

Managing Orthokeratology Induced Aberration with large pupils

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Background

Orthokeratology (ortho-k) contact lenses have proven to be an effective method to correct myopic refractive error. The corneal shape created by ortho-k lenses offers the optical benefit of slowing axial elongation in the progression of myopia but can have visual consequences. Spherical aberration is induced that can disrupt subjective image quality.

Case Description

A 24 year old, female presented to the clinic with an interest in ortho-k lenses

Refractive error:

- OD: -1.75 -0.25 x 117
- OS: -2.00 -0.50 x 085

HVID:

- OD: 12.1mm
- OS: 12.2mm

Pentacam (Oculus) Tomographer Simulated Keratometry

- OD: 41.25 / 41.50 @ 075
- OS: 41.25 / 41.50 @ 049

A MAX (Euclid) lens was empirically ordered and fit was assessed

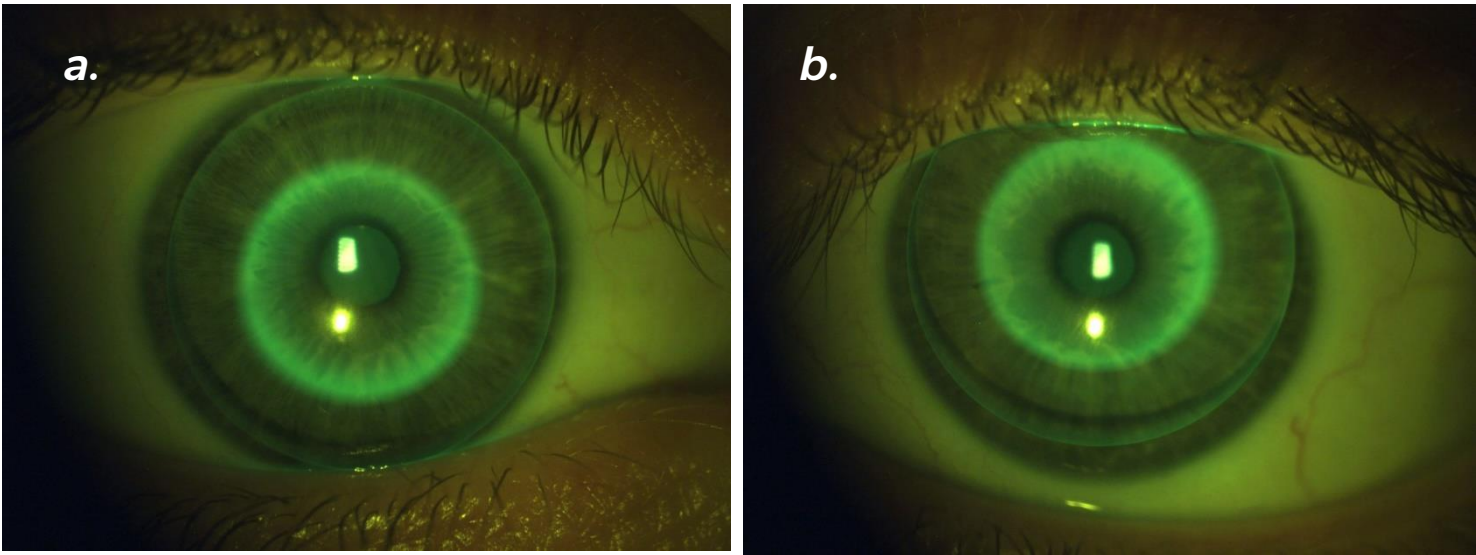


Figure 1. Right (a) and left (b) lenses with sodium fluorescein and Wratten filter in place revealing adequate centration and central flatten with midperipheral steepening.

Follow Up Care

	Chief Complaint	Entering VA	Subjective Refraction	Refraction over Lens	Plan
1 day	Mildly blurred vision OU	OD: 20/25- OS: 20/20-	OD: +0.50 OS: +0.50	OD: +0.75 OS: plano	Continue with OrthoK wear qpm OU
1 month	Glare and blurred vision OU, worse in settings with florescent lighting or dim illumination	OD: 20/20 OS: 20/20	OD: +1.00 OS: +0.50	OD: +0.50 OS: plano	Begin use of brimonidine tartrate ophthalmic solution 0.025%, Lumify (Bausch & Lomb, Rochester, NY) Qam to BID OU. Continue with wear of OrthoK wear qpm OU
2 months	Improvement in vision OU, less glare	OD: 20/20 OS: 20/20	OD: +1.00 OS: +0.50	OD:+0.50 OS: plano	Continue with OrthoK and Lumify use OU

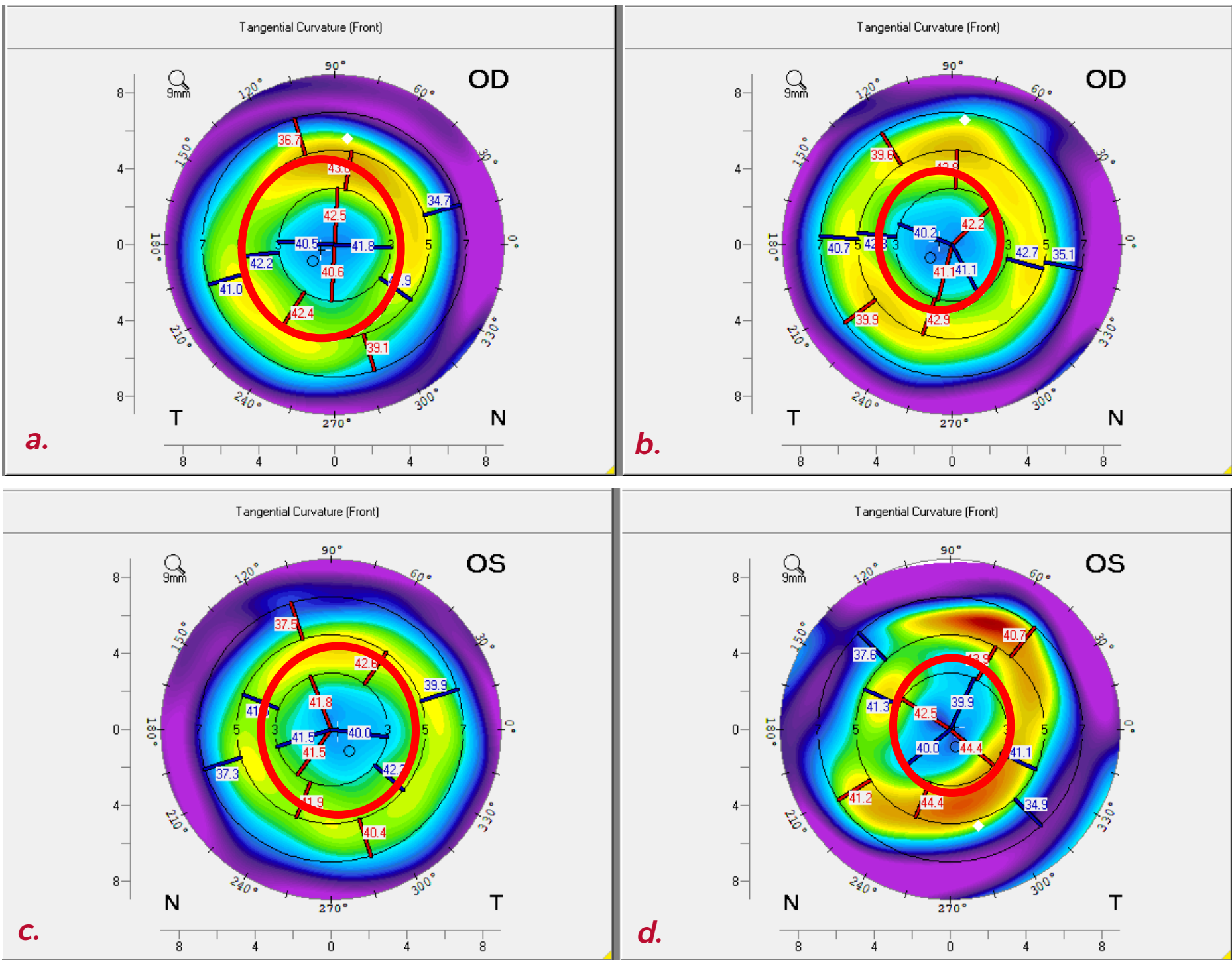


Figure 2. Pentacam (Oculus) tomography revealing well centered and adequate treatment zone at one month follow up OD (a) OS (c) and two months follow up; one month after beginning Lumify use Qam to BID OD (b) OS (d) with ring denoting pupil size.

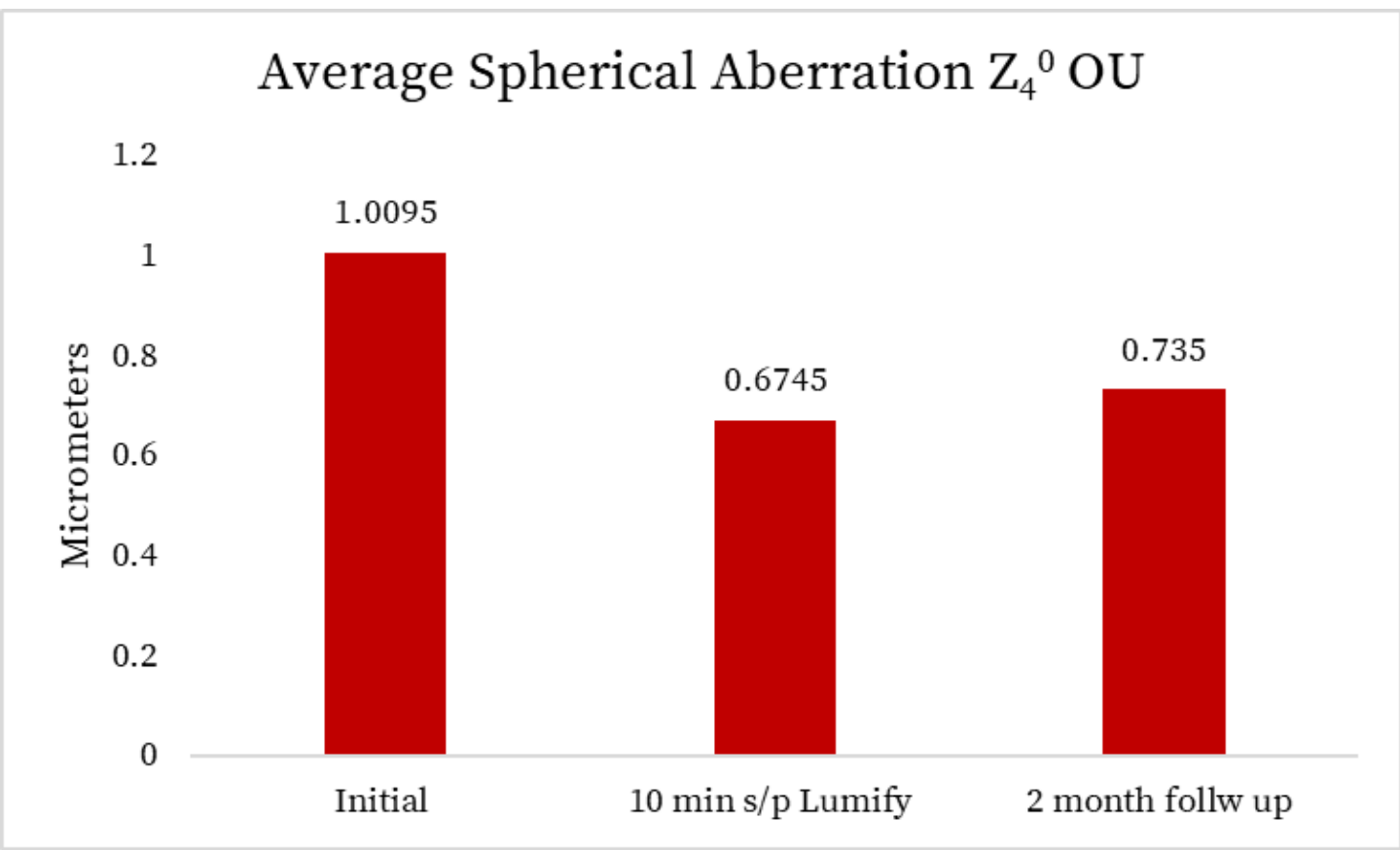


Figure 3. Serial aberrometry (OVITZ) indicating a decrease in in spherical aberration within 10 minutes and sustained after 1 month of use of Lumify 1 gtt QD OU.

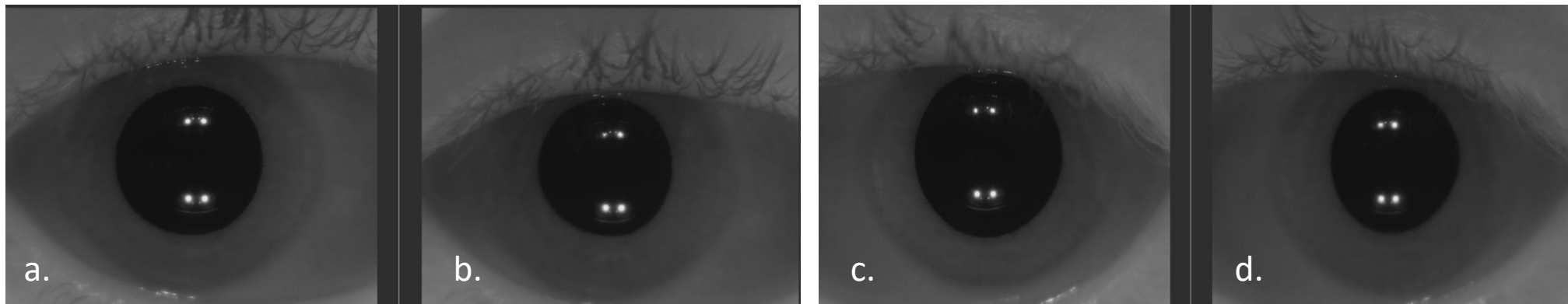


Figure 4. Differences in pupil size prior to Lumify OD (a) OS (c) both 7.37 mm in diameter and 10 minutes after 1 gtt of Lumify OD (b) OS (d) both 2.28 mm in diameter.

Discussion

The flattening of the central cornea by an ortho-k lens can create additional aberrations beyond that from the normal corneal shape. When used in myopia control, the flattening of the central cornea provides clear central vision while the steeper mid-peripheral cornea creates peripheral hyperopic blur. While this intended corneal shape is effective in slowing the eye growth that causes myopia, the nature of this optical variation can be noticed visually by certain patients, despite excellent visual acuity. This is likely due to the aberrations created by this corneal shape.

As pupil size increases, more light enters the eye through the treated corneal surface and increases the amount of aberration. The combination of these two factors is responsible for the symptoms of glare and blurred vision reported by the patient.

Spherical aberration has been shown to increase when pupil size exceeds 6 mm in diameter. In this case, the normal pupil size of this patient exceeded 7 mm in each eye. The topical over-the-counter medication brimonidine tartrate ophthalmic solution 0.025% is used to reduce conjunctival redness but has noted miotic side effects. This eye drop has been demonstrated to significantly decrease pupil size in scotopic conditions. The severity of this side effect can be impacted by the pigmentation of the iris. The blue irides of this patient likely contributed to the 2 mm miosis experienced after Lumify application and thus was effective in decreasing the spherical aberrations caused by her large pupil size.

Conclusion

Spherical aberration induced by ortho-k lenses can be effective in controlling myopia progression, however this side effect may not be tolerable for patients with large pupils. While it may not be our first thought, pharmacologically induced miosis can safely and effectively reduce spherical aberration and allow us to meet patient needs.

Bibliography

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