

ORIGINAL RESEARCH

Prevalence of corneal astigmatism in patients before cataract surgery in Northern India

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ABSTRACT

Objective: To study the prevalence, amount and axis of pre-existing corneal astigmatism in patients undergoing cataract surgery.

Methods: The study was carried out at a tertiary care ophthalmic institute in Prayagraj, in patients admitted for cataract surgery from July 2017 to December 2017. In this prospective study, patients aged 36-85 years of both genders were included and statistically analysed. A Bausch and Lomb Manual keratometer was used for measurement of keratometry. Only eyes without a previous history of ocular surgery or any eye abnormality were included.

Results: Out of 997 patients, with-the-rule (WTR) astigmatism was found in 429 patients (43%) and against-the-rule (ATR) astigmatism was found in 389 patients (39%) while no astigmatism was found in 179 patients (18%). In females, WTR astigmatism was found in 226 (41%) eyes; ATR astigmatism in 229 (42%) eyes; and no astigmatism in 94 (17%) eyes. In males, WTR astigmatism was found in 203 (45%) eyes; ATR astigmatism in 160 (36%) eyes; and no astigmatism in 85 (19%) eyes. The most prevalent astigmatism in this study was <1D (with average amount of astigmatism +0.80D.)

Conclusion: Most frequently observed pre-existing corneal astigmatism in this study is <1 D. WTR astigmatism is found to be more common in younger patients which shifts to ATR astigmatism in older patients which is more evident in females. This can be easily corrected with appropriate measures like limbal or corneal relaxing incisions, excimer laser refractive procedures, femto laser assisted astigmatic keratectomy or toric IOL implantation.

Key words: Astigmatism, Cataract, Prevalence.

INTRODUCTION

Cataract surgery has evolved tremendously in all these years and the expectations of the patients are increasing by the day. It is important to analyse the magnitude and pattern of pre-existing corneal astigmatism to control postoperative astigmatism that is responsible for visual dissatisfaction of the patient after cataract surgery.

The distribution and prevalence of corneal astigmatism in cataract patients of different countries have been previously reported.^[1,2,3,4] However, there are no similar reports for cataract patients in India.

Astigmatism varies with both advancing age and gender. The residual astigmatism after the cataract surgery which has to be corrected with spectacles and contact lenses can be easily managed with simple measures during the cataract surgery.

The goal of cataract surgery is to achieve a desirable refractive outcome with minimal surgically induced astigmatism (SIA) after cataract surgery.^[5] Some of the factors affecting SIA are site of incision, surgical skill and to a great extent, pre-existing corneal astigmatism.^[6] Therefore it is important to know the astigmatism prevalent in Indian patients.

In cataract surgery, the corneal incision has a slight flattening effect on the corneal curvature which can be used to reduce pre-existing corneal astigmatism.^[7] Pre-existing corneal astigmatism can be corrected at the time of cataract surgery by making limbal or corneal relaxing incisions on the steeper axis or by the implantation of toric IOLs.^[8]

This study assessed all consecutive cataract cases done in 6 months in a tertiary care hospital in Prayagraj, to investigate the prevalence of corneal astigmatism in a tertiary care hospital in Northern India. The results of this may help in deciding the measures of correcting pre-existing astigmatism.

MATERIAL AND METHODS

A prospective study of the keratometry of 997 patients who were to undergo cataract surgery was done in a tertiary care ophthalmic institute in Prayagraj between 1st July 2017 and 31st December 2017.

Admitted patients between the age of 36 years and 85 years, regardless of gender were included and examined in outpatient department. Informed written consent was taken prior to the procedure in accordance with the declaration of Helsinki and the study was approved by the ethical committee of our institute. The measurement was taken at least three times for each patient by the same observer to counter the inter-observer bias. It was done by Bausch and Lomb keratometer. The subjects were divided into 5 age subgroups (36-45, 46-55, 56-65, 66-75, 76-85 years).

Patients with a history of contact lens wear, surgery, corneal diseases, pterygium, ptosis, congenital anomalies – were excluded from the study.

Data collected included the age and sex of the patient, keratometric readings in diopters along the two principal corneal meridians, and the anterior corneal astigmatism in diopters. Astigmatism was calculated from dioptric difference of vertical reading and horizontal reading. When vertical reading (Kv) was found greater than horizontal reading (Kh), it was considered WTR astigmatism and the reverse was considered as ATR astigmatism.

STATISTICAL ANALYSIS

The collected data were organized, tabulated, and statistically analysed by chi square test.

RESULTS

Of the total 997 patients 448(44.93 %) were male and 549(55.07 %) were female with the age ranging from 36 – 85 years. The data was further divided into 5 subgroups(36-45, 46-55, 56-65, 66-75, 76-85 years) and amount of astigmatism was calculated for individual age subgroups and gender.

Out of total 997 patients WTR astigmatism was found in 429 patients (43.03%) and ATR astigmatism was found in 389 patients (39.02%), while no astigmatism was found in 179 patients (17.95%).(figure 1)

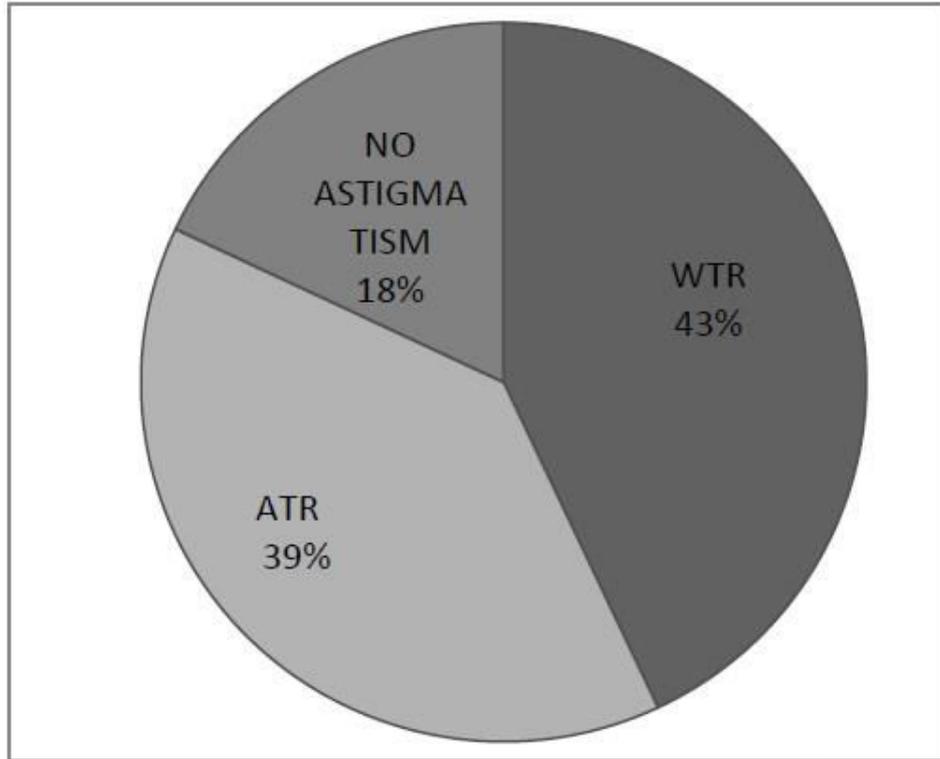


Figure 1. Frequency of astigmatism among the population.

The amount of astigmatism varied from 0 to +3.75D, while average amount of astigmatism was +0.80D. In patients with WTR astigmatism, it varied from 0 to + 3.75 D, while in patients with ATR astigmatism it was between 0 and + 3.50 D.

MAGNITUDE OF PRE-EXISTING CORNEAL ASTIGMATISM AMONG THE STUDY GROUP (997 PATIENTS)

In 516 patients (51.76%), the astigmatism was found to be <1D, in 462 patients (46.34%), it was between 1D and 2D while it was more than 2D in 19 patients (1.90%). (table 1)

Table 1 -Magnitude of pre-existing corneal astigmatism

Pre-existing corneal astigmatism(+D)	No. of patients	Percentage
<1	516	51.76%
1-2	462	46.34%
>2	19	1.90%

ASTIGMATISM WITH RELATION TO AGE

WTR astigmatism was more frequent in 36-45 age group while with advancing age, ATR astigmatism was found to be more frequent. It was analysed by chi square test (P value = 0.000058) which is highly significant. (table 2, figure 2)

Table 2 -Astigmatism in different age groups

Age (yrs)			WTR		ATR		No Astigmatism	
	N	%	N	%	N	%	N	%
36-45	133	13.34	80	60.15	33	24.81	20	15.03
46-55	208	20.86	99	47.60	71	34.13	38	18.27
56-65	382	38.32	157	41.10	155	40.58	70	18.32
66-75	227	22.77	79	34.80	104	45.81	44	19.38
76-85	47	4.71	14	29.79	26	55.32	7	14.89

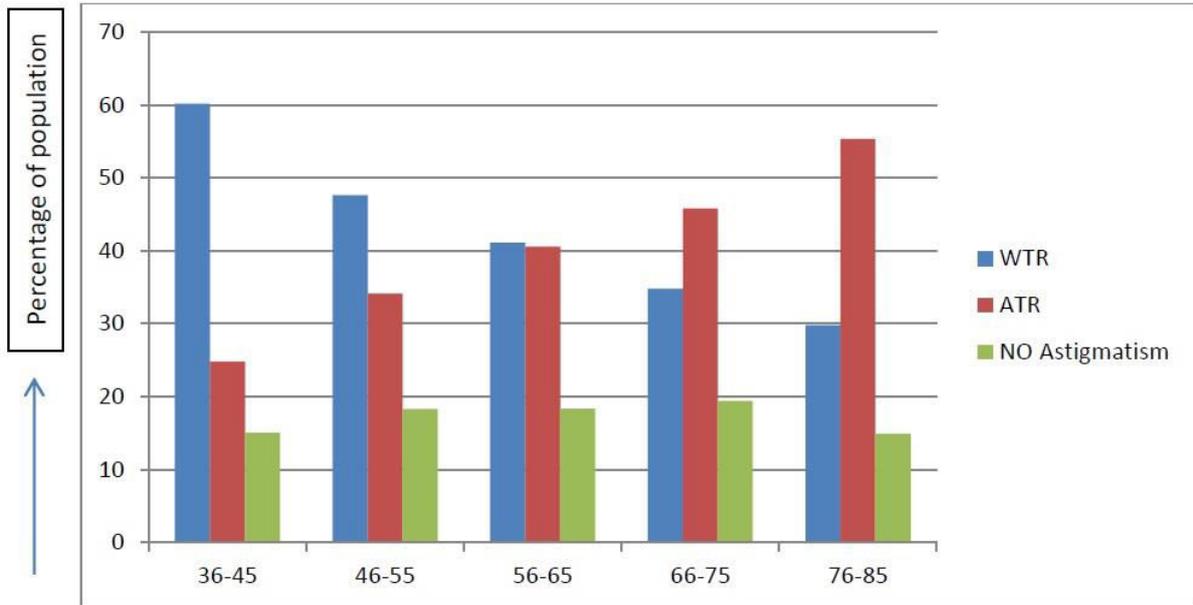


Figure 2-Astigmatism in different age groups.

→ Age in years

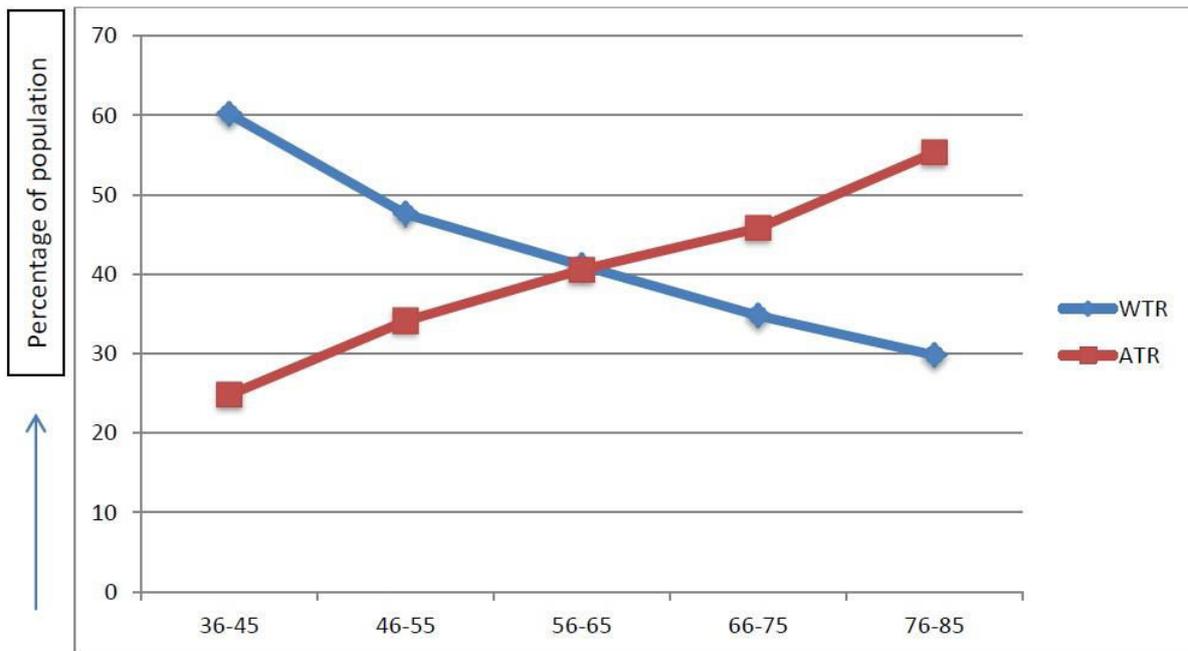


Figure 3- Astigmatism in different age groups.

→ Age in years

It is clearly evident from the figure 2 and figure 3 that as the age advances percentage of patients with WTR astigmatism decreases. In the age group, 56-65 years WTR astigmatism and ATR astigmatism are almost equal.

ASTIGMATISM WITH RELATION TO GENDER

MALE

Out of the 997 patients 448 were males, as the age advances ATR astigmatism becomes more common in male study group (P value =0.0121) which is statistically significant. (table 3, table 4, figure 4)

Table 3- Demographic data of male study group

Astigmatism	No. of patients	Percentage
WTR	203	45.32%
ATR	160	35.71%
No astigmatism	85	18.97%

Table 4 -Astigmatism in different age groups in male study group

Age (yrs)			WTR		ATR		No astigmatism	
	N	%	N	%	N	%	N	%
36-45	58	12.95	37	63.80	14	24.14	7	12.06
46-55	70	15.63	38	54.28	16	22.86	16	22.86
56-65	165	36.83	71	43.04	64	38.78	30	18.18
66-75	121	27	44	36.36	50	41.52	27	22.32
76-85	34	7.59	13	38.23	16	47.06	5	14.71

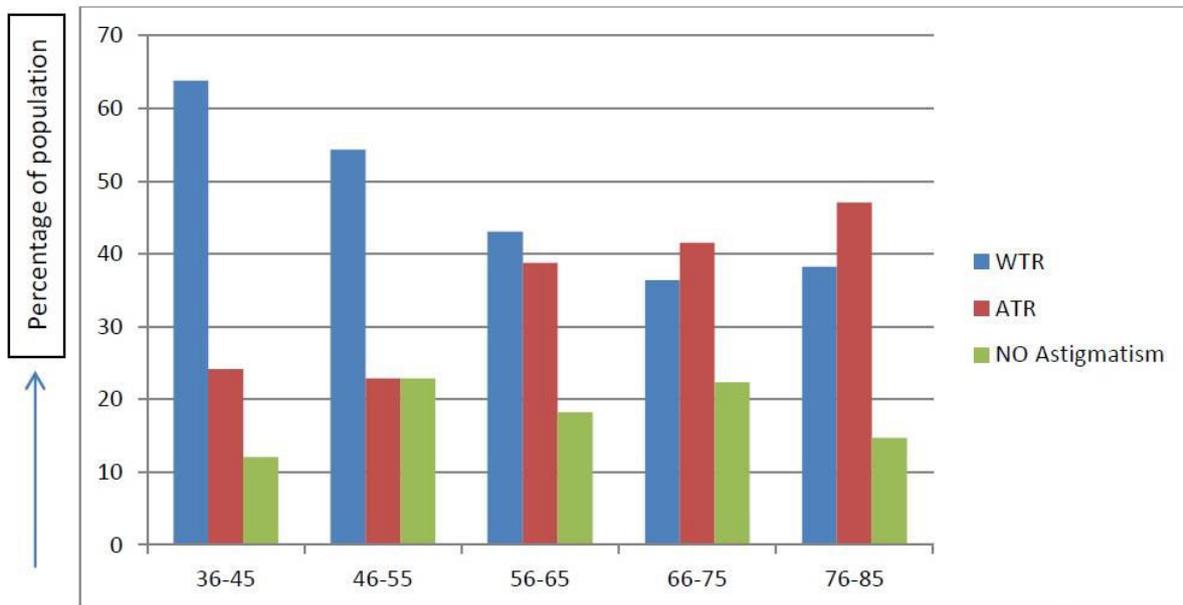


Figure 4- Astigmatism in different age groups in male study group. → Age in years

FEMALE

Out of the 997 patients 448 were females, similar to male study group ATR astigmatism becomes more common in female study group as the age advances (*P* value = 0.00521)(table 5,table 6,figure 5).

Table 5-Demographic data of female study group

Astigmatism	No. of patients	Percentage
WTR	226	41.16 %
ATR	229	41.71 %
No astigmatism	94	17.12 %

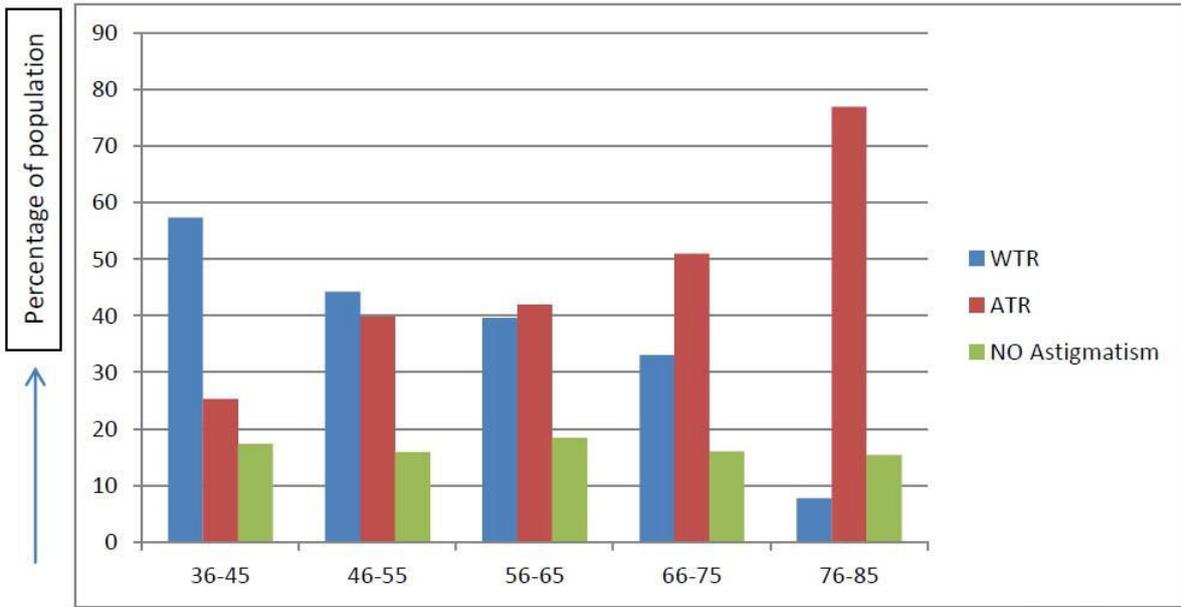


Figure 5- Astigmatism in different age groups in female study group. —————> Age in years

Table 6- Astigmatism in different age groups in female study group

Age (yrs)	WTR		ATR		No astigmatism			
	N	%	N	%	N	%		
36-45	75	13.66	43	57.33	19	25.33	13	17.33
46-55	138	25.14	61	44.20	55	39.86	22	15.94
56-65	217	39.53	86	39.63	91	41.94	40	18.43
66-75	106	19.31	35	33.02	54	50.94	17	16.04
76-85	13	2.37	1	7.69	10	76.92	2	15.38

ATR astigmatism is seen to be more common in females as compared to males.(figure 6)

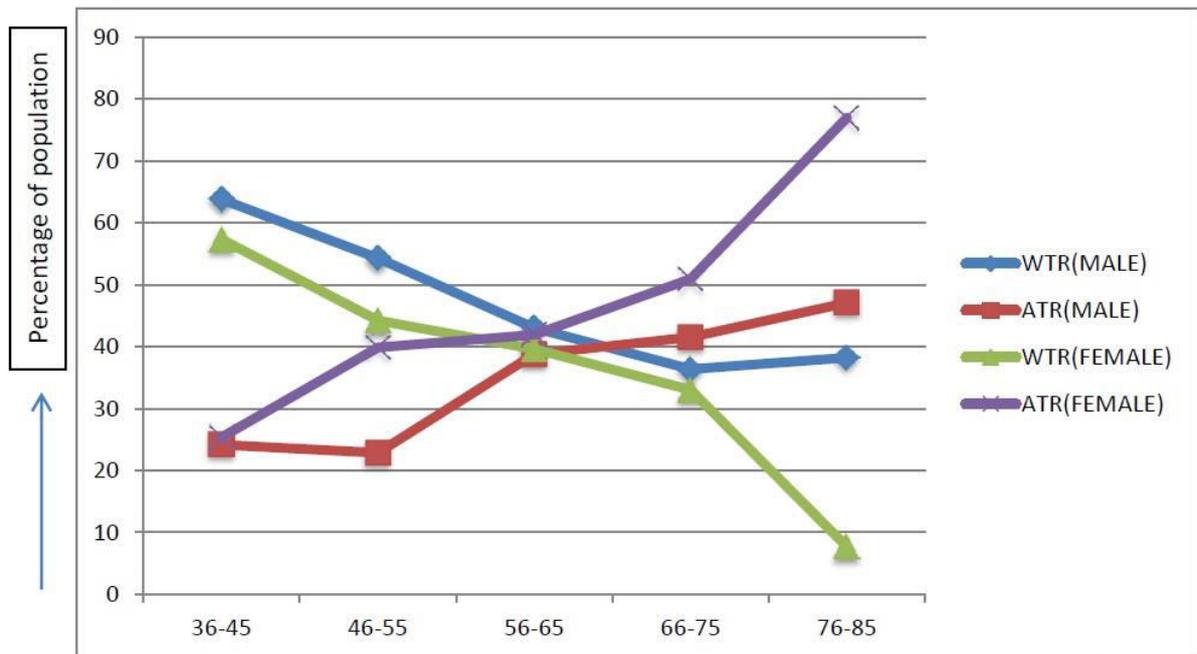


Figure 6-Comparison between male and female study group. —————> Age in years

As the age advances WTR astigmatism decreases and ATR astigmatism increases in both male and female group, but the rate of decrease in WTR astigmatism and increase in ATR astigmatism is more in female group.(figure 6)

DISCUSSION

It is evident from our study, which evaluates the amount and axis of astigmatism and its relation to age and gender, that there is fair amount of pre-existing corneal astigmatism in the population which needs correction.

Miyake et al^[10] observed the mean corneal astigmatism to be 1.02+/- 0.81 D. Corneal astigmatism was 1D or less in 63.6%, more than 1D and 1.5D or less in 20.9%, more than 1.5D and 2D or less in 7.4%, more than 2D and 2.5D or less in 3.8% ,more than 2.5D and 3 D or less in 1.8%.Khan MI et al^[5] observed corneal astigmatism to be 0.50 or less in 301 eyes (24.47%), 1.5D or less in 978 eyes (79.50%), and 3.00D or more in 24 eyes (1.93%). Ferrer-Blasco T et al^[6] observed that in most of the patients corneal astigmatism was less than 1 D. In their study they found no corneal astigmatism was present in 13.2%, corneal astigmatism was between 0.25 and 1.25D in 64.4% and 1.5D or higher in 22.2%.

Leffler et al^[11] found 1.00 D pre-existing corneal astigmatism observed in their series of 161 patients. A study conducted in Germany,^[12] involving 23,239 eyes also showed comparatively lower rates of significant pre-operative corneal astigmatism with only 33% of patients having astigmatism >1.00 D. Shen et al^[13] observed mean preoperative corneal astigmatism to be 2.77+/- 0.74 D. In our study we found that 516 patients(51.76%) had the astigmatism <1D, in 462 patients(46.34%), it was between 1D and 2D while it was more than 2D in 19 patients(1.90%), which concurs with above studies.

Elinborg Gudmundsdottir^[14,15] observed age group 60 and above had more inclination towards ATR, while the amount of astigmatism varied from 0.25 to 2D, in agreement with other studies^[16,17,18] evaluating the amount of astigmatism in the elderly. In our study, the incidence of WTR astigmatism was 60.15 % in 36-45 years age group which decreased to 29.79 % in 76-85 years age group. On the other hand the incidence of ATR astigmatism was 24.81 % in 36-45 years age group which increased to 55.32 % in 76-85 years age group.

As the age advances the ATR astigmatism becomes more common which is more evident in females as compared to males, this can be attributed to age related changes in the corneal curvature which is mainly due to decrease in the eyelid pressure due to weakness of the eye muscles in old age. This has been confirmed in a study conducted by Read et al.^[19]

So during cataract surgery the incision should be placed superiorly at 12 o'clock position in younger patients, as WTR astigmatism is more common in these patients. While in older patients ATR astigmatism is more common, so the incision should be marked on temporal side.

Elinborg Gudmundsdottir and other researchers^[20,21,22] who tried to find the influence of gender on astigmatism also found the relevant findings that astigmatism has gender-related distribution in the subjects. In a study conducted in Iran males were found to be more astigmatic than females in the sample.^[23] While in our study, we found that astigmatism was more common in females.

So, it is important to analyse the prevalence and magnitude of pre-existing corneal astigmatism in patients to undergo cataract surgery, for better postoperative visual outcome.

CONCLUSION

Most frequently observed pre-existing corneal astigmatism in this study is <1 D or in the range of 1-2 D. WTR astigmatism is found to be more common in younger patients which shifts to ATR astigmatism in older patients which is more evident in females. This can be easily

corrected with appropriate measures like limbal or corneal relaxing incisions, excimer laser refractive procedures, femto laser assisted astigmatic keratectomy and toric IOL implantation.

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