

Original research article

A comparative study of post-operative astigmatism and visual out come in manual small incision cataract surgery and phacoemulsification

¹Dr. K. Swathi, ²Dr. P. Sireesha

^{1,2}Assistant Professor, Department of Ophthalmology, Kurnool Medical College, Kurnool, Andhra Pradesh, India

Corresponding Author:

Dr. K. Swathi

Abstract

Aim: “To compare the post operative astigmatism and visual out come in Manual small incision cataract surgery and Phacoemulsification”.

Methodology: This comparative study of post operative astigmatism between Manual SICS and phacoemulsification was done in Department of Ophthalmology Kurnool Medical College, Kurnool. 50cases were Manual SICS and 50 cases were Clear corneal phacoemulsification.

Results: The mean age group of patients in SICS and phaco was 62.16 and 60.7years respectively. In 50 cases, Manual SICS was done with superior frown shaped 6.5mm incision 2mm from the limbus. In 50 cases of Phacoemulsification was done with Clear corneal 3mm biplanar incision at 11o clock. Postoperative astigmatism was studied with keratometer and automated- refractometer at the end of 6weeks. Surgically induced astigmatism was calculated by vector method of Jaffe. The induced astigmatism at the end of 6 weeks was ATR in 24 cases, WTR in 10 cases and oblique astigmatism in 16 cases in Manual SICS group. The induced astigmatism at the end of 6 weeks was ATR in 22 cases WTR in 17 cases and oblique astigmatism in 10 cases in Clear corneal phacoemulsification group. There was a net tendency towards against the rule astigmatism in both the groups at the end of 6 weeks. Mean induced astigmatism at the end of 6 weeks was 0.91 in Manual SICS group and 0.49 in Phacoemulsification group (statistically significant difference). Uncorrected VA and Best corrected VA at the end of 6 weeks were much better in Clear corneal phaco group (p value significant). Uncorrected near VA at the end of 6 weeks were almost similar in both the groups (p value not significant).

Conclusion: Our study concluded that there is a statistically significant ($p < 0.00001$) difference in the magnitude and severity of surgically induced astigmatism at the end of 6 weeks between Manual SICS and Clear corneal phacoemulsification group.

Keywords: Cataract, SICS, phacoemulsification, astigmatism, visual acuity

Introduction

Cataract surgery with intraocular lens implantation has changed the concept of post-surgical rehabilitation. Tremendous changes are taking place in the wound construction for cataract surgery mainly to minimize the astigmatism without compromising on wound stability.

The conventional ECCE with five or more sutures is associated with delayed rehabilitation and considerable and unpredictable astigmatism due to multiple sutures and wound length. The most exciting innovation in cataract surgery in 20th century is the technique of phacoemulsification. It permits the removal of cataract through very small incision thus eliminating many complications related to wound healing and large incision. There is less tissue injury, less postoperative pain and inflammation. Foldable implants, rollable implants and multifocal lenses can be implanted with phacoemulsification. There is less incidence of posterior capsule opacification. The amount of surgically induced astigmatism is very less.

The purpose of this study is to compare post operative astigmatism between Manual small incision cataract surgery and Phacoemulsification.

Aim of the Study

“To compare the post operative astigmatism and visual out come in Manual small incision cataract surgery and Phacoemulsification”.

Materials and Methods

Case Selection

Inclusion Criteria

- Age-50-80yrs.
- Surgeries done by a single surgeon with 5 yrs of experience both in Manual SICS and

Phacoemulsification.

- **Manual SICS:** 6.5 mm superior frown shaped incision 2mm from the limbus.
- **Phacoemulsification:** Clear corneal phacoemulsification with 3mm biplanar incision at 11 o clock position and a side port at 1 o clock position.
- Cataracts of nuclear sclerosis grade 1-2.
- Preoperative astigmatism <2D.

Exclusion Criteria

- Complicated cataract.
- Traumatic cataract.
- Paediatric cataract.
- Eyes with evidence of corneal pathology, glaucoma, squint, posterior segment pathology.

Preoperative Examination Included

- Complete ocular examination was done which included VA, Intra ocular pressure (Goldmann Applanation Tonometry), fundus examination, keratometry, A-scan biometry (SRKII formula used).
- Preoperative astigmatism-preoperative cylinder power in diopters measured by auto-refractometer.
- All the patients were subjected to detailed general and systemic examination and preoperative fitness was taken for every patient who underwent cataract surgery.
- Preoperative preparations-dilatation of pupil was done with Tropicamide and Phenylephrine drops for every 10 min 2 hrs before surgery.

Anesthesia

All were done under local anesthesia with peribulbar block with 2% Xylocaine, 0.75% Bupivacaine and Hyalase.

Surgical Technique

All surgeries done by a single surgeon with 5 yrs of experience both in Manual sics and phacoemulsification.

SICS was done in 50 patients and Clear corneal phacoemulsification in 50 patients.

Post Operative

Uncorrected VA, Best corrected VA, Uncorrected near vision, keratometry readings, Cylinder power and axis as measured by automated refractometer were recorded and compared at the end of 6 weeks.

Observations

Study Design: A comparative clinical study with 50 patients, randomized into two groups, 50 patients in Group SICS and another 50 patients in group Phacoemulsification is undertaken to study and compare the incidence, magnitude, type and course of astigmatism using keratometer and auto-refractometer in manual SICS and Clear corneal phacoemulsification.

A total of 120 patients with uncomplicated cataracts and with clear corneas were taken for the study. Out of which only 100 patients have turned up for regular post operative follow up.

- The study was conducted between months of September 2021 to February 2023.
- A detailed preoperative examination and evaluation was done which included visual acuity, slit lamp examination, IOP recording, preoperative K readings, A scan were done for all the patients.
- The observations of our study are shown in the tabular form based on the age distribution, percentage of type of cataracts operated, post operative astigmatism in SICS, post operative astigmatism in Phaco, complications we have come across in our study and lastly comparison of post operative astigmatism in SICS and Phaco at the end of 6 weeks.

Table 1: Age Distribution

Age in Years	SICS		PHACO	
	No	%	No	%
51-60	20	40	23	46
61-70	22	44	21	42
>70	8	16	6	12
Total	50	100	50	100

Table 2: Age Distribution

	Mean	Standard deviation	Standard error
MANUAL SICS	62.16	6.990839487	0.9886540015
PHACO	60.76	6.557625255	0.9273882572
t value	1.032799574		
P value	0.30423975. Not Significant.		

Samples are age matched with p= 0.30423975 (not significant)

Table 3: Gender Distribution

Gender	MSICS		PHACO	
	No.	%	No.	%
Males	26	52	27	54
Females	24	48	23	46
Total	50	100%	50	100%
Chisquare	0.4014452027			
P value	0.8411982781 Not significant			

Table 4: Types of CATARCT Operated

S. No.	Type of cataract	No.	%
1	Senile	100	100%

100% of cases in our study are senile cataracts.

Table 5: Incidence of Complications on First Post Operative Day

S. No.	Complication	MSICS		PHACO	
		No	%	No	%
1.	Iritis(cells2+)	5	10%	4	8%
2.	Striate keratopathy	3	6%	4	8%
3.	Wound leak	1	2%	3	6%

Table 6: Uncorrected VA at the end of 6 WKS

VA	MSICS		PHACO	
	NO.	%	NO.	%
6/6	0	0	5	10%
6/9-6/18	33	66%	37	74%
6/24	17	34%	8	16%
Chi square	6.125937628			
P value	0.04674870079 Significant			

Table 7: Best Corrected Visual Acuity at the end of 6 WKS

VA	MSICS		PHACO	
	No.	%	No.	%
6/6	15	30%	28	56%
6/9-6/18	32	64%	21	41%
<6/24	3	6%	1	2%
Chi squaretest	7.213251426			
P value	0.02714328174. Significant.			

Table 8: Comparison of Preoperative Uncorrected Near VA in MSICS and PHACO

Near VA	MSICS		PHACO	
	NO:	%	NO:	%
>N8	18	36%	15	30%
N8-N18	26	52%	27	54%
<N18	6	12%	8	16%
Chi square test-	0.577309483			
P value-	0.7492708529 Not Significant			

Table 9: Comparison OFPOST Operative Uncorrected Near Vision at the end of 6 WKS

Near VA	MSICS		PHACO	
	No.	%	No.	%
>N8	17	34%	10	20%
N8-N18	23	46%	27	54%
<N18	10	20%	13	26%
Chi square	2.526119163			
P-value	0.2827874902. Not Significant.			

Comparison of Surgically Induced Astigmatism

Change in the keratometric cylinder was examined in two ways:-

1. Vector analysis method of determining induced cylinder described by Jaffe and Clayman which is

explained in the next page.

- The simple subtraction method of calculating cylinder change without regard to axis.

Differences between induced cylindrical changes were analyzed using unpaired t test.

Assessment of Axis Change of Cylinder Manual SICS Group

(Cylinders between 70° and 110° were considered as with the Rule Astigmatism, Cylinders between 160° and 20° as Against the Rule, Axes in between considered Oblique).

Table 10: Preoperative Astigmatism

S. No.	Type of Astigmatism	No. of cases	Percentage
1.	Against the rule	20	40%
2.	With the rule	16	32%
3.	Oblique	14	28%

Table 11: Net Induced Type of Cylinder (By Vector Method of Jaffe) in Manual SICS Group (6 weeks)

S. No.	Type of astigmatism	No. of cases	Percentage
1.	ATR	24	48%
2.	WTR	10	20%
3.	Oblique	16	32%
Total		50	100%

Table 12: Severity of Induced Astigmatism at the end of 6 WKS (By Vector Method of Jaffe) in Manual SICS Group

Amplitude of cylinder	0.00D	<0.5 D	0.5-1D	1-1.5D	1.5-2D
No. of cases	-	4	27	8	11

Phacoemulsification Group

Table 13: Preoperative Astigmatism

S. No.	Type of Astigmatism	No. of cases	Percentage
1.	Against the rule	25	50%
2.	With the rule	18	36%
3.	Oblique	7	14%

Table 14: Postoperative Astigmatism (6 WKS)

S. No.	Type of Astigmatism	No. of cases	Percentage
1.	Against the rule	25	50%
2.	With the rule	19	38%
3.	Oblique	6	12%

Table 15: Net Induced Cylinder at the end of 6 WKS (From Vector Method of Jaffe) in Phacoemulsification Group

Type of Astigmatism	No. of cases	Percentage
ATR	22	44%
WTR	17	34%
OBLIQUE	10	20%
Total	50	100

Hence here also the tendency is towards against the rule of astigmatism.

Table 16: Assessment of Magnitude of Induced Cylinder at the end of 6 WKS between the Two Groups

- Comparison of groups done by unpaired t test

	Mean	Standard Deviation	Standard Error
MSICS	0.9176	0.4084543289	0.05776416515
PHACO	0.4912	0.2807252997	0.03970055261
t value	6.083467757		
P value	< 0.00001 Significant		

Discussion

This study was performed to compare postoperative astigmatism at the end of 6 weeks in two groups of patients who had Manual small incision cataract surgery and Clear corneal phacoemulsification using

keratometer and automated refractometer. In the present study we primarily focus on the corneal curvature precisely at 6 weeks of post operative period. Chi square test and unpaired t test were used to calculate statistical differences.

In our study the mean induced cylinder at the end of 6 weeks was:-

0.91 Diopter for Manual Sics group.

0.49 Diopter for Clear corneal phacoemulsification group.

Thus, the differences in the amplitude of induced cylinders between both the groups are found to be statistically significant with $p < 0.0001$. The Clear corneal phacoemulsification technique, with its small self-sealing incision requires no stitches in most cases. The wound is more stable with a minimum of complications. With Phacoemulsification, the patient heals faster, recovers rapidly, and can resume normal activities more quickly. There are also fewer follow ups/check-ups by patients. Additionally, the cornea is less likely to become distorted with the small incision and astigmatism is minimized. With recent developments of advanced microprocessors, the Phacoemulsification technique offers a safe and elegant disassembly and aspiration.

The cost-effectiveness of Phacoemulsification comes from its ability to return patients to work and to their functioning lives more quickly than conventional surgery. In developed countries with large health budgets, the Phacoemulsification technique is generally preferred, however, in developing countries, the cost of Phacoemulsification can be prohibitive due to limited health budgets and more especially when there is a backlog of untreated cataracts.

Studies

Minassian *et al.* (2001) conducted a randomized trial on extracapsular cataract extraction (232 patients with age related cataracts) and Phaco (244 patients). They found that surgical complications and capsule opacity within 1 year after surgery higher with ecce and higher proportion of the Phaco group achieved unaided VA 6/9 or better^[7].

George *et al.* (2005) compared surgically induced astigmatism, SICS and phacoemulsification with non-foldable intraocular lens implant in 186 eyes with nuclear sclerosis of grade 3 or less. Mean surgically induced astigmatism was, 1.17D in the SICS group and 0.77D in the Phaco group ($P = 0.001$).

Conclusion-Statistically significant difference was found in surgically induced astigmatism between sics and phaco^[8].

Gogate *et al.* (2005) compared the efficacy, safety, and astigmatic change after cataract surgery by phacoemulsification and MSICS via a randomized control trial at H. V. Desai Eye Hospital, Pune, India.

The authors found that at week 1, there were 68.2% patients in the phacoemulsification group and 61.25% patients in the SICS group that had UCVA better than or equal to 6/18. 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. Gogate *et al.* (2005) concluded that both phacoemulsification and SICS are safe and effective for visual rehabilitation of cataract patients. They also concluded that phacoemulsification gives better UCVA in a larger proportion of patients at 6 weeks^[9].

Reddy *et al.* (2007) compared astigmatism induced by superior incision in manual SICS and astigmatism induced by clear corneal incision. The study comprised of a total of 64 eyes (64 patients: 34 males, 30 females) that was divided into two groups: Manuals SICS and phacoemulsification.

The authors found a significant against the rule shift in astigmatism in the Phaco. At 90 days, conventional SICS superior incisions showed 1.92 ± 0.53 D of against the rule astigmatism. Phacoemulsification with clear corneal incisions showed 1.08 ± 0.36 D of astigmatism respectively^[10].

Cook *et al.* (2011) also recently reported the findings of a study conducted on the randomized clinical trial of Phaco vs. MSICS in South Africa at the Canadian Ophthalmology Congress in Vancouver, Canada. Using an equal number of patient for the two techniques (100), they found no difference in the VA on day one.

This study found that Corrected VA ($p=0.03$) and uncorrected VA ($p=0.02$) after 8 weeks was found to be slightly better in Phaco than in MSICS.

These scientists are of the opinion that consideration should be given to “encouraging a transition to phacoemulsification” in the South African VISION 2020 programme^[11].

Conclusions

1. In our study undertaken there is a statistically significant ($p < 0.00001$) difference in the magnitude and severity of surgically induced astigmatism at the end of 6 weeks between Manual SICS and Clear corneal phacoemulsification group.
2. Post operatively at the end of 6 weeks there was an astigmatic drift towards against the rule astigmatism in both the groups.
3. Uncorrected VA and Best corrected VA at the end of 6 weeks were much better in Clear corneal phacoemulsification group (p value significant).
4. Complication rates on the first post operative day were almost similar in both the groups.

5. Uncorrected near vision at the end of 6 wks was similar in both the groups (p value not significant).

Conflict of Interest: None.

Funding support: Nil.

References

1. Daviel J. A new method of curing cataract by extraction of the lens. *Memoires de L'Academie Royale de Chirurgie, Paris.* 1753;2:337-54.
2. Koller K. The application of cocaine to the eye as an anaesthetic. *Wein Med Bl.* 1884 Oct;23:1352-5.
3. Apple DJ, Sims J. Harold Ridley and the invention of the intraocular lens. *SURV Ophthalmol.* 1996;40:279-92.
4. Kelman CD. Phacoemulsification and aspiration: a new technique of cataract removal. A preliminary report. *Am J Ophthalmol.* 1967;64:23-35.
5. McFarland MS. Surgeon undertakes phaco, foldable IOL series sans sutures. *Ocular Surgery News,* 1990, 8.
6. Wilson ME, Pandey SK, Wegner L, Ram J, Apple DJ Paediatric cataract surgery: Current techniques, complications and management. In: Agarwal S, Agarwal A, Sachdev MS, Mehta KR, Fineih, Agarwal A (eds). *Phacoemulsification laser cataract surgery and foldable IOLs* Jaypee Brothers, Medical Publishers. New Delhi. India, 2000, 368-88.
7. Minassian DC, Rosen P, Dart JK, *et al.* Extracapsular cataract extraction compared with small incision surgery by phacoemulsification: a randomised trial. *Br J Ophthalmol.*, 2001, 85.
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;12:293-297. ISSN: 0928-6586. DOI:10.1080/09286580591005778.
9. Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Joshi SA, Palimkar A. Safety and efficacy of phacoemulsification compared with manual small incision cataract surgery by a randomized controlled clinical trial-six week results. *Ophthalmology.* 2005;112(5):869-874.
10. Reddy B, Raj A, Singh VP. Site of Incision and Corneal Astigmatism in Conventional SICS versus Phacoemulsification. *Annals of Ophthalmology.* 2007;39(3):209-216. DOI:10.1007/s12009-007-0020.
11. Phaco-emulsification versus manual small-incision cataract surgery in South Africa. 2012;102:6.