



STUDY OF SURGICALLY INDUCED ASTIGMATISM IN STRAIGHT AND FROWN INCISIONS IN MANUAL SMALL INCISION CATARACT SURGERY

Ophthalmology

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ABSTRACT

Aim- To determine and compare surgically induced astigmatism in straight and frown incisions in post-operative patients of manual small incision cataract surgery.

Methodology- A longitudinal study was conducted at a tertiary care hospital for a period of 1 year. A total of 60 patients having cataract were selected for undergoing manual small incision cataract surgery (MSICS) and divided into 2 groups- straight incision (group A) and frown incision (group B). Keratometry readings were estimated pre-operatively followed by on post-operative day 1, 3 weeks and 6 weeks. Surgically Induced Astigmatism (SIA) was calculated and compared between the 2 groups.

Results- The mean age in Group A was 62.53 ± 11.21 years and in Group B was 63.4 ± 11.16 years. Among the total patients, 51.6% were male and 48.4% were female. Mean SIA in Group A was 1.63 ± 1.10 on post op day 1, 1.37 ± 0.69 at post-operative 3 weeks and 1.32 ± 0.60 at post-operative 6 weeks while in Group B it was 1.25 ± 1.03 on post op day 1, 0.65 ± 0.32 at post-operative 3 weeks and 0.56 ± 0.26 at post-operative 6 weeks. The difference is statistically significant at post-operative 3 weeks and 6 weeks with p value < 0.001 and is statistically not significant at post op day 1 with p value > 0.05 .

Conclusion- Frown incision achieves lower SIA and offers greater corneal topographic stability as compared to straight incision in manual small incision cataract surgery.

KEYWORDS

SIA, straight incision, frown incision

INTRODUCTION:

Any opacity in the lens or its capsule whether developmental or acquired is called cataract.^[1] Cataract is the leading cause of blindness (51%) and low vision (33%) worldwide.^[2]

Blindness due to cataract presents an enormous problem, especially in developing countries like India not only in terms of human morbidity but also in terms of economic loss and social burden.

Surgical techniques for cataract extraction have undergone major advancement – from intracapsular extraction to the present-day phacoemulsification. However, the most widely used surgical technique for cataract extraction in third world countries is the suture-less Manual Small Incision Cataract Surgery (MSICS).

MSICS by virtue of its self-sealing suture-less incision appears as a ray of hope for tackling the cataract burden in developing countries. Lower cost of instrumentation and disposables in MSICS is an added advantage.^[3-4]

The “Incision” is the most important step of refractive procedures performed today. From submillimetre cataract surgery days of Sushruta (couching) in the 600 BC to the present-day submillimetre cataract surgery, we have probably come a full circle.^[5]

Corneal or keratometric SIA (Surgically induced astigmatism) is the vector difference between the preoperative corneal or keratometric astigmatism and the postoperative astigmatism.^[6]

Corneal astigmatism is associated with cataract surgery since the first limbal incision was made. Recent progress in cataract surgery had heightened patient expectations of outcomes. Good postoperative vision without spectacles is considered the norm. Thus, control of postoperative astigmatism is key in meeting these expectations.^[7] The concept of surgically induced astigmatism has added an entirely unique dimension to cataract surgery with emphasis more focused on the refractive aspect of the surgery in the present era.

With the popularity of intraocular lens implantation surgery and availability of accurate intraocular lens power calculation methods, the chief impediment to early visual rehabilitations is postoperative astigmatism. The cataract surgeon of today is challenged to control the sphere as well as the cylinder of the refraction after surgery.^[8] The alterations in corneal curvature in the early post-operative period are

primarily attributable to the surgical procedure. The cataract incision and its closure can have a profound effect on astigmatism and therefore the refractive status postoperatively.

The incision being the first and the most important determinant of postoperative astigmatism which can be modified in various ways in terms of size, shape, axis etc. to reduce the degree of postoperative astigmatism.^[9]

In this study an attempt has been made to study the role of incision shape depending on the pre-operative keratometry readings in reducing surgically induced astigmatism in manual small incision cataract surgery.

Herein, we compared SIA (surgically induced astigmatism) between two groups of patients who underwent frown and straight incision forms of MSICS at Pravara Rural Hospital, Loni.

METHODOLOGY:

A longitudinal study was conducted in the department of ophthalmology in a tertiary care hospital. The study was carried out over a period of 1 year (Dec 2019-2020).

The study was approved by the institutional ethics committee and informed consent was taken from all participants.

In this study 60 patients were selected belonging to 50 years of age and above of either sex and undergoing MSICS. Patients having any corneal pathologies, congenital or developmental cataract, complicated cataract, posterior segment pathologies and associated ocular pathologies like glaucoma, uveitis were excluded. Data was collected using a structured proforma. Pre-operative visual acuity along with refraction was recorded using Snellen's chart. Cataract evaluation for grading and complete ophthalmic examination using slit lamp biomicroscopy and ophthalmoscopy was performed. Corneal curvatures (Kh and Kv) were measured in diopters using Automated Keratometer.

Selected patients were divided into 2 groups. Group A undergoing MSICS with straight incision and Group B with frown incision.

All surgeries were performed under peribulbar anesthesia. After making fornix based conjunctival flap, in group A a 6 mm Straight incision was made 2 mm away from superior limbus, in group B a 6

mm Frown incision was made, the centre of the frown being 1.5 mm and periphery 4 mm from the superior limbus. A sterile disposable crescent blade was used to create a self sealing scleral corneal tunnel, which extended into clear cornea for 1 mm. A 3.2 mm keratome was used to enter the anterior chamber through the tunnel incision. Continuous curvilinear capsulorhexis was done using a 26 G cystitome through the main tunnel under viscoelastic cover. The internal wound was now enlarged to 8-10 mm length approximately sufficient to accommodate large nucleus as well. Hydrodissection and delineation was performed. The nucleus was prolapsed in the anterior chamber and was delivered by viscoexpression. After irrigation and aspiration, a single piece PMMA IOL was implanted in the capsular bag and dialed. Self sealing wound was left suture less after checking for any wound leakage.

Patients were followed up on post op day 1, at 3 weeks and at 6 weeks for post-operative keratometry and refraction. Surgically induced astigmatism was calculated using SIA calculator version 2.1 and data

was analyzed using appropriate statistical tests.

RESULTS:

The mean age in Group A was 62.53 ± 11.21 years and in Group B was 63.4 ± 11.16 years.

Table 1: Age And Sex Wise Distribution

Age in years	Straight incision (Group A)			Frown incision (Group B)		
	Males	Females	Total	Males	Females	Total
50-60 yrs.	12	3	15	8	5	13
60-70 yrs.	2	8	10	4	7	11
70-80 yrs.	1	3	4	3	3	6
>80 yrs.	1	0	1	0	0	0
Total	16	14	30	15	15	30

Amount of astigmatism in both groups was calculated at different follow up visits. (Table 2)

Table 2: Amount Of SIA

SIA	POST OP DAY1				POST OP 3 WEEKS				POST OP 6 WEEKS			
	GROUP A (SI)		GROUP B (FI)		GROUP A (SI)		GROUP B (FI)		GROUP A (SI)		GROUP B (FI)	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
0.00-0.5	6	20.00%	11	36.67%	4	13.33%	15	50.00%	4	13.33%	22	73.33%
0.75-1.00	5	16.67%	0	0%	10	33.33%	13	43.33%	8	26.67%	7	23.33%
1.25-1.50	8	26.67%	11	36.67%	8	26.67%	1	3.33%	9	30.00%	1	3.33%
1.75-2.00	3	10.00%	4	13.33%	2	6.66%	1	3.33%	6	20.00%	0	0%
2.25-2.50	1	3.33%	0	0%	6	20.00%	0	0%	3	10.00%	0	0%
2.75-3.00	4	13.33%	2	6.66%	0	0.00%	0	0%	0	0.00%	0	0%
>3.00	3	10.00%	2	6.66%	0	0.00%	0	0%	0	0.00%	0	0%
TOTAL	30	100%	30	100%	30	100%	30	100%	30	100%	30	100%

Mean SIA in Group A (straight incision) was 1.63 ± 1.10 at post op day 1, 1.37 ± 0.69 at post-operative 3 weeks and 1.32 ± 0.60 at post-operative 6 weeks while in Group B (frown incision) was 1.25 ± 1.03 at post op day 1, 0.65 ± 0.32 at post-operative 3 weeks and 0.56 ± 0.26 at post-operative 6 weeks (Table 3)

Table 3: Progress Of SIA

	POST OP DAY 1	POST OP 3 WEEKS	POST OP 6 WEEKS
	MEAN $\pm$ SD	MEAN $\pm$ SD	MEAN $\pm$ SD
GROUP A (SI)	1.63 ± 1.10	1.37 ± 0.69	1.32 ± 0.60
GROUP B (FI)	1.25 ± 1.03	0.65 ± 0.32	0.56 ± 0.26
Statistical Significance	p>0.05, Not significant	p<0.001, significant	p<0.001, significant

The difference is statistically significant at post-operative 3 weeks and 6 weeks.

Group B shows maximum reduction in SIA from Post-operative 3 weeks and Post-operative 6 weeks as compared to Group A.

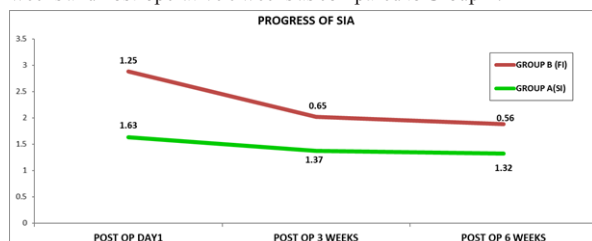


Figure 1: Progress of SIA

DISCUSSION:

The size, shape & location of external incision influence the induced astigmatism after cataract surgery. Paul S Koch^[10] formed a composite illustration called "INCISIONAL FUNNEL". Geometrically, the incisional funnel consists of an imaginary pair of curved lines diverging outward from the limbus. As the incision ends are placed farther from the cornea & incision falls within the incisional funnel frown incision becomes more stable as compared to straight incision which falls out of the funnel.^[11]

In our study, maximum patients i.e. 9 (30%) in group A with straight incision had SIA in range of 1.25-1.50 D followed by 8 (26.6%) in range 0.75-1.00 D at the end of 6 weeks. In group B with frown incision

maximum patients i.e. 22 (73.3%) had SIA in range of 0.00-0.50 D followed by 7 (23.3%) in range of 0.75-1.00 D. Findings consistent with our study were found in study conducted by Rajkumar Patra et al^[12] where patients with straight incision 28% had astigmatism in range of 1.1-1.5 D and with frown incision 52% patients showed <1D astigmatism where maximum were between 0.5-1 D at end of 6 weeks. Similar results were seen in study by Bhumbla S. et al^[13] showing maximum patients after 1 months had SIA in range of 1.25-1.50 D in straight incision group while in frown incision maximum patients were in range of 0.75-1.00 D. Jauhari et al^[14] also had similar findings in his study with maximum patients with straight incision having SIA in range of 1.25-2 D while patients in frown incision having SIA <1 D.

Mean SIA in Group A (straight incision) was 1.63 ± 1.10 at post op day 1, 1.37 ± 0.69 at post-operative 3 weeks and 1.32 ± 0.60 at post-operative 6 weeks while in Group B (frown incision) was 1.25 ± 1.03 at post op day 1, 0.65 ± 0.32 at post-operative 3 weeks and 0.56 ± 0.26 at post-operative 6 weeks as shown in Table 3. The difference is statistically significant at post-operative 3 weeks and 6 weeks suggesting frown incision cause less SIA as compared to straight incision. Similar results were seen in studies by Bhumbla S. et al^[13] and Singer et al^[15]. However, Jauhari et al^[14] concluded that straight and frown incision did not have any significant difference in post-operative SIA.

CONCLUSION:

In MSICS type of incision performed, significantly changes the outcome in terms of surgically induced astigmatism. Frown incision achieves lower SIA and offers greater corneal topographic stability as compared to straight incision.

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