Mechanical Performance and Profiles of Hydrogel Contact Lenses Under Central Point Load

Abstract

When a contact lens is under a central point load, its constitutive relation depends not only on the mechanical properties, such as elastic modulus of the hydrogel material, but also the thickness variations along the meridional direction.

Background

The previous research is focus on the uniform thickness contact lenses. However, the plus and minus diopter contact lenses show the inconsistent thickness. Myopic lenses (d<0) are thinnest at the apex along the optical axis and thick out gradually along the meridian (figure a), while hyperopic lenses (d>0) are thicker at the apex (figure b). This research is trying to find the different mechanical performance of different diopter contact lenses under central point load.

Goal

By using laser topography which is designed by undergraduate student M. Robitaille and Agilent T150 Universal Testing Machine with force and displacement resolutions of 30 nN and 10nm. The force-displacement figure and 2D profiles of different diopter lenses can be found.

Measurement results

2-D profiles of different diopter contact lenses under same point load

2-D profiles of +5 diopter contact lenses under different displacement central point load and F-D figure

Conclusion

The measurement results shows that the figure curves for minus and plus diopter contact lenses are different. And by comparing the profiles of different diopter contact lenses the reason of differences of F-D figures should be found. This research proved that properties of contact lenses under central point load will be influenced by lens geometry dominantly, rather than the materials of the lens. There are still many measurements need to be done. And the reason for differences of different profiles of F-D figures can be found and proved.

References

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Multiple load and unload F-D figure for +5 diopter lens