Drop the Base: Prism Incorporation in Scleral Lenses for Management of Vertical Phorias

Christopher Albright, OD; Josh Lotoczky, OD, FAAO; Chad Rosen, OD, MBA, FAAO

FERRIS STATE UNIVERSITY
VISION RESEARCH INSTITUTE

Introduction

Small amounts of vertical heterophoria have been shown to create visual discomfort when left uncorrected. Patients may experience headaches, eyestrain, double vision, motion sickness and head/neck/back pain. This has traditionally been difficult to correct with contact lenses, often requiring an overlying spectacle correction. Attempts to correct vertical imbalance using a corneal gas permeable lens comes with the added challenge of the prism affecting the fit/position of the lens and/or potentially causing corneal desiccation in the area of the increased lens thickness. This case series shows how vertical phorias could potentially be managed using toric haptic scleral lenses, which allow the practitioner to properly position vertical prism in the optic zone of the lens.

Methods

Two 24-year-old Caucasian females, patient 1 and patient 2 respectively, presented separately to the clinic with complaints of intermittent vertical diplopia. Patient 1 has a history of high myopia, retinal detachment, scleral buckle and comitant 1.5^{Δ} right hyperphoria in primary gaze with subsequent binocular diplopia. Patient 2's history was remarkable for a comitant 1.0^{Δ} right hyperphoria in primary gaze and binocular diplopia. Both patients wore overlying spectacle prismatic correction to alleviate their symptoms. Here a novel solution was proposed to incorporate vertical prism into a scleral lens to help alleviate spectacle dependence while managing their diplopia.

	Overall Diameter	Sagittal Depth	Base Curve	Power	Limbal Curves	Peripheral Curves	Prism
Pt 1 OD	15.8 mm	4570 µm	7.85	-7.00 -1.25 x030	200 µm flat	210 µm Toric	1.5 BD
Pt 1 OS	15.8 mm	4570 µm	7.85	-7.50 -1.25 x070	200 µm flat	210 µm Toric	
Pt 2 OD	15.8 mm	4390 µm	8.23	+1.25 sph	200 µm flat	210 µm Toric	1.0 BD
Pt 2 OS	15.8 mm	4390 µm	8.23	+1.50 -0.75 x055	200 µm flat	210 µm Toric	

Case Report

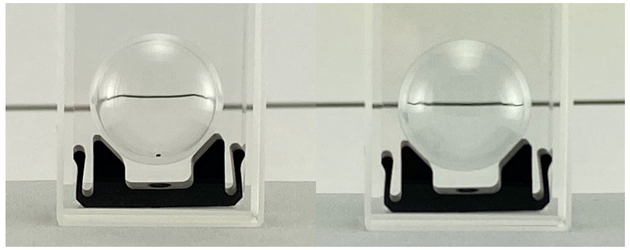

Figure 1: Left: Base down prism within the optic zone causes upward image displacement. Right: No prism is present in the optical zone of the lens thus no prismatic effect.

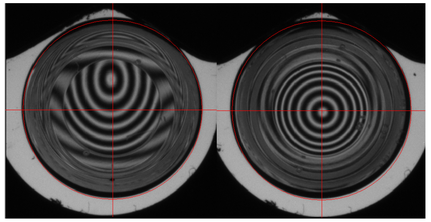

Figure 2: Schlieren fringes are produced by light passing through a Schlieren filter within the NIMO TR1504. Fringes displace vertically in the left image secondary to the base down prismatic effect. No displacement is observed in the right image that lacks prism.

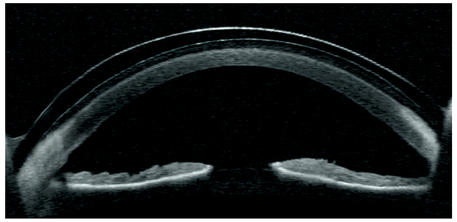

Figure 3: A vertical cross section depicts the increase in thickness profile from right to left due to the addition of base down prism.

Results

The results of the cases are as follows:

- Custom Stable Elite lenses from Valley Contax were successfully fitted for both patients
- Base down prism was successfully integrated within the optical zone for each patient (Figures 1,2, & 3)
- Subjective and objective data support correction and resolution of vertical misalignment and diplopia
- Habitual vertical phorias were successfully neutralized with scleral lens prism in both patients

Discussion

Small amounts of vertical disparity can disrupt binocularity, resulting in diplopia. Traditionally these vertical deviations are managed with a spectacle correction, however, this can be frustrating in patients who desire to wear contacts for pleasure or sport. Scleral lenses offer a platform where prism can be incorporated successfully. In order to achieve the desired prismatic effect, prism is introduced into the optical system by altering the anterior surface profile within the optical zone and utilizing toric haptics to properly stabilize/position the prism. As prism is added, the thickness of the lens increases towards the direction of the prism base. In both of our cases the prism was base down, thus the lenses were thickest inferiorly as seen in Figure 3. Prism incorporation within a scleral lens has its limitations. As more prism is added the thickness and subsequently lens mass increases, leading to problems with centration and potential issues with oxygen transmission. Currently, only about 5^{Δ} of prism can be added before these limitations pose an issue. Fortunately, both patients required less than 5^{Δ} of prism to reach a positive outcome, restoring binocularity while maintaining sharp visual function.

Conclusion

Scleral lenses can be used as a novel solution to correct small amounts of vertical deviation using toric haptics to control both lens orientation and vertical prism alignment within the optical zone of the lens.

References:
1. Vincent J. Stephen, Fadel Daddi. Optical Considerations for Scleral Contact Lenses: A Review. *Cont Lens Anterior Eye.* **2019**, 42 (6), 598-613.
2. Joannes, Luc. NIMO: a new tool for asphere and free-form optics measurement. *Proceedings of SPIE 6341.1* **2006,** 634134-634134-7.

The investigators would like to thank Valley Contax for providing scleral lenses to the patients in this case series.