



Outside Toric Limits: Correcting High Corneal Toricity with Orthokeratology

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Background

Reverse geometry lenses used in Ortho-K temporarily correct myopia by reshaping the corneal epithelium during overnight wear. In accordance with FDA approval, laboratory manufacturers of Ortho-K lenses define ideal candidates as myopes between 1.00D to 5.00D with astigmatism up to 1.50D. Patients with refractive astigmatism greater than half of the sphere or ATR astigmatism greater than 0.75D are considered poor candidates. The objective of this mini case series is to demonstrate two cases where Ortho-K was used to correct high astigmatism beyond the recommended parameters.

FDA
Approval

Euclid¹

Paragon
Z CRT²

oprifocon A
Dk=85
2004

tisilfocon A
Dk=180
2006

MYOPIA ≤ 5.00D ≤ 6.00D

CYL ≤ 1.50D ≤ 1.75D

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CASE 1

A 24-year-old female presented for an Ortho-K fit. The patient's medical history was remarkable for atopy including asthma, eczema, and cold urticaria. The patient was interested in spectacle free correction for running and had become intolerant to soft toric contact lenses due to untreated GPC at age 19. At age 21, treatment was initiated with courses of topical prednisolone acetate, loteprednol etabonate, and fluoromethalone, which minimally improved the chronic GPC. Corneal GPs and scleral lenses were unsuccessful due to discomfort.

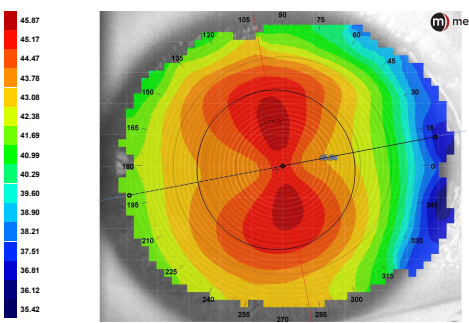


Figure 1. Baseline axial topography OD showing high WTR corneal toricity

OD	Baseline Data	OS
-2.25/-2.00x180 20/20	Subjective rx	-1.50/-2.75x168 20/20
43.54/45.85	K-values	43.30/46.29
ΔK=2.32D @ 11°	Corneal cyl	ΔK=2.99D @ 172°
49um	Sag differential	65um

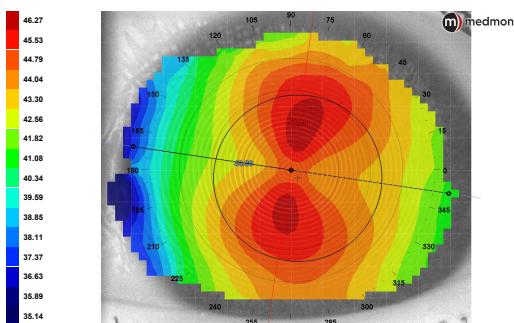


Figure 2. Baseline axial topography OS showing high WTR corneal toricity

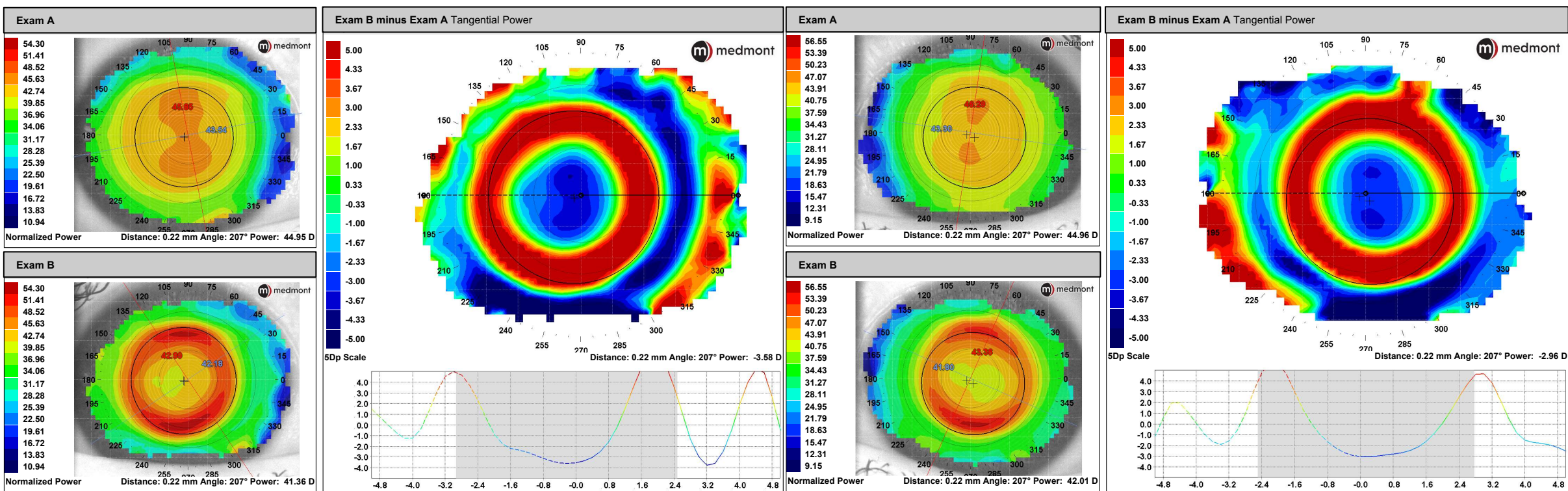


Figure 3. Tangential difference map for treatment outcome compared to baseline OD and OS

OD	Outcome Data	OS
20/20	Unaided VA	20/20
-2.91D	Max correction on axial difference map	-2.61D
Lens Parameters		
BC: 8.40 Diam: 10.6 OZ: 6.20 RC: proprietary		BC: 8.23 Diam: 10.6 OZ: 6.20 RC: proprietary

CASE 2

A 22-year-old male presented for an Ortho-K fit. The patient had previously washed out of Ortho-K due to fluctuating vision, blur, and lens discomfort. The patient wore soft toric contact lenses for 16 hours daily and reported blur. Pentacam topography was used due to patient's deep-set eyes making Medmont topography difficult to obtain.

OD	Baseline Data	OS
-1.25/-3.25x029 20/20	Subjective rx	-1.50/-2.50x164 20/20-2
40.7/43.8	K-values	40.7/44.0
ΔK=3.1D @ 18.9°	Corneal cyl	ΔK=3.3D @ 163.4°

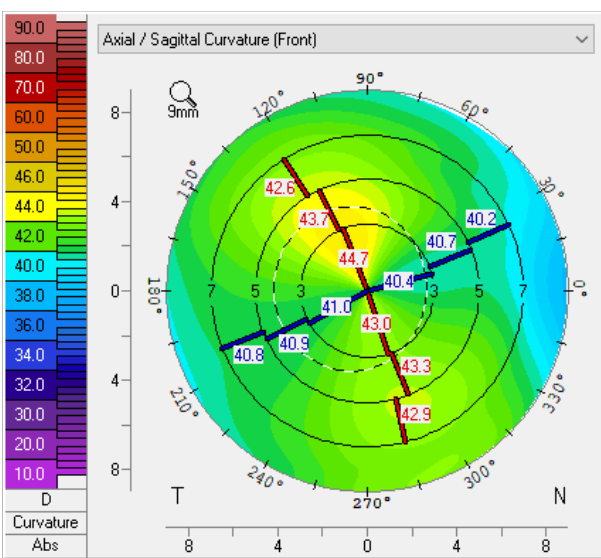


Figure 4. Baseline axial topography OD showing high WTR corneal toricity

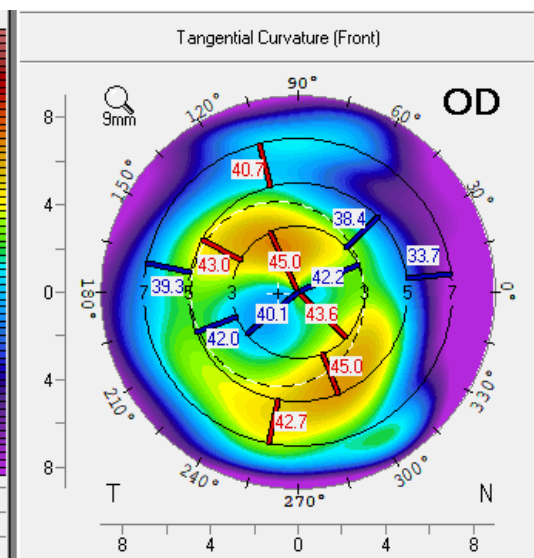


Figure 5. Tangential difference map for treatment outcome compared to baseline OD

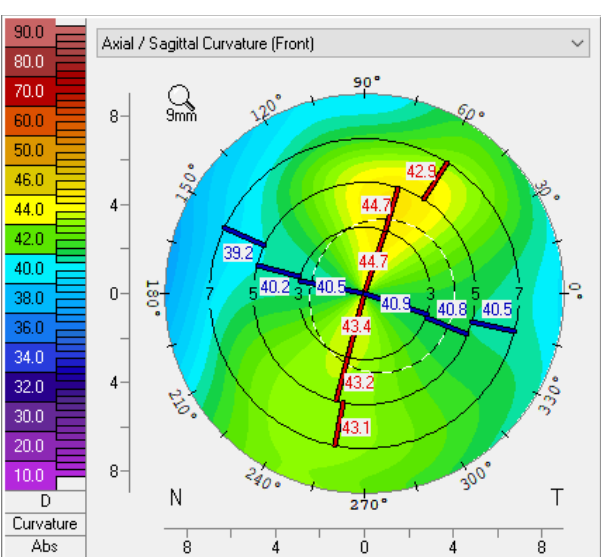


Figure 6. Baseline axial topography OS showing high WTR corneal toricity

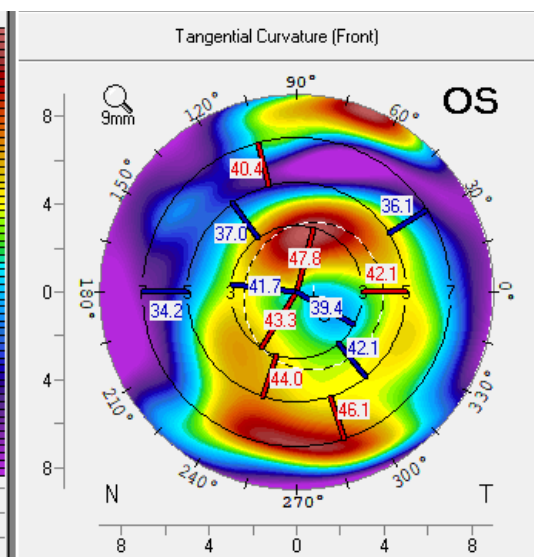


Figure 7. Tangential difference map for treatment outcome compared to baseline OS

OD	Outcome Data	OS
20/25+2	Unaided VA	20/20-2
-1.50D	Max correction on axial difference map	-2.20D
Lens Parameters		
BC: 8.82 Diam: 10.6 OZ: 6.0 RCD: 471/575 (104um toricity) AZA: 29.14/31.58		BC: 8.85 Diam: 10.6 OZ: 6.0 RCD: 470/579 (109um toricity) AZA: 28.81/31.35

Discussion

Toric reverse geometry lenses have a spherical base curve. The asymmetric reverse and alignment curves allow for stabilization on highly toric corneas especially with limbus-to-limbus astigmatism as in both cases. Centration of treatment is essential for optimal correction and to minimize subjective glare for patients. Astigmatic correction results from corneal elevation changes during treatment. A higher sag differential between flat and steep meridians can result in better correction.

Conclusion

Used off-label, toric reverse geometry designs can correct high astigmatism for carefully selected patients interested in temporary refractive correction.

- References:
- Food and Drug Administration. (2022). Approval For The JSZ Orthokeratology (OPRIFOCON A) Contact Lenses. [accessdata.fda.gov](https://www.accessdata.fda.gov).
 - Food and Drug Administration. (2022). Approval For The Paragon Z CRT (TISILFOCON A) Rigid Gas Permeable Contact Lenses. [accessdata.fda.gov](https://www.accessdata.fda.gov).