Horizontal Diplopia Corrected By Scleral Lens

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Background

Traditionally, diplopia has been corrected using prism spectacles, surgery, or occlusion.[1] Due to gravitational forces and patient subjective comfort, corneal gas permeable lenses have been used to correct minor vertical diplopia with base down prism only.[2]

Recently, scleral lenses (SLs) have been used to correct for both vertical and horizontal diplopia.[3,4] Theoretically, up to 5 diopters of prism in any direction can be incorporated into the optical zone of a SL if a lock-and-key fit results in rotational stability on the ocular surface.[5]

A corneo-scleral topographer creates a single topographic profile (Fig. 2) by stitching together three images (Fig. 1) to aid in the design of a freeform SL (Fig. 3).[6] Unlike placido disc topographers, this corneo-scleral topographer uses fluorescence to detect the ocular surface shape and is not affected by poor tear film, corneal scarring, or other irregularities.[6]

Case History

Chief Complaint:

- A 39-year-old Caucasian female with occasional horizontal diplopia at distance wanted to wear contact lenses for exercise

Medical History:

- Schizo-affective disorder at 16 years old

Medication History:

- Depakote, Lithium, Risperidone, and Lamictal (previous use)
- All include side effects of double vision or uncontrolled eye movements

Ocular History:

- Failed vision therapy attempt at 20 years old
- Historically used 6 base out (BO) prism in spectacles for 19 years

Tables

Baseline Findings	OD	OS
Lensometry	+ 0.25 – 1.00 x 065, 20/20 prism: 3 BO	pl – 1.25 x 125, 20/20-1 prism: 3 BO
Manifest Rx	+ 0.25 – 1.00 x 065, 20/20 prism: 3 BO	pl – 1.25 x 125, 20/20-1 prism: 3 BO
Keratometry Values	42.25 @ 177 43.12 @ 087	42.12 @ 160 43.27 @ 070
Intraocular Pressure	13 mmHg	17 mmHg
Cover Test	Ortho at distance and near through spectacles	
Pupils, EOMS, CVF	Unremarkable	
Slit Lamp Exam	Unremarkable	

Table 1. Baseline findings at initial visit.

Visit	1		2		3	
Lens Design	Pair 1: Toric Landing Zone*		Pair 2: Freeform SL*		Pair 3: Freeform SL	
	OD	OS	OD	OS	OD	OS
Prism Diopters (BO)	0	1.5	1.5	1.5	1.5	1.5
Visual Acuity	20/25-3	20/200	20/30+	20/40	20/25-	20/20-
Rotation in Degrees	45 right	50 left	80 right	63 left	0	7 right
Visit	**4**		**5**		**6**	
Lens Design	Pair 4: Freeform SL*		Pair 5: Freeform SL		Pair 6: Freeform SL	
	OD	OS	OD	OS	OD	OS
Prism Diopters (BO)	0	1.5	1.5	1.5	1.5	1.5
Visual Acuity	20/20	20/20-	20/25-	20/25-	20/25	20/25-
Rotation in Degrees	NA	0	0	0	0	0

Table 2. Summary of findings through trial SLs. No optical prism was in the right lens of trial pair 4 as this lens had a front surface toric pre vscription that corrected for residual astigmatism. Although visual acuity improved, the patient reported diplopia. * = Subjective report of diplopia

Trial Pair 3	Diameter	Power	Prism Diopters	Material
OD	16.5 mm	-0.25 SPH	1.5 Base Out	Contamac
Fit description	CC 250 um / adequate mid periphery and limbal clearance Adquate peripheral alignment 360 / no rotation			
OS	16.5 mm	-1.85 SPH	1.5 Base Out	Contamac
Fit description	CC 150 um / adequate mid periphery and limbal clearance Adquate peripheral alignment 360 / 7 deg right rotation			

Table 3. Parameters and fit of finalized scleral lenses (pair 3).

Clinical Insights

Stability

- Lock-and-Key fit achieved when converting from a traditional back surface landing zone to a customized freeform SL
- Poor lens stability can lead to tear reservoir debris and late forming bubbles (Fig. 4)

Clarity

- Currently, front surface astigmatism and optical prism may not be combined into a single SL
- SL decentration may cause an uneven tear reservoir with prismatic effects which may affect vision
- Necessary prismatic power in SLs may differ from spectacles

Figures

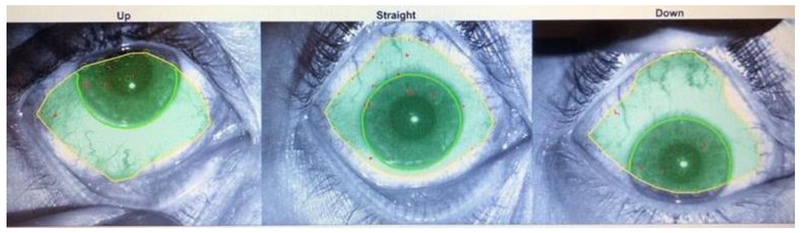

Figure 1. Patient images after fluorescein instillation in primary, up, and down gaze.

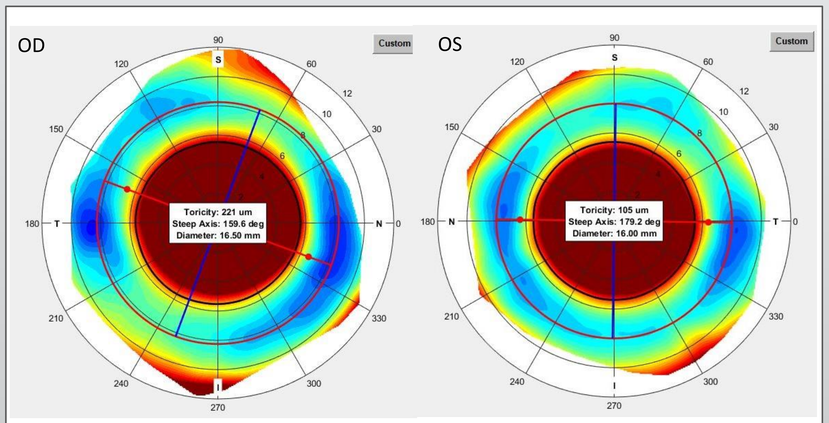

Figure 2. Topographical scleral elevation map showing greater with-the-rule scleral toricity in the right eye.

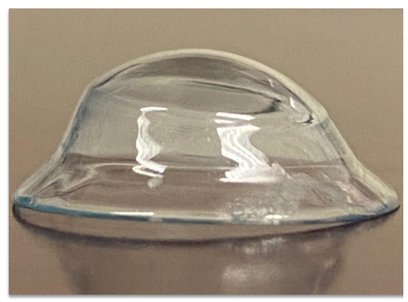

Figure 3. Side profile of prismatic scleral lens. Note thickened optic zone.

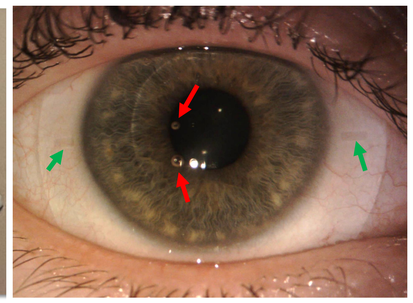

Figure 4. No rotation seen in a scleral lens with 1.5 BO prism. Green arrows highlight lens rotation markings. Red arrows highlight late forming bubbles.

Conclusion

Small amounts of horizontal diplopia can be corrected with SLs. Ensure rotational stability when incorporating horizontal prism in SLs with a customized freeform landing zone designed with data gathered using a corneo-scleral topographer.

References

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