Everted Soft Contact Lens Overnight Orthokeratology in a Post-LASIK Patient

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Introduction

Myopic LASIK results in an oblate cornea that may complicate the fit of a regular geometry contact lens. Regression of myopia following LASIK may affect up to 10% of eyes with low to moderate myopia.[1] The oblate post-LASIK cornea and other post-surgical complications like dry eye may also decrease a patient's comfort in a daily wear or regular geometry contact lens. A reverse-geometry lens provides an optimal fit for an oblate cornea and may be used for daily wear or overnight wear. This case explores overnight wear of an everted high-minus soft contact lens (SCL) to induce an orthokeratology (OK) treatment on a patient experiencing post-LASIK refractive regression.

Case Report

AB is a 34-year-old patient who underwent LASIK at age 26. He has noticed a gradual decrease in vision throughout the years and presented to our clinic interested in attempting off-label overnight orthokeratology.

Manifest Rx

OD: -0.50 -0.25 x 032 **BCVA:** 20/20^{+} **scVA OD:** 20/25^{-}

OS: -0.75 -1.25 x 165 **BCVA:** 20/20^{+} **scVA OS:** 20/30^{-2}

AB was fit with custom OK lenses on both eyes and wore the lenses for one month without ocular complications. Despite the adequate fit and comfort of the lenses overnight, the treatment zones continued to decenter inferiorly.

AB was able to achieve 20/20^{+} vision in both eyes, but discontinued OK in his right eye due to glare and difficulty studying for long periods of time.

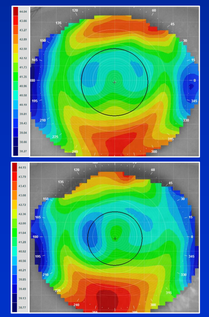

Figure 1. Right (top) and left eye (bottom) baseline topographies
K's (Right): 41.06/40.09 @ 014
K's (Left): 41.27/40.11 @ 166

10-Day Ortho-K Treatment Results and Lens Fit

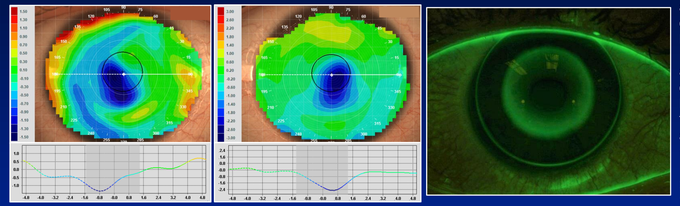

Figure 2 (Left). Right eye post-treatment axial map exhibiting inferior treatment zone decentration when compared to baseline. **BCVA 20/20+**
Figure 3 (Center). Left eye post-treatment axial map exhibiting inferior treatment zone decentration. when compared to baseline. **BCVA 20/20+**
* The pupil size in **Figures 2 and 3** are affected by the white light reflecting the mires off of the cornea. *
Figure 4 (Right). Right eye fluorescein pattern at initial custom OK lens dispense revealing a centered lens and optic zone.

Overnight Everted SCL "Ortho-K" Results

An everted high minus (-10.00DS), high modulus SCL approved for extended wear (EW) was trialed on the right eye and AB continued OK on the left eye. After 10 days of wear on the right eye, topographies revealed large, well-centered TZ and an appropriate amount of treatment leaving the patient 20/20+ throughout day without ocular complications. AB decided that he would like to also initiate SCL OK on his left eye.

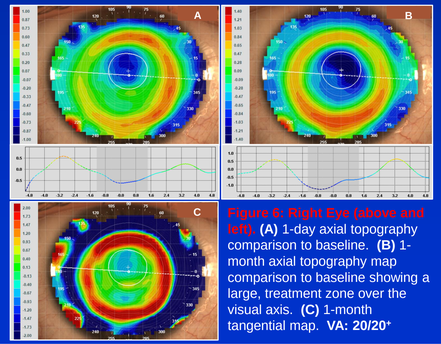

Figure 6: Right Eye (above and left). (A) 1-day axial topography comparison to baseline. **(B)** 1-month axial topography map comparison to baseline showing a large, treatment zone over the visual axis. **(C)** 1-month tangential map. **VA: 20/20^{+}**

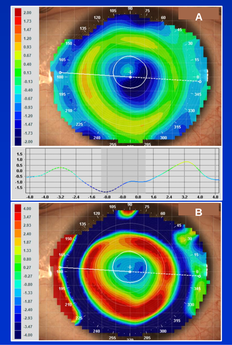

Figure 7: Left Eye (Left). (A) 1-month axial topography comparison to baseline. An island within the superior nasal area of the pupil resulted in minimal visual symptoms and AB decided to continue with the everted SCL modality. **VA: 20/20^{+}**
(B) 1-month tangential topography map comparison to baseline exhibiting inferior decentration with a large, treatment zone over the visual axis.

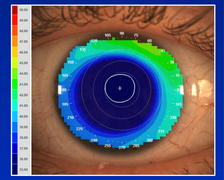

Figure 5 (above). An axial topography map over the everted SCL on the right eye. A centered SCL fit and a slightly inferior temporal decentration of the "treatment zone" (TZ) can be appreciated.

Clinical Implications

Previous work using finite-element analysis provided evidence that an everted, high minus, high modulus SCL creates a push force in the central cornea and a zone of negative pressure in the corneal midperiphery, comparable to that of the reverse curve in an OK lens. [2,3] The modulus of the SCL contributes to the efficacy of the everted lens treatment with higher modulus SCLs inducing an average treatment of 1.00-2.00D and lower modulus lenses creating a minimal effect on the epithelium.[2,3] One potential advantage this case presents is the large treatment zone, which may present visual benefits for adults. There are other considerations associated with an overnight SCL modality, mainly the risk of infection with overnight SCL wear. Expanding and optimizing the everted SCL lens design concept may be a potential modality of visual correction for individuals with low myopia.

Conclusion

Utilizing the reverse-geometry profile of an everted SCL, an axial topographical profile that mimics a post-orthokeratology topography map was observed, and AB reported clear and comfortable vision. AB's main concern was waking up in the middle of the night and not being able to see due to the significant minus power of the everted SCL. Further optimizing the central power of the lens and maintaining the thicker minus peripheral design may be able to induce a similar effect with adequate vision through the SCL.

References

1. Yan M, Chang J, Chan T. Refractive regression after laser in situ keratomileusis. *Clin Exp Ophthal.* Nov 2018;46:934-944.
2. Conrad, F., Ehrmann, K., Choo, J. D., and Holden, B. A. (August 4, 2010). "Finite Element Modeling of Inverted (Inside Out) Soft Contact Lenses." ASME. *J. Med. Devices*. June 2010; 4(2): 024501. https://doi.org/10.1115/1.4001519
3. Evans SR, Ho A, Choo JD. Orthokeratology–Like Effects of Everted Soft Contact Lenses: A Mechanical Model. *Invest. Ophthalmol. Vis. Sci.* 2005;46(13):2059.