
Friction between lubricated soft contact lens and eyelid from free responses measurements

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Abstract

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1. Introduction

Friction coefficient is considered as a measurement for clinical comfort of soft contact lenses (SCLs). The comfort of soft contact lenses is affected by many factors, including those related to the patients and to contact lens material (1). This study aims to evaluate the friction at the soft contact lens-eyelid contact. In order to evaluate precisely the ultra-low friction at this contact, an original technique developed at the Laboratory of Tribology and System Dynamics (LTDS), called "Dynamic Oscillating Tribometer" (2), is used. A variety of soft contact lenses are tested with some lubricants under many physiological conditions. The results are discussed and compared with those in the literature.

2. Methods

A variety of soft contact lenses materials is tested in contact with a flat surface made of polyethylene terephthalate (PET) material with saline solution with and without hyaluronic acid under different physiological conditions. Different percentages of hyaluronic acid is tested in order to understand the effect of hyaluronic acid with saline solution on the soft contact lenses.

3. Experimental Setup

The dynamic oscillating tribometer consists of a pin-on-plane contact. This tribometer is based on a single-degree-of-freedom (SDOF) mass-spring oscillator system supporting the sliding contact. This tribometer allows us to measure the dynamic free responses at the contact between the SCL and PET. The friction is analyzed from the decaying envelope of the free response (3). Using a pseudo-polynomial friction law, the different friction contributions are identified by solving the non-linear equation of motion (4).

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4. Operating conditions

The experiments are performed at room temperature with applied normal loads between 50 and 250 mN and sliding velocities varying from 0 to 230 mm/s. The sliding speed corresponds to the blinking speed when closing and opening the eyelid. The applied normal load corresponds to the contact pressure of the eyelid on the cornea.

5. Conclusion

This research shows the feasibility of measuring friction at the eyelid-lens contact using the oscillating dynamic tribometer. The results have demonstrated that the precision is very high for low friction coefficient. This study presents the friction coefficient for different soft contact lenses. In this work, the effect of Hyaluronic acid in the saline solution has been discussed as well as the influence of different operating conditions.

6. References

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