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Evaluation of Biometry Parameters of patients from a Tertiary Eye Care Centre

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ABSTRACT

Background: To evaluate the distribution of A- scan Biometry parameters and Corneal Astigmatism before Cataract Surgery in patients from a Tertiary Eye Care Centre.
Methods: Cataract patients were recruited at a Tertiary Eye Care Hospital. Ocular axial length (AL), Lens thickness (LT), keratometry values, anterior chamber depth (ACD) and horizontal corneal diameter (white to white [WTW]) of each cataract-affected eye were measured using the Axis Nano Device (Immersion Technique).
Results: The study evaluated 418 eyes of 209 cataract patients. The mean AL, ACD, and WTW were 23.17±1.81 mm, 3. 25 ± 0.40 mm, and 10.50 ± 0.36 mm, respectively. Corneal astigmatism of 0.71 to 1.00 diopters (D) was the most common range of values. The flat and steep keratometry values both gradually increased with age. The mean ACD and WTW showed increasing trends as the AL increased. When the AL was below 26.0 mm, the keratometry values decreased as AL increased. The against-the-rule (ATR) astigmatism proportion increased with age and the with-the-rule (WTR) astigmatism proportion decreased with age. The Oblique Astigmatism whereas shows gradual decrease in the percentage in-accordance to the age.
Conclusions: In conclusion, our study determined the distribution of ocular biometric parameters and the characteristics of corneal astigmatism as well as their variation among different age groups in Delhi region. The profile of ocular biometric data and corneal astigmatism may help ophthalmologists to achieve better outcome by improving their surgical procedures including appropriate IOL choice and more accurate corneal incision made to gain a high quality of postoperative vision.

Keywords: Biometry, Keratometry, Corneal astigmatism, Axial Length, Lens thickness

INTRODUCTION

Phaco-emulsification, Micro Incision Cataract Surgery, Small Incision Cataract Surgery, Extra Capsular Cataract Extraction etc. are the most commonly used and effective surgical method for the treatment of cataract worldwide. Nowadays accurate measurement of ocular axial length, keratometry, anterior chamber depth and corneal diameter before cataract surgery is crucial for obtaining the precise degree of implanted intraocular lens (IOL). To control the postoperative Diopter (D) value plus or minus 0.50 D as well as to achieve satisfactory postoperative refractive results and improve the visual quality for cataract patients [1, 2]. The Ultrasound Biometer and IOL Calculation Axis Nano is a high precision Ultrasound Biometer which is able to measure all eye types. Pro Beam biometry probe that permits automatic focusing in the visual axis, measurements are obtained quickly with an accuracy of 0.01mm. Combining this high level of accuracy with an IOL power calculation software including Post Refractive formulas, Axis Nano is the Ultrasound Biometer of choice for all practices. Main

Characteristics are: - Precision A-scan and IOL calculation, 6 formulas for standard IOL calculation and 6 formulas for post-refractive surgery IOL calculation & is also portable. However, most previous studies of preoperative ocular biometry and corneal astigmatism on cataract patients focused on the European and American populations [2–5]. Although there have also been some region related studies, they aimed to evaluate the Southern, Northern, and Eastern Chinese populations [1, 6, 8]. However, the epidemiological investigation of ocular biometry and corneal astigmatism of cataract patients in the Central Delhi, India region has not investigated yet.

Therefore, the aim of our study was to evaluate the distribution of A- scan Biometry parameters and Corneal Astigmatism before Cataract Surgery in patients from tertiary eye care centre.

METHODS

It is a Prospective Study where the Subjects with cataract scheduled for any forms of Cataract removal surgery were recruited at a Tertiary Eye Care Centre, New Delhi. All patients who were local residents of Delhi region, had cataract, and were older than 18 years were included. All operating stage Cataract Patients were included in this study. Type of cataract patients were taken including pseudo-phakic condition in other eye. Subjects with any history of ocular surgery, such as refractive surgery, corneal diseases, ocular inflammation, and trauma were excluded in this study. Regular& Routine eye examinations were performed before surgery, including visual acuity, refraction, and tonometry, slit lamp evaluation, and dilated fundus evaluation.

Corneal astigmatism was measured by Bausch Lomb manual keratometer. Senior optometrist was taken measurements. Axial length, Lens thickness, anterior chamber depth was measured by Axis-Nano Ascan Biometer. The procedures were explained to each patient, and they were provided with written consent.

RESULTS

Distribution of ocular biometry: - This study evaluated 418 eyes of 209 cataract patients. The patient demographics are shown in the below consecutive tables. The Keratometry values, Axial Length Anterior Chamber Depth, Lens thickness and corneal diameter were denoted according to the age. The Keratometry values, Astigmatism, ACD, LT, CORNEAL Diameter values all showed average progression rate and stability in all groups of age. Whereas the LT and Corneal Dimaeter showed increasing trend.

Different age groups: - Table 2 shows the mean and standard deviation values of all measured biometric parameter values in the 4 different age groups. The flat and steep keratometry values gradually increased with age.

TABLE 1: Descriptive statistics for the four age groups.

AGE GROUP	K VALUE	ASTIGMATISM	AXL LENGTH	ACD	LT	CORNEAL DIAMETER
UNDER 40	43.27±2.07	1.31±0.82	23.67±2.34	3.4±0.41	3.83±0.53	10.89±0.32
40-60	44.11±1.85	0.71±0.81	22.97±1.05	3.31±1.5	4.28±0.56	10.70±0.78
60-80	44.00±1.75	0.97±1.20	23.32±1.63	3.28±1.76	4.37±0.49	10.62±0.51
80 ABOVE	44.12±1.49	1.25±0.94	23.77±2.38	3.2±0.5	4.34±0.68	10.73±0.51

The flat and steep keratometry values gradually increased with age. Most eyes in this cohort study were between 40 and 60 years old, followed by below 40 and above 60 years old. The Axial length showed up first gradual increasing trend moving forward to an average rate. In addition, the ACD, and WTW values showed a gradually decreasing trend with age. Corneal astigmatism showed first a rising trend than average to again towards a rising trend (Fig. 2)

Distribution of axial length:- The AL in the majority of eyes was between 22.0 and 24.5 mm. The mean ACD and WTW showed increased as the AL increased. When the AL was shorter than 26.0 mm, the mean Keratometry values decreased with an

increase in AL. However, this trend seemed to revert in patients with an AL of more than 26.0 mm. The smallest mean corneal astigmatism (0.62 D) was in eyes with an AL between 24.5 and 26 mm, and the largest (1.32D) was in eyes with a longer AL than 26.0 mm.

TABLE2: The distribution of ocular biometry for different axial lengths.

AXIAL LENGTH (mm)	K VALUE	ASTIGMATISM	ACD	LT	CORNEAL DIAMTER
SHORTER THAN 22	45.26±1.99	0.92±1.13	2.90±0.46	4.28±0.6	10.58±0.51
22-24.5	43.97±1.63	0.77±0.81	3.29±1.25	4.31±0.56	10.69±0.73
24.5-26	42.36±1.96	0.62±0.67	3.49±0.42	4.32±0.46	10.70±0.45
26 ABOVE	43.71±1.96	1.32±2.00	3.25±1.12	4.19±0.33	10.87±0.40

Distribution of corneal astigmatism:- The ATR astigmatism proportion increased with age and the WTR astigmatism proportion decreased with age. The proportion of oblique astigmatism changed little with increasing age. The percentages of WTR, ATR, and oblique corneal astigmatisms in the 4 groups are shown in Table 3

TABLE 3: The distribution of Astigmatism (WTR, ATR, OBL) in accordance to age.

AGE GROUP	WTR (%)	ATR (%)	OBL (%)
BELOW 40	77.78	5.56	16.67
40-60	51.38	35.84	10
60-80	46.25	35.63	18.13
ABOVE 80	36.37	36.37	27.28

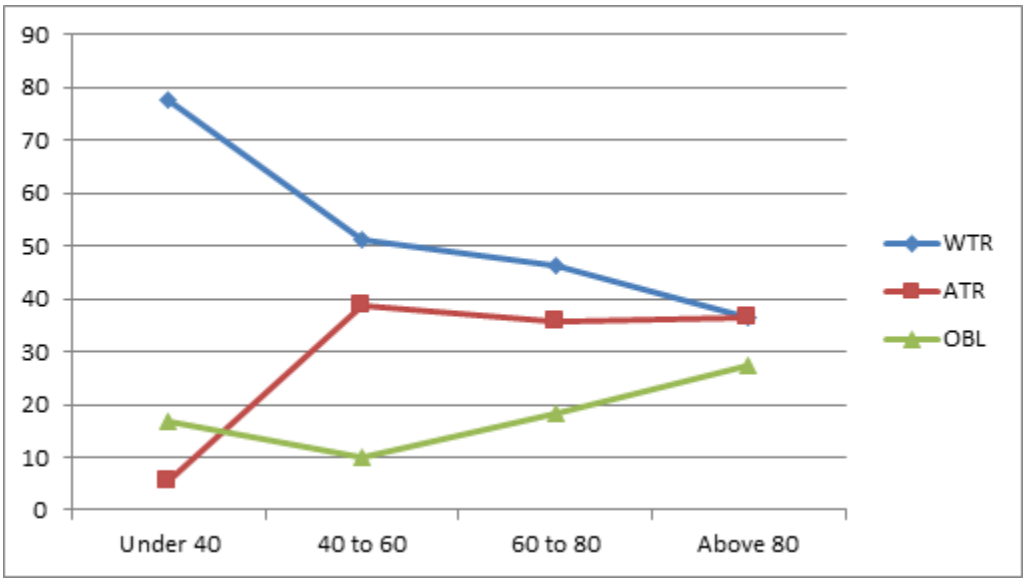


Figure 1

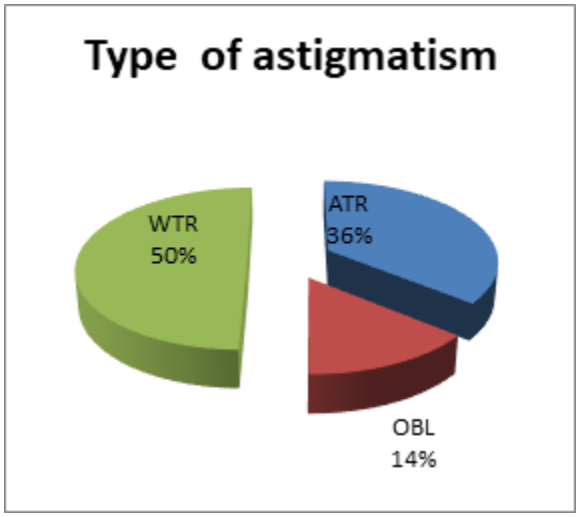


Figure 2

Figure. 1&2 The distribution of Astigmatism (WTR, ATR, OBL) in accordance to age.

DISCUSSION

This study evaluated the distribution of ocular biometric parameters and characteristics of corneal astigmatism measured using the Axis-Nano Device (Immersion Technique) in cataract patients residing in Delhi region. Corneal astigmatism across all age groups showed a similar distribution pattern compared to previous studies [3, 5, 6, 10]. The vast majority of eyes with cataract had a corneal astigmatism between 0.92 D to 1.32 D. In contrast, only a small percentage of eyes with corneal astigmatism greater than 3.0 D were observed.

Understanding the distribution of astigmatism is important to help ophthalmologists choose first-line treatment that will be most effective and reduce the occurrence of postoperative astigmatism. This includes procedures such as limbal relaxing incisions [11], opposite clear corneal incisions [18], excimer laser refractive procedures [9,13, 14], femto-second laser-assisted astigmatic keratotomy [15], and toric IOL implantation [16–17]. At present, toric IOL implantation is highly recognized and it can be used to correct up to 8.0 D of corneal astigmatism after cataract surgery [18, 19]. All biometric parameters that were measured using the Axis Nano device were presented as differences between age groups.

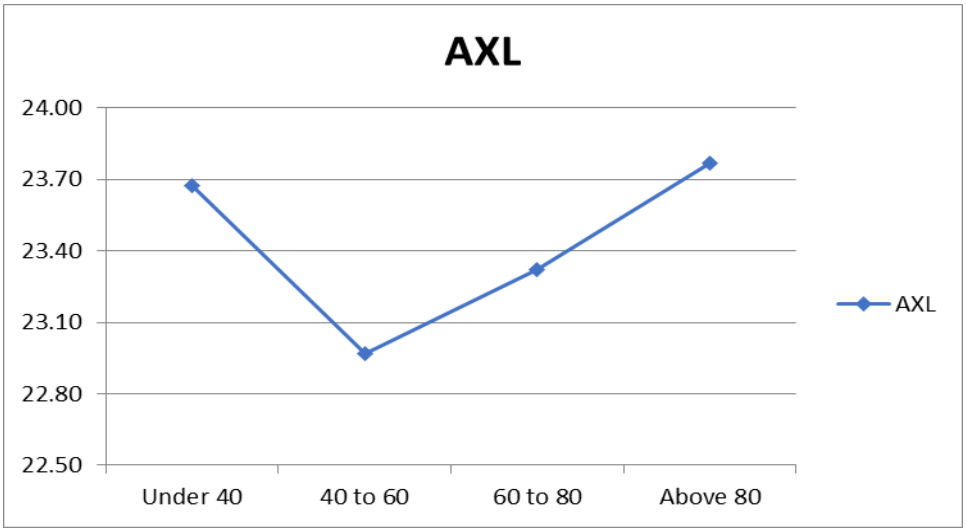


Figure 3a

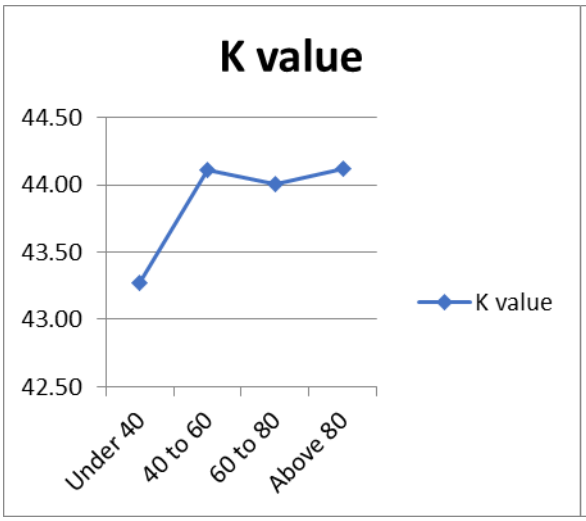
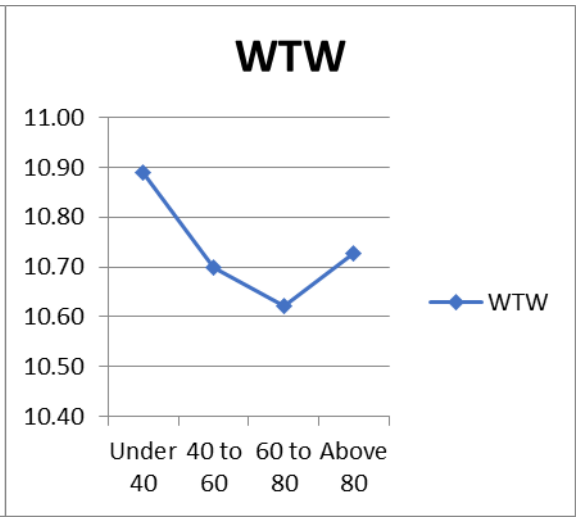


Figure 3b



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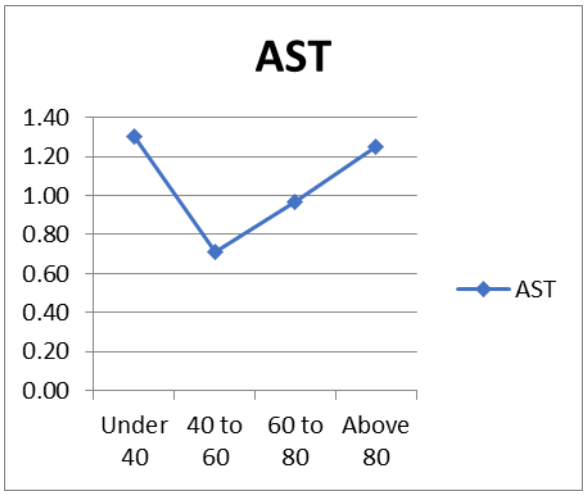

Figure 3d

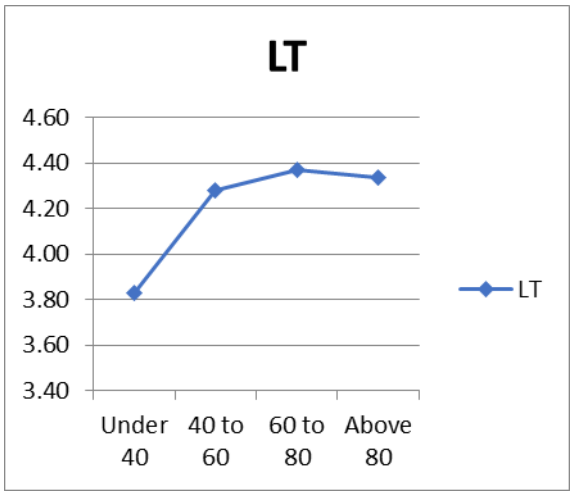

Figure 3e

Figure. 3 The biometric parameters stratified and analyzed according to age. 3a Axial length, 3b Keratometry, 3c White to white, 3d Corneal astigmatism, 3e Lens thickness

The flat and steep keratometry values gradually increased with age. Most eyes in this cohort study were between 40 and 60 years old, followed by below 40 and above 40years old. The Axial length showed up first gradual increasing trend moving forward to an average rate. In addition, the ACD, and WTW values showed a gradually decreasing trend with age. Corneal astigmatism showed first a rising trend than average to again towards a rising trend (Fig. 2).

This might be related to the occurrence of lens opacity and thickening, accommodative lags, cornea Arcus senilis, extra-ocular muscle relaxation and orbital fat prolapsed generating compression on the eye. Ocular axial length affects other components of the biometric parameters in eyes. In the present study, we found that as the AL increased, ACD and WTW also increased. Additionally, the keratometry values (Mean K) decreased when the AL was between 22.0 and 26.0 mm. These results are consistent with the findings reported in previous studies [1, 3, 20, 21]. This suggests that the cornea becomes flatter when the AL increases, accompanied by a larger horizontal WTW. However, this characteristic was not observed when the AL was greater than 26.0 mm. ATR astigmatism accounted for the majority of the cataract population, and the prevalence increased with age. By contrast, the percentage of WTR astigmatism were not stagnant which either increased/decreased with age. These findings are consistent with the characteristics seen in populations from different countries and regions [3, 6, 22]. These changes have been found to be due to a discrepancy in eyelid morphology and power [22]. It is well known that a toric IOL is indicated when there is a corneal astigmatism of 1.50 D or more. Therefore, we believe that for the selection of toric IOLs, one should consider both the corneal topography and Ocular parameters measurements in order to make a comprehensive judgment.

Total astigmatism is determined by corneal astigmatism, which is the major factor affecting postoperative visual quality; therefore it is crucial to select a reasonable and economical operative procedure to correct corneal astigmatism [1]. The most cost-effective methods to reduce corneal astigmatism are to make smaller incision and choose the most appropriate location for the corneal incision. Our study reported that WTR astigmatism accounted for the majority of the cataract population, and that prevalence increased. The characteristics of corneal astigmatisms in our study suggest

that when considering large-scale cataract surgery for patients with a low socioeconomic status in different regions in Delhi, smaller and temporal corneal incisions should be used frequently to reduce pre existing corneal astigmatism, especially in the underdeveloped areas in Delhi. Our study has some limitations. First, the ocular biometric data drawn from the cataract patients in our hospital do not completely represent the data of the whole population in Delhi. Second, we did not make a comparative analysis of eye biometric parameters with data reported abroad because previous studies reported much more detail, and we did not compare findings between men and women.

Furthermore, we did not assess the relationship between biometric parameters and genetics, diet, education, occupation, and the severity of the cataract due to lack of relevant data.

CONCLUSION

In conclusion, our study determined the distribution of ocular biometric parameters and the characteristics of corneal astigmatism as well as their variation among different age groups in Delhi region. The profile of ocular biometric data and corneal astigmatism may help ophthalmologists improve their surgical procedures including appropriate IOL choice and more accurate corneal incision made to gain a high quality of postoperative vision.

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Conflict of Interest: None

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Ethical Approval: Approved

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