers, melanoma is the most dangerous, so early detection and diagnosis is critical. Recent studies have described methods to distinguish melanoma from benign pigmented lesions on OCT imaging [10], but it remains under-developed and largely experimental. Light scattering and melanin absorption limit OCT imaging of pigmented lesions [9] but using contrast agents may help mitigate these issues. In Photoacoustic Imaging (PAI), gold nanoparticles conjugated to an antibody of melanoma-associated antigens provided enhanced PAI signals in tumor-bearing mice [11]. However, it is currently unknown if contrast agents can enhance *in-vivo* OCT imaging to help distinguish melanoma from benign pigmented lesions.

As skin cancer detection with OCT improves, the next logical question is whether Artificial Intelligence (AI) could utilize OCT images to predict if a lesion is benign or malignant. A recent study showed that a computer algorithm utilizing convolutional neural networks to analyze dermoscopic images performed better than the majority of 58 dermatologists in accurately

diagnosing melanoma [12]. Creating an AI system that analyzes both OCT and dermoscopic images could theoretically increase the diagnostic accuracy of the algorithm. Currently, however, the differences between melanoma and benign pigmented lesions on non-enhanced OCT imaging are not consistent enough to develop a successful AI system. Contrast agents may better illustrate these differences on OCT imaging.

In conclusion, OCT is a promising non-invasive imaging modality whose utility will continue to increase in everyday clinical dermatology. O’leary et al. described OCT image features of healthy and aging skin in sun-exposed areas, further demonstrating the ability of OCT in assessing photoaged skin. While the detection of NMSC on OCT imaging is improving, future work is needed to better differentiate melanoma from benign pigmented lesions on OCT.

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