

Surgically Induced Astigmatism (SIA) After Superior Scleral Incision in Small Incision Cataract Surgery (SICS) Vs Phacoemulsification

Dr. Mayuri Chitre¹, Yagnik Nadir², Shankar Ganvit³

¹MBBS, MS Ophthalmology, Senior Resident, SSG Hospital and Medical College, Vadodara, Gujarat, India

Corresponding author Email: [drmayuri2017\[at\]gmail.com](mailto:drmayuri2017[at]gmail.com)

Contact No. 8980808356

²MBBS, MS Ophthalmology, Senior Resident, SSG Hospital and Medical College, Vadodara, Gujarat, India

³MBBS, MS Ophthalmology, Associate Professor, SSG Hospital and Medical College, Vadodara, Gujarat, India

Abstract: Objective: This study aims to determine Surgically Induced Astigmatism (SIA) after Superior Scleral Incision in Small Incision Cataract Surgery (SICS) Vs Phacoemulsification in the inpatient department of a tertiary care centre of Gujarat. Design: It was a Prospective Randomized Interventional study which was carried out at the Department of Ophthalmology, Medical College and S.S.G Hospital, Vadodara for one-year period. Subjects: 100 eyes of 100 patients admitted in eye ward at SSG Hospital undergoing cataract surgery above 40 years of age with uncomplicated senile cataract were considered. Methods: It was a prospective randomized study. Patients who were enrolled for cataract extraction either by SICS or Phacoemulsification underwent assessment of visual acuity on Snellen's chart both unaided and aided and keratometry on Bausch and Lomb manual keratometer in vertical (90°) i.e. K1 and horizontal (180°) i.e. K2 preoperatively and postoperatively on day 1st, 7th, 21st, 45th. Surgically Induced Astigmatism (SIA) was calculated by Algebraic Subtraction Technique. P values less than 0.05 were considered as statistically significant. Results: At postop day 45, in Phaco group 12 (30.8%) patients, in SICS group 29 (61.7%) patients had postoperative astigmatism ≥ 1.5 D. On applying the t test, the difference between the two groups was statistically significant ($p < 0.0001$). Conclusion: Our study demonstrates that the least amount of astigmatism is induced when cataract extraction is done by Phacoemulsification by making 3.2 mm superior scleral incision than with small incision cataract surgery (SICS) by making 6mm superior scleral incision.

Keywords: Cataract, Corneal astigmatism, Phacoemulsification, Surgically Induced Astigmatism, Small Incision Cataract Surgery (SICS)

1. Introduction

ASTIGMATISM is a condition of refraction wherein a point focus of light cannot be formed upon the retina. Astigmatism occurs when toricity of the any of the refractive surfaces of the optical system produces two principal foci delimiting an area of intermediate focus call **Conoid of Sturm** [1]. Thomas Young in 1801 was first to describe ocular astigmatism; however, it was some years later that Airy (1827) corrected astigmatism with cylindrical lenses. Corneal astigmatism was characterized by Knapp and also by Donders. Astigmatism induces distortion of the principal meridians. It may be an error of curvature, of centering, or of refractive index. Curvatural astigmatism, if of any high degree, has its seat in the cornea and is generally congenital. The acquired causes of astigmatism could be corneal diseases like conical cornea, inflammations and ulcerations. Any trauma to the cornea including surgical trauma can affect the astigmatism. Though the curvature, decentration and refractive index of lens has clinical significance for causing astigmatism, cornea forms the major refractive unit of the eye and changes in its curvature is what causes the major changes in astigmatism. When the two principal meridians are at right angle to each other it is called Regular astigmatism. Regular astigmatism is further divided into 4 types namely Direct or With the Rule Astigmatism where the two principal meridians are at right angles and the vertical meridian is more curved than the horizontal, Indirect or Against the Rule Astigmatism where the two principal meridians are at right angles to each other

and the horizontal meridian is more curved than horizontal, Oblique Astigmatism where two principal meridians are not the horizontal and vertical but are at right angle to each other and Bi-oblique Astigmatism where the principal meridians are not at right angle to each other. Irregular change of refractive power in different meridians is called Irregular Astigmatism. There are 3 types of refractive astigmatism namely Simple, Compound and Mixed Astigmatism. The corneal astigmatism is directly proportional to the cube of the length of the incision [2]. Astigmatism is inversely related to the distance from the limbus.

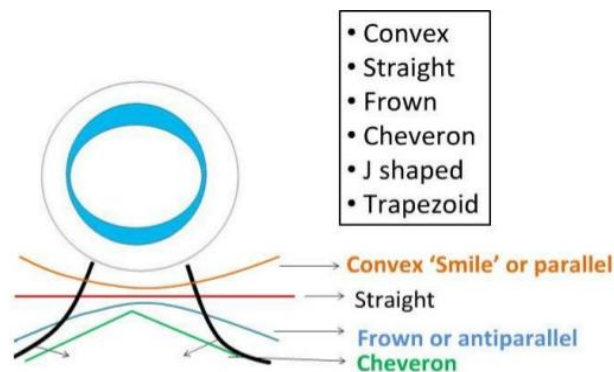


Figure 1: The various types of external incisions are as follows

According to the Axis, scleral tunnel can be done at superior, superotemporal or temporal positions. The superior incision is associated with greater amount of astigmatism.

Volume 11 Issue 6, June 2022

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

The palpebral pressure and /or extraocular muscle action has been proposed to influence the astigmatism. The temporal site is considered astigmatically neutral as it is more away from the centre of the cornea. The superotemporal incision is also called as BENT incision (Between Nine & Twelve O' clock position) . The palpebral pressure and extraocular muscle action have significantly lesser effect on BENT and hence lower amount of astigmatism [3].Astigmatism can be measured by various methods like refraction, keratometry, and corneal topography. **Keratometry** directly measures the radius of outer corneal curvature over a central area approximately 3 mm in diameter, although this may vary with different instruments. The accuracy of quantitative keratometers is 0.25 D to 0.75 D [4].Surgically Induced Astigmatism is calculated by Simple Subtraction Technique, Algebraic Subtraction Technique.

2. Methods

Type of Study: The present study is a Prospective Randomized Interventional study.

Place of Study: The study was conducted after the approval from the Institutional research and ethics committee. Written and informed consent from all the patients were obtained. This study was conducted at Department of Ophthalmology, SSG Hospital, Vadodara, a tertiary health care centre associated with Baroda Medical College.

Sample Collection: This hospital draws patients from the entire state of Gujarat as well as from areas of neighbouring states of Madhya Pradesh and Rajasthan.

Inclusion Criteria: All patients aged above 40 years of either sex with clinically diagnosed uncomplicated senile cataract, patients with preoperative astigmatism of any amount and cataracts of all grades of nuclear sclerosis admitted in ophthalmology ward of SSG Hospital to undergo cataract extraction by SICS or Phacoemulsification comprised the population for the study.

Exclusion Criteria: Those with complicated cataract, traumatic cataract, Cataract with glaucoma, Uveitis, Cataract associated with Pterygium, Corneal opacity, the eyes which have undergone C3R or LASIK, Zonular dehiscence, the eyes which have undergone previous ocular surgery like scleral tear repair, retinal detachment buckling surgery, glaucoma surgery, squint, corneal suturing, intraoperative complication in scleral tunnel incision, an absence of continuous curvilinear capsulorhexis and / or a posterior capsule rent leading to possibility of IOL tilt contributing to post-operative astigmatism.

Procedure: A study proforma was developed and filled up for each patient which included present, past and family

history, history of previous ocular surgery. Detailed ocular and systemic examination was done. Visual acuity was assessed pre-operatively aided and unaided on Snellen's chart and keratometry readings were taken pre-operatively on Bausch and Lomb Manual Keratometer in the horizontal (180^0) i.e. K2 and vertical (90^0) i.e. K1 meridians (Figure 2).The type and amount of astigmatism was noted. After undergoing cataract surgery with Superior Scleral Incision either by Small Incision Cataract Surgery (SICS) or Phacoemulsification, visual acuity was assessed postoperatively both aided and unaided on Snellen's chart and postoperative keratometry was done on Bausch and Lomb Manual Keratometer on 1st, 7th, 21st and 45th day. Astigmatism is calculated by subtracting K2 from K1. Surgically Induced Astigmatism (SIA) was calculated by Algebraic Subtraction Technique were pre-operative astigmatism is subtracted from post-operative astigmatism and the resultant value is assigned a particular sign according to whether it is with the rule (plus) or against the rule (minus). Data was compiled and tabulated and analysis was performed.

Statistical method: P values less than 0.05 were considered as statistically significant.



Figure 2: Bausch and Lomb Manual Keratometer

3. Results

Demographics: Total of 100 cases in the age group above 40 years of either sex with clinically diagnosed uncomplicated senile cataract, patients with preoperative astigmatism of any amount and cataracts of all grades of nuclear sclerosis admitted in ophthalmology ward of SSG Hospital to undergo cataract extraction by SICS or Phacoemulsification.

Table 1: Baseline Characteristics of the Patients:

Characteristics	Total N=100	Type of Surgery				P Value	
		Phaco		SICS			
		%	%	%	%		
SEX							
FEMALE	51	51%	25	50%	26	52%	0.8
MALE	49	49%	25	50%	24	48%	

AGE IN YEARS							
MEAN (SD)	61.8	10.4	61.86	8.13	61.74	12.3	0.9
GRADING OF CATARACT							
NS I	0	0	0	0	0	0	0.00002
NS II	52	52%	15	30%	37	74%	
NSIII	40	40%	31	62%	9	18%	
NS IV	8	8%	4	8%	4	8%	
PRE-OPERATIVE ASTIGMATISM							
NEUTRAL	9	9%	3	6%	6	12%	0.55
WTR	55	55%	28	56%	27	54%	
ATR	36	36%	19	38%	17	34%	

The Mean age in Phaco group was 61.86 years and that in SICS group was 61.74 years. The Preoperative astigmatism in Phaco group was Neutral in 3 (6%) patients, WTR in 28 (56%) patients and ATR in 19 (38%) patients whereas it was neutral in 6 (12%) patients, WTR in 27 (54%) patients and ATR in 17 (34%) patients. Immature cataract was diagnosed in 15 patients in Phaco group whereas in 37 patients in SICS group. NS III Immature cataract was diagnosed in 31 patients in Phaco group and 9 patients in SICS group. NS IV Immature cataract was diagnosed in 4 patients in Phaco as well as in SICS group. Out of 100 patients, there were 49 males and 51 females, the male: female ratio being 0.96: 1, almost equal. Right eye was operated in 50 patients and left eye was operated in 50 patients.

Table 2: Distribution of Preoperative Unaided Vision

Preoperative Unaided Vision	PHACO		SICS	
	Frequency	Percent (%)	Frequency	Percent (%)
6 12	2	4	17	34
6 18	10	20	17	34
6 24	11	22	5	10
6 36	9	18	3	6
6 60	3	6	6	12
FC 20 FEET	1	2	0	0
FC 19-20FEET	3	6	1	2
FC 18-19 FEET	2	4	0	0
FC 16-17FEET	3	6	0	0
FC 15-16 FEET	2	4	1	2
FC 9-10 FEET	1	2	0	0
FC 5-6 FEET	1	2	0	0
FC 3-4 FEET	2	4	0	0
TOTAL	50	100	50	100

In Phaco group, maximum no. of patients i.e. 22% (11 patients) had preoperative unaided vision 6/24 and in SICS maximum no. of patients i.e. 34% each had preoperative unaided vision 6/12 and 6/18.

Table 3: Distribution of Postoperative Day 45 Unaided Vision

Postop Unaided Vision	PHACO		SICS	
	Frequency	Percent (%)	Frequency	Percent (%)
6 6	25	50.00%	4	8.00%
6 9	16	32.00%	7	14.00%
6 12	9	18.00%	26	52.00%
6 18	0	0	13	26.00%
TOTAL	50	100.00%	50	100.00%

In the Phaco group out of 50 patients, postoperative day 45 unaided vision was 6 | 6 in 25 (50%) patients.

In the SICS group out of 50 patients, postoperative day 45 vision was 6 | 6 in 4 (8%) patients.

Table 4: Distribution of Postoperative Day 45 Aided Vision:

Postop Aided Vision	PHACO		SICS	
	Frequency	Percent (%)	Frequency	Percent (%)
6 6... plain	25	50%	4	8%
6 6...-0.5 x 90°	10	20%	5	10%
6 6...-0.75 x 90°	4	8%	3	6%
6 6...-1.0 x 90°	6	12%	11	22%
6 6...-1.25 x 90°	1	2%	2	4%
6 6...-1.5 x 90°	3	6%	7	14%
6 6...-1.75 x 90°	0	0%	0	0%
6 6...-2.0 x 90°	0	0%	4	8%
6 6...-2.25 x 90°	0	0%	0	0%
6 6...-2.5 x 90°	0	0%	2	4%
6 9...-0.5 x 90°	0	0%	2	4%
6 9...-0.75 x 90°	1	2%	0	0%
6 9...-1.0 x 90°	0	0%	0	0%
6 9...-1.25 x 90°	0	0%	0	0%
6 9...-1.5 x 90°	0	0%	2	4%
6 9...-1.75 x 90°	0	0%	0	0%
6 9...-2.0 x 90°	0	0%	4	8%
6 9...-2.25 x 90°	0	0%	0	0%
6 9...-2.5 x 90°	0	0%	4	8%
TOTAL	50	100%	50	100%

In the present study on postop day 45 maximum i.e. 25 (50%) patients had 6 | 6 vision without glasses in Phaco group and maximum i.e. 11 (22%) patients had 6 | 6 with -1.0 x 90° in the SICS group.

Table 5: Distribution of Preoperative Astigmatism (According to Amount)

Range (D)	PHACO NO. (%)		SICS NO. (%)	
	WTR	ATR	WTR	ATR
Neutral (0)	3		6	
0.25-0.5	9 (32.2%)	3 (15.8%)	1 (3.7%)	2 (11.8%)
0.6-1.0	16 (57.1%)	12 (63.2%)	5 (18.5%)	8 (47.1%)
1.1-1.5	3 (10.7%)	3 (15.8%)	1 (3.7%)	0 (0%)
1.6-2.0	0 (0%)	1 (5.3%)	12 (44.4%)	2 (11.8%)
2.1-2.5	0 (0%)	0 (0%)	1 (3.7%)	2 (11.8%)
2.6-3.0	0 (0%)	0 (0%)	5 (18.5%)	1 (5.9%)
3.1-3.5	0 (0%)	0 (0%)	0 (0%)	2 (11.8%)
3.6-4.0	0 (0%)	0 (0%)	1 (3.7%)	0 (0%)
4.1-4.5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
4.6-5	0 (0%)	0 (0%)	1 (3.7%)	0 (0%)
TOTAL	50 (100%)		50 (100%)	

The majority of patients in Phaco group had Preoperative astigmatism in the range of 0.6-1.0 D whereas in SICS group majority of patients had preoperative astigmatism in the range of 1.6-2.0 D.

Table 6: Comparison of Mean Surgically Induced Astigmatism Segregated by Phaco Vs SICS:

	AXIS	PHACO			SICS			p value
		MEAN	SD	N	MEAN	SD	N	
SIA AT POSTOP DAY 1	NEUTRAL	0	0	15	0	0	3	
	WTR	0	0	0	0	0	0	
	ATR	0.45	0.26	35	2.28	1.12	47	
	TOTAL	0.31	0.30	50	2.15	1.22	50	p < 0.0001
SIA AT POSTOP DAY 7	NEUTRAL	0	0	0	0	0	1	
	WTR	0	0	0	0	0	0	
	ATR	0.71	0.34	50	2.43	1.19	49	
	TOTAL	0.71	0.34	50	2.38	1.23	50	p < 0.0001
SIA AT POSTOP DAY 21	NEUTRAL	0	0	1	0	0	0	
	WTR	0.25	0	10	0	0	0	
	ATR	1.26	0.82	39	2.75	0.98	50	
	TOTAL	1.03	0.84	50	2.75	0.98	50	p < 0.0001
SIA AT POSTOP DAY 45	NEUTRAL	0	0	3	0	0	0	
	WTR	0	0	0	2.25	0	1	
	ATR	0.98	0.39	47	3.05	0.96	49	
	TOTAL	0.61	0.60	50	3.03	0.95	50	p < 0.0001

The Mean Surgically Induced Astigmatism in SICS is significantly different than Phaco (p < 0.0001). This shows that Phaco emulsification induces less astigmatism than Small Incision Cataract Surgery (SICS).

Table 7: Distribution of SIA -Postop Day 45 (According to Amount)

Range (D)	PHACO NO. (%)		SICS NO. (%)		Total No. (%)
	WTR	ATR	WTR	ATR	
Neutral (0)	3		0		3 (3%)
0.25-0.5	0 (0%)	8 (17%)	0	0	8 (8%)
0.6-1.0	0 (0%)	21 (44.6%)	0	1 (2.0%)	22 (22%)
1.1-1.5	0 (0%)	16 (34.0%)	0	3 (6.1%)	19 (19%)
1.6-2.0	0 (0%)	2 (4.2%)	0	6 (12.2%)	8 (8%)
2.1-2.5	0	0	1 (100.0%)	7 (14.3%)	8 (8%)
2.6-3.0	0	0	0	12 (24.4%)	12 (12%)
3.1-3.5	0	0	0	9 (18.3%)	9 (9%)
3.6-4.0	0	0	0	7 (14.3%)	7 (7%)
4.1-4.5	0	0	0	2 (4.0%)	2 (2%)
4.6-5.0	0	0	0	1 (2.0%)	1 (1%)
5.1-5.5	0	0	0	0	0
5.6-6.0	0	0	0	1 (2.0%)	1 (1%)
TOTAL	50 (100%)		50 (100%)		100 (100%)

The Maximum Surgically Induced Astigmatism in Phaco group was in the range of 0.6-1.0 D ATR in 21 (44.6%) patients. The Maximum Surgically Induced Astigmatism in SICS group was in the range of 2.6-3.0 D ATR in 12 (24.4%) patients.

4. Discussion

Cataract surgery has evolved a long way from the times of Sushruta and couching to Sir Harold Ridley and implantation of IOL to the present day when emmetropia with spectacle independence is the norm with multifocal and accommodative IOLs in use. At each step, the surgery has undergone multiple modifications and improvisations.

One of the major problems faced post cataract surgery was the induced astigmatism which decreased the quality of vision. Since the early 1900s, it has been observed that astigmatism after cataract extraction is generally of the "Against - The- Rule" variety. That is when the incision is made above in the usual location, a postoperative flattening of the vertical meridian results. This is the basis of surgical procedures designed to reduce the corneal astigmatism.

Gogate et al compared the efficacy, safety, and astigmatic change after cataract surgery by phacoemulsification and MSICS. The intraoperative and postoperative complications, UCVA, BCVA and astigmatism were recorded at 1 and 6 weeks postoperatively. They found that 68.2% patients in the phacoemulsification group and 61.25% patients in the SICS group had UCVA better than or equal to 6/18 at 1 week. At 6 weeks follow up, 81.08% patients in the phacoemulsification group and 71.1% patients in the SICS group had UCVA of better than or equal to 6/18. They concluded that both phacoemulsification and SICS are safe and effective for visual rehabilitation of cataract patients, although phacoemulsification gives better UCVA in a larger proportion of patients at 6 weeks [5].

Gokhale Nikhil and Saurabh Sawhney compared the astigmatism induced by superior, superotemporal and temporal incision in manual small incision cataract surgery and found that mean postoperative astigmatism at three months follow up for the superior incision group was 1.45±0.94 ATR and mean Surgically induced astigmatism was 1.36 ± 1.03 D ATR [6].

George et al compared surgically induced astigmatism (SIA) following MSICS and Phacoemulsification (PE) in 186 eyes with Nuclear sclerosis of grade III or less. Mean SIA was 1.17D (0.95 D) in the SICS group and 0.77D (0.65D) in the PE group (p=0.001) .PE induced less astigmatism than SICS [7]

George R et al compared the surgically induced astigmatism (SIA) and endothelial cell loss following conventional extra-capsular cataract surgery, manual small incision cataract surgery and phaco emulsification (PE) with non-foldable intraocular lens implantation. Mean SIA was 1.77D (1.61D) for the ECCE group. 1.17 D (0.95 D) for the SICS group and 0.77 D (0.65D) for the phacoemulsification group at the end of 6 weeks [8]

Umesh Harakuni et al compared the Surgically Induced Astigmatism with Small Incision Cataract Surgery and Phacoemulsification. The measurement of induced astigmatism was taken: dk, the net keratometric change in corneal toricity. Average d K for Group A (SICS) was +0.05 D and for Group B (Phacoemulsification) was -0.53D. There was a difference of -0.49 D between the two groups in terms of induced keratometric astigmatism. The SICS group actually demonstrated on the average a greater iatrogenic astigmatism than the phacoemulsification group keratometrically. This is clinically or statistically significant (p < 0.001). This study proved Phacoemulsification induces

less astigmatism than SICS. Iatrogenic astigmatism is more with SICS [9]

Comparison of SIA on postoperative 45th day in the study group

Post-operative day	SIA in group A	SIA in group B	Z value	p value
45 th day	+ 0.05	-0.53	5.387	< 0.001

Vijay Damor et al compared the Post-operative Astigmatism after SICS and Phacoemulsification. The study included total 80 cases out of which 40 cases (group 1) were operated by SICS, 40 cases (group 2) were operated by Phacoemulsification surgery. Surgically induced astigmatism (SIA) after 3 months of surgery was compared in two groups. Majority of cases was ‘with the rule’ astigmatism, (WTR). SIA 1D-2D was noted in 4 cases (10%) in group 1, while in group 2 SIA was noted < 1 D in all cases. More cord length was associated with more astigmatism. There is definitely more astigmatism in patients with ≥ 7mm incision, (the average SIA was >1.0 D) than in patients with < 6mm incision (the average SIA was < 0.6D) at the end of three months. As incision size is reduced SIA is reduced. There is more SIA in limbal section (average SIA having 0.75 D) than scleral tunnel section (0.5 mm to 3 mm away from the limbus average SIA was ranging from 0.38 D to 0.71 D) as the site of incision moves away from the cornea, SIA is reduced. So, patients with scleral tunnel incision had very less amount of SIA. SIA was less with frown and straight incision (average SIA 0.6 D) [10]

GROUP	WTR			ATR			TOTAL	
	No. of Cases	Average	SD	No. of Cases	Average	SD	Average	SD
I	26	0.60	0.28	14	1.03	0.68	0.75	0.50
II	22	0.38	0.26	18	0.52	0.25	0.44	0.26

In comparing the overall surgically induced astigmatism in these two groups, it is seen that in group 1 (SICS) average SIA was 0.75 D (0.50 D), while in group 2 (PE), average SIA was 0.44 D (0.26 D). On statistical analysis it is derived that the difference of SIA, in group 1 and group 2 is significant (p< 0.1).

Siva ramareddy kolli et al did clinical comparative study of Small Incision Cataract Surgery and Phacoemulsification.

Mean Pre-operative astigmatism in both SICS group and Phacoemulsification group is 0.68 D and Mean Post-operative Astigmatism in SICS group and Phacoemulsification group is 1.68 D and 1.65 D respectively. Statistically significant post-operative shift to ATR Astigmatism in 86.70% and 76.70% both in SICS and Phacoemulsification group respectively. Mean SIA in SICS group and Phacoemulsification group is 1.17 D and 1.10 D respectively [11]

Uncorrected Postop Day 45 Visual Acuity

Visual Acuity	Umesh Harakuni et al ⁴²		Siva Ramareddy et al ⁴⁴		Present study	
	PHACO	SICS	PHACO	SICS	PHACO	SICS
6/60-6/24	0	5	0	0	0	0
6/18-6/12	20	10	4	12	9	39
6/9-6/6	35	30	26	17	41	11

This is a table showing the visual acuity of patients who underwent phaco or SICS surgery.

In Umesh Harakuni et al study for patients operated by Phaco -35 patients had a best possible visual acuity in the range of 6/9- 6/6 while 20 patients had a visual acuity in the range of 6/18-6/12. In the SICS group 30 patients had a best possible visual acuity in the range of 6/9- 6/6, 10 patients had a visual acuity in the range of 6/18-6/12 and 5 patients had a visual acuity in the range of 6/60 -6/24 [9]

In Siva Ramareddy et al study for patients operated by Phaco -26 patients had a best possible visual acuity in the range of 6/9- 6/6 while 4 patients had a visual acuity in the range of 6/18-6/12. In the SICS group 17 patients had a best possible visual acuity in the range of 6/9- 6/6, 12 patients had a visual acuity in the range of 6/18-6/12 [11]

In our study, for patients operated by Phaco -41 patients had a best possible visual acuity in the range of 6/9- 6/6 while 9 patients had a visual acuity in the range of 6/18-6/12. In the SICS group 11 patients had a best possible visual acuity in

the range of 6/9- 6/6, 39 patients had a visual acuity in the range of 6/18-6/12.

Surgically Induced Astigmatism on Postop Day 45 (According to Axis)

Group	Vijay Damor et al						Present Study					
	WTR			ATR			WTR			ATR		
	No. of Cases	Average	SD	No. of Cases	Average	SD	No. of Cases	Average	SD	No. of Cases	Average	SD
PHACO	22	0.38	0.26	18	0.52	0.25	0	0	0	47	0.98	0.39
SICS	26	0.60	0.28	14	1.03	0.68	1	0	0	49	3.07	0.96

The Mean ± SD SIA with WTR on Postop day 45 was 0.38± 0.26 D and for ATR 0.52 ± 0.25 D in Phaco group in Vijay Damor et al study whereas it was for ATR 0.98 ± 0.39 D in the present study.

The Mean ± SD SIA with WTR on postop day 45 was 0.60 ± 0.28 D and for ATR 1.03 ± 0.68 D in SICS group in Vijay Damor et al study whereas it was for ATR 3.07 ± 0.96 D in the present study.

Distribution of SIA on Postop Day 45

SIA POSTOP 45	Siva Ramareddy et al		Present study	
	PHACO	SICS	PHACO	SICS
0-0.5	5	4	8	0
0.75- 1	9	11	21	1
1.25 – 1.5	12	7	16	3
1.75-2	4	8	2	6
2.25-2.5	0	0	0	8
>2.5	0	0	0	32

This is a table showing Surgically Induced Astigmatism on postop day 45.

In Siva Ramareddy et al study, Minimum Surgically Induced Astigmatism was in the range of 0-0.5 D seen in 5 patients in the Phaco group and 4 patients had in SICS group.

Maximum Surgically Induced Astigmatism was in the range of 1.75-2 D seen in 4 patients in Phaco group and 8 patients in SICS group [11]

In the present study, Minimum Surgically Induced Astigmatism was in the range of 0-0.5 D seen in 8 patients in the Phaco group and it was in the range of 0.75 to 1 D seen in 1 patient in the SICS group. Maximum Surgically Induced Astigmatism was in the range of 1.75-2 D seen in 2 patients in Phaco group and was more than 2.5 D seen in 32 patients in the SICS group.

5. Conclusion

The present study demonstrates that the least amount of astigmatism is induced when cataract extraction is done by phacoemulsification by making 3.2 mm superior scleral incision than with small incision cataract surgery (SICS) by making 6mm superior scleral incision.

References

[1] Astigmatism; David Abrahams: Duke-elder’s Practice of Refraction.10th Edition, B.I Churchill Livingstone; New Delhi: 65-71.
 [2] Gills JP, Sanders DR (eds): Small Incision Cataract Surgery, Foldable lens, one stitch surgery, sutureless

surgery, Astigmatic keratotomy: Thorafore, NJ, Slack, 1990, 147-150
 [3] Shashi Kapoor: Phacoemulsification, Laser cataract surgery and foldable IOL’s. Is ted 1998:9:67-80.
 [4] Rene R. ”Skip” Rivard, FCLSA (H).Principles of the Keratometer
 www.nao.org/cec/.../principles%20of%20the%20keratometer.html
 [5] Gogate. Cost effectiveness of phacoemulsification and MSICS. Ophthalmology.2008;115 (1):211-2
 [6] Gokhale NS, Sawhney S. Reduction in Astigmatism in Manual Small Incision Cataract surgery through change of Incision Site. Indian J Ophthalmol 2005; 53:201-203
 [7] George. Surgically induced astigmatism in MSICS and Phacoemulsification. Ophthalmic Epidemiol.2005;12 (5):293-7
 [8] George R, Rupauliha P, Sripriya AV, Rajesh PS, Vahan PV, Praveen S. Comparison of endothelial cell loss and surgically induced astigmatism following conventional extracapsular cataract surgery, manual small incision surgery and phacoemulsification. Ophthalmic epidemiology 2005;12 (5):293-7
 [9] Harakuni U, Bubanale S, Smitha K.S, Arvind L. Tenagi. Kshama K.K, Meena A, Kathyayini S.V, Abhinav Biala. “Comparison of Surgically Induced Astigmatism with Small Incision Cataract Surgery and Phacoemulsification”. Journal of Evolution of Medical and Dental Sciences 2015; Vol.4, Issue 71, September 03; Page:12354-12360, DOI:10.14260/jemds/2015/1784
 [10] Damor V, Mahant A. Post-operative Astigmatism After SICS and Phacoemulsification. themedicalacademy.in
 [11] Kolli ramareddy S, Endreddy A. Clinical comparative study of Small Incision Cataract Surgery and Phacoemulsification. Indian Journal of Applied Research March 2016;Vol6:106-108