

PURPOSE

There has been an increasing interest in orthokeratology over the past few years. Contact lens fitters are seeking ways of providing better visual outcomes for their patients. One area of study has been with applying toric alignment curves to help a lens better achieve symmetric fluid forces across the treatment zone. This pilot study examined the outcome of fitting a lens with less toricity than indicated as compared to one with more toricity than indicated. Toricity indications were based on recommended fitting of Euclid's designs with respect to corneal elevation differences measured by topography.

METHODS

A 10 year old Asian male presented for orthokeratology fitting with a history of myopic progression. Ocular health findings were normal. BCVA was 20/20 OD and OS and refraction was -5.00-0.50x010 OD and -4.25-1.00x180 OS.

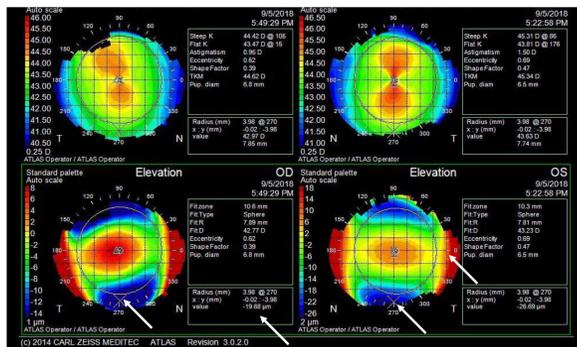


Figure 1: Topography showed low amount of corneal astigmatism on axial map, 1.0 to 1.5 D, while the elevation map showed borderline significant levels of elevation difference between horizontal and vertical meridians, 27 microns OD and 35 microns OS. White arrows indicate places where elevation values were measured along an 8.0 mm chord.

The patient's HVID was around 10.6 mm OD and OS. Euclid orthokeratology lenses were designed empirically using these data along with corneal elevation values. A Sapphire (toric) lens was intentionally designed for the eye with less elevation difference (OD) while the fellow eye received an Emerald (spherical) lens. The Sapphire lens had 1.0 D of toricity in the alignment curve of the contact lens. The lenses exhibited good centration upon slit lamp examination with appropriate bull's-eye fluorescein patterns.

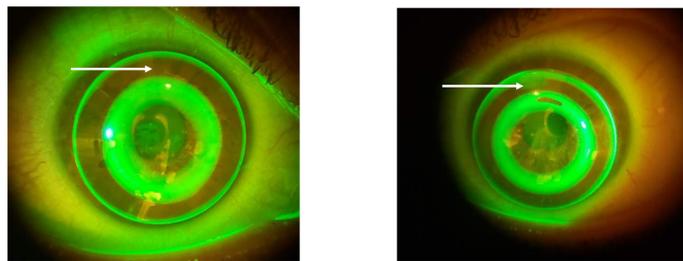


Figure 2: Lenses showed good centration with expected bull's-eye pattern. The lens OS (right image) may have exhibited more tear flow in the alignment zone compared to OD along vertical meridian. The toric lens OD (on left) shows no sign of tear flow in the alignment zone (see arrows).

The patient returned for a one day follow up after nine hours of wear the night before. VA was 20/100 OD and OS uncorrected and residual refraction was -3.00 OD and OS. The patient was to continue wear and follow up in one week. Topography for this visit is shown in Figure 3.

RESULTS

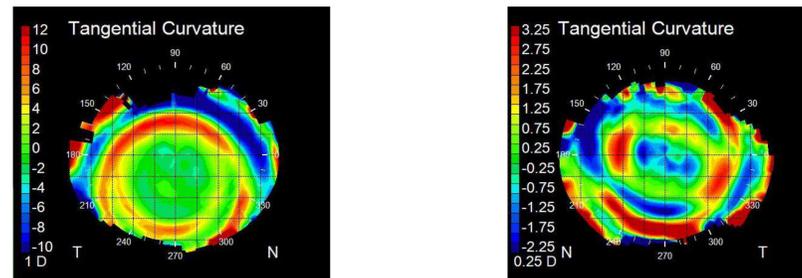


Figure 3: Tangential difference maps after one night showed a more distinct treatment zone OD (on left) after one night of wear compared to OS (on right)

The patient followed up for the one week evaluation with complaints of irritation over several nights while wearing the lenses and had discontinued wear for the past two. VA was still 20/100 OD and OS and refraction was -3.00 OD and OS. Lenses showed signs of deposits along with mild peripheral staining coinciding with them. The lenses were cleaned, and he and his parents were reeducated on proper application, removal, and care of the lenses. It was also recommended a drop of artificial tears be used with application. Topographies showed similar patterns to the one day follow up. He returned a week later and indicated vision had continued to improve to the point he no longer had to wear spectacles in the evening. Uncorrected VA was 20/50 OD and 20/40 OS. The topographies obtained are shown in Figure 4. The lenses were then changed to incorporate toric alignment curves OD and spherical curves OS.

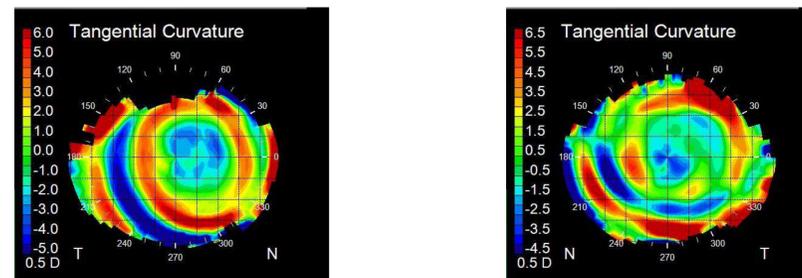


Figure 4: Tangential difference maps after 2 weeks of wear showed lateral decentration this time OD (left image) and incomplete treatment OS (right image).

The patient returned after wearing the new lenses for one week and stated vision had improved and the new lenses were more comfortable. Uncorrected VA was 20/20 OD with plano over refraction and 20/30 OS with -0.75 residual refractive error. The lenses showed no signs of deposits or defects and the cornea was clear. Topography showed improved centration and treatment zone completion in both eyes (Figure 5). The patient followed up a final time a week later with uncorrected VA of 20/20 OD and OS.

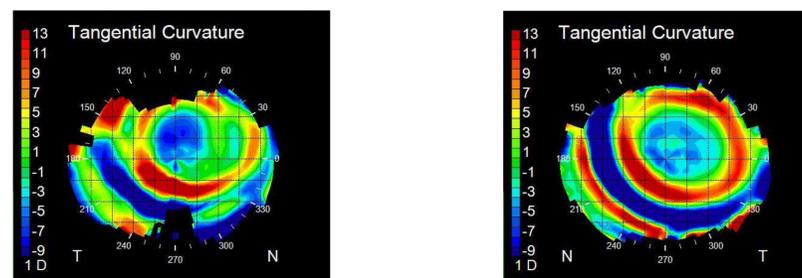


Figure 5: Tangential difference maps with final design showed better centration OD (left image) with spherical lens and more complete treatment zone OS (right image) with the toric lens.

DISCUSSION

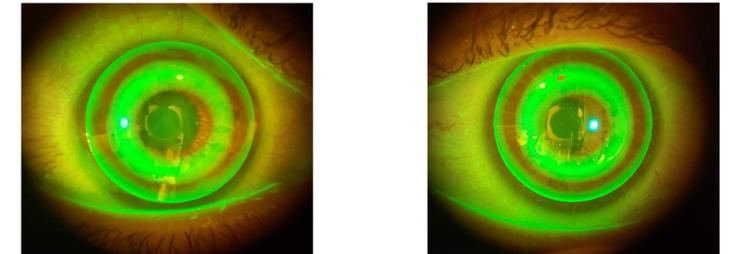


Figure 6: Fluorescein patterns of final designs on eye. Lenses showed better centration with bull's-eye pattern and good alignment.

Lens Parameters (mm)

	Lens	Base Curve	Optic Zone	Overall Diameter	Alignment Curve 1	Alignment Curve 2
OD Initial	Toric	9.12	6.2	10.0	7.89/0.6	8.18/0.4
OS Initial	Sphere	9.0	6.2	10.0	7.85/0.6	8.13/0.4
OD Redesign	Sphere	9.12	6.2	10.0	7.86/0.6	8.13/0.4
OS Redesign	Toric	9.0	6.2	10.0	7.85/0.6	8.13/0.4

Figure 7: This table shows the comparison of the curves between the initial fits and final redesigned lenses. A diopter of toricity was incorporated into the alignment curves of the toric Sapphire lenses.

This pilot study showed effects of disregarding corneal elevation differences when fitting orthokeratology lenses. In the case of the lens OD, toric alignment curves were used despite there being less than 30 microns of difference. This resulted in a lens that fit tighter and decentered in different positions, initially inferiorly at the one day then laterally after two weeks. It was also uncomfortable for the patient because of a tighter fitting relationship. This design recommends one diopter of toricity in the alignment curve beginning at 30 microns of elevation difference and increasing by 0.5 diopters with every additional 15 microns in difference because of these reasons. An eye fit with a lens without enough toricity may result in an incomplete treatment zone.

CONCLUSION

Orthokeratology has the ability to give patients clear quality vision without spectacles; it is highly customizable to allow optimal centration over the cornea and proper reshaping of the surface. This case demonstrated it is better to only use toric alignment curves when necessary. Too much or too little toricity resulted in an uncomfortable wearing experience, either because of a tight fit or edge lift along the steep meridian, respectively. Excessive toricity can also result in decentration while not enough toricity can result in uneven fluid forces and incomplete treatment zones. In this example it was proven that despite orthokeratology designs being highly customizable for the doctor to change, it is best to follow recommended manufacturer's guidelines initially when fitting empirically.

REFERENCES

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