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## Original Article

# Prevalence of corneal astigmatism before cataract surgery in Western Indian Population

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## ABSTRACT

**Background:** The prevalence and nature of corneal astigmatism among cataract surgery candidates has not been well-documented in Indian population. The purpose of the study is to analyse prevalence and presentation patterns of corneal astigmatism (CA) in cataract surgery candidates.

**Methods:** Keratometric values were measured in patients before cataract extraction. Descriptive statistics of CA were analysed including the assessment with age ranges.

**Results:** Mean CA of 223 eyes of 223 patients [mean age  $61 \pm 10$  years (range, 29–90 years)] was  $0.88 \pm 0.61$  (95% CI, 0.80–0.96) with 27.8%, 51.1% and 21.1% having with the rule (WTR), against the rule (ATR) and oblique astigmatism (OBL) respectively. Between 40 and 50 years, ATR exceeds WTR and reaches 100% by 80 years. A trend of less negative CA was seen up to 60 years and then increases up to 90 years. CA was below 0.25 dioptre (D) in 17.5% of eyes, between 0.25 and 1.25 D in 63.7% and  $\geq 1.50$  D in 18.8% of eyes.

**Conclusions:** Considering CA  $< 1.25$  D in majority of cataract surgery candidates, it is preferable to perform inexpensive keratorefractive procedures rather expensive toric IOLs, especially in developing world.

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## Introduction

With the advancement in the calculation of intraocular lens (IOL) power, a significant reduction in spherical error has been achieved. However, residual astigmatism remains concern

for both the treating surgeon and the patient due to reduced visual acuity after phacoemulsification. There exist several techniques to reduce pre existing corneal astigmatism including axis phacoemulsification,<sup>1</sup> opposite clear corneal incisions (OCCI),<sup>2</sup> limbal relaxing incisions (LRI's),<sup>3</sup> excimer laser refractive procedures,<sup>4</sup> femtosecond laser-assisted

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astigmatic keratotomy,<sup>5</sup> and toric intraocular lens (IOL) implantation.<sup>6</sup> The procedure chosen primarily depend on the type and the strength of astigmatism. The current study is primarily aimed to study the parameters pertaining to corneal astigmatism in patients selected to undergo cataract surgery so that an estimate could be done by the hospitals and the manufacturing companies of the percentage of patients who would be requiring toric IOL implantation and the percentage of patients who would benefit from low cost keratorefractive surgery. In effect it would help in assessment of the need of astigmatically neutral surgery vis-a-vis implantation of toric intraocular lenses.

**Material and methods**

This study adheres strictly to the tenets of the Declaration of Helsinki, and a prior approval of the institutional ethical committee has been taken. In this cross-sectional study, keratometric values of cataract surgery candidates were collected from January 2015 to December 2015. A total of 223 eyes of 223 patients have been included and the study was carried out in a tertiary care hospital in Western India. The above sample size was calculated based on true prevalence value of corneal astigmatism (CA) as 87% (based on previous study),<sup>7</sup> confidence interval as 95% and an absolute error of margin as 5%. Written informed consent was taken from all the patients.

Patients with corneal diseases, irregular astigmatism, history of ocular inflammation, corneal or intraocular surgery have been excluded from the study. All eyes underwent complete ophthalmological assessment before the cataract surgery procedure, including visual assessment, slit lamp anterior segment examination and ophthalmoscopy through the dilated pupils. Corneal curvature was assessed by IOL Master 500 (Carl Zeiss Meditec AG). The keratometric values were collected by an experienced technician for the consecutive patients and an average of three measurements of the parameters was subjected to analysis. CA was categorised as with the rule (WTR) when meridian of maximum curvature was within 30° of vertical 90° or against the rule (ATR) when meridian of maximum curvature was within 30° of horizontal 180° and oblique (OBL) if it was neither WTR nor ATR.

**Statistical analysis**

Data analysis was done by using SPSS (Statistical package for social sciences) version 19:0. Descriptive statistics was applied to estimate the mean astigmatism, the percentage of individuals in different types and ranges of astigmatism in addition to the percentage of different types of astigmatism in different age brackets. One-way analysis of variance (ANOVA) was applied for the comparison of variance for normally distributed data among different age groups. ANOVA was carried out after testing for homogeneity assumption. Post hoc analysis was done using bonferoni test. *p*-Value < 0.05 is considered as significant.

**Results**

This study comprises of 223 eyes of 223 patients. Of these, 121 (54.30%) were male, while 102 (45.70%) were female. The mean age of the patients was 60.70 ± 10.46 years (range: 35–90 years). Right eye was operated in 124 patients and left eye in 99. The mean preoperative keratometric (K) astigmatism was 0.87 ± 0.61 (95% CI, 0.80–0.96) with mean anterior corneal power at one axis (K1) as 44.12 ± 1.612 dioptre (D) (range, 39–48 D) and mean anterior corneal power at 90° to K1 (K2) as 44.95 ± 1.62 D (range, 39–50 D). The most common cylindrical value lies in between 0.25 and 1.25 D and seen in 63.7% of eyes followed by >1.25 D of astigmatism in 18.8% of eyes. The least amount of astigmatism i.e. 0–0.25D is seen in 17.5% of eyes.

Using analysis of variation, Table 1 and Fig. 1 depict that the mean CA does not show a statistically significant difference (*p* = 0.253) in different age groups. However, a trend is being seen of decrease in mean astigmatism up to 60 years of age and thereafter, an increase in mean astigmatism up to 90 years of age.

Out of 223 eyes, WTR astigmatism was found in 62 eyes (27.8%; 95% CI, 44.56–51.64), ATR astigmatism in 114 eyes (51.1%; CI, 44.56–51.64) and OBL astigmatism in 47 eyes (21.1%; CI, 16.10–26.75). Table 2 shows that WTR predominates up to 40 years of age. Thereafter, ATR predominates and its predominance continues with advancing age and beyond 80 years, ATR is seen in 100% of eyes.

**Table 1 – Mean corneal astigmatism (CA) in different age groups. Using ANOVA, insignificant difference (*p* = 0.253) was observed in CA among different age groups.**

Age groups	n	Mean CA	Std. deviation	Std. error	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper bound		
≤40	14	-.93	.605	.162	-1.28	-.58	-2	0
41-50	20	-.89	.598	.134	-1.17	-.61	-3	0
51-60	57	-.70	.619	.082	-.87	-.54	-3	0
61-70	99	-.95	.581	.058	-1.06	-.83	-3	0
71-80	30	-.91	.671	.122	-1.16	-.66	-3	0
81-90	3	-1.13	.749	.432	-2.99	.73	-2	0
Total	223	-.88	.610	.041	-.96	-.79	-3	0

CA: corneal astigmatism.

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