Orthokeratology: Reset to Reassess

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Background

Orthokeratology (OK) is a practice that uses reverse geometry designed, highly oxygen permeable contact lenses to reshape the cornea.[1,2] Worn at night and taken off during the day, this temporarily reduces or eliminates refractive error via central epithelial cell fluid redistribution. The effects of overnight OK lenses are prompt, with changes seen after the first night of lens wear and corneal stability achieved after seven to thirty days.[3] This process is also reversible, as discontinuation of lens wear will all the cornea to rebound back to its original shape and power.[4] Continuing care for established OK wearers can be challenging as numerous lens designs are available globally and intricate design details are often not easily recognizable on eye.

Case Presentation

Visit 1:

A 22-year-old Asian female presents for OK fitting of the right eye only

Chief Complaint: Decreased vision OD, lens is from from China and is 2+ years old

Ocular History:

- Orthokeratology user for 4 years, each eye was fit separately

Presenting sc VAs:

- 20/40 OD, 20/30 OS, 20/20-1 OU

Manifest Refraction:

- OD: -3.75-0.50x020, 20/20
- OS: +0.25-1.00x180, 20/20

Slit Lamp Findings: Unremarkable OU

Topography: Incomplete treatment zone OD (Fig. 1)

Left eye will be omitted from remainder of poster.

Habitual Lens Observations:

- 9.08 Base curve (BC)/10.5 overall diameter (OAD)/plano SPH (limited information)
- Refraction over lens (ROL): -0.25 DS (20/20)
- Fit: good centration, light central bearing, paracentral pooling, mid peripheral bearing, adequate edge lift 360

Initial Trialed Diagnostic OK Lens:

- 9.2 BC /10.50 OAD /550-600 RZD /33 LZD /+0.50 SPH / 0.167 CT
- VA: 20/20-1
- ROL: +0.25 SPH (20/20-)
- Fit description: light central bearing, paracentral pooling, midperipheral bearing, thin edge lift 360, adequate centration

Assessment:

- Previous OK wearer
- Patient demonstrated adequate comfort and vision with ROL ith diagnostic OK lens OD.

Plan:

- Dispense: OD: 9.2 BC / 10.50 OAD / 550-600 RZD / 33 LZA / +0.50 SPH / 0.167 CT
- Pt to wear original left lens with dispensed right lens to observe fit
- Order lens: 9.3 BC /11.0 OAD / 500-600 RZD / 34 LZA / +0.50 SPH / Grn
- If further improvement is not seen, consider wash out period before re-fitting

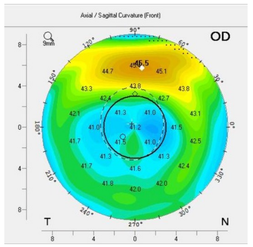

FIGURE 1. Baseline axial topography with habitual OK lens.

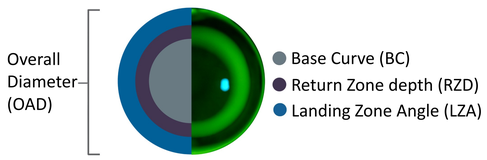

FIGURE 2. Paragon CRT® legend orthokeratology lens diagram.
Photo credit: CooperVision Specialty EyeCare

Exam Findings of Right Eye

TABLE 1. Summary of pertinent findings after each visit.

VISIT 1	Unknown Orthokeratology Lens		
	VA sc	Manifest Refraction	Keratometry
	20/40	-3.75 DS, 20/20	41.25 x 42.37 @ 084
	Trial lens #1: 9.2 BC / 10.50 OAD / 550-600 RZD / 33 LZA		
	VA cc	Refraction Over Lens	Wear Time
	20/20-1	+0.25, 20/20	14 nights
Visit 2	VA sc	Manifest Refraction	Keratometry
	20/30-1	-1.00-1.00-x070, 20/20	40.0 x 40.5 @ 089
	Trial lens #2: 9.3 BC / 11.0 OAD / 500-600 RZD / 34 LZA		
	VA cc	Refraction Over Lens	Wear Time
	+20/30-2	+0.50-1.25x066, 20/20	7 nights
Visit 3	VA sc: 20/30-	WASHOUT PERIOD: 3 DAYS	
VISIT 4	VA sc	Manifest Refraction	Keratometry
	20/25	-1.75-0.50x068, 20/20	41.12 x 41.87 @ 067
	Trial lens #3: 9.3 BC / 10.50 OAD / 500-600 RZD / 33 LZA		
	VA cc	Refraction Over Lens	Wear Time
	20/15-	+0.50 DS, 20/15	4 nights
Visit 5	VA sc: 20/50	WASHOUT PERIOD: 14 DAYS	
VISIT 6	VA sc	Manifest Refraction	Keratometry
	20/200	-4.25-0.25x095, 20/15-	42.1 x 43.4 @ 091
	Trial lens #4: 8.9/10.50/525-575/33		
	VA cc	Refraction Over Lens	Wear Time
	20/20-1	+0.50, 20/20	12 nights
Visit 7	VA sc	MRx	Keratometry
	20/20-	+0.25 DS, 20/20-	40.3 x 41.1 @ 093
	FINALIZED Trial lens #5: 8.9/10.50/525-600/33		
	VA cc	Refraction Over Lens	Wear Time
	20/20	+0.50, 20/20	Current Lens (5+ months)
Visit 8	VA sc	Manifest Refraction	Keratometry
	20/20	+0.50, 20/15	40.4 x 40.5 @ 031

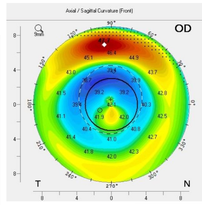

FIGURE 3. Axial map from visit 2 after wearing trial lens #1 for 14 nights. Note incomplete treatment zone and central island.

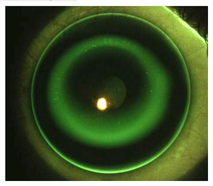

FIGURE 4. Photo of trial lens #2 taken during visit 2. Note typical bull's eye orthokeratology pattern.

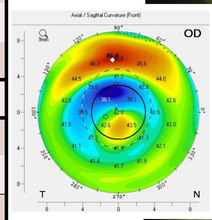

FIGURE 5. Axial map after 3-day washout period. Note incomplete corneal rebounding.

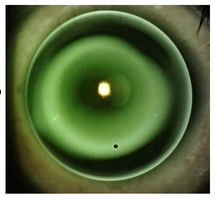

FIGURE 6. Photo of trial lens #3 taken during visit 4. Lens dispensed due to adequate on eye findings combined with a decent fluorescein pattern.

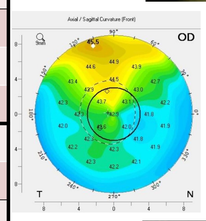

FIGURE 7. Axial map after 14-day washout period. Note near complete corneal rebounding.

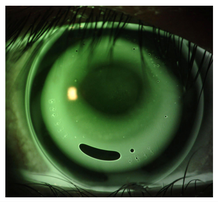

FIGURE 8. Photo of trial lens #4 taken during visit 6. Note uneven RZD with bubble indicating need for increased RZD difference design.

Clinical Insights

The return zone depth (RZD) accounts for the sagittal depth of an orthokeratology gas permeable lens. A clinician aims for an ideal circumferential RZD to ensure good centration, adequate compressive forces, and a uniform landing of the lens on the cornea. In some cases, a toric cornea may result in an uneven landing, incomplete peripheral alignment, and lens decentration. A lens with a difference in RZD (Fig. 9) offers different depths at two meridians to account for corneal cylinder. Some OK designs also allow for a dual axis landing zone angle (LZA), enhancing circumferential edge lift on a toric peripheral cornea.

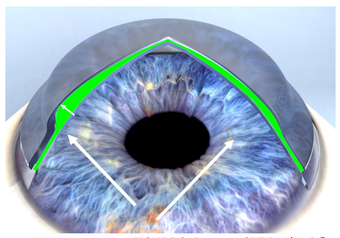

FIGURE 9. Paragon CRT Dual Axis®
Photo credit: CooperVision Specialty EyeCare

Final Examination

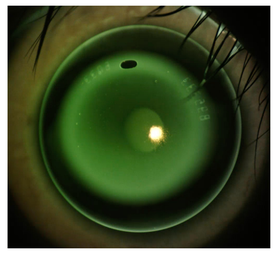

FIGURE 10. Sodium fluorescein pattern of final lens on right eye.

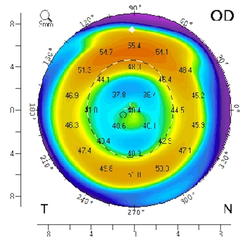

FIGURE 11. Axial map taken at visit 8 after finalized lens had been worn for 1 month.

Conclusions

Fitting orthokeratology lenses on a patient with unknown previous parameters will have a better success rate after an adequate washout period with discontinuation of habitual lens wear. Although in-office findings may appear promising (Table 1, Fig 4), overnight corneal reshaping outcomes truly can be unpredictable. A two-week corneal rebound period was found to be effective in reversing the refractive changes of prior OK lens wear and the subsequent OK fitting process was straightforward.

Peripheral corneal astigmatism may prevent the creation of necessary compressive forces as a semi-closed environment is not fully achieved. If the peripheral corneal elevation difference is greater than 14 microns when measuring the two meridians at the 8mm chord on topography, a dual axis design may be indicated.

Contemporary orthokeratology lens designs are complex and allow for meridional sagittal depth differences in both the return zone and landing zone. Manufacturer consultation can be an invaluable resource when fitting challenges are encountered.

References

1. Vincent, Stephen J., et al. "BCLA Clear - Orthokeratology." *Contact Lens and Anterior Eye*, Elsevier, 25 Mar. 2021,.
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Acknowledgments

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