# Countering Higher Order Aberration in Keratoconus

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## BACKGROUND

Keratoconus (KC) is a progressive corneal condition characterized by ectasia that results in a significant reduction in vision and a substantial impact on the patient's quality of life. KC patients often experience a range of visual disturbances, including distorted images, glare, ghosting, blurring, and reduced contrast, which cannot be fully addressed with spectacles. These visual aberrations are primarily attributed to irregular astigmatism and disparities in corneal curvature between the anterior and posterior corneal surfaces, leading to higher order aberrations (HOA). The use of gas permeable (GP) and scleral lenses have been frequently utilized to help alleviate these symptoms; however, scleral lenses are preferred in patients with HOA because of the stability of the lens. To optimize visual acuity for the patient, wavefront technology derived from an aberrometer can be incorporated into the lens design to minimize aberrations and provide the patient with the best possible visual outcome.

## CASE DESCRIPTION

A 32-year-old Hispanic male with severe keratoconus OD presented for a contact lens fitting. Patient reported poor vision with his spectacles and issues with glare at night. A scleral lens fit was performed OD with the following parameters: BC 7.50/ OAD 16.8/ Pwr -14.50 giving 20/40 VA with glare and ghosting. Aberrometry was then performed which illustrated high amounts of trefoil and coma HOAs. A lens was then ordered to correct these findings

## METHODS

Topography was performed to help confirm that the aberrations were from the corneal surface. Aberrometry was then performed with a scleral lens that had registration dots (black dots) and a stable appropriate fit for the right eye. These values were sent to the lab and a lens was received with wavefront technology to counter the aberrations.

**Lens Parameters**

| | BC | OAD | Pwr | Flat edge | Steep edge |
|---|---|---|---|---|---|
| OD | 7.50 | 16.8 | -14.50 | 30 microns flat | 90 microns steep |

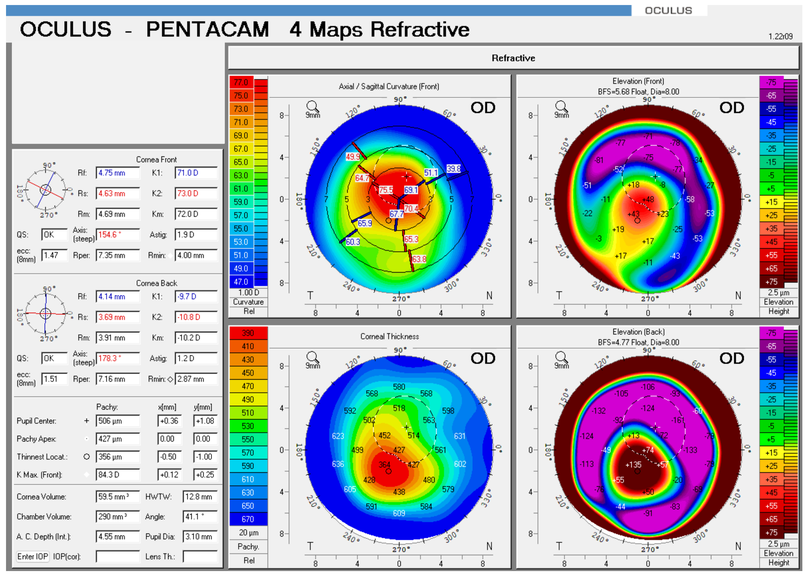


Fig 1: Pentacam right cornea. Central steeping, inferior thinning and posterior steepening present.

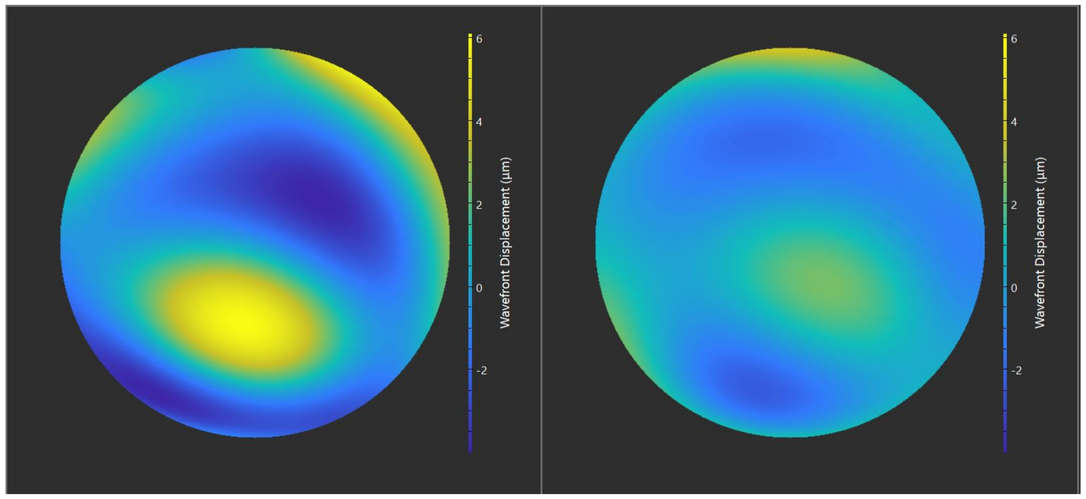


Fig 2: Aberrometry values displaying wavefront displacement, left image baseline lens with black dots and right image HOA countering lens.

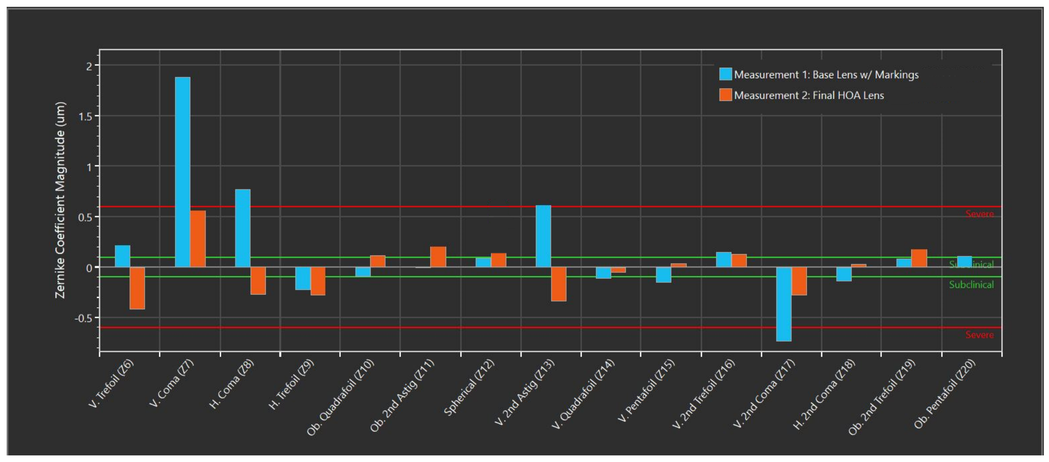


Fig 3: Correction of aberrations, Blue bar represents baseline lens and Orange bar represents final HOA lens. Decrease in most aberrations especially coma

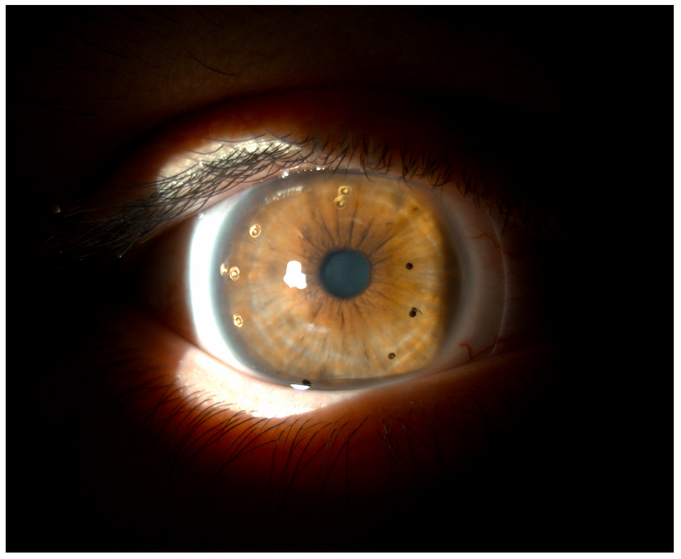

Fig 4 (above): Baseline trial lenses from Valley Contax that is used for initial aberrometry scan.

## RESULTS

The patient reported significant improvement in ghosting/glare and overall improvement in quality of the vision with the new HOA lens and improvement in BCVA to 20/25 from 20/40. The wavefront displacement from figure 2 and 3 display that there was an overall decrease in aberrations (especially coma) which resulted in higher quality of vision for the patient.

## CONCLUSION

For patients with corneal irregularities, it is crucial to not solely focus on visual improvement measured by the Snellen Chart, but also prioritize their subjective perception of visual quality. During patient encounters, it's important to conduct a thorough history and appropriate screenings in order to provide the most suitable solutions tailored to their specific needs. It's essential to recognize that visual disturbances can be just as, if not more, debilitating than not achieving optimal visual acuity correction. The ability to address higher order aberrations through the use of scleral lenses can substantially enhance the patient's overall visual experience and significantly improve their quality of life.