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A Comparative Study of Short Term Post-Operative Astigmatism Between Superior and Temporal Clear Corneal Through 3.2Smm Incision in Phacoemulsification

KEYWORDS: Clear corneal incision, with the rule astigmatism and against the rule astigmatism.

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ABSTRACT *OBJECTIVE: To compare surgically induced postoperative astigmatism results between superior and temporal clear corneal incisions phacoemulsification*

SETTING: Tertiary eye care center at asram medical college hospital.

PATIENTS AND METHODS: This prospective randomised clinical study comprised 100 eyes with grade2 to 3 nuclear cataract (LOCS III classification) who were randomly assigned to two groups of 50 eyes each. Group A underwent superior and group 2 underwent temporal clear corneal approach in phacoemulsification. The patients were examined on day 1, 1week, 1month and 6 weeks postoperatively. Surgically induced astigmatism (SIA) was calculated using vector method.

RESULTS: Out of 50 patients in Group A- 30% developed WTR astigmatism with a mean astigmatism of 1.18D and 56% developed ATR astigmatism with a mean astigmatism of 1.13D, 14% had no SIA. In Group B- 50% developed WTR astigmatism with a mean astigmatism of 1.14D and 22% developed ATR astigmatism with a mean astigmatism of 0.91D, 28% had no SIA. The average surgically induced astigmatism in patients who underwent phacoemulsification with PC IOL with superior clear corneal incision was 0.99 D and 0.75 D with temporal clear corneal incisions. The difference between the two groups was statistically significant (p value= 0.024, chi-square). By 6 weeks, 96% eyes in both groups had visual acuity between 6/12 to 6/6.

CONCLUSION: The average surgically induced astigmatism is less with temporal clear corneal incision as compared to superior clear corneal incision phacoemulsification with foldable intraocular lens implantation.

INTRODUCTION:
Corneal astigmatism has been the byproduct of cataract surgery since first limbal incision was made. The visual outcome of surgery is mainly attributed to degree of post-operative astigmatism which in turn depends on the type, length, architecture and position of incision and also the method of wound closure.

Surgically induced astigmatism refers to the difference between preoperative and postoperative values calculated by Vector method. This is a more accurate reflection of the actual amount of astigmatism produced by a surgical procedure. Thus in the present study we have endeavored to evaluate surgically induced astigmatism after phacoemulsification with temporal and superior clear corneal incisions using foldable intra ocular lens based on keratometry.

PATIENTS AND METHODS:
This was a prospective hospital based study conducted between January 2011 to January 2012. All surgeries were performed by a single surgeon. A total of 100 eyes were included taken. Patients with cataract of grade 2 to 3 (LOCS III classification) between 45- 80 years of age, controlled for diabetes and hypertension and without any cardiovascular disease were taken. Exclusion criteria included eyes with associated pseudoexfoliation, corneal scarring, traumatic cataract, glaucoma, diabetic retinopathy and patients having oblique astigmatism. All patients underwent a detailed ophthalmic evaluation which included best corrected visual acuity assessment (BCVA), slit lamp biomicroscopy, applanation tonometry and fundus evaluation with 90D or 78D. Written consent was taken from all the patients. Patient were divided into two groups (A &B) of 50 eyes each, in which group A and group B superior and temporal clear corneal incision phacoemulsification with foldable intraocular lens implantation respectively.

All clear corneal self-sealing incision was made with a 3.2mm keratome. Postoperative assessment of the patient was carried out on day 1, 1 week, 1 month and then after 6weeks. Ocular examination during follow-up involved visual acuity assessment, slit lamp examination, keratometry. Surgically induced astigmatism was calculated from preoperative keratometric and postoperative keratometry readings by vector method described by Jaffe and Clayman.[1] Statistical analysis was performed using SPSS software package.

RESULTS:
22 (44%) of patients in group A belonged to age group of 61-70 years and 20 (40%) patients group B belonged to age group 70-80 years (Table 1). In group A, 28 (56%)

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patients were males patients where as equal sex distribution was seen in group B(Table 2). In group A, 66% (n = 33) patients had a preoperative best corrected visual acuity(BCVA) between 6/18 – 6/60. In group B, 37 patients i.e. 74% had BCVA of 6/18 – 6/60. (Table 3)

In Group A 20 patients (40%) had with the rule (WTR) astigmatism, 15 patients i.e. (30%) had against the rule (ATR) astigmatism and 15 patients (30%) had nil preoperative astigmatism. In Group B, 17 (34%) patients had WTR astigmatism, 24 (48%) patients had ATR, and 9 (18%) patients had no astigmatism preoperatively. (Table4)

32 patients (64%) of Group A developed ATR astigmatism after phacoemulsification with superior clear corneal incision. While 17 patients (34%) developed WTR astigmatism. Only one patient (2%) had nil postoperative astigmatism. In Group B, 27 patients (54%) developed WTR astigmatism after phacoemulsification with temporal clear corneal incision. 18 patients (36%) developed ATR astigmatism. 5 patients (10%) had no astigmatism postoperatively (Table5)

Of the patients having a preoperative WTR astigmatism, 7 patients (14%) of Group A and 12 patients (24%) of group B continued to have WTR astigmatism postoperatively. 12 patients (24%) of Group A and 2 patient (4%) of group B showed a post-operative ATR drift. 1 patient (2%) of group A and 3 patients (6%) of group B showed no astigmatism postoperatively. Of the patients having ATR astigmatism preoperatively, 7 patients (14%) of group A and 10 patients (20%) of group B shifted towards WTR astigmatism. 7 patients (14%) of group A and 12 patients (24%) of group B continued to remain ATR even after surgery. 1 patient (2%) of group A and 2 patients (4%) of group B developed shift to nil astigmatism. Of the patients having no astigmatism preoperatively, 3 patients (6%) of group A and 5 patients (10%) of group B developed WTR astigmatism postoperatively. Also 12 patients (24%) of group A and 4 patients (8%) of group B developed ATR astigmatism after surgery. (Table 6)

In Group A, 17 patients (34%) had astigmatism in the range 0.25 to 0.5 D, 8 patients (16%) had induced astigmatism in range of 0.75 to 1D. 10 patients (20%) had astigmatism in the range of 1.25 to 1.5D. 3 patients (6%) had astigmatism in the range 1.75 to 2D. 2 patients (4%) had astigmatism in the range of 2.25 to 2.50 D. 3 patients (6%) had astigmatism >2.5 D. 7 patients (14%) had no surgically induced astigmatism. In Group B, 13 patients (26%) had induced astigmatism in the range of 0.25 to 0.5D. 12 patients (24%) had surgically induced astigmatism in the range of 0.75 to 1D. 7 patients (14%) had astigmatism in the range of 1.25 to 1.5D. 2 patient (4%) had SIA in the range of 1.75 to 2D. No patients in this group had astigmatism in the range of 2.25 to 2.5 D. 2 patients (4%) had astigmatism >2.5D. 14 patients (28%) had no induced astigmatism. (Table 7)

Group A, 15 (30%) developed WTR astigmatism with a mean astigmatism of 1.18 D and 28 patients (56%) developed ATR astigmatism with a mean astigmatism of 1.13 D. 7 patients (14%) had no surgically induced astigmatism. In Group B, 25 (50%) developed WTR astigmatism, with a mean astigmatism of 1.14 D and 11 patients (22%) developed ATR astigmatism with a mean astigmatism of 0.91D. 14 patients (28%) had no surgically induced astigmatism. (Table 8)

This study shows that the average surgically induced astigmatism in patients who underwent phacoemulsification with PC IOL with superior clear corneal incision was 0.99 D and 0.75 D with temporal clear corneal incisions. (p-value =0.024) (Table 9)

Table 1: Age groups of patients among both the groups

Age group	Group A (Superior)		Group B (Temporal)	
	No. of Patients	Percentage	No. of Patients	Percentage
41-50	5	10.00	3	6.00
51-60	13	26.00	9	18.00
61-70	22	44.00	18	36.00
71-80	10	20.00	20	40.00
Total	50	100.00	50	100.00

Table 2. Sex distribution among both the groups

Sex	Group A (Superior)		Group B (Temporal)	
	No. of Patients	Percentage	No. of Patients	Percentage
Male	28	56.00	25	50.00
Female	22	44.00	25	50.00
Total	50		50	

Table 3. Preoperative best corrected visual acuity among both the groups.

Visual Acuity	Group A (Superior)		Group B (Temporal)	
	No. of Patients	Percentage	No. of Patients	Percentage
6/18 – 6/60	33	66.00	37	74.00
>6/60 – CF 3 metres	12	24.00	7	14.00
CF 2 metres – HM	2	4.00	6	12.00
PL + PR accurate	3	6.00	--	--
Total	50	100	50	100

Table 4: Preoperative astigmatism in both the groups

Type	Group A (Superior)		Group B (Temporal)	
	No. of Patients	Percentage	No. of Patients	Percentage
WTR	20	40.00	17	34.00
ATR	15	30.00	24	48.00
Nil	15	30.00	9	18.00
Total	50	100	50	100

Table 5: Post-operative astigmatism in both the groups

Type	Group A (Superior)		Group B (Temporal)	
	No. of Patients	Percentage	No. of Patients	Percentage
WTR	17	34.00	27	54.00
ATR	32	64.00	18	36.00
Nil	1	2.00	5	10.00
Total	50	100	50	100

Table 6: Change in preoperative to postoperative astigmatism in both the gropus

Change	Group A (Superior)		Group B (Temporal)	
	No. of Patients	Percentage	No. of Patients	Percentage
WTR – WTR	7	14.00	12	24.00
WTR – ATR	12	24.00	2	4.00
WTR – Nil	1	2.00	3	6.00
ATR – WTR	7	14.00	10	20.00
ATR – ATR	7	14.00	12	24.00
ATR – Nil	1	2.00	2	4.00
Nil – WTR	3	6.00	5	10.00

WTR- With the rule, ATR- Against the rule

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Table 7: Final postoperative astigmatism in Group A & Group B

Range (diopters)	Group A		Group B	
	No. of Patients	Percentage	No. of Patients	Percentage
0.25 – 0.5	17	34.00	13	26.00
0.75 – 1	8	16.00	12	24.00
1.25 – 1.5	10	20.00	7	14.00
1.75 – 2	3	6.00	2	4.00
2.25 – 2.5	2	4.00	--	--
>2.5 D	3	6.00	2	04.00
0	7	14.00	14	28.00
Total	50	100	50	100

Table 8: Final mean postoperative astigmatism in Group A & Group B

Type of astigmatism	Group A			Group B		
	No. of Patients	Percentage	Mean in diopters	No. of Patients	Percentage	Mean in diopters
WTR	15	30.00	1.18 D	25	50.00	1.14 D
ATR	28	56.00	1.13 D	11	22.00	0.91 D
Nil	7	14.00	--	14	28.00	--
Total	50	100		50	100	

Table9. Average surgically induced astigmatism in each group

	Group A	Group B
Average surgically induced astigmatism	0.99 D	0.75 D

Discussion

The goal of modern cataract surgery is to minimize corneal shape changes postoperatively. This requires an exact evaluation of corneal curvature and astigmatism. The most important predisposing factor for rapid changes in astigmatism were large preoperative astigmatism, young age and preoperative IOP.[2]

Cataract incision causes flattening of the corneal meridian at right angles to the direction of incision. When incision is closer to the steeper axis preoperative astigmatism reduces and if incision is taken on the steeper axis the astigmatism totally neutralizes whereas preexisting astigmatism with steeper cornea and incision taken on the opposite axis postoperative astigmatism increases.

In this study eyes which under superior clear corneal incision showed ATR type of postoperative astigmatism in majority of cases whereas the one which underwent temporal incision showed WTR type of postoperative astigmatism in majority of patients probably due to the incision being away from visual axis.

When incision is taken superiorly which is closer to central cornea which have nearly twice the astigmatic effect than horizontal axis. A study done by Simsek S et al showed that temporal incision has significantly lower astigmatism. Upper lid pressure on superior corneal incisions led to fluctuating ATR astigmatism was significantly higher than that induced by temporal incision. [3]

To reduce postoperative astigmatism and to correct preoperative astigmatism requires exact evaluation of corneal topography and precise predictability of SIA. [4]

Stan J roman et al showed in their study that the superior corneal incision produced significant SIA as compared to temporal incisions produced minimal SIA. They concluded in their study that superior corneal incisions rarely allows to reach minimal postoperative astigmatism as with temporal location.[5]

The incision in the cornea or sclera cause flattening immediately adjacent to it and also perpendicular to incision. As a result of coupling effect the meridian 90 degrees away is steepend. Hence superior incision being closer to visual axis, gravity and blink create drag on the incision, impact more corneal changes and postoperative astigmatism. Whereas temporal incision being away from visual axis is more stable causes flattening around the wound and is less likely to effect corneal curvature which results in least astigmatism.

In this study the mean SIA in superior group is 0.99 D and 0.75 D in temporal clear corneal incision group respectively. The higher induced astigmatism in superior (Group A) is because the incision is closer to the pupillary axis.

Conclusion:

The incidence of post-operative astigmatism following phacoemulsification with foldable intra ocular lens implantation with temporal clear corneal incision is less than with superior clear corneal incision.

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