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Publication date:
2022

Document Version
Publisher's PDF, also known as Version of record

Atopic Dermatitis Severity Assessment using High-Speed Dermal Atomic Force Microscope

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Atopic dermatitis (AD) is a chronic inflammatory skin disease that involves complex interactions of genetic, environmental, and immunologic factors. Due to its high-resolution imaging ability, atomic force microscopy (AFM) can resolve dermal nanotexture, making it a clinical tool for assessing AD. Moreover, methods such as tape stripping provide a non-invasive and simple way to obtain skin corneocyte samples. However, the low imaging rate of common AFMs makes them impractical to obtain the amounts of data needed for bio-statistical analysis. Although speed can be improved significantly by using advanced high-speed AFMs, their high prices limit their use in practical applications. In this work, a high-speed dermal atomic force microscope (HD-AFM) is custom-built for AD severity assessment. 190 images of skin samples from volunteers with and without AD were measured at a rate of 9.3 seconds per image (512x512 pixels, 55 lines/s, tip-sample velocity of 2,546.5 µm/s) and analyzed to obtain a dermal topographical index (DTI). The results confirm that the DTI is reliable for AD severity assessment. Moreover, the DTI also distinguished between control samples from healthy volunteers and non-lesional samples from AD volunteers, which displays the potential of the HD-AFM for early AD diagnosis.

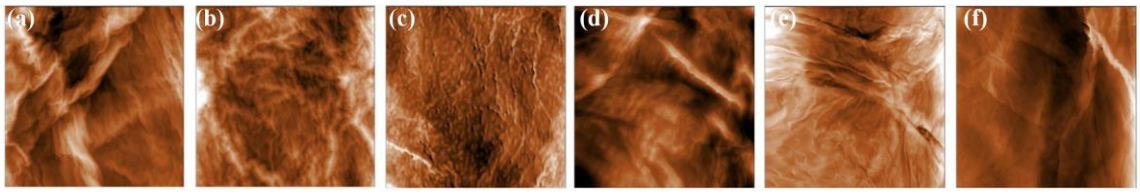

Figure 1. Skin corneocyte nanotexture images from AD and healthy volunteers. AD skin at (a) non-lesional, (b) closed to lesional and (c) lesional . Skin nanotexture images from (d) female 23, (e) female 24, (f) female 25 years old healthy volunteers.

References

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