Corneal astigmatism following myopic laser keratorefractive surgery

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Background

Total corneal power is determined by the relative contributions of the anterior and posterior corneal curvatures.[1,2] An understanding of the posterior corneal curvature is important for toric intraocular lens (IOL) power calculations and when an eye has undergone previous laser keratorefractive surgery.[2,3] Posterior corneal astigmatism following myopic keratorefractive surgery is not described in the literature.

This study aims to describe the pattern and epidemiology of standard corneal astigmatism, based on anterior corneal astigmatism, and posterior corneal astigmatism.

Methods

Consecutive eyes undergoing cataract surgery between July 2017 and December 2022 were included in the study. All eyes had undergone previous myopic laser vision correction. Corneal astigmatism was measured preoperatively using a swept-source optical coherence tomography device (IOLMaster 700, Carl Zeiss Meditec, Jena, Germany).

Results

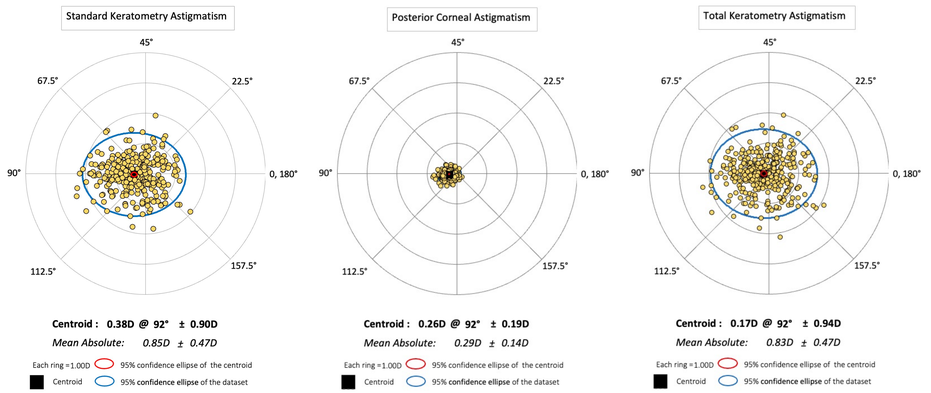
Three hundred and forty one eyes of 218 patients were included in the study. Median age was 59 years (range 38-79). Mean axial length was 26.99 ± 1.84 mm (range 23.19 – 34.57). Mean central corneal thickness was 487 ± 43 µm (range 334 – 628). Mean astigmatism magnitude is presented in Table 1.

Table 1: Mean astigmatism for standard, posterior and total keratometry

	Mean (D)	SD (D)	Range (D)
Standard keratometry astigmatism (SKA)	39.65	±2.16	32.97 – 45.79
Posterior corneal astigmatism (PCA)	-5.82	±0.24	-7.13 – -5.20
Total keratometry astigmatism (TKA)	39.15	±2.34	31.76 – 45.83

The vectoral mean of astigmatism is presented as centroid values on double angle plots in Figure 1.

Figure 1: Centroid values for standard keratometry astigmatism, posterior corneal astigmatism and total keratometry astigmatism



Standard keratometry astigmatism (SKA) was with-the-rule in 58% of eyes, while total keratometry astigmatism (TKA) was with-the-rule in 42% of eyes. Posterior corneal astigmatism (PCA) was vertically-orientated in 92% of eyes. Posterior corneal astigmatism was vertically-orientated for 95%, 87% and 85% of eyes with with-the-rule, oblique and against-the-rule astigmatism on standard keratometry respectively (Table 2).

There were no significant differences in magnitude and orientation of astigmatism between genders. The magnitude of PCA decreased significantly with age ($p < 0.05$). The proportion of PCA with a vertically-orientated steep axis increased with age.

There was a positive correlation between the magnitude of SKA and PCA. This correlation was strongest when SKA was WTR.

Table 2: Orientation of posterior corneal astigmatism

SKA	PCA	Patients (n)	% all patients	% SKA orientation
WTR	Vertical	188	55%	95%
	Oblique	7	2%	4%
	Horizontal	2	1%	1%
Oblique	Vertical	73	21%	87%
	Oblique	11	3%	13%
	Horizontal	0	0%	0%
ATR	Vertical	51	15%	85%
	Oblique	7	2%	12%
	Horizontal	2	1%	3%
Total		341		

Conclusions

The patterns of posterior corneal astigmatism following myopic laser vision correction are similar to those in virgin eyes. This would suggest that there is no change in posterior corneal curvature following myopic LVC. Assumptions made about posterior corneal astigmatism in toric IOL formulas for virgin eyes are similarly made in post-myopic laser vision correction toric IOL formulas. A further study is planned to assess the refractive accuracy of toric IOL formulas in post-myopic LVC eyes.

References

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