Accurately Predicting Extreme Reverse Geometry Scleral Lens Fit in Post PKP Cases with Corneo-Scleral Topography

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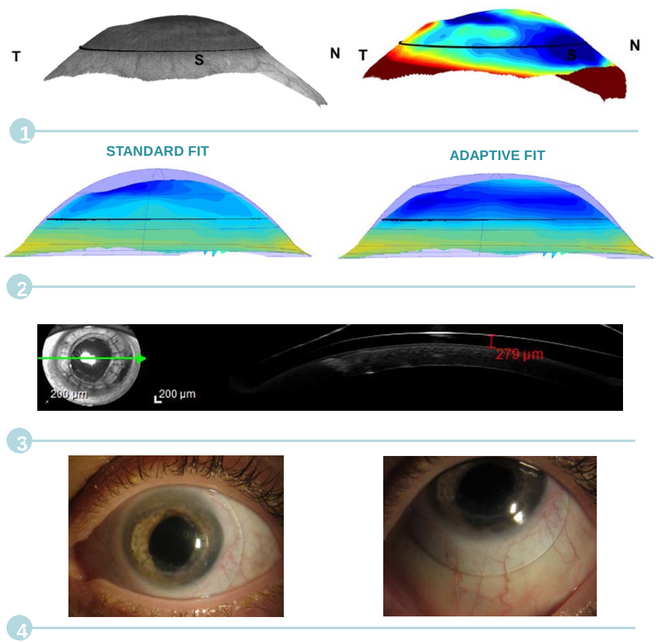
BACKGROUND

Because of the extreme central flattening that can occur post-penetrating keratoplasty (PKP), these cases represent a unique scleral lens fitting challenge to optimize central and optical zone clearances. Standard fitting set diagnostic lenses are not designed to help with these extreme cases. In the past, multiple remakes have been required to optimally fit these patients. However with the advent of a novel Corneo-scleral topography system, the sMap3D, virtually fitting of even the most extreme ocular surfaces is now possible .This report summarizes 2 such cases that each required a 19D reverse geometry scleral lens and were fit and dispensed with no design remakes required.

CASE DESCRIPTION 1

This 54-year-old female keratoconic patient with PKP suffered a globe rupture secondary to trauma that left her aphakic with UCVA= 20/400. The patient also had a history of retinal detachment. **Figure 1** shows the sagittal imaging of the front surface of the eye. The left image shows the ocular surface profile and the right image the color-coded elevation map. Both demonstrate an extremely flat central cornea with an irregular shoulder of elevation in the paracentral region (T=temporal, N=nasal, S=superior).

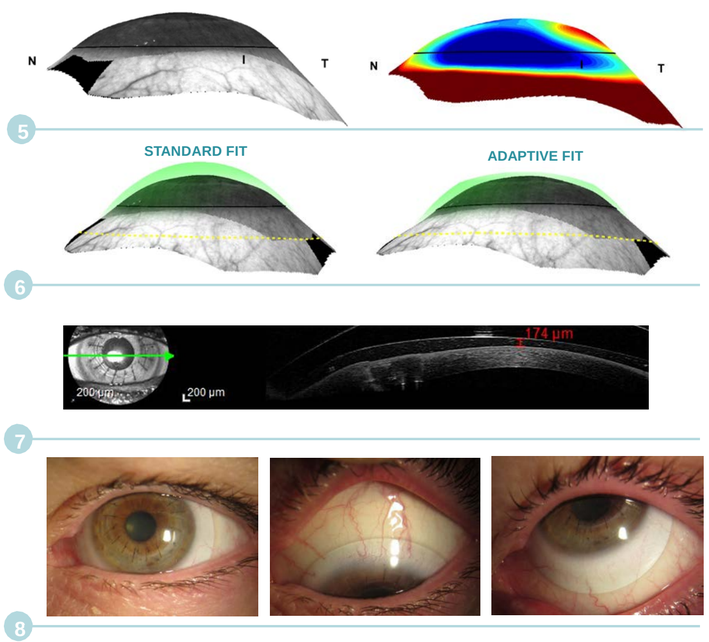
Utilizing the "standard fit" mode, which preserved the normal relationship between the base curve (BC) and first peripheral curve (PC1) of the Europa Scleral lens, the sMap3D software predicted a central corneal clearance (CCC) of 567µ to adequately provide good optical zone (OZ) clearance using a base curve lens of 44D and PC1 of 45D. **Figure 2** (left) shows the clearance of the standard Europa lens in purple overlying the color-coded ocular surface. The CCC was considered excessive so the eye was "virtually fit" using the adaptive fit software mode which breaks the relationship between BC and PC1 seen in diagnostic fitting lenses (normally the PC1 is slightly steeper because the Europa standard is a reverse geometry design) and attempts to "best fit" the requested CCC and OZ clearance. A BC (28.5D) had to be 19D flatter than PC1 [47.5D] (reverse geometry) to achieve a predicted pre-settled 300µ of CCC. **Figure 2** (right) shows the clearance of the adaptive fit Europa lens in purple overlying the color-coded ocular surface where lens clearance is more evenly distributed across the surface of the eye. The adaptive fit lens had a pre-settled central clearance of 279 µ as measured by OCT examination (**Figure 3**) and patient had a BCSVA of 20/60. The fit on the eye was excellent centrally and peripherally (**Figure 4**).



CASE DESCRIPTION 2

This 61-year-old female 7 months post PKP for keratoconus presented for scleral lens fitting. UCVA=20/400, BCSVA=20/100. **Figure 5** shows the sagittal imaging of the front surface of the eye; the left image shows the ocular surface profile and the right image the color-coded elevation map. Both demonstrate an extremely flat central cornea with an irregular shoulder of elevation in the paracentral region (T=temporal, N=nasal, I=inferior).

Utilizing the "standard fit" mode, the sMap3D software predicted a central corneal clearance (CCC) of 887µ to adequately provide good optical zone (OZ) clearance using a base curve lens of 45.75D and PC1 of 46.5D. **Figure 6** (left) shows the clearance of the standard Europa lens in green overlying the ocular surface image (dotted yellow line represents the edge of the scleral lens). The CCC was considered excessive so the eye was "virtually fit" using the adaptive fit software mode. To achieve a predicted pre-settled 300µ of CCC, the BC (27.5D) had to be 19D flatter than PC1 (46.5D). The adaptive fit lens (**Figure 6**, right) had a post settled clearance of 174 µ by OCT (**Figure 7**); the patient had a BCSVA of 20/30. The fit on the eye was excellent centrally and peripherally (**Figure 8**).



CONCLUSIONS

These 2 remarkably similar cases have, in the past, represented challenging fits, which required multiple visits and remakes. In these cases only a single fitting examination was required to virtually fit and design extreme (19D) reverse geometry lenses that provided accurately predicted central, optical zone, and limbal clearances as well as a comfortable peripheral haptic fit. The sMap3D corneo-scleral topographer has been demonstrated to be highly repeatable with regard to ocular sagittal height measurements and scleral toricity measurements[1]. Using stitching technology it can provide coverage 360° out to 16-18mm (necessary for scleral toricity measurements)[2]. It has been shown effective in designing lenses with scleral obstacles such as filtering blebs and pinguecula[3] as well as in cases with highly irregular scleral shapes not fit well with spherical or toric haptic scleral lenses.[4] A recent paper stated "*Corneo-scleral topography provides accurate measurement and shape analysis that allows practitioners to efficiently select the appropriate lens design to successfully fit an individual eye. Measurement of the sclera transitions the philosophy of fitting scleral lenses from art to science.*" [5]

REFERENCES

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DISCLOSURE: Drs. DeNaeyer and Sanders are shareholders in Precision Ocular Metrology, the manufacturer of the sMap3D® instrument. Dr. Sanders is a shareholder of and Dr. DeNaeyer is a consultant to Visionary Optics.