

Original article:

Study of assessment of changes in the pattern of corrected astigmatism over a period of 6 months with limbal relaxing incisions (LRI's)

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Abstract:

Introduction: Astigmatism is a refractive anomaly in which, no point focus is formed because of unequal refraction of light rays in different meridians by dioptric system of the eye

Material and methods: This Prospective interventional case series study was carried out in the Department of Ophthalmology in Jawaharlal Nehru Hospital and Research Centre, Bhilai Steel Plant, Bhilai, Chhattisgarh. . Ethical clearance was obtained from the ethical committee of our institute. 200 eyes of 200 patients who underwent cataract surgery with pre-operative astigmatism more than 1 diopter were enrolled in the study. Informed written consent was taken on previous day of the surgery and patients were explained regarding complications of surgery and anesthesia in their local language.

Results : There is no statistically significant variation in the amount of reduction of astigmatism at different points of time like 1week to 6weeks(3.8%), 6 weeks to 6months(1.59%),1week to 6 months with (5.39%).

At 6 months post operatively there is a reduction of 66.67%, 68.82%,66.86% of astigmatism in age group between 30- 49 yrs, 50-69yrs and 70-90yrs respectively. There is statistically no significant difference in amount reduction of astigmatism between all the age groups over a period 6 months time (P=0.67).

Conclusion: Limbal relaxing incision is a simple, safe, effective, easy to learn, vision optimizing refractive surgical procedure to correct mild to moderate astigmatism in the eyes at the time of cataract surgery.

Keywords: Astigmatism , Limbal relaxing incision

Introduction

Astigmatism is a refractive anomaly in which, no point focus is formed because of unequal refraction of light rays in different meridians by dioptric system of the eye.¹ Surgically induced astigmatism is mainly influenced by preoperative astigmatism as well as by the shape and length of anterior chamber entry incision, suture technique and wound healing.²With the advent of latest foldable intraocular lens as a deviation from conventional rigid intra ocular lens, it is possible to implant the lens through an incision as small as 2 to 3mm, this helps in significantly reducing surgically induced astigmatism. Spherical results have become more predictable because of increased attention to breakthrough technology of IOL power calculation like biometry

technique & partial coherence interferometry³. As the technology has evolved to smaller, sutureless wounds, attention has shifted from avoiding surgically induced astigmatism to modifying pre-existing astigmatism. Now today in order to fully embrace the concept of “refractive cataract surgery” one must be able to address and reduce the pre-existing as well as the post-operative astigmatism.

Material and methods

This Prospective interventional case series study was carried out in the Department of Ophthalmology in Jawaharlal Nehru Hospital and Research Centre, Bhilai Steel Plant, Bhilai, Chhattisgarh. .

Ethical clearance was obtained from the ethical committee of our institute. 200 eyes of 200 patients who underwent cataract surgery with pre-operative astigmatism more than 1 diopter were enrolled in the study. Informed written consent was taken on previous day of the surgery and patients were explained regarding complications of surgery and anesthesia in their local language.

Inclusion criteria:

- 1) Patients aged 30 to 90 years undergoing cataract surgery by phacoemulsification method,
- 2) Pre-existing corneal astigmatism of more than 1 diopter,
- 3) Any type of cataract in which phacoemulsification is feasible.

Exclusion criteria:

- 1) Irregularly irregular astigmatism like Keratoconus or keratoglobus.
- 2) Corneal degeneration, dystrophies and scars.
- 3) Pannus or pterygium at the steep axis.
- 4) Peripheral corneal thickness less than 600 microns.
- 5) Dry eye and ocular surface disorders.
- 6) Recurrent uveitis and Glaucoma.
- 7) Collagen vascular diseases.
- 8) Immunocompromised status.
- 9) Posterior segment pathologies.
- 10) Any previous surgery on the eye

200 eyes of 200 patients who underwent phacoemulsification with limbal relaxing incisions were evaluated for preoperative and postoperative astigmatism. All the patients completed 6months follow up.

Statistical analysis of the results was done using Student “t’ test, χ^2 test, z test. A p-value of <0.05 was taken as statistically significant.

Results:

Selected patients age ranged from 30 years to 90 years with mean age 58.39 ± 12.05 years. Maximum no. of patients are in age group of 50-69 yrs (53.5%) .Only 17.5% patients are in age group of 70-90 yrs, while 29% patients are in age group of 30-49yrs

Out of the 200 patients who underwent surgery, 115(57.50%) were males and 85(42.50%) were females.

At the end of 6 months post operatively there is 65.63%, 69.89%, 73.58% reduction in 1D-2D, 2.1D-3D, 3.1D-4D of pre operative astigmatism group respectively. There is statistically significant difference in reduction in astigmatism between the 3 groups(and also between 2groups) (P <0.001).With increasing preoperative astigmatism , reduction of postoperative astigmatism also increases.

Table 1) Comparison of pre and post results

AST	Pre op		Post op					
	No. of pts	Mean D ± SD	1 week		6 weeks		6 months	
			Mean D ± SD	% of red	Mean D ± SD	% of red	Mean D ± SD	% of red
1 – 2D	169	1.61±0.21	0.62±0.14	61.49	0.55±0.16	65	0.53±0.21	65.63
2.1 – 3D	27	2.6±0.24	0.91±0.08	65.84	0.88±0.17	66.15	0.76±0.07	69.89
3.1 – 4D	4	3.52±0.26	1.21±0.09	67.08	1.06±0.08	70.77	0.93±0.07	73.58

At 6m, there is no statistically significant difference (p = 0.53) in the amount of reduction of astigmatism between the WTR (67.39%) and ATR (68.18%) groups .

There is no statistically significant variation in the amount of reduction of astigmatism at different points of time like 1week to 6weeks(3.8%), 6 weeks to 6months(1.59%),1week to 6 months with (5.39%).

At 6 months post operatively there is a reduction of 66.67%, 68.82%,66.86% of astigmatism in age group between 30- 49 yrs, 50-69yrs and 70-90yrs respectively.

There is statistically no significant difference in amount reduction of astigmatism between all the age groups over a period 6 months time (P=0.67).

Age	# of pat	Pre op Ast	Post op residual astigmatism					
			1 week	% Red	6 week	% Red	6 months	% Red
30-49yrs	58	1.65±0.37	0.63±0.17	61.82	0.56±0.21	66.06	0.55±0.24	66.67
50-69yrs	107	1.86±0.51	0.69±0.19	62.9	0.61±0.2	67.2	0.58±0.21	68.82
70-90yrs	35	1.75±0.45	0.67±0.17	61.71	0.63±0.24	64	0.58±0.19	66.86

Table 2: Reduction in amount of astigmatism with respect to different age

There is reduction of 68.96%% correction in Left eye, and 67.03% correction in Reft eye at 6 month post operatively. Both eyes has statistically equal amount of reduction of astigmatism. (P=0.72)

Discussion:

Astigmatism is the most common cause of suboptimal vision in well done cataract surgery. There are several approach for reducing pre-existing astigmatism during cataract surgery. Perhaps the most basic & effective is the placement of limbal relaxing incisions.^{4,5,6} In this study, the use of limbal relaxing incisions during phacoemulsification significantly reduced preoperative corneal astigmatism. Additionally, the refraction remained stable in the eyes treated with limbal relaxing incisions through-out the entire 6 month postoperative follow-up period. The mean preoperative astigmatism was $1.7793D \pm 0.47D$. Out of them 154 of 200 (77%) had ATR, 23 of 200(46%) had WTR astigmatism with the mean astigmatism of 1.7599D, 1.844D respectively in both the groups. In the present study there was a significant decrease in amount of astigmatism post operatively with a mean post operative astigmatism at 1 week was $0.6689D \pm 0.1852D$ with the reduction of 1.1104D (62.4%). At 6 weeks it was $0.6014D \pm 0.2092D$ with the reduction of 1.1779D(66.2%). At 6 months it was $0.5703D \pm 0.2169D$, with reduction of 1.209D (67.95%).^{7,8} Results of different studies are compared in the following table, the results matches well with our study. The astigmatic correction in different age groups at the final follow up of 6 months are 66.67 % in 30-49yrs, 68.82 % in 50-69yrs, 66.86% in 70-90yrs age group. There is no statistically significant difference in astigmatic correction between 3 groups ($p=0.67$).

The astigmatic correction depending on the different amounts of pre operative astigmatism reveals 65.63% reduction in 1-2D group, 69.89% reduction in 2.1 to 3D group, and 73.58% reduction in 3.1 to 4 D age group at final follow up at 6 months. The amount of astigmatism correction increases as pre- op astigmatism increases from 1 to 4 D. ($P<0.001$) . In the present study WTR and ATR group had reduction of 67.39% and 68.18% respectively at the end of 6 months. There is no statistically significant difference between the two groups ($P=0.53$). In our study no statistical difference in the amount of correction with respect to laterality (RE/LE) was noted. There was 68.96% reduction in LE and 67.03% reduction in RE at the final follow up. ($P=0.72$) With respect to sex there was 67.42% reduction in males and 68.54% reduction in females at the final follow up. The difference between the sexes is statistically insignificant. ($P=0.86$)

In our study at 6th month postoperatively ,11 of 200 (5.5%) had astigmatism less than 0.25D , 138(69%) patients had 0.26 to 0.75 D, and 51(25.5%) patients had more than 0.76D . 74.5% of post operative patients had 0.75D or less astigmatism and 98.5% of post operative patients had 1D or less astigmatism.

Conclusion:

Limbal relaxing incision is a simple, safe, effective, easy to learn, vision optimizing refractive surgical procedure to correct mild to moderate astigmatism in the eyes at the time of cataract surgery.

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