Two curves are better than one: Management of post-refractive myopia with a novel custom-soft dual base curve lens design

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Introduction

LASIK and PRK are common corneal refractive surgeries for myopia that can potentially regress post-operatively. Due to the nature of ablation, the resultant oblate-shaped cornea often leads to an unstable fit with conventional soft contact lenses, thus inadequate vision and discomfort. Additionally, other post-LASIK complications such as dry eyes and post-refractive ectasia can render unique challenges to contact lens fitting options for patients who may be reluctant to return to vision correction after refractive surgery.

Post-surgical corneas are oblate with a flatter central curvature relative to peripheral curvature. Modern mass-produced soft contact lenses have a constant base curve that is prolate. Specialty lens modalities such as post-LASIK GP and scleral lenses incorporate oblate designs to better contour this corneal shape; however, these options require more adaptation to handling and comfort.

Novel Lens Design

A novel custom soft contact lens design was augmented with a flatter central BC and steeper peripheral BC to provide a more optimal fit for individuals with post-refractive corneal shape while remaining in a more common contact lens modality.

The material is a latheable Silicone Hydrogel (SiHy) material; The ability to lathe cut the lenses, similar to a GP lens, allows for advanced customization.

Figure 1: Schematic showing new reverse curve peripheral lens profile: in this design we specify a peripheral curve radius that is steeper than the base curve. This is specified in .10 mm steps. The use of the OZ controls when the peripheral curve begins, essentially where the steepening starts. Since most post-surgical corneas have a central ablation area of approximately 8.00mm this is often a good starting point for the OZ.

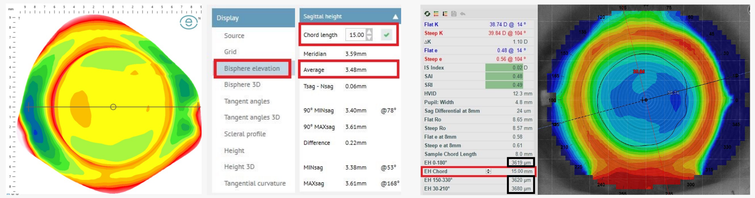
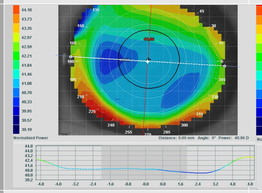
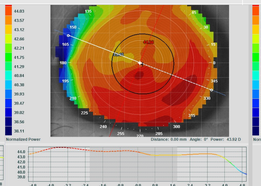
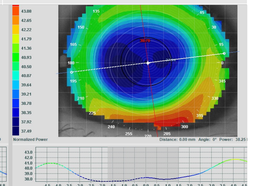


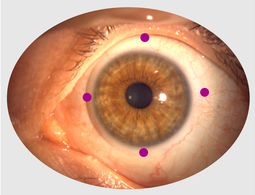
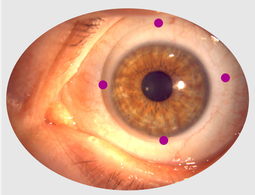
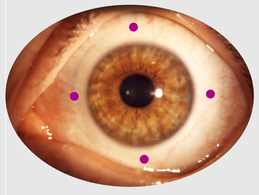
Figure 2: Sagittal height of lenses was predicted using a comparison and average of digital data generated by profilometry biosphere elevation sagittal height measurement (left) and placido disc ring extrapolation (right), both at chords of 15.0mm

Selected Case Series and Results

- All cases unable to wear conventional lenses at BC 8.4, 8.6, or 9.0 d/t instability of vision and
- Patients declined hard specialty lens modalities and requested soft lenses for perceived handling ease
- Optical zone (OZ) started at 8.0mm for all lenses
- Left eye (OS) shown for all cases

	PATIENT A	PATIENT B	Patient C
Surgical Hx	PRK	PRK	LASIK
Regression Rx	-1.75-0.50x100	-0.75-0.25X165	-1.00-0.25X075
Shape Profile			
HVID	12.0mm	11.7mm	11.9mm
Profilometry Sag	3890um	3830um	3480um
Placido Sag	3921um	3884um	3599um
Final Lens Sag	3961um	3651um	3639um
Lens Central BC	9.0	8.5	9.4
Lens Peripheral BC	8.5	8.2	8.5
Lens Diameter	14.8mm	14.5mm	15.0mm

Comparison of Reverse Curve to Conventional Lenses

	PATIENT A		
BC/Lens	8.5/Commercial	9.0/Commercial	9.0;8.5/Custom
Comments	• Slight decentration • Flexing vision with blink • Never clear VA	• Significant decentration • Excessive movement • Clear VA between blinks	• Best centration • WNL movement • Clear VA
Lens Schematic			
Anterior Segment Photo (Slit Lamp)			

Discussion

This novel dual BC soft CL design demonstrates the possibility to fit the oblate shaped cornea without excessive central clearance and land adequately in the periphery for acceptable lens movement; consequently, the device may provide more optimal fits which result in stable vision correction and all-day comfort.

Fully digital design is becoming more possible than ever using may tools on the market which are capable of imaging the comprehensive eye. The Pacific University Scleral Sag study highlights diversity in sagittal height of standard soft contact lenses and highlights the importance of matching appropriate sagittal height of soft contact lenses to the anterior eye, for best comfort and performance.

Multifocal and toric options will be needed to further explore the clinical use of dual BC soft contact lenses, as these may be less forgiving than single vision powers with lens flexure; nonetheless possibilities for soft lens customization are expanding, as rigid GP lenses have, with improved lathing and materials

Conclusions

Many patients undergo refractive surgeries to seek freedom from spectacles and post-operative vision challenges cannot be overlooked. Specialty contact lenses can accomplish improved fit, comfort, and vision compared to conventional contact lenses. Understanding a patient's corneal shape and how to customize soft contact lenses to better contour the unique eye can achieve an optimized contact lens fit.

This novel custom soft, oblate, dual base curve lens design was effective for several post-refractive contact lens fittings. Further study will be needed to elucidate impact of other lens fitting parameters used in conjunction with custom-soft dual base curve designs.

Offering a more personalized contact lens option can help satisfy the needs of our patients and enhance their quality of life.

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