



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

Liao, H.-S.; Wang, J.-H. ; Raun, E.; Nørgaard, L.O.; Dons, F.E.; Hwu, E. E.-T.

Publication date:
2022

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

[Link back to DTU Orbit](#)

Citation (APA):

Liao, H.-S., Wang, J.-H., Raun, E., Nørgaard, L. O., Dons, F. E., & Hwu, E. E.-T. (2022). *Atopic Dermatitis Severity Assessment using High-Speed Dermal Atomic Force Microscope*. Abstract from AFM BioMed Conference 2022, Nagoya-Okazaki, Japan.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

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

H.-S. Liao¹, J.-H. Wang², E. Raun³, L. O. Nørgaard³, F. E. Dons³ and E. E.-T. Hwu^{3*}

¹ Department of Mechanical Engineering, National Taiwan University, Taipei, Taiwan

² Mechatronics and Robotics, Technical University of Munich, Germany

³ Department of Health Technology, Technical University of Denmark, Lyngby, Denmark

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 $\mu\text{m/s}$) 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.

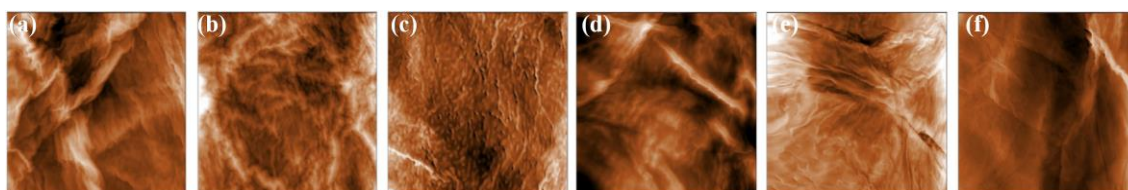


Figure 1. Skin corneocyte nanotexture images from AD and healthy volunteers. AD skin at (a) non-lesional, (b) closed to lesional and (c) lesional. Skin nanotexture images from (d) female 23, (e) female 24, (f) female 25 years old healthy volunteers.

References

- [1] W.-M. Wang *et al.* *Nanotechnology* 2013, **24**, 455503.
- [2] Riethmuller, C. *Exp. Dermatol.* 2018, **27**, 923.