

# Case Report: Effects of Neuroadaptation and Pupil Size in Custom Wavefront-Guided Scleral Lens Correction

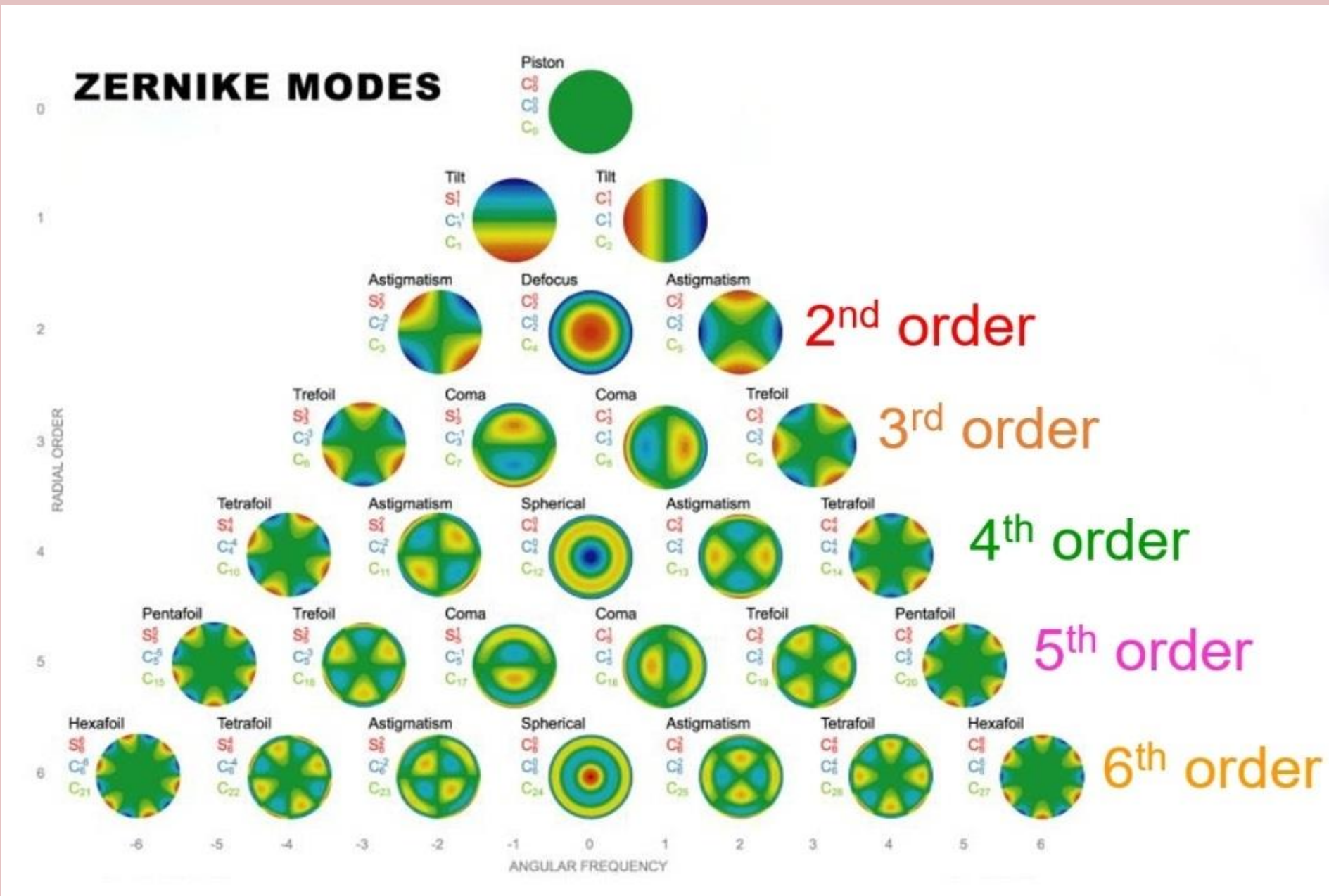


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## Introduction

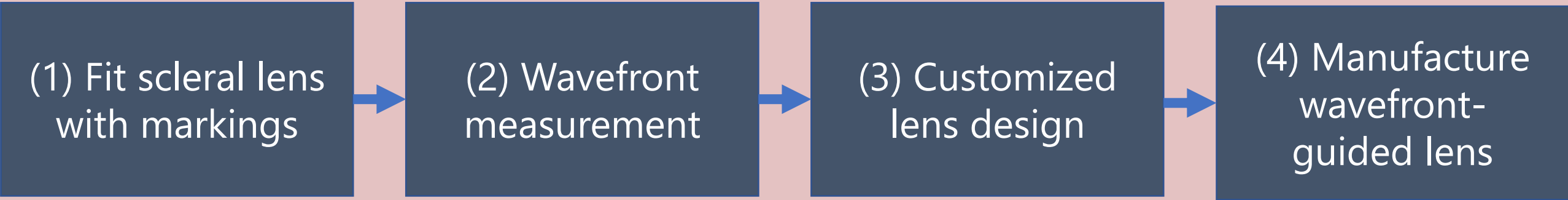
Despite utilizations of gas permeable lenses, residual higher order aberrations (HOA) cannot be effectively diminished with traditional sphero-cylindrical optics, which subsequently contribute to persistent monocular diplopia, visual distortions, and other photic disturbances. While wavefront-guided scleral lenses have emerged as novel treatment options in combating residual HOA, the perceptions of the clinical complexity involved in incorporating a new technology may explain its slow adaptation. This case report presents clinical pearls on how to successfully fit patients with custom wavefront-guided scleral lenses.



Individual ocular aberrations represented by Zernike polynomials.

## Methods

During a scleral lens evaluation, the patient was screened for residual HOAs with an OVITZ aberrometer which were found to be significant in OD. A set of orientation dot markings were added to the initial scleral lens to help align the wavefront-guided correction profile over the visual axis of the patient. This is referred to as the “conventional lens” or the “Lower Order Aberration (LOA)” lens. The patient was remeasured with the LOA lens and a wavefront-corrected scleral lens was created. Visual performance of the wavefront-guided lens was compared to the original scleral lens.

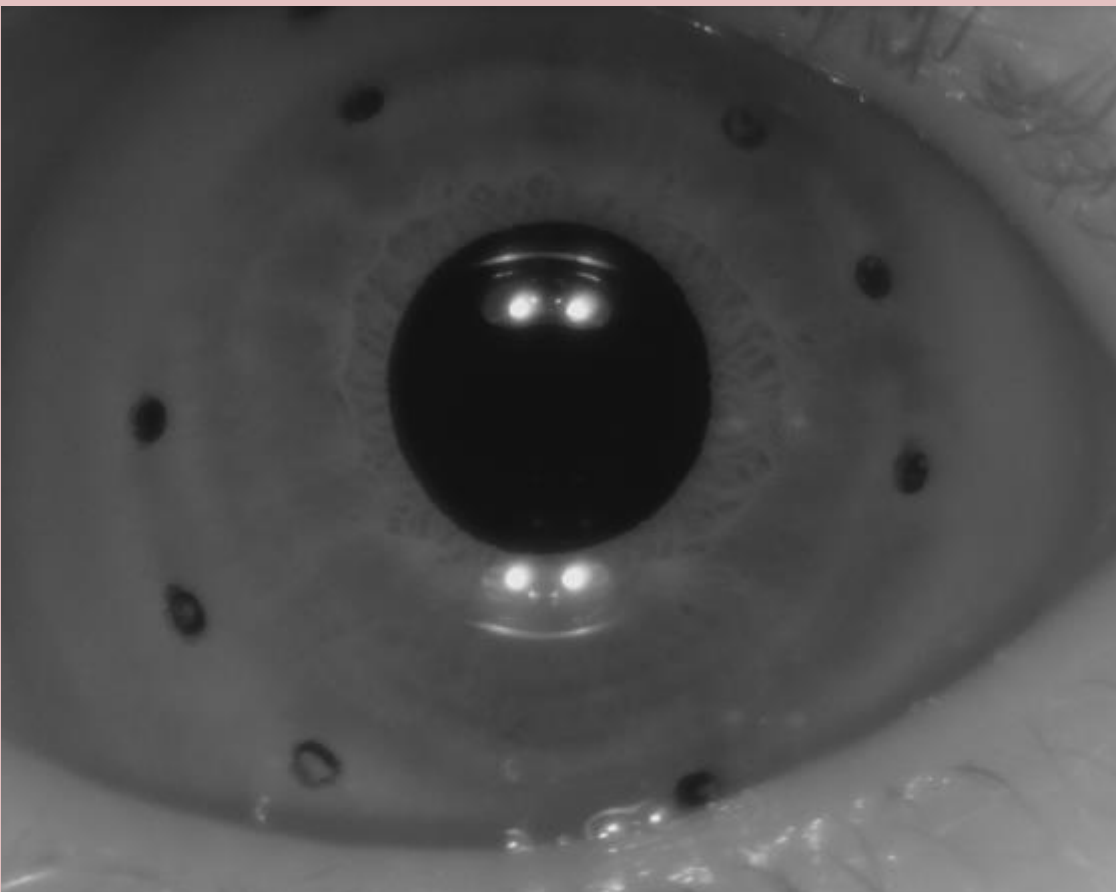


Step-by-step process of creating a wavefront-guided lens.

Technologies used: **OVITZ<sup>®</sup> xwave**    **OVITZ<sup>®</sup> ares**  
Manufactured by Valleycontax



OVITZ xwave system used for aberrometry measurement and wavefront-guided lens design.



Conventional scleral lens with index marks used as an intermediary for fitting wavefront-guided lens.

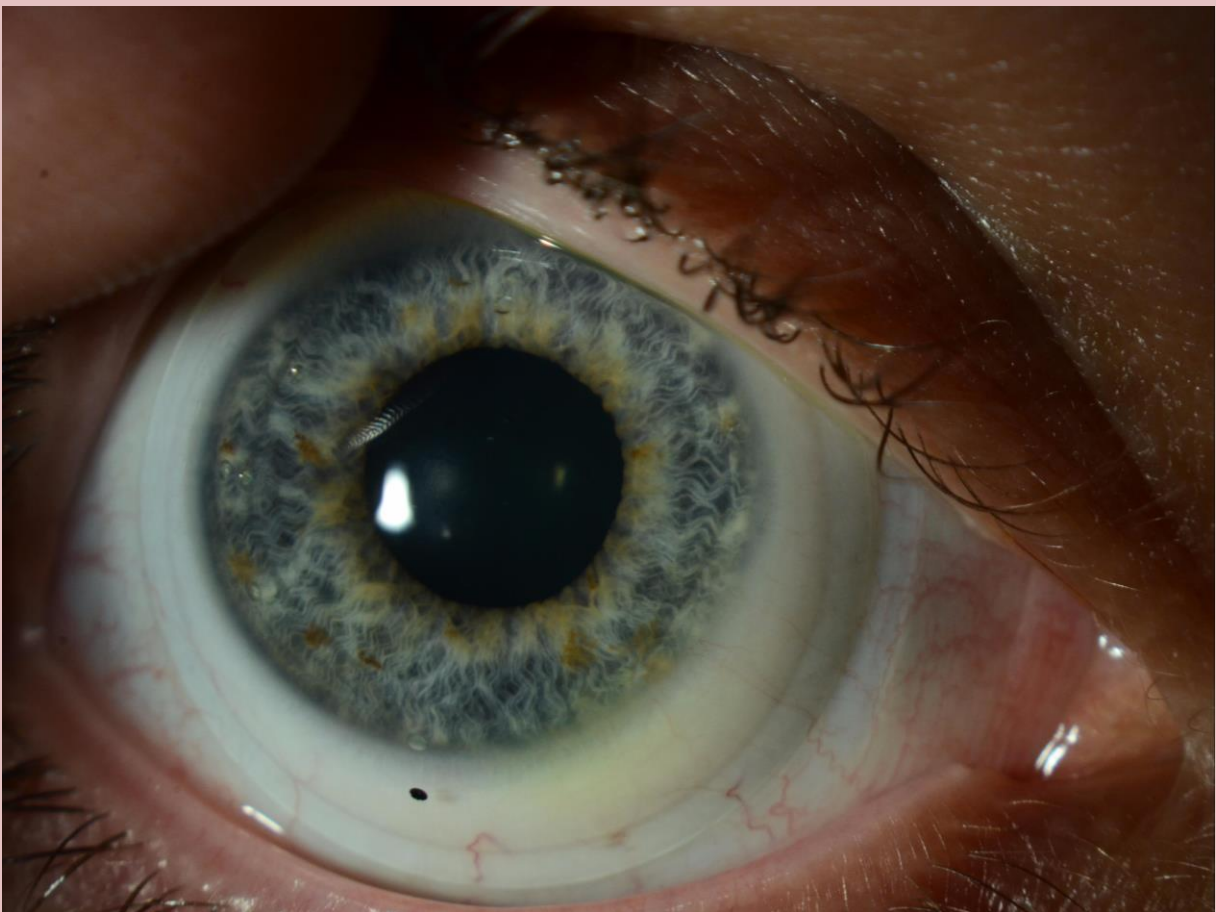
## Case Summary

33-year-old Caucasian female presents with histories of dry eyes and keratoconus OU, corneal crosslinking OD (PO 6 months), and Intacs removal OD (PO 1 month) due to reduced BCVA after Intacs implantation, with both glasses and corneal gas permeable lens (GP). Previous scleral lens fittings, both before and after Intacs removal, yielded poorer BCVA when compared to GP. She also reported growing GP intolerance within last 12 months, notwithstanding BCVA in current habitual GP remain reduced compared to BCVA in GP before Intacs.

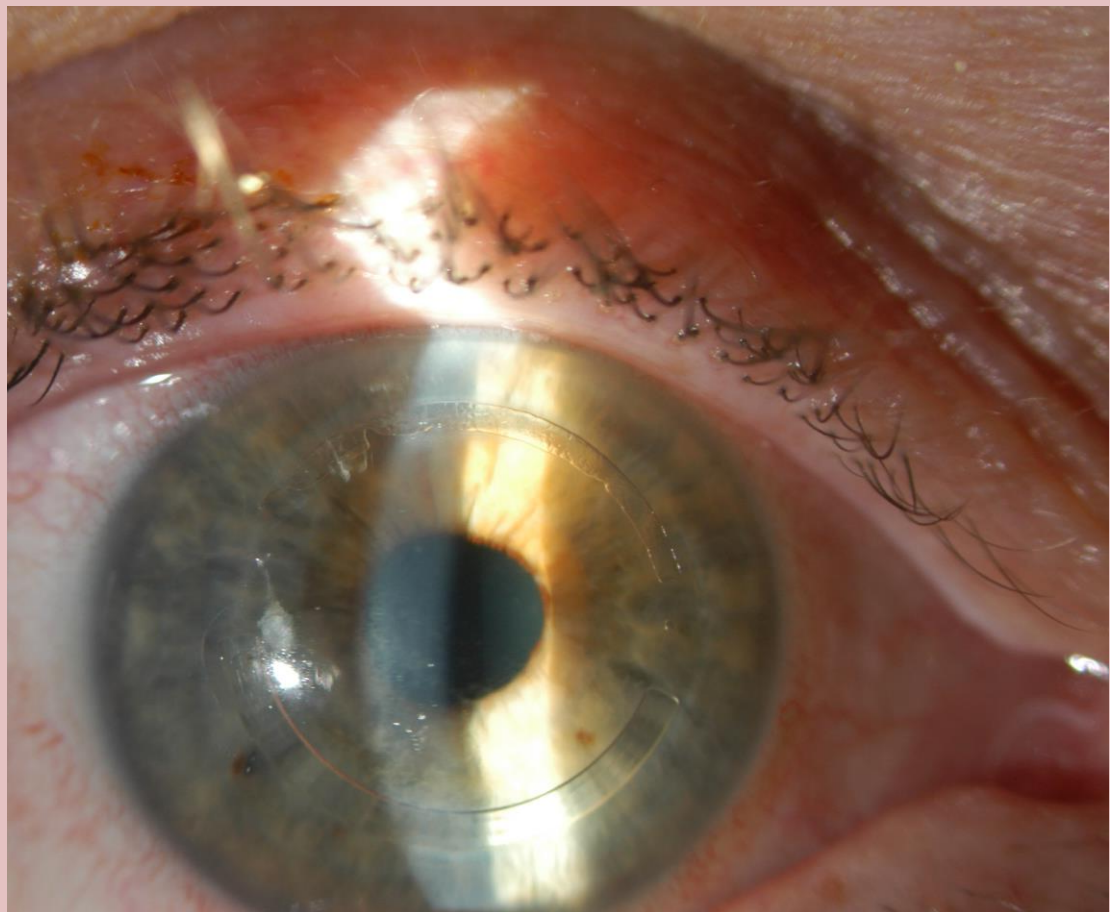
BCVA with habitual GP was **20/70** and diagnostic scleral lens refraction produced BCVA of **20/50**. At follow-up examinations, patient reported improved tolerance with the LOA lens but unsatisfactory BCVA of **20/100**. Aberrometry taken over scleral lens revealed elevated residual HOA with root-mean-square (RMS) of **1.06µm** OD (6.3mm pupil diameter).

Due to residual HOA detected, the needs for wavefront-guided optics (ARES lens, Valley Contax, Eugene, OR) and for neuro-adaptation before finalizing the lower order aberration (LOA) Rx were discussed. At the HOA lens dispense visit, patient complained of extreme initial blur upon lens dispensing (VA **20/200**) but reported subjective VA improvement with HOA lens after 1 week of wear. Entry BCVA at the 2-month follow-up was **20/25** which further improved to **20/20** with a small sphero-cylindrical overrefraction (SCOR) of PL -0.25 x145. HOA RMS simulated at 6.3mm pupil diameter in OD was reduced to **0.67µm (37% improvement)**. Also, she noted significantly improved visual quality in both normal and low light conditions.

## Data Summary

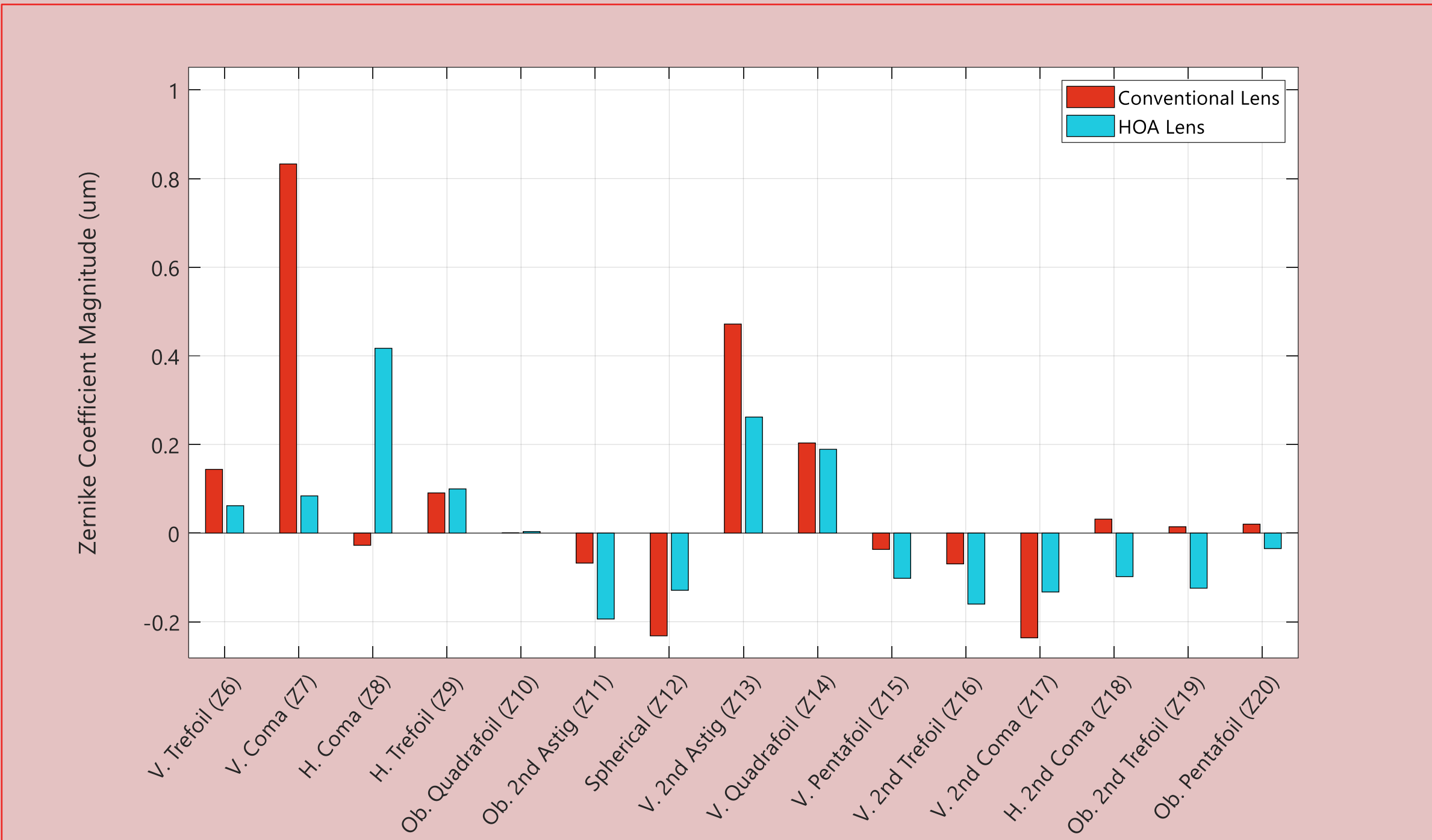


Anterior segment image of the eye with the conventional scleral lens.



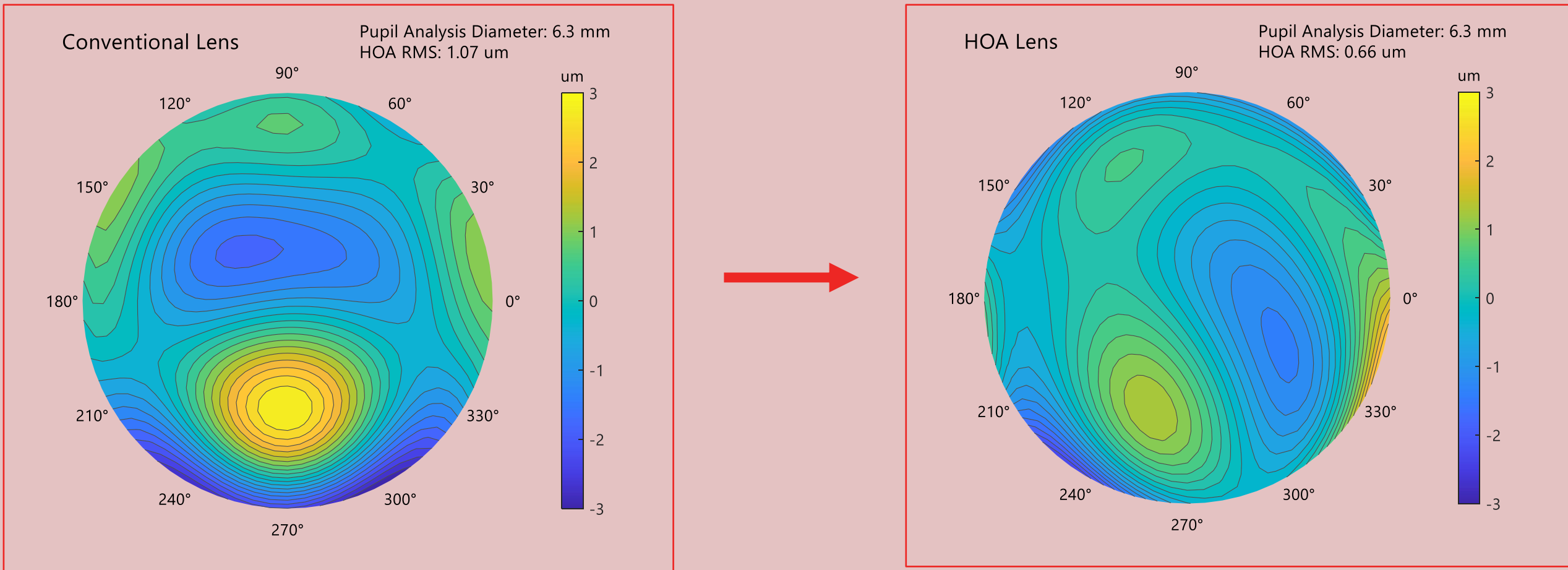
Slit lamp image on a different patient showing the channel remaining after removal of superior Intacs segment

### Conventional LOA Lens and HOA Lens Results Comparison

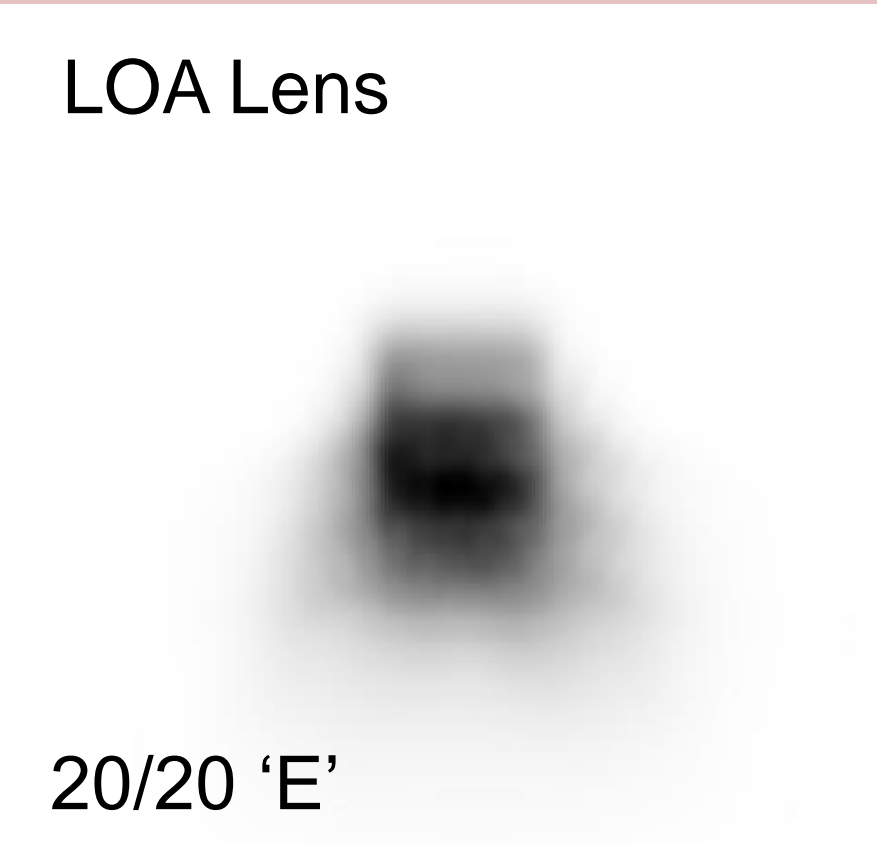


Comparison of Zernike coefficients between the LOA scleral lens and the wavefront-guided scleral lens (HOA lens). Smaller bar indicates less aberrations. Improvement in primary coma.

### Conventional Lens and HOA Lens Lens Wavefront Maps



Comparison of wavefront maps between conventional lens and HOA lens. Data at 6.3 mm pupil diameter.



Simulation of 20/20 Snellen 'E' based on wavefront data over the conventional scleral lens and HOA lens. Simulation performed at photopic pupil diameter (3mm) to simulate exam lane.

OS	OD	HOA
Habitual GP Lens	20/70	-
LOA Lens	20/100	1.06µm @ 6.3mm P.D.
HOA Lens Dispense	20/200	0.67µm @ 6.3mm P.D.
HOA Lens Follow-up	20/25	
HOA Lens After OR	20/20	

Subjective worsening  
Objective improvement

Visual performance comparison between best correct lens before starting HOA fit, conventional scleral lens and wavefront-guided scleral lens (HOA lens).

## Pearl 1: Fine-Tune SCOR After HOA & Neuroadaptation

HOA patients often require SCOR changes post-correction. This patient's OR fluctuated from +5.50D to -3.00D during follow up examinations with LOA lens but required only a SCOR of PL -0.25 x145 after adapting to the wavefront-corrected HOA lens. It is best until after HOA correction to fine-tune SCOR on the patient.

## Pearl 2: Allow for Neuroadaptation

If objective improvement is observed in wavefront aberrometry but subject vision has decreased, dispensing the lens and allow a minimum of 1-2 week of neuroadaptation for patient to acclimate to the total HOA corrections. This may yield significant subjective improvement before deciding further clinical course(s) to take.

## Conclusion

Wavefront-guided scleral lenses are an effective method of correcting residual HOAs and improving overall vision quality in patients experiencing distorted vision and photic disturbances with scleral lenses. However, clinicians should be mindful of the importance of neuro-adaptation and the clinical sequencing of finalizing LOA Rx after incorporating an HOA profile.