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The Friction Coefficient of Commercially Available Contact Lenses at a Cornea-Contact Lens Biointerface

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Abstract

Background: At the ocular surface, epithelial cells are subject to shear and friction forces during blinking. This can lead to wear damage, especially when there is inadequate lubrication in the presence of a compromised tear film[1]. Contact lenses are associated with increased lid wiper damage, epitheliopathy and tear film instability[2] caused by increased friction due to the lens material[3]. This may lead to dry eye disease. Due to this, lenses often include agents that attempt to improve surface properties. These properties, particularly friction, are therefore paramount to preventing ocular surface damage and discomfort.

Methods: A custom cornea-contact lens biomechanical friction test was used to test commercially available contact lenses (Air Optix Aqua, Acuvue Oasys, Acuvue2, and Acuvue TruEye Dailies) The contact lenses and human corneas (obtained from Lions Eye Bank, n=5) were articulated against each other in a saline bath at effective sliding velocities between 0.3-30 mm/sec and under loads of approximately 12-32 kPa. Friction coefficients were calculated from the axial load and torque measured during articulation of the test surfaces.

Results: Kinetic friction coefficients, $<\mu_{kinetic}, N_{eq}>$, in saline for each lens was approximately 0.08±0.02, 0.12±0.04, 0.15±0.05 and 0.09±0.02 for Acuvue2, Air Optix, TruEye and Oasys respectively (mean±sem). Values of $<\mu_{kinetic}, N_{eq}>$ in TruEye were significantly greater than those in both AC2 and Oasys ($p<0.05$), which were not similar to each other and Air Optix Aqua ($p>0.05$).

Conclusions: TruEye, a silicone hydrogel daily wear lens, had higher friction than both Oasys and Acuvue2, which were not significantly different from each other. These results suggest that the unique wetting agent contained in Oasys and TruEye do not significantly affect in vitro friction measurements. Future experiments will examine if adding ocular lubricants, such as hyaluronan and/or lubricin, can further reduce the friction of these lenses and ultimately improve in vivo wear.

Keywords: Boundary lubrication - Human Cornea - Contact Lens

References

1. Holly FJ, Holly TF. Advances in ocular tribology. Adv Exp Med Biol 350, 1994. pp. 275-283.
2. Glasson MJ, Stapleton F, Keay L, et al. Differences in clinical parameters and tear film of tolerant and intolerant contact lens wearers. Invest Ophthalmol Vis Sci 44.12, 2003. pp. 5116âĂŞ5124.
3. Yeniad B, Beginoglu M, Bilgin LK. Lid-wiper epitheliopathy in contact lens users and patients with dry eye. Eye Contact Lens 36.3, 2010. pp 140-143.