

RISING DERM STARS

Optical Coherence Tomography for the Scalp

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The advancement of technology-based diagnostic and therapeutic modalities are rapidly changing the dermatology practice by allowing clinicians to expand noninvasive indications. Hair loss disorders afflict people of all subtypes, are difficult to treat, and are disruptive to the psychological wellbeing of patients.^{1,2} Scalp biopsies remain cumbersome, invasive procedures that permit only single time-point analysis. Clinicians are often left to gauge treatment efficacy or disease progression over time subjectively, which may limit ability to treat these conditions optimally. Real-time assessment of living tissue has invaluable potential for bolstering histologic and dermatoscopic characterization of follicular disorders of the skin, particularly alopecia.

Optical coherence tomography (OCT) is an imaging technology that offers safe and effective noninvasive examination of skin. This technology is fundamentally analogous to ultrasound, but uses infrared interferometry to generate depth-resolved images from backscattered light.³ Its high resolution output allows visualization of the epidermis, upper dermis, dermal-epidermal junction, blood vessels, and skin appendages.⁴ Our analysis shows that OCT technology is nondiscriminatory and can obtain reliable data in different Fitzpatrick skin types among multiethnic populations. As applications for OCT continually expand, this

study aims to determine its utility in subsurface structural analysis for inflammatory and follicular diseases of the scalp.

We successfully devised an imaging cap to precisely relocate scalp areas, captured images that minimize data loss to light absorption, and described parameters of follicular disease, such as number of follicles, hair thickness, presence and absence of doublets and triplets, as well as epidermal thickness. We record these measurements across separate 5x7x1.3 mm areas in common alopecia locations including frontal, vertex, and temporal scalp.

Twenty subjects with alopecia (10 scarring and 10 non-scarring) were compared to 5 control subjects for epidermal thickness, hair follicle quantity and diameter. Control subjects were expected to have larger average follicular diameter and higher average hair-bearing follicle density compared to alopecia subjects in all scalp regions.

Preliminary results show significant variation in measurements of control subjects based on ethnicity and hair type. No significant differences exist between alopecia subjects and controls in unaffected scalp locations. Epidermal thickness is significantly larger in scarring alopecia subjects compared to non-

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scarring and control subjects. Scarring patients exhibit higher proportions of doublets and triplets than non-scarring control subjects. And ratio of follicle to hair shaft diameter was not significantly different across subject groups.

Image characteristics learned from this analysis will serve as an atlas for future follicular application of OCT in hair disease diagnosis, prognosis, and therapy assessment.

References:

References:

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