



Aberration Frustration: Improving a Post LASIK Visual Outcome

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Abstract

An Ampleye scleral lens with aberration control was utilized as a novel solution to alleviate visually significant aberrations precipitated by hyperopic LASIK.

Introduction

LASIK often results in success, however when complications do arise it can create an environment that is visually detrimental to the patient. Although visual acuity often remains intact, the patient can be subject to higher order aberrations reducing functional acuity. This case report demonstrates how a scleral lens can be used to reduce higher order aberrations thus diminishing symptoms and restoring functional acuity.

Methods

A 41-year-old male presented to the clinic for a contact lens fitting. He was referred by an outside provider with reports of a longstanding visual disturbance OS exacerbated by high definition LCD screens. Previous examinations ruled out posterior and binocular pathology, suggesting a corneal problem related to hyperopic LASIK in 2007. The patient reported difficulties in job performance and daily activities related to visually significant aberrations. Due to previous failed corneal GP wear, a scleral lens modality was chosen. Goals of a scleral lens fitting for the left eye included reducing visually significant aberrations, improving symptoms, and quality of life.

Exam Findings

| | OD | OS |
|----------------------|--------------------------|--|
| BCVA | 20/20 | 20/20 |
| Pupils | Round, reactive, (-) APD | Round, Reactive, (-) APD |
| Motility | No restrictions | No restrictions |
| Confrontation Fields | FTFC | FTFC |
| Cornea | Clear | Clear, Well delineated LASIK flap scar |

Case Report

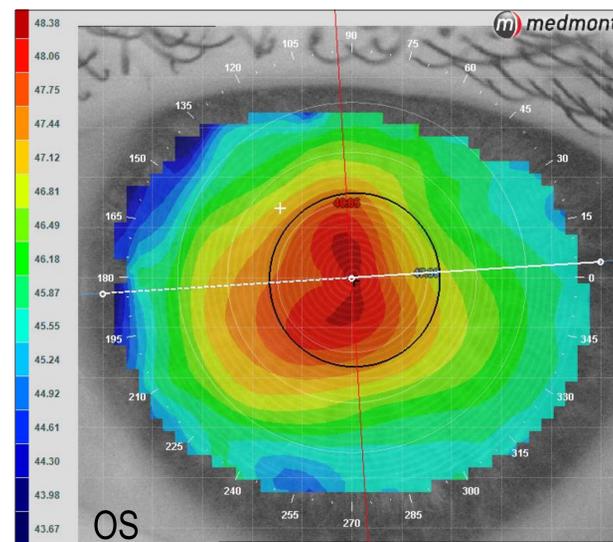


Figure 1: Axial topography demonstrating central steepening from hyperopic LASIK

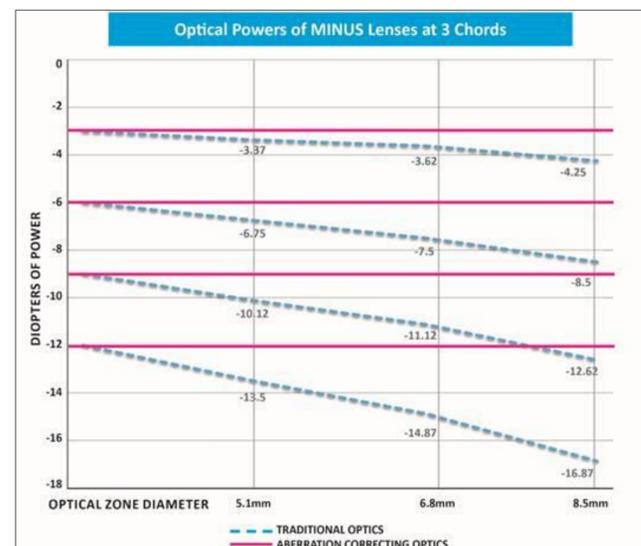


Figure 2: Power profile comparison of traditional optical corrections vs. aberration-correcting optics over 3 chords

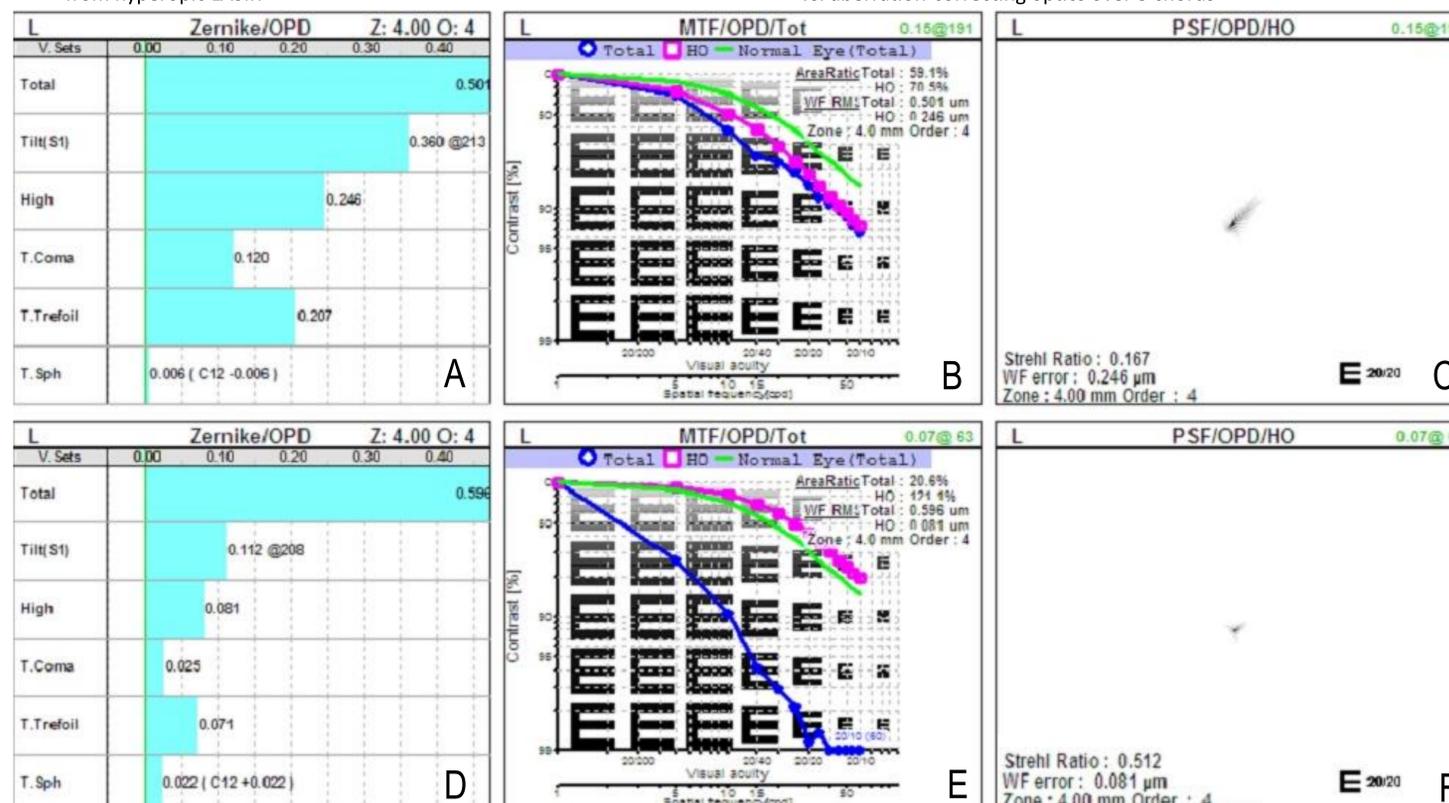


Figure 3: (A,D): Zernike Graph depicting contributions of total and higher order aberrations in habitual (A) and CL-corrected (D) optical systems. (B,E): Predicted modulation transfer functions for H-O aberrations, total aberrations, and idealized emmetropic eye within the habitual (B) and CL-corrected (E) systems. (C,F): A 2-D visual representation of the predicted point spread function for the habitual (C) and CL-corrected (F) optical systems.

Results

Outcomes

- Objective and subjective reduction in higher order aberrations (Figure 3)
- Relief of fatigue, eyestrain, and headaches
- Improved work performance and functional acuity

| Final Lens Order | OS |
|------------------|----------------------------|
| Lens Design | Ampleye Aberration Control |
| Diameter | 15.5 |
| Sagittal depth | 3800 |
| Base Curve | 8.04 |
| Power | +4.00 |
| Visual Acuity | 20/20 |

Discussion

LASIK is a corneal surgical procedure that utilizes patterned tissue removal to correct refractive error. Depending on the type of refractive error will dictate the ablation profile used. Hyperopic LASIK seeks to steepen the central cornea while flattening the periphery. This type of ablation profile is subject to higher order aberrations, specifically, coma and trefoil and can be exacerbated by a decentered ablation. In order to ameliorate visually significant aberrations a rigid lens modality that offers a large optic zone and stability is ideal. In the case of our patient the Ampleye scleral lens with aberration control was chosen. Aberration control is achieved by varying the eccentricity throughout the optic zone to create a consistent, stable prescription (Figure 2).

Conclusion

Scleral lenses with aberration control offer a novel solution to provide improved vision and aberration reduction in an environment where conventional optical corrections fail to produce a positive outcome.

References

- Padmanabhan Prema, Rachapalle Reddi Sudhir, Devi Sivakumar Poornima. Topographic, Tomographic, and Aberrometric Characteristics of Post-LASIK Ectasia. *Optom. Vis. Sci.* 2016, 93, 1364-1370.
- Kohnen Thomas, MD; Mahmoud Khaled, MD, FRCSEd; Bühren Jens, MD. Comparison of Corneal Higher-Order Aberrations Induced by Myopic and Hyperopic LASIK. *Ophthalmology*, 2005, 112, 1692.