

**Research Article****Comparative study of superior and temporal scleral tunnel incision in small incision cataract surgery (SICS)**

Authors

Rakesh Kumar Nirala¹, Umesh Kumar²^{1,2}RIMS, IndiaEmail: rakeshmd_2010@rediff.com¹, umerashsugu113108@gmail.com²**Abstract**

Introduction: Any opacity of lens and its capsule, whether developmental or acquired is called cataract. SICS has almost all the advantages of phacoemulsification and at the same time it is of reasonable cost as conventional ECCE with posterior chamber intraocular lens implantation. SICS can be done through superior or temporal approach.

Materials and Methods: Study was done on 80 patients selected from the patient admitted to indoor ward of RIMS, Ranchi, Jharkhand from December 2013 to July 2014. 40 patients underwent superior & 40 cases temporal small incision cataract surgery with IOL implantation. 80 eyes of patients were randomly allocated in four groups.

Results: In the present study, all patients of group 1 (superior – linear) had post-operative astigmatism whereas 85% patients of group 3 (Temporal – linear) had post-operative astigmatism. In group 2 (Superior – Frown), all patients had post-operative astigmatism while in group 4 (Temporal – Frown), only 85% patients had post-operative astigmatism. Frown incision group had shown less mean induced astigmatism as compared to linear incision group.

Conclusion: Cataract surgery continues to be evolutionary. Post-operative astigmatism is one of the most important factors which binders attainment of near normal unaided visual acuity following intraocular lens implantation.

Keywords: SICS (Small incision cataract surgery), IOL (Intraocular Lens), Astigmatism.

Introduction

“Any opacity of lens and its capsule whether developmental or acquired, is called cataract.”

Cataract is the commonest and treatable cause of blindness in India. It has been truly said by St Mathews. “The eye is the lamp of the body. If eye is not sound whole body will be in darkness.”

Now a days, cataract surgery is being done by three methods by different surgeons in different parts of the world with intraocular lens

implantation. (a) Conventional large incision extracapsular cataract extraction (ECCE) (b) Sutureless manual small incision cataract surgery (SICS) (c) Cataract surgery by phacoemulsification method.

SICS has almost all the advantages of phacoemulsification and at the same time it is of reasonable cost as conventional ECCE with posterior chamber intraocular lens implantation.

SICS is stitchless cataract through a relatively smaller incision.

SICS can be done through superior or temporal approach. In each approach incision can be different types eg. Frown and linear. Surgically induced astigmatism is variable in magnitude & direction, by selecting different incision types and location. It can also be dependent on the size of incision.

In this study, superior approach will be compared to temporal approach cataract surgery in different incision types by keeping the size of incision stable. In one part, superior linear incision to temporal linear incision was compared. In the other part, superior frown incision to temporal frown incision was compared. For both incision types, two approaches in context of surgically induced astigmatism was compared.

This study was a humble endeavour to establish the better procedure of cataract extraction for a large number of economically underprivileged people of the society.

This study helps us in selecting the best site of incision for SICS surgery with PCIOL implantation regarding the astigmatism post operatively.

Materials and Methods

The purpose of this study is to make a comparative study of degree of astigmatism achieved post operatively after SICS; PCIOL in superior versus temporal approach in small incision cataract surgery.

Patients were selected from the patient admitted to indoor ward of Regional Institute of Ophthalmology, RIMS, Ranchi, Jharkhand.

This was done on 80 patient of uncomplicated & mostly senile cataract of different age& sex, of which 40 patients underwent superior, 40 cases temporal small incision cataract surgery with intraocular lens implantation. All patients had undergone SICS.

Study period extended from December 2013 to July 2014. 80 eyes of patient were randomly allocated in four groups.

Group I: Consisted of patients undergoing 'Linear external scleral incision' by superior approach.

Group II: Consisted of patients undergoing 'Frown external scleral incision' by superior approach.

Group III: Consisted of patients undergoing 'Linear external scleral incision' by temporal approach.

Group IV: Consisted of patients undergoing 'Frown external scleral incision' by temporal approach.

Cases with glaucoma, uveitis or any associated systemic diseases like Diabetes mellitus, Hypertension etc. were excluded from the study.

A detailed medical and ophthalmological history of every selected patient was taken and full clinical and laboratory examination were done according to prepared proforma. Snellen's test was used for assessment of visual acuity – both distant direct & indirect ophthalmoscopy, slit lamp biomicroscopy, retinal function test (e.g Maddox rod test, two point discrimination test, perception of light, projection of rays) was done.

The power of IOL was determined by heap of Keratometer and A Scan. The aim was to obtain a post- operative emmetropia or slight myopia. The type of lens chosen for the study were PMMA single piece modified 'c' loop lenses.

The PCIOL constant for our lenses were 118.20 & AICOL constant 115.00.

Pre-operative preparation of the patients were done. Both types of operation were done under peribulbar anaesthesia.

This study has been done using APPASAMY Keratometer.

Proper post operative advice was followed. All the uncomplicated cases were discharged on 2nd post operative day with advice of regular medications & routine periodic check-up. On 3rd post operative day, patient should be re-examined in O.P.D. & for visual acuity & any problem was treated during follow up period.

Visual acuity of cases were assessed on the 1st, 3rd, 15th post operative day & at the end of 1½ month.

A record of refractive error & their correction by suitable glasses at the end of six weeks were kept for study.

Pre-operative & post-operative (90th day) Keratometric readings were used for analysis. Amplitude of pre-operative & post-operative astigmatism was calculated from the difference in the Keratometric value in the steeper & flatter meridian, using the plus cylinder notation.

Results

The study is based on 80 cases who underwent manual small incision cataract surgery in the RIO, RIMS, Ranchi. Out of 80 cases, 41 were males & 39 were females. The age varied from 37 to 79 years.

Table-1 Age and Sex Distribution

Age group (years)	Male		Female		Total	
	No.	%	No.	%	No.	%
31-40	07	17.07	10	25.64	17	21.25
41-50	06	14.63	06	15.38	12	15.00
51-60	12	29.26	09	23.07	21	26.25
61-70	10	24.39	08	20.51	18	22.50
71-80	06	14.63	06	15.38	12	15.00
Total	41	51.25	39	48.75	80	100

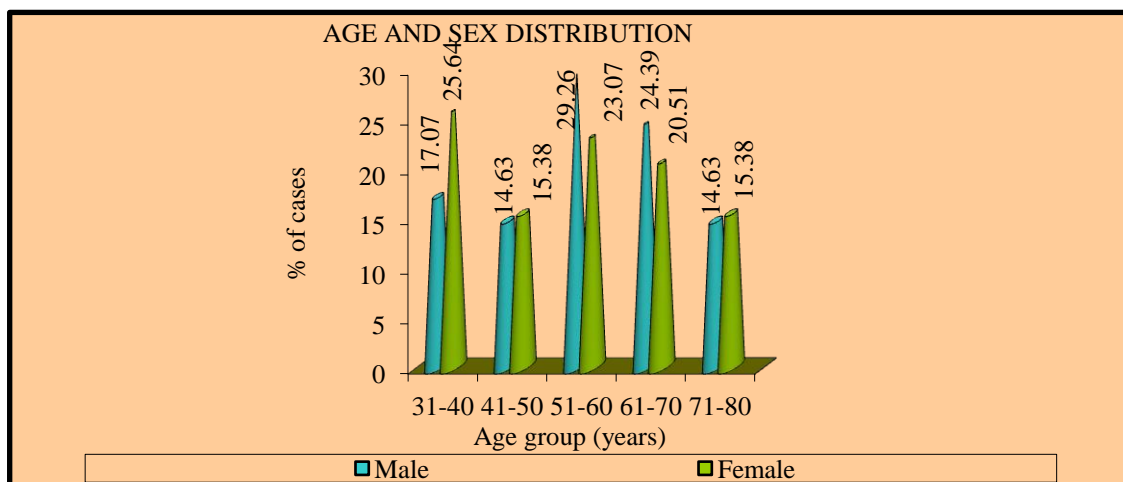


Table-2 Preoperative Pattern of Astigmatism in Patients Undergoing Linear Incision

Pattern of astigmatism	Group I (Superior-Linear)			Group III(Temporal-Linear)		
	n	%	Mean amplitude (in Diopter)	n	%	Mean amplitude(in Diopter)
WTR	4	20	1.0625	4	20	0.6875
ATR	12	60	0.6667	14	70	1.2678
NIL	4	20	--	2	10	--
Total	20	100	0.6125	20	100	1.0250

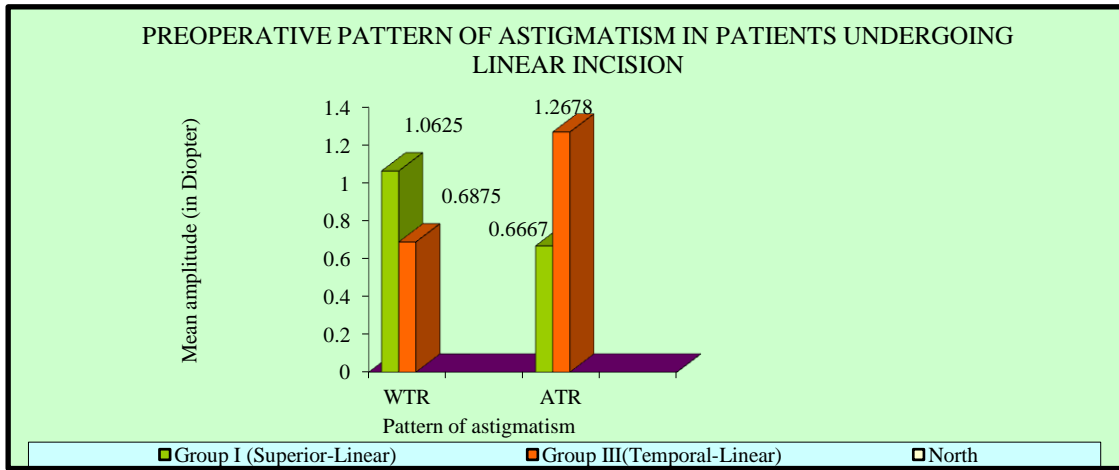


Table-3 Preoperative Pattern of Astigmatism in Patients Undergoing Frown Incision

Pattern of astigmatism	Group II (Superior-Linear)			Group IV (Temporal-Linear)		
	n	%	Mean amplitude (in Diopter)	n	%	Mean amplitude (in Diopter)
WTR	3	15	1.1667	4	20	1.0625
ATR	13	65	0.6722	13	65	1.0192
NIL	4	20	--	3	15	--
Total	20	100	0.6125	20	100	0.8750

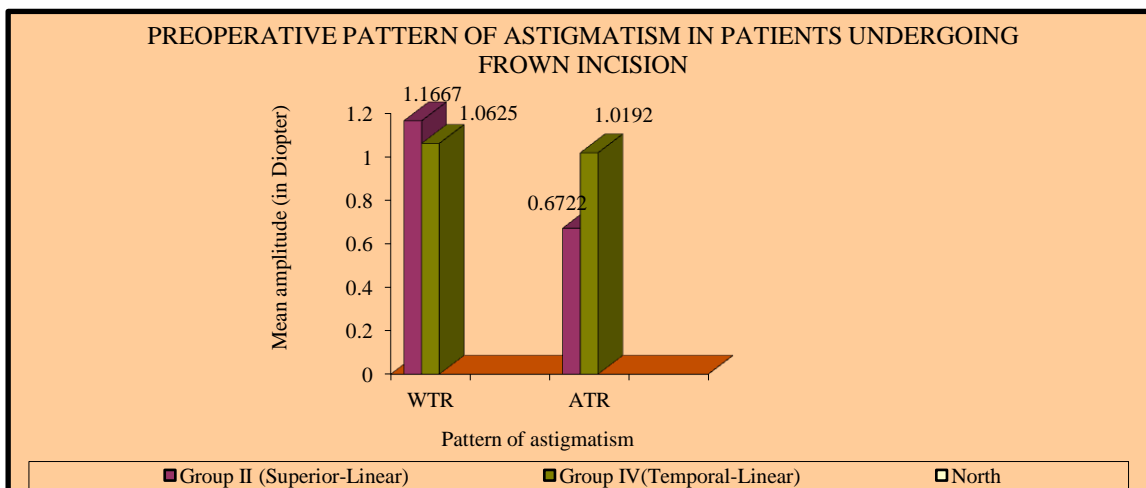


Table-4 Group- I (Superior-Linear Incision) – Age Distribution & Preoperative Magnitude and Pattern of Astigmatism

Range (in diopter)	Below 40 years			41-50 years			51-60 years			61-70 years			Above 70 years		
	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL
0.00-0.50	--	--	--	--	--	2	--	1	1	1	--	1	--	--	--
0.50-1.00	--	--	--	--	1	--	1	3	--	--	3	--	--	1	--
1.00-1.50	--	--	--	--	--	--	--	1	--	--	2	--	--	--	-
1.50-2.00	1	--	--	1	--	--	--	--	--	--	--	--	--	--	--

Table-5 Group- I (Temporal-Linear Incision) – Age Distribution & Preoperative Magnitude and Pattern of Astigmatism

Range (in diopter)	Below 40 years			41-50 years			51-60 years			61-70 years			Above 70 years		
	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL
0.00-0.50	--	--	--	1	--	--	--	--	1	--	--	1	--	--	--
0.50-1.00	--	--	--	--	--	--	1	2	--	1	1	--	--	--	--
1.00-1.50	--	--	--	--	1	--	--	2	--	--	2	--	1	--	-
1.50-2.00	--	--	--	--	--	--	--	3	--	--	1	--	--	2	--

Table-6 Group– II (Superior-Frown Incision) – Age Distribution & Preoperative Magnitude and Pattern of Astigmatism

Range (in diopter)	Below 40 years			41-50 years			51-60 years			61-70 years			Above 70 years		
	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL
0.00-0.50	--	--	--	1	1	--	--	--	2	--	1	2	--	--	--
0.50-1.00	--	--	--	--	2	--	--	3	--	--	2	--	--	1	--
1.00-1.50	--	--	--	--	--	--	--	--	--	--	1	--	--	1	--
1.50-2.00	1	--	--	1	--	--	--	1	--	--	--	--	--	--	--

Table-7 Group– IV (Temporal-Frown Incision) – Age Distribution & Preoperative Magnitude and Pattern of Astigmatism

Range (in diopter)	Below 40 years			41-50 years			51-60 years			61-70 years			Above 70 years		
	WTR	AT R	NI L	WTR	AT R	NIL	WTR	ATR	NIL	WTR	AT R	NIL	WTR	ATR	NIL
0.00-0.50	--	--	--	--	--	1	--	--	1	--	--	1	--	--	--
0.50-1.00	--	--	--	1	1	--	1	3	--	--	2	--	--	1	--
1.00-1.50	1	--	--	--	1	--	--	1	--	--	1	--	--	--	--
1.50-2.00	--	--	--	--	--	--	--	--	--	1	3	--	--	--	--

Table-8 Group– I (Superior-Linear Incision) –Preoperative and Post Operative Magnitude and Pattern of Astigmatism

Range (in diopter)	Preoperative astigmatism			Postoperative astigmatism								
	WTR	ATR	NIL	7 th day			30 th day			90 th day		
				WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL
0.00-0.50	1	1	4	--	--	--	--	--	--	1	--	--
0.50-1.00	1	8	--	--	--	--	--	1	--	1	--	--
1.00-1.50	--	3	--	--	1	--	--	1	--	--	--	--
1.50-2.00	2	--	--	--	--	--	--	--	--	--	2	--
2.00-2.50	--	--	--	--	1	--	--	2	--	--	7	--
2.50-3.00	--	--	--	--	2	--	--	6	--	--	4	--
Above 3.00	--	--	--	--	16	--	--	10	--	--	5	--
Total	4	12	4	--	20	--	--	20	--	2	18	--

Table-9 Group– II (Superior-Frown Incision) –Preoperative and Postoperative Magnitude and Pattern of Astigmatism

Range (in diopter)	Preoperative astigmatism			Post operative astigmatism								
	WTR	ATR	NIL	7 th day			30 th day			90 th day		
				WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL
0.00-0.50	1	2	4	--	--	--	--	--	--	--	--	--
0.50-1.00	--	8	--	--	--	--	--	--	--	2	--	--
1.00-1.50	--	2	--	--	--	--	--	--	--	--	2	--
1.50-2.00	2	1	--	--	--	--	--	3	--	--	6	--
2.00-2.50	--	--	--	--	2	--	--	4	--	--	7	--
2.50-3.00	--	--	--	--	3	--	--	7	--	--	2	--
Above 3.00	--	--	--	--	15	--	--	6	--	--	1	--
Total	3	12	4	--	20	--	--	20	--	2	18	--

Table-10 Group– III (Temporal-Linear Incision) –Preoperative and Post Operative Magnitude and Pattern of Astigmatism

Range (in diopter)	Preoperative astigmatism			Postoperative astigmatism								
	WTR	ATR	NIL	7 th day			30 th day			90 th day		
				WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL
0.00-0.50	1	--	2	1	--	1	1	4	--	2	4	3
0.50-1.00	2	3	--	2	--	--	8	--	--	2	5	--
1.00-1.50	1	5	--	2	--	--	4	--	--	2	1	--
1.50-2.00	--	6	--	12	--	--	2	--	--	1	--	--
2.00-2.50	--	--	--	1	--	--	1	--	--	--	--	--
2.50-3.00	--	--	--	1	--	--	--	--	--	--	--	--
Above 3.00	--	--	--	--	--	--	--	--	--	--	--	--
Total	4	14	2	19	--	1	16	4	--	7	10	3

Table-11 Group– IV (Temporal-Frown Incision) –Preoperative and Postoperative Magnitude and Pattern of Astigmatism

Range (in diopter)	Preoperative astigmatism			Postoperative astigmatism								
				7 th day			30 th day			90 th day		
	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL	WTR	ATR	NIL
0.00-0.50	--	--	3	4	--	--	5	1	3	3	4	3
0.50-1.00	2	7	--	5	--	--	3	2	--	2	3	--
1.00-1.50	1	3	--	4	1	--	2	--	--	2	1	--
1.50-2.00	1	3	--	2	--	--	2	--	--	1	--	--
2.00-2.50	--	--	--	2	--	--	1	--	--	1	--	--
2.50-3.00	--	--	--	2	--	--	1	--	--	--	--	--
Above 3.00	--	--	--	--	--	--	--	--	--	--	--	--
Total	4	13	3	19	1	--	14	3	3	9	8	3

Table-12 Mean Astigmatism in Patients Undergoing Linear Incision

	Group I (Superior-Linear) n=20	Group III (Temporal-Linear) n=20
	Mean amplitude (in Diopter)	Mean amplitude (in Diopter)
Preoperative	0.6125	1.0250
Postoperative (90 th day)	2.3725	0.5125

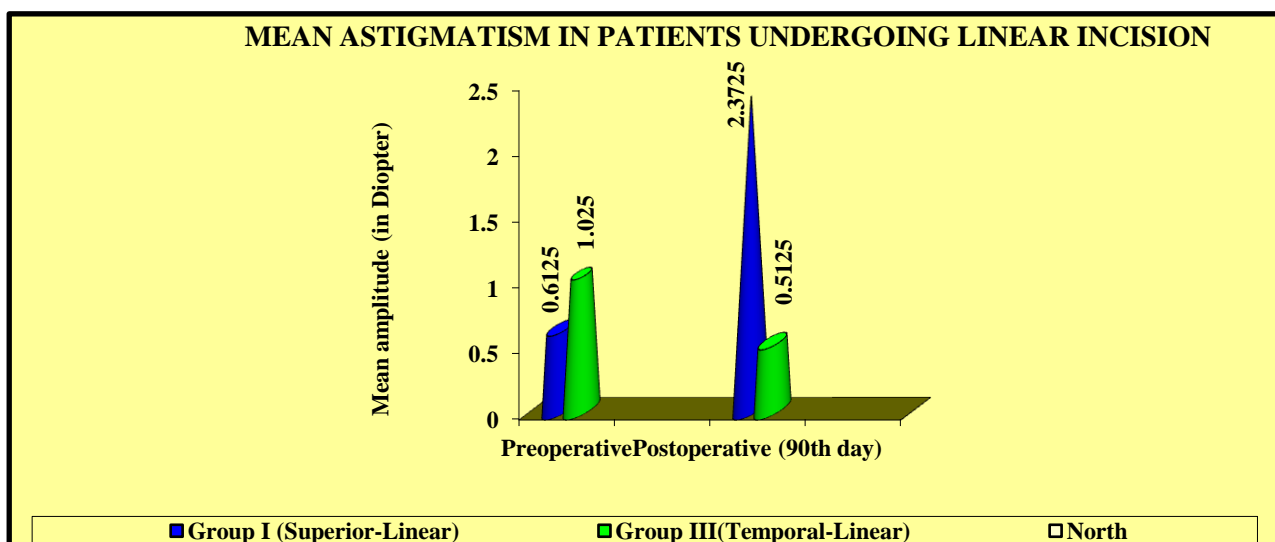


Table-13 Mean Astigmatism in Patients Undergoing Frown Incision

	Group II (Superior-linear) n=20	Group IV (Temporal-Linear) n=20
	Mean amplitude (in Diopter)	Mean amplitude (in Diopter)
Preoperative	0.6125	0.8750
Postoperative (90 th day)	1.8872	0.6125

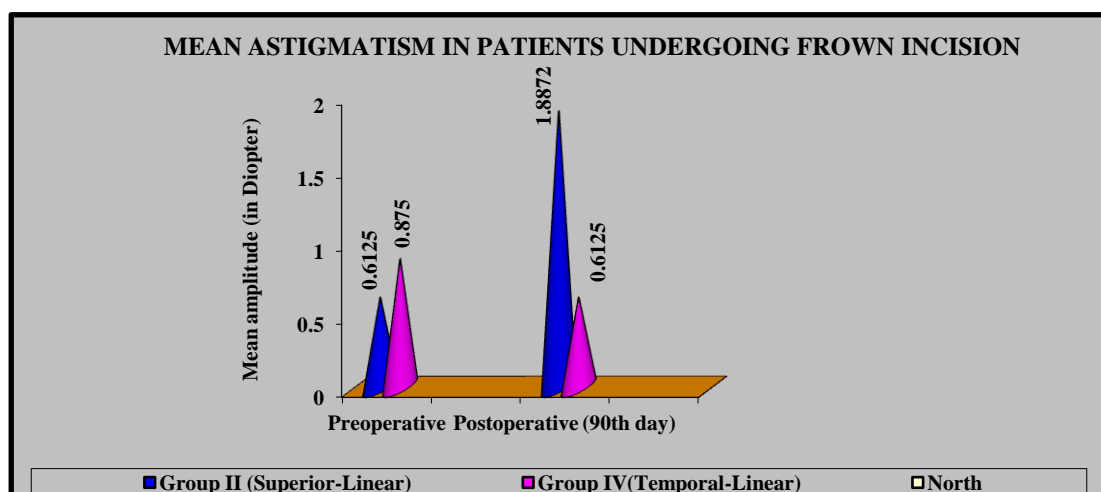


Table-14 Analysis of Magnitude and Pattern of Astigmatism in Patients Undergone Linear Incision

Pattern	Group I (Superior-Linear)			Group III (Temporal-Linear)		
	n	%	Mean amplitude (in Diopter)	n	%	Mean amplitude (in Diopter)
Preoperative						
WTR	4	20	1.0625	4	20	0.6875
ATR	12	60	0.6667	14	70	1.2678
NIL	4	20	--	2	10	--
Total	20	100	0.6125	20	100	1.0250
1st week (7th day)						
WTR	--	--	--	19	95	1.4350
ATR	20	100	3.2871	--	--	--
NIL	--	--	--	1	5	--
Total	20	100	3.2871	20	100	1.3620
4th week (30th day)						
WTR	--	--	--	16	80	0.8901
ATR	20	100	2.5371	4	20	0.2500
NIL	--	--	--	--	--	--
Total	20	100	2.5371	20	100	0.7510
3 month (90th day)0						
WTR	2	10	0.3750	7	35	0.7500
ATR	18	90	2.5972	10	50	0.5000
NIL	--	--	--	3	15	--
Total	20	100	2.3725	20	100	0.5125

Table-15 Analysis of Magnitude and Pattern of Astigmatism in Patients Undergone Frown Incision

Pattern	Group II (Superior-Linear)			Group IV (Temporal-Linear)		
	n	%	Mean amplitude (in Diopter)	n	%	Mean amplitude (in Diopter)
Preoperative						
WTR	3	15	1.1667	4	20	1.0625
ATR	13	65	0.6722	13	65	1.0192
NIL	4	20	--	3	15	--
Total	20	100	0.6125	20	100	0.8750
1st week (7th day)						
WTR	--	--	--	19	95	1.0121
ATR	20	100	3.2872	1	5	1.0000
NIL	--	--	--	--	--	--
Total	20	100	3.2872	20	100	1.1123
4th week (30th day)						
WTR	--	--	--	14	70	0.9109
ATR	20	100	2.5374	3	15	0.5000
NIL	--	--	--	3	15	--
Total	20	100	2.5374	20	100	0.7125
3 month (90th day)0						
WTR	2	10	0.5000	9	45	0.2500
ATR	18	90	2.0416	8	40	0.5000
NIL	--	--	--	3	15	--
Total	20	100	1.8872	20	100	0.6125

Table-16 WTR:ATR Ratio In Patients Undergone Linear Incision

	WTR:ATR	
	Group I(Superior-Linear)	Group III(Temporal-Linear)
Preoperative	1:3	1:3.5
Postoperative (90 th day)	1:9	1:1.43

Table-17 WTR:ATR Ratio in Patients Undergone Frown Incision

	WTR:ATR	
	Group II(Superior-Linear)	Group IV(Temporal-Linear)
Preoperative	1:4.33	1:3.25
Postoperative (90 th day)	1:9	1:0.89

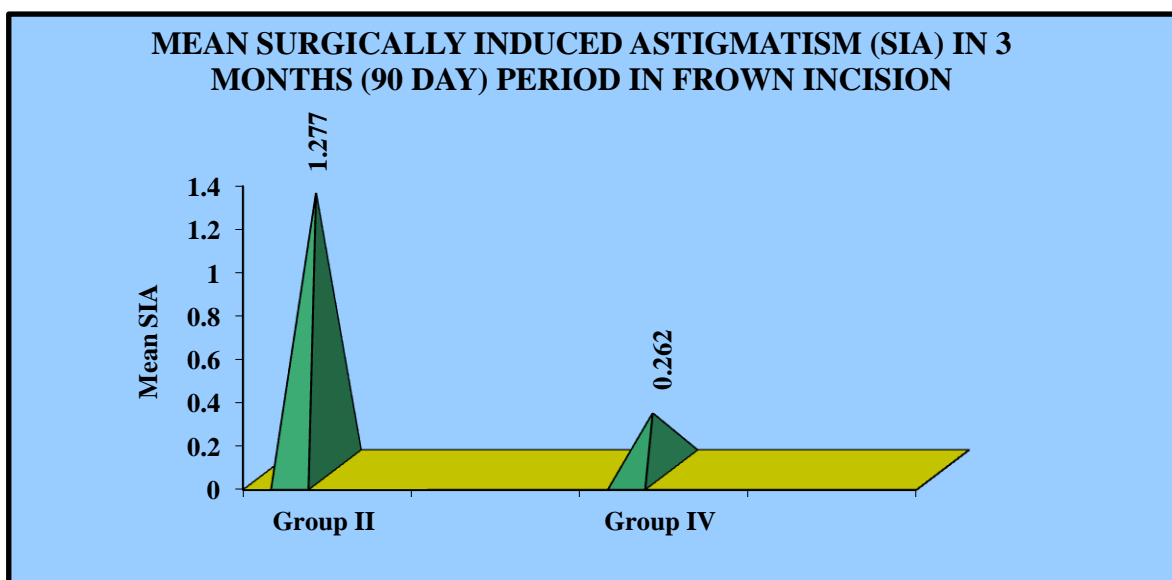
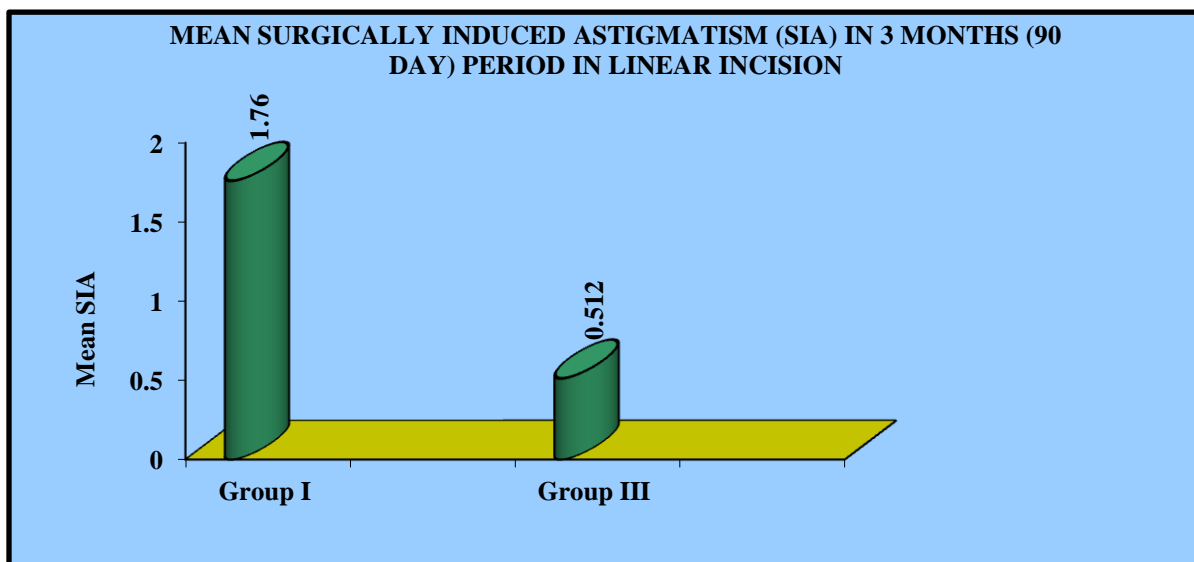


Table-18 Mean Surgically Induced Astigmatism (SIA) in 3 Months (90 Days) Period in Present Study

	Preoperative Vs Postoperative (90 days)			
	Linear incision		Frown incision	
	Group I (Superior)	Group III (temporal)	Group II (Superior)	Group IV (temporal)
Mean SIA	1.760	0.512	1.277	0.262

Discussion

The goal of modern cataract surgery is not only to improve vision but to provide a good unaided visual acuity. Correcting astigmatic errors and control of surgically induced astigmatism are now an integral part of this operative procedure.

SICS bridges the gap between conventional extracapsular cataract extraction (ECCE) & Phaco Surgery with the same objective. In the present study, the placement of wound on vertical & horizontal meridian was used for comparison while the other factors were constant in both study

group. Only corneal astigmatism was computed in the study.

The incidence of pre-operative astigmatism similar to our series was found by Beasley (79%), Taffe (82%) & Mahesh & Rao (90%). The astigmatism less than our series were found by Cavara (44%). The astigmatism more than our series was found by Duke-Elder (95%).

Magnitude is marginally the same as reported by Duke-Elder (0.5.-0.75D) & Beasley 0.75D .

Against the rule (ATR) astigmatism similar to our study was found by Kamlesh and Bihari (54.6%).

With the rule (WTR) astigmatism similar to our study was found by Taffe and Singh & Kumar (30%).

	Preoperative Vs Postoperative (90 days)			
	Linear incision		Frown incision	
	Group I (Superior)	Group III (temporal)	Group II (Superior)	Group IV (temporal)
Mean SIA	1.760	0.512	1.277	0.262

Frown incision group had shown less mean induced astigmatism as compared to linear incision group.

In the present study of group I (superior-Linear), the mean surgically induced astigmatism (SIA) was 1.760D while in group III (Temporal-Linear), it was 0.512D. This observation was similar to Donglas Koch et al (1987) 1.9D, Flahorty and Siepser (1989) 1.83 D and it was more than Steve Samuelson (1990) 1.0 D and Shalini Kaul et al (2005) 0.72 D. The observation in group III was similar to Shegaonkar et al 0.65D.

In group II (Superior-Frown) the mean surgically induced astigmatism (SIA) was 1.277 D which was similar to Isakov Itzhak 1.32 D, Gokhale Nikhil et al (2005) 1.28D and A Khurana et al (2006) 1.36 D and it was more than Stenert et al 0.82D and Sinsky and Stoppel 0.50 D.

In group IV (Temporal-Frown), the mean surgically induced astigmatism (SIA) was 0.262 D which was similar to Gokhale Nikhil et al (2005) 0.37 D and was less than Shegaonkar et al 0.65D.

Pattern

In the present study, Group I (Superior-Linear) and group II (Superior-Frown) had increased number of patients of against-the-rule (ATR) astigmatism in postoperative period in contrast to

Postoperative Astigmatism in Relation with Preoperative Astigmatism

Incidence

In the present study, all patients of group I (Superior-Linear) had postoperative astigmatism whereas 85% patients of group III (Temporal-Linear) had postoperative astigmatism.

In group II (Superior-Frown), all patients had postoperative astigmatism while in group IV (Temporal-Frown), only 85% patients had postoperative astigmatism.

Mean Surgically Induced Astigmatism (SIA) in 3 Months (90 Day) Period in Present Study

their number in preoperative period. Goel et al (2001) and Gokhale Nikhil et al (2005) found similar tendency towards against-the-rule shift in their unsutured superior scleral tunnel incision series.

Group III (Temporal-Linear) and group IV (Temporal-Frown) had increased number of patients of with-the-rule astigmatism in postoperative period in contrast to their in preoperative period. Gokhale Nikhil et al (2005) found similar tendency towards with-the-rule shift in their unsutured temporal scleral tunnel incision series.

Conclusion

Cataract surgery continues to be evolutionary. Postoperative astigmatism is one of the most important factors which binders attainment of near normal unaided visual acuity following intraocular lens implantation. The astigmatism is largely due to alteration in the corneal curvature but may also be due to the intraocular lens (uncommon). The ultimate astigmatic result is predominantly influenced by wound size and the site of incision.

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