Cells Sense and Respond to Frictional Shear Stress

CATEGORY OR KEYWORD

Biotribology

AUTHORS AND INSTITUTIONS

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INTRODUCTION

The body's first line of defense against the external world is primarily composed of epithelial cells. These cells and the soft tissues they comprise often bear significant stresses under large strains, conduct complicated mass and heat transport functions, and continuously restructure, remodel, and rebuild in response to physical challenges, insults, and injuries. The body manages these challenges through high water content gel layers, which are continuously secreted by all moist epithelial cells. These gel networks may be thought to act as mechanical fuses under shear forces, thereby protecting the underlying epithelia.

ABSTRACT

The tribology of mucinated cellular monolayers has revealed that cells are capable of producing strong pro-inflammatory signaling molecules, or cytokines, following excessive shear stresses [1]. Recent studies used a series of progressively stiffer hydrogel probes (by decreasing water content) to impart shear stresses of 40, 60, and 80 Pa under identical normal forces against cell monolayers. This work revealed that higher shear stresses under identical normal force conditions led to an increase in apoptotic cells in the monolayer. These findings suggest that mitigating frictional shear stress could be a viable design strategy for soft implantable devices.

ACKNOWLEDGMENTS

This work was graciously supported by Alcon Laboratories and conducted at the University of Florida.

REFERENCES

[1] Pitenis, A.A., Urueña, J.M., Hart, S.M., O'Bryan, C.S., Marshall, S.L., Levings, P.P., Angelini, T.E., and Sawyer, W.G., 2018, "Friction-Induced Inflammation," *Trib. Lett.*, **66**(1), pp. 81.