Scleral Lenses Have you Seeing Double? Utilizing Vertical Prism in Sclerals

Nicholas Gidosh, OD, FAAO

SALUS UNIVERSITY

PURPOSE

Scleral lenses have been steadily increasing in popularity over the last decade. As we learn more about them we find they are useful in managing a variety of conditions. They provide sharp gas permeable optics while offering comfort comparable to that of a soft lens. Scleral lenses have the benefit of being stable on the eye, showing little to no movement, along with being highly customizable. These two features may have implications in managing new conditions previously unexplored with scleral lenses. This case report describes the use of prism in a scleral lens to manage vertical diplopia.

METHODS/CASE REPORT

A 57 year old white male presented for a contact lens fitting with a history of keratoconus OU and pseudophakia OS. The patient was referred by a corneal specialist to try and improve his vision beyond his current contact lenses to avoid a corneal transplant. He reported he was fit with scleral lenses OU and mentioned he had discomfort with them that was worse OS. He was formerly an engineer and had visual demands at near with small detailed work. There was also a report of constant "ghosting" which affected his ability to drive in certain situations. His visual goal was to see better than 20/40 OS to meet his standard of visual performance and thereby avoid corneal transplant. His entering acuity was 20/30- OD and he was unable to read the chart OS due to ghosting. Slit lamp examination showed his habitual scleral lenses were touching the cornea in each eye. Staining was seen OU with scarring OS. Topography showed steepening much greater OS with less irregular astigmatism OD.

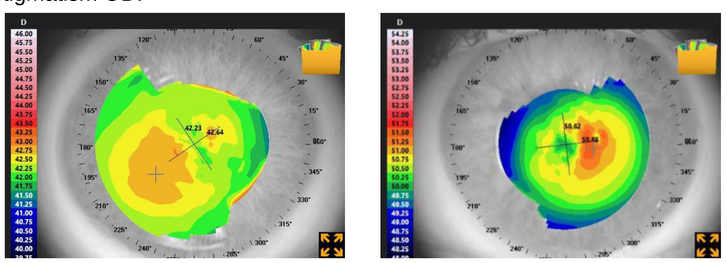


Figure 1: Normalized axial maps showed more steepening OS (right image) coinciding with greater corneal ectasia and more advanced keratoconus.

The patient was then refit into Custom Stable Elite scleral lens.

Lens Parameters

	Overall Diameter	Sagittal Depth	Base Curve	Power	Limbal Curves	Peripheral Curves
OD Initial	15.8 mm	4.87 µ	7.50 mm	-2.25	Standard	210 µ toric
OS Initial	15.8 mm	5.25 µ	7.03 mm	+7.75-1.50x010	100 µ flat Q1, Q4	210 µ toric

Upon dispense the lenses displayed initial clearances of 200 µ over the apex of the cones and no rotation. VA was improved to 20/20 OD and 20/40 OS but he still noticed "ghosting." The patient tried the lenses for two weeks and still complained of the same symptom at follow up. When asked to describe the symptom more he explained a tail coming off the letters and seeing two images on top of each other. He went on to describe how he felt like he had poor depth perception which also affected his ability to drive and catch softballs thrown to him. Further review of systems revealed a history of head trauma from multiple motor vehicle accidents which resulted in left sided nerve damage. Binocular testing showed 6$^{\Delta}$ intermittent left hypertropia.

CASE REPORT/RESULTS

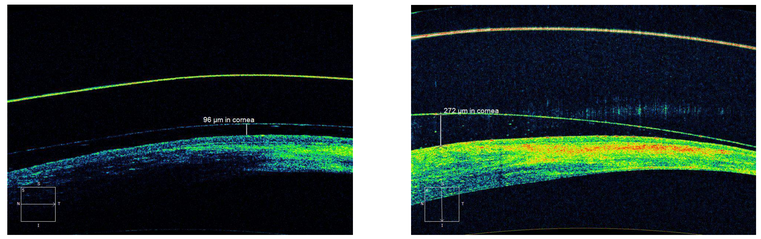


Figure 2: OCT of initial lens central clearance OS (left) compared to central clearance with prism lens (right).

The patient was presented with the option of prism glasses over his contacts as well as the option of trying prism incorporated into his contacts. The patient elected to try prism in his scleral lenses. The left lens was redesigned to incorporate 3$^{\Delta}$ of base down prism to help with vertical fusion. This lens was chosen because it was the worse seeing eye and had a higher plus power along with this patient's lenses decentering inferiorly. This allowed the prism to be generated from a combination of decentered optics and being ground into the optical zone. The patient followed up to trial the lens.

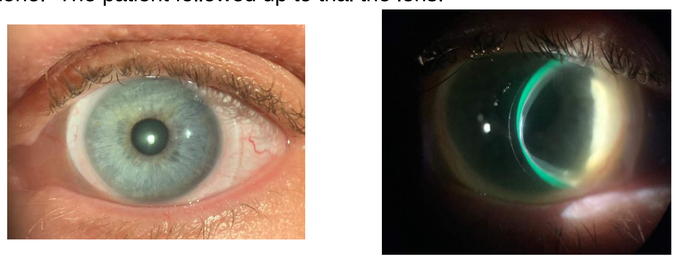


Figure 3: The increased thickness in the bottom half of the lens caused it to decenter inferiorly. The resulting prism power was a function of adjusted thickness across the lens's optic zone (3$^{\Delta}$ base down as specified) as well as inferior decentration of a plus power lens.

The lens showed appropriate clearance across the surface of the cornea, and the patient noticed an immediate improvement in his binocular vision. However, the patient followed up two weeks later and explained that despite there being an overall improvement in visual function from the binocularity, the vision was worse OS. VA was 20/60 OS with +0.50-1.00x010 over refraction giving 20/40. VA was 20/25 OD which improved to 20/20 with +0.25-0.75x002 with 12 degrees left rotation. Upon trial framing he reported there was still mild diplopia. Binocular testing showed there was still 1$^{\Delta}$ of vertical deviation. Both lenses were reordered with these over refractions and of 1$^{\Delta}$ base up prism was added to the lens OD. Additionally toricity was added to peripheral curves to prevent rotation. The final lenses provided resolution of diplopia and ghosting. However, VA was still only 20/60 OS with no improvement from over refraction. The lens showed appropriate clearance after settling and no rotation. The patient decided to use both a non-prism lens with spectacles for detailed tasks and night driving and keep a prism scleral lens to use when being more active.

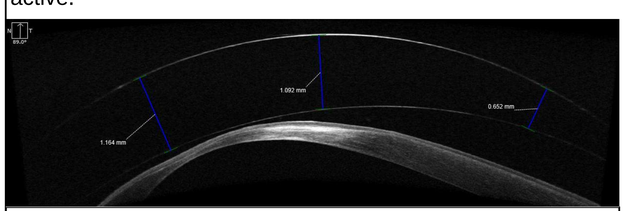
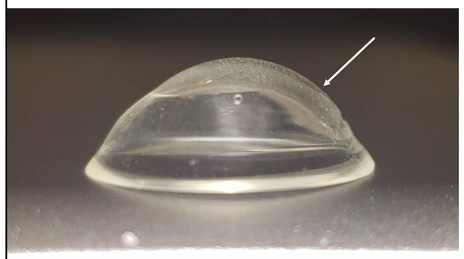


Figure 4: OCT (left) showing clearance over apex of cone OS after settling. A vertical section through the lens shows distinct variations in thickness across the optic zone to achieve prism power. The right image shows a decentered optic zone which generates additional prism power.

DISCUSSION

In Focal Points, a standard prism ballast is a calculated decentration factor; this is how far the center of the base profile is offset from the center of the front profile. Thickness is added to the lens evenly to ensure the thin side (opposite side of the prism ballast) still meets the minimum junction thicknesses. A prism ballast can be added at any meridian from 0 to 359. A slab off can be defined within the last anterior zone of the lens to reduce the edge thickness of the prism ballast.



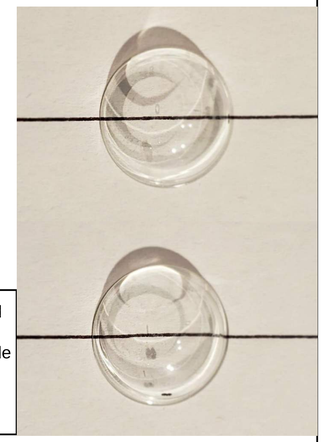


Figure 5: The above image shows increased thickness added to bottom of the lens to create base down prism power. The apparent effect of this power seems small when viewed outside the contact lens where the base down oriented lens (bottom right) only seems to move an image slightly compared to the upper right image where the prism is oriented along the line.

Lens Parameters

	Overall Diameter	Sagittal Depth	Base Curve	Power	Limbal Curves	Peripheral Curves
OD Final	15.8 mm	4.92 µ	7.50 mm	-2.00-0.75x014	100 µ flat	300 µ toric
OS Final	15.8 mm	5.25 µ	7.03 mm	+8.25-2.50x010	100 µ flat Q1, Q4	300 µ toric

In this case prism incorporated into scleral lenses was helpful in restoring functional binocular vision for the patient despite not reaching the goal of 20/30. He was happy enough with the outcome to not purse a corneal transplant and continue wearing contact lenses.

CONCLUSION

The application of scleral lenses is vast since they are helpful in managing conditions for normal eye and irregular cornea patients. Advanced manufacturing technology allows high precision and customization options to improve clinical performance and meet new challenges as they arise. In this case, base down prism helped stabilize a lens in position and provide improved vertical fusion abilities. This can translate to better visual performance from improved binocularity and stereopsis. However, it may have a negative impact on quality of vision with decentration of optics. In this case the acuity was not satisfactory for the patient with the prism lens despite the binocularity. This may be complicated by the amount of prism required and the limitation of an eye with aberration issues. Further research is required in this area.

REFERENCES

Available upon request

Thank you to Valley Contax for their support in manufacturing lenses