

# Efficacy of Dual Axis and Spherical Corneal Refractive Therapy (CRT) Lenses in Decreasing Corneal Astigmatism



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## PURPOSE

- Previous studies showed a lack of agreement between corneal toricity and subjective refraction with orthokeratology,<sup>1</sup> possibly due to higher order aberrations.
- One study suggested orthokeratology reduces pre-existing corneal astigmatism by approximately 50% in patients with 0.50 to 1.75 DC.<sup>2</sup>
- To date, limited data exists on patients with moderate astigmatism (>1.25 DC).<sup>3,4</sup>
- The purpose of this study was to objectively compare changes in corneal astigmatism after successful Paragon Dual Axis or spherical CRT lens wear in patients with mild to moderate astigmatism.

## METHODS

- This retrospective study evaluated 20 eyes of 10 subjects
- 8 eyes had low astigmatism (<1.25 DC), 12 eyes had moderate astigmatism (>1.25 DC)
- Half of the subjects were fit with Dual Axis and half with spherical CRT lenses.
- All subjects had reliable baseline topography and pre-treatment refractive data, as well as post-treatment data after finalization of a successful CRT fit (1-3 months of nightly wear).
- Medmont and Pentacam topographers were both used but within each subject remained consistent.
- Data were collected from the University Eye Institute at the University of Houston College of Optometry.

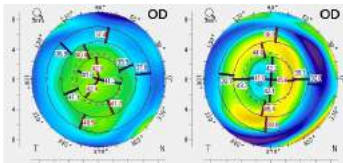


Figure 1. Tangential maps from the Pentacam tomographer showing the successful treatment (right) after 2 months of spherical CRT lens wear compared to baseline (left).

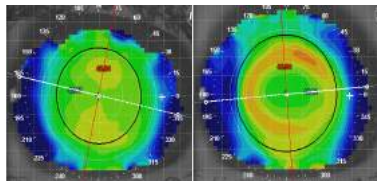


Figure 2. Tangential maps from the Medmont topographer showing the successful treatment (right) with Dual Axis lenses after 1 month of wear compared to baseline (left).

## RESULTS

### BASELINE

Eyes fit with Dual Axis lenses began with greater myopia ( $p=0.03$ ), refractive astigmatism ( $p<0.01$ ), and corneal astigmatism ( $p<0.01$ ). The baseline corneal elevation difference between the primary meridians at a 7-8 mm chord showed a statistically significant difference ( $p=0.04$ ) for Dual Axis and spherical CRT wearers (see Tables 1 and 2).

Spherical CRT	BASELINE	Dual Axis
-1.93 ± 0.54 DS	<b>Refractive Error – Sphere</b> ( $p=0.03$ )	-3.00 ± 1.30 DS
-0.43 ± 0.26 DC	<b>Refractive Error – Cylinder</b> ( $p<0.01$ )	-1.18 ± 0.64 DC
24.45 ± 6.76 μm	<b>Elevation Difference</b> ( $p=0.04$ )	32.75 ± 9.35 μm

Table 1. Baseline measurements comparing subjects fit in spherical CRT lenses versus Dual Axis lenses

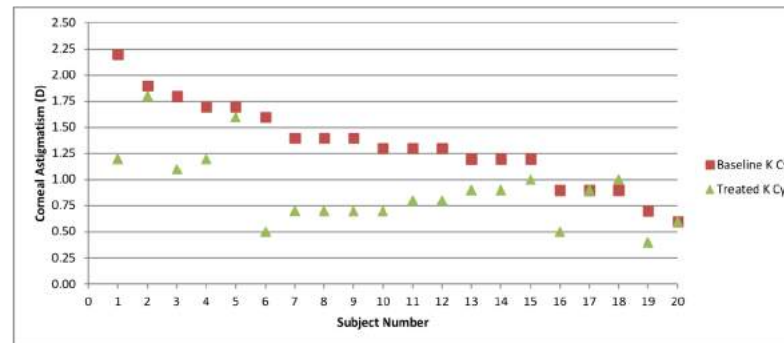


Figure 3. Scatterplot showing the change in corneal astigmatism within each subject

	Corneal Astigmatism		Mean Change	Percent Decrease
	Baseline	Residual		
<b>Overall</b>	1.33 ± 0.41 DC	0.90 ± 0.35 DC	0.43 ± 0.33 DC ( $p<0.001$ )	21%
<b>Spherical CRT</b>	1.04 ± 0.28 DC	0.76 ± 0.21 DC	0.28 ± 0.27 DC ( $p<0.001$ )	24%
<b>Dual Axis</b>	1.62 ± 0.30 DC	1.04 ± 0.42 DC	0.58 ± 0.33 DC ( $p=0.01$ )	37%

Table 2. Change in corneal astigmatism after successful orthokeratology treatment between spherical CRT lens wearers and Dual Axis lens wearers

### AFTER TREATMENT

The change in corneal astigmatism (see Table 2) was statistically significant for all subjects ( $p<0.001$ ), as well as those fit in Dual Axis ( $p<0.001$ ) and spherical CRT lenses ( $p=0.01$ ). In this sample, the amount of corneal astigmatism corrected was statistically significantly different between lens designs ( $p=0.04$ ). Overall, about 20-40% of corneal astigmatism was reduced; with greater reduction being seen with the Dual Axis lenses.

There was only one eye that showed a slight increase in corneal astigmatism after treatment (Figure 3), likely because it had low baseline astigmatism (<1.00 DC). There appears to be more variable results in the moderate astigmatic group (>1.50 DC), with about half showing a large decrease in corneal astigmatism and half showing little change after treatment.

## CONCLUSION

Overall both groups experienced a statistically significant decrease in astigmatism, with Dual Axis wearers starting with more and achieving a greater decrease in corneal astigmatism.

Further research is needed to understand how to optimize corneal and refractive astigmatism correction with orthokeratology. Future studies should explore the direct comparison of refractive astigmatism to residual corneal astigmatism and the effect on visual performance.

## REFERENCES

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## DISCLOSURES

Dr. Richdale has been a consultant for Paragon and received research funding from Euclid. Dr. Morrison has received speaker honoraria. Dr. Tomiyama and Dr. Morrison have received travel funding from Paragon. Contact: Dr. Erin S. Tomiyama at estomiya@central.uh.edu