Visual Potentials of Wavefront Guided Scleral Lenses in Post LASIK Ectasia: A Case Report

UMSL Optometry
University of Missouri–St. Louis

Sabari Arcot OD
UMSL College of Optometry

Introduction

- Post-LASIK ectasia is a devastating post-surgical complication, causing significant corneal warpage. Most patients with post-LASIK ectasia had received their surgeries prior to advent of screening technologies that investigate posterior corneal float, abnormal corneal topographies, and low preoperative corneal thickness. [1]
- Due to the deleterious effects of higher order aberrations induced by the ectasia, these individuals tend to suffer from halos, glare and fluctuations in visual acuity, even with scleral lenses. [1]
- This case report delineates the use of wavefront guided scleral lenses to achieve qualitative improvement in vision.

Case History

Chief Complaint: A 49-year-old female with history of post-LASIK ectasia presents for scleral lenses fitting. Patient had LASIK twenty years ago and was diagnosed with post-LASIK ectasia ten years after the surgery. She was previously unsuccessful with corneal gas permeable lenses, hybrid lenses and scleral lenses in providing clear vision. Patient was interested in optimizing her vision, particularly at night.

History of Present Illness: **significant blurry vision and ghosting** with habitual scleral lenses

Ocular History: LASIK in 2000, Post LASIK ectasia causing keratoconus (diagnosed in 2010), Cross-linking in 2011

Medical History: Type 2 Diabetes and Hypercholesteremia

Medications: metformin and atorvastatin

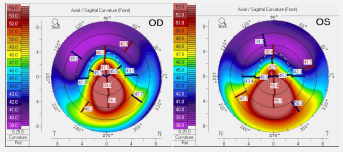

Figure 1 and 2: Pentacam images of OD and OS

Case Findings

	OD	OS
VA (corrected)	20/50 (PH: 20/25-1)	20/25-1
SLE (Cornea)	LASIK scar	LASIK scar
Topography	Oval cone with inferior steepening and irregular astigmatism (keratoconus)	Inferior cone with irregular astigmatism (keratoconus)
Pachymetry	351 um	339 um

Treatment and Management

Patient was fit in Digiform Scleral lenses for wavefront correction.

- OD: Digiform Scleral Lenses/7.94 BC/16.6 dia/-2.50 sph 20/30- (ghosting)
- OS: Digiform Scleral Lenses/7.50 BC/16.6 dia/-4.25 sph 20/30+2 (ghosting)

- After finalizing scleral lenses fit, patient was dilated and Nikon OPD Scan II and Visionix scans were taken to measure HOA aberrations with the finalized scleral lenses on eye.

OD	Point Spread Function	Wavefront Summary
Conventional Scleral		LOA (µm): 1.31 · HOA (µm): 1.14 · RMS (µm): 1.74 · Coma Z(3,±1) (µm): 0.85@88°
With Wavefront Correction		LOA (µm): 0.83 · HOA (µm): 0.61 · RMS (µm): 1.03 · Coma Z(3,±1) (µm): 0.44@136°

OS	Point Spread Function	Wavefront Summary
Conventional Scleral		LOA (µm): 1.00 · HOA (µm): 1.31 · RMS (µm): 1.65 · Coma Z(3,±1) (µm): 1.04@106°
With Wavefront Correction		LOA (µm): 0.79 · HOA (µm): 0.44 · RMS (µm): 0.91 · Coma Z(3,±1) (µm): 0.38@83°

- With HOA correction, patient was correctable to 20/25 OD and 20/20-2 OS with significant reduction in ghosting and glare. Patient required two sets of trials with HOA aberration correction before achieving ideal vision.
- Rotation was noted with the first pair of lenses, therefore offsetting wavefront correction was needed to compensate for lens misalignment and allowed for accurate HOA correction.

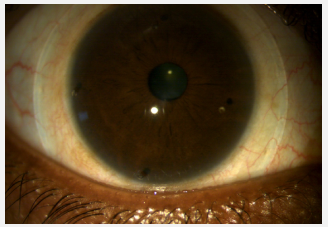

Figure 5: Digiform Scleral lenses with wavefront correction (dots help identify rotation – HOA correction is shifted in relation to the rotation)

Discussion and Conclusion

- Post-LASIK ectasia may occur in around 0.6% of the patients undergoing LASIK.[1]
- Patients with corneal ectasias require rigid corneal or scleral lenses to correct and mask anterior corneal irregularities, however residual anterior corneal surface aberrations remain along with posterior corneal irregularities, not masked by contact lenses.[2]
- Typically, patients with corneal ectasias have elevated levels of residual higher order aberrations. Wavefront guided scleral lenses masks those aberrations to reduce symptoms of ghosting and glare, often seen in keratoconic patients.[2]
- While fitting patients with corneal ectasia may pose its own challenges, quantification of misalignment in lenses and making appropriate changes to wavefront-guided scleral lenses is critical to achieving ideal visual performance. [3]
- Even though increase in visual acuity was modest, recent studies have illustrated that it is possible that with some adaptation, visual performance in wavefront guided scleral lenses, like progressive spectacles, can improve. [4]

References

1. Tatar, Mehmet Gurkan et al. "Risk Factors in Post-LASIK Corneal Ectasia." Journal of ophthalmology vol. 2014 (2014): 204191. doi:10.1155/2014/2041912. Feizi S. Corneal endothelial cell dysfunction: etiologies and management. Ther Adv Ophthalmol.
2. Marsack JD, Ravikumar A, Nguyen C, Ticak A, Koenig DE, Elswick JD, Applegate RA. Wavefront-guided scleral lens correction in keratoconus. Optom Vis Sci. 2014 Oct;91(10):1221-30. doi: 10.1097/OPX.0000000000000275. PMID: 24830371; PMCID: PMC4232493.
3. Rijal S, Hastings GD, Nguyen LC, Kauffman MJ, Applegate RA, Marsack JD. The Impact of Misaligned Wavefront-guided Correction in a Scleral Lens for the Highly Aberrated Eye. Optom Vis Sci. 2020 Sep;97(9):732-740. doi: 10.1097/OPX.0000000000001577. PMID: 32976324; PMCID: PMC7523500.
4. Hastings GD, Applegate RA, Nguyen LC, Kauffman MJ, Hemmati RT, Marsack JD. Comparison of Wavefront-guided and Best Conventional Scleral Lenses after Habituation in Eyes with Corneal Ectasia. Optom Vis Sci. 2019 Apr;96(4):238-247. doi: 10.1097/OPX.0000000000001365. PMID: 30943184; PMCID: PMC6450417.