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ADSORPTION OF PRG4 ON COMMERCIALLY AVAILABLE CONTACT LENSES

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INTRODUCTION

Contact lens wear can cause corneal damage, which destabilizes the tear film that protects the ocular surface and may lead to Dry Eye Syndrome [1]. Contact lens-induced Dry Eye Syndrome causes substantial discomfort and affects the quality of life of millions worldwide [2,3]. A possible cause of this discomfort is increased friction between ocular tissues and the contact lens [4]. Proteoglycan 4 (PRG4) is a mucin-like glycoprotein that was originally found in synovial fluid, but has also recently been discovered on the eye. It was shown to function as an effective boundary lubricant for the ocular surfaces, specifically between the cornea and eyelid or a contact lens [4,5]. However, these initial studies were not performed in the presence of tear film proteins, which can accumulate on lenses with wear, causing discomfort [6]. The objectives of this project therefore were to determine if PRG4 adheres to commercially available contact lenses, and to clarify whether PRG4 is able to maintain its boundary-lubricating ability at a cornea-contact lens biointerface in the presence of tear film proteins.

METHODS

PRG4 adsorption. A western blot was performed to assess adhesion of PRG4 on contact lenses. Samples were prepared by soaking commercial contact lenses Air Optix Aqua (AO), Acuvue Oasys (OAS), and Acuvue 2 (Av2) in bovine PRG4 [5] overnight. The lenses were then rinsed three times in saline to remove excess PRG4, and then heated to 70°C to release PRG4 adhered to the lenses. These samples were subjected to 3-8% SDS-PAGE western blotting to detect PRG4.

Friction tests. The lubricity of commercially available contact lenses OAS and Acuvue TruEye (TE) was analyzed using a custom cornea-contact lens friction test [1]. Lenses were soaked in an artificial tear solution (ATS), sent from collaborators at University of Waterloo, or ATS doped with PRG4 (ATS+PRG4), to challenge the lenses to a proteinaceous condition. Friction tests measure axial load and torque to calculate kinetic friction coefficients, $<\mu_{kinetic,\ Neq}>$. Statistics were analyzed using a two-way ANOVA test with lenses as one variable and sliding velocities as the other.

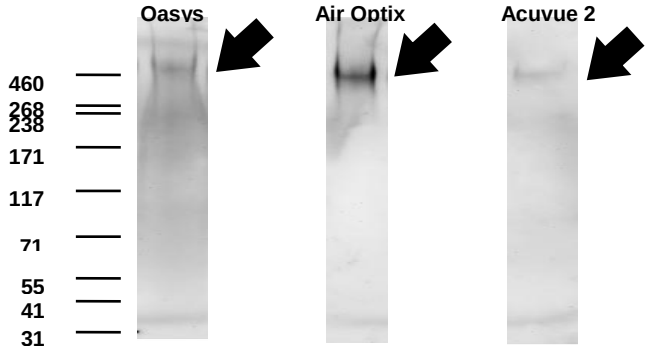

Figure 1. Western blot showing PRG4 adhesion on OAS, AO, and Av2 contact lenses soaked in PRG4.

RESULTS

Western blots showed strong PRG4 adhesion (denoted by the density of the PRG4 bands) on silicone hydrogel contact lenses (OAS and AO), and little adhesion on a conventional hydrogel lens (Av2) (Figure 1). Kinetic friction coefficients were not different for the ATS and ATS+PRG4 conditions. Values of $<\mu_{kinetic,\ Neq}>$ were higher for TE than OAS (0.35±0.18 TE; 0.28±0.14 OAS mean±SEM).

DISCUSSION AND CONCLUSIONS

These results demonstrate PRG4 adsorbs better to silicone hydrogel lenses compared to conventional hydrogel lenses. Adding silicone to a lens makes it more hydrophobic, allowing PRG4 to better adhere to it [6]. AO appeared to retain PRG4 the best for the lenses tested here. PRG4 had no apparent friction-reducing effect in ATS. This may be due to PRG4 binding to lipids in ATS and not being able to adhere to the lens. Future experiments are required to understand the dependence of PRG4's friction-reducing effects on hydrophobic moieties, either in contact lenses or in tears.

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