Profilometry Designed Free-Form Scleral Lens Aids in Vaulting Over Large Corneal Elevation Difference

Stacy Zubkousky OD, FSLS

Nova Southeastern University College of Optometry, Fort Lauderdale, Florida

Purpose

This case report details a patient post-radial keratotomy (RK) with a large difference in corneal elevation in the left eye. In addition to the diagnostic benefit of 3-D profilometry for scleral asymmetry, the report emphasizes the aid of profilometry in designing free-form lenses for highly irregular corneas with large differences in corneal elevation.

Background

A 48-year-old Hispanic man presented for a contact lens evaluation. He was referred by his corneal specialist to see if it was possible to fit his left eye in a lens, otherwise the ophthalmologist would proceed with a corneal transplant. He had a history of radial keratotomy in both eyes with advanced ectasia in the left eye greater than the right.

Exam Findings

VA (sc) OS: 20/400
BCVA OS with manifest refraction: 20/200
Kmax OS: 82.8 diopters
Pertinent corneal findings OS: RK scars with visible inferior ectasia

Contact Lens Diagnostic Fitting:

A diagnostic 19.0 diameter standard scleral lens was evaluated and was unable to vault over his inferior mid-peripheral ectasia of the left eye.

Diagnostic lens:
+0.25/19.0/8.50/3200 OR: -5.75 sph, VA: 20/25

Contact Lens Follow-up

A trial 19.0 diameter lens was designed in an oblate design. The lens cleared the central cornea with approximately 370 microns of central clearance after 20 minutes of lens settling (Image 1); however, this lens unsuccessfully vaulted the inferior corneal ectasia as seen in the anterior segment ocular coherence tomography (AS-OCT) image below (Image 2).

Trial lens:
-2.50 sph/9.0/19.0/3550, VA: 20/25

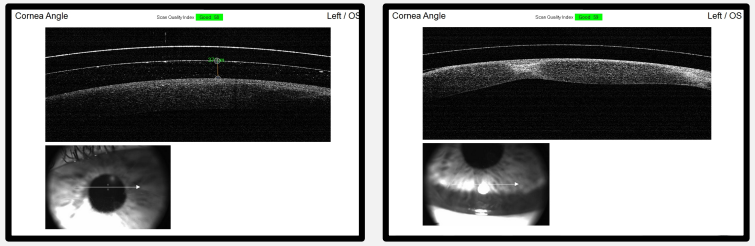

Image 1: *AS-OCT shows central corneal clearance. Image 2: A-OCT shows mid peripheral touch along inferior RK scars.*

Profilometry was then performed to visualize ocular shape including corneal elevation (Image 3).

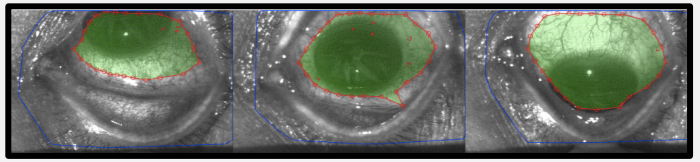

Image 3: *Images taken of superior, primary and inferior gazes to capture ocular shape data using one million measurement points.*

Results

Using profilometry, a 3-D image (Image 4) helped visualize an over 800-micron difference in corneal elevation that contributed to the poor fit with the standard, large diameter scleral lens.

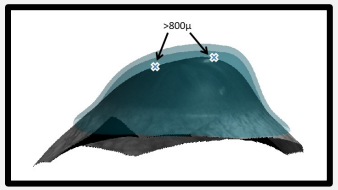

Image 4: *This image illustrates a greater than 800-micron elevation difference of the patient's cornea and a digital image of a free-form lens vaulting evenly over the cornea.*

Final Lens Design

A 17.50 diameter free form lens was designed to vault evenly over the entire cornea, including the highly elevated inferior mid-peripheral cornea.

Final lens: +8.17 sph/12.58/17.50/SAG 6288, VA: 20/20

Discussion and Conclusion

A corneal elevation with a difference of greater than 350 microns indicates the use of a scleral lens over a GP lens.[1] However, there is little documentation on how much corneal elevation difference indicates a free-form scleral lens.

3-D profilometry can give the clinician a more thorough understanding of ocular shape and can aid in designing a free-form scleral lens. These lenses can evenly vault over corneas with large differences in corneal elevation.

1. Zheng F, Caroline P, Kojima R, Kinoshita B, André M, Lampa M. Corneal Elevation Differences and the Initial Selection of Corneal and Scleral Contact Lens. Poster presented at the Global Specialty Lens Symposium. Las Vegas, January 2015.