EUROPEAN PRESSURE ULCER ADVISORY PANEL

EPUAP2021

Virtual Meeting

INNOVATION THROUGH NECESSITY:
Lessons learned in the past for a brighter future for pressure ulcer prevention and management

18 - 19 October, 2021

ABSTRACT BOOK

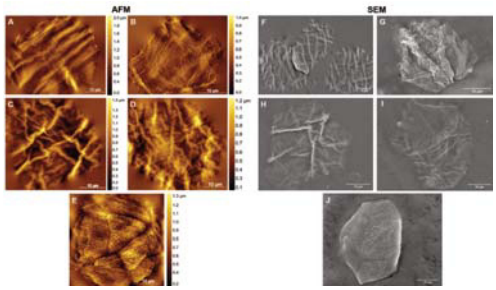
SPS1.1

BIOMECHANICAL AND TOPOGRAPHICAL CHARACTERIZATION OF CORNEOCYTES USING AFM WITH RESPECT TO ANATOMICAL LOCATION

Ana Evora[1], *Simon A. Johnson*[1], *Zhibing Zhang*[1], *Michael J. Adams*[1]

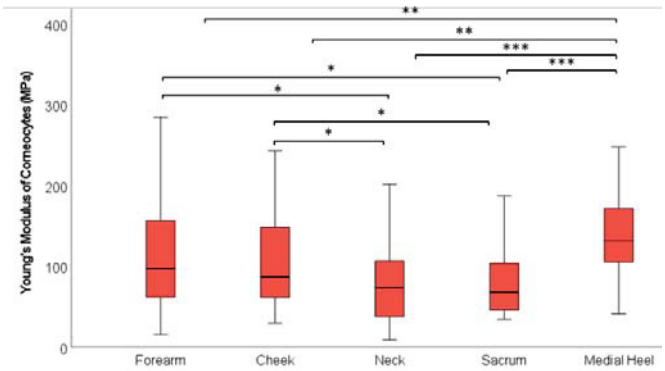
1 *University of Birmingham, School of Chemical Engineering, Birmingham, United Kingdom*

Introduction: The stratum corneum (SC) comprises corneocytes, which are differentiated dead keratinocytes composed of a cornified envelope and a keratin-filled interior and connected by corneodesmosomes [1]. Understanding how these cells sustain load is relevant to better comprehend the mechanisms leading to loss of skin integrity and the development of pressure ulcers. The current work aims to understand the relationship between the topographical features of corneocytes and their mechanical properties using Atomic Force Microscopy (AFM).



Methods: Corneocytes were collected from five different regions: forearm, cheek, neck, sacrum, and the medial heel by tape stripping. The tape was attached to a glass slide and single corneocytes were analyzed by AFM. Tapping mode (TM) cantilevers (stiffness = 40 N/m) were used. Each corneocyte was indented to obtain 100 force curves.

Results: Forearm, sacrum, and neck corneocytes presented similar topography: vein-like features across the surface, while cells from the cheek displayed a corrugated topography and those from the medial heel presented villi-like structures (Fig. 1). The apparent Young's modulus, E, was obtained using the Oliver-Pharr method [2] and differences were found to be significant between medial heel corneocytes and the remaining locations (Fig. 2). The neck and sacrum presented the lowest apparent E.



Conclusions: Cells from the medial heel were shown to be the stiffest. Cheek cells, though distinct in topography from the forearm, showed similar values of E, while neck cells, though displaying similar topography, were softer. This work shows the importance of combining the study of morphology and mechanics to understand the mechanical function of the SC. While the maturation of the SC may be one of the most important factors in skin barrier function, the intrinsic differences in mechanical properties of corneocytes may help reveal how different body sites behave against load and pressure. It must also be noted that only the apparent elastic modulus could be calculated as the compliance of the tape was not considered. Future work will focus in obtaining real values of E.

References

1 *Menon GK, Cleary GW, Lane ME. The structure and function of the stratum corneum. International Journal of Pharmaceutics. 2012;435(1):3-9.*

2 *Oliver WC, Pharr GM. An improved technique for determining hardness and elastic modulus using load and displacement sensing indentation experiments. Journal of Materials Research. 1992;7(6):1564-83.*