

3MM SUPEROTEMPORAL SICS VS PHACOEMULSIFICATION- A COMPARATIVE STUDY

Ophthalmology

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ABSTRACT

Cataract is the leading cause of reversible blindness worldwide and cataract surgery aim to restore vision with minimal refractive error. Surgically Induced Astigmatism (SIA) result from corneal incision related changes and can affect postoperative visual quality refractive stability, wound healing and patient satisfaction. This studied compared postoperative keratometric changes, refractive outcomes and surgically induced astigmatism following phacoemulsification and 3 mm superotemporal small incision cataract surgery. Both techniques demonstrated excellent visual rehabilitation with minimal corneal curvature changes and low surgically induced astigmatism. Post-operatively visual acuity improved significantly in both groups. These findings suggest that 3mm superotemporal small incision cataract provide outcomes comparable to phacoemulsification supporting its effectiveness as safe and cost-effective cataract surgery. **Results-** After 15 days, postoperatively no statistically significant difference was observed between 3mm superotemporal small incision cataract surgery and phacoemulsification regarding K1 and K2, postoperative corneal astigmatism refractive sphere or cylinder and unaided visual acuity. Surgically induced astigmatism was comparable between small incision cataract surgery (0.82+-0.50) and phacoemulsification (0.72+-0.44), $p=0.336$ with no significant difference between two groups. **Conclusions-** Both 3mm superotemporal SICS and phacoemulsification provides excellent visual rehabilitation with minimal surgically induced astigmatism and stable postoperative corneal curvature. The comparable refractive and visual outcomes suggest that 3mm SICS is an effective and safe and cost effective alternative to phacoemulsification cataract surgery.

KEYWORDS

Cataract, Phacoemulsification, Small Incision Cataract Surgery, Superotemporal SICS, Surgically Induced Astigmatism, Keratometry, Refractive Outcome, Visual Acuity

INTRODUCTION

Cataract is the leading cause of reversible blindness and remains major public health problem particularly in developing countries. Cataract surgery is one of the most commonly performed surgical procedures and has evolved from vision restoring operation to a refractive procedure aim at providing rapid visual rehabilitation with minimal postoperative astigmatism and optimal visual acuity.

Surgically induced astigmatism (SIA) is an important determinant of postoperative visual acuity. It results from change in corneal curvature caused by surgical incision and can influence uncorrected visual acuity, refractive stability, patient satisfaction. The magnitude of surgically induced astigmatism depends on several factors including size of incision, location of incision and architecture of incision.

Phacoemulsification is considered gold standard for cataract surgery because of small incision and excellent refractive outcomes. However, small incision cataract surgery remains widely practiced due to its cost effectiveness shorter learning curve and is not machine dependent. Modifications such as 3mm superotemporal incision has been introduced to reduced surgically induced astigmatism and improve postoperative visual outcomes.

Although several studies have been done the present study aims to compare postoperative corneal curvature changes, surgically induced astigmatism, refractive outcomes and visual rehabilitation between phacoemulsification and 3mm superotemporal small incision cataract surgery.

By evaluating preoperative and postoperative keratometric and refractive parameters this study seeks to determine 3mm superotemporal small incision cataract surgery can achieve outcomes comparable to phacoemulsification while remaining an effective and economical option for cataract management.

MATERIALS AND METHODS

Total 104 Patients were included in the study out of which 52 were belonging to 3mm superotemporal SICS group and 52 were belonging to phacoemulsification group.

Study Design: Prospective comparative observational study

Study Type: Hospital based prospective comparative observational study

Inclusion Criteria

- Patients aged 40yrs and above with all different types of cataracts were included in the study.
- Patients undergoing elective cataract surgery either by phacoemulsification or 3mm superotemporal SICS with posterior chamber IOL implantation were included in the study.
- Patients who were willing to participate and provide informed consent.

Exclusion Criteria

- Patients with preexisting irregular astigmatism.
- Glaucoma or optic nerve disease affecting visual outcome
- Retinal or macular disease likely to influence postoperative vision. For example, diabetic macular edema, age related macular degeneration.
- Patient with high myopia or high hypermetropia
- Patients with corneal pathology (opacity, dystrophy, degeneration)
- Patients with traumatic, congenital, developmental and complicated cataract.

Wound Construction

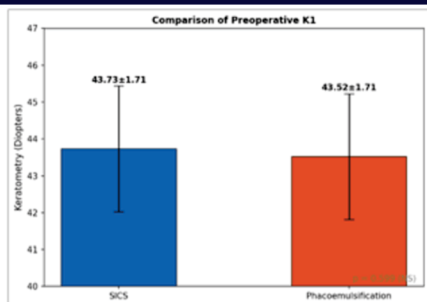
3mm incision taken in superotemporal quadrant 2mm away from limbus. Two oblique sidecuts (angles) are made at each end of incision (linear) approximately 1mm in length (blumenthal incision). Partial thickness sclerocorneal tunnel is dissected with side pockets creating internal incision of approximately (4.5-5mm) in length. Nucleus delivery is done through this small sized tunnel. Nucleus cracking gets done by auto fragmentation method within the tunnel at the time of nucleus delivery. Alost 1/3 part of nucleus gets delivered by fragmentation rest part is delivered by either viscoexpression method or by using wire Vectis.

Preoperative Keratometry

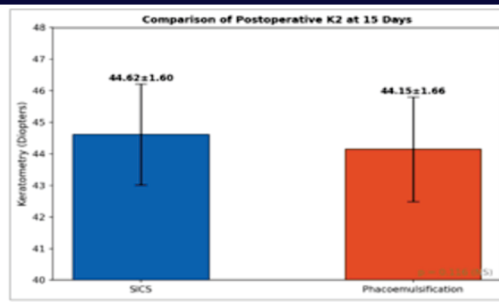
Table 1: Comparison of Preoperative Keratometry between SICS and Phacoemulsification Groups

Parameter	SICS Mean $\pm$ SD	Phaco Mean $\pm$ SD	p-value	Sig.
Preop K1 (D)	43.73 $\pm$ 1.71	43.52 $\pm$ 1.71	0.599	NS
Preop K2 (D)	44.55 $\pm$ 1.70	44.13 $\pm$ 1.61	0.170	NS
Preop Mean K (D)	44.14 $\pm$ 1.69	43.82 $\pm$ 1.64	0.309	NS
Preop Corneal Astigmatism (D)	0.82 $\pm$ 0.50	0.61 $\pm$ 0.43	0.020	S*

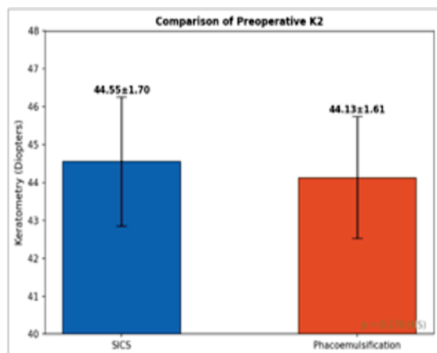
NS = Not Significant; S* = Significant ($p < 0.05$). Test used: Mann-Whitney U test. Values expressed as Mean $\pm$ SD.



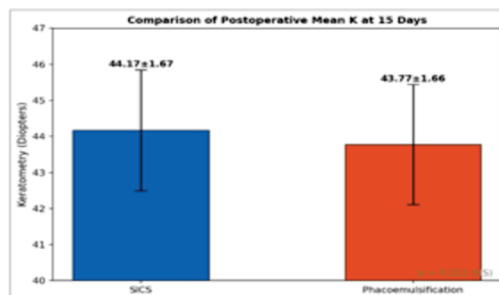
Preoperative K1 Comparison between SICS and Phacoemulsification (Mean ± SD)



Postoperative K2 at 15 Days: SICS vs Phacoemulsification (Mean ± SD)



Preoperative K2 Comparison between SICS and Phacoemulsification (Mean ± SD)



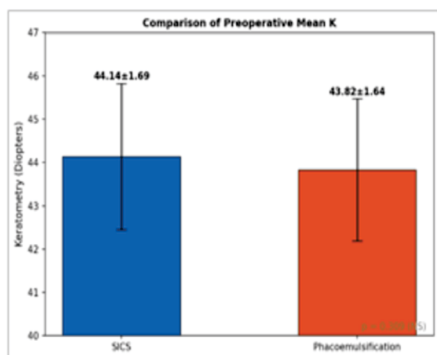
Postoperative Mean K at 15 Days: SICS vs Phacoemulsification (Mean ± SD)

Change in Keratometry (Preoperative to Postoperative)

Table 3: Within-Group Change in Keratometry – Paired Analysis (Preoperative vs Postoperative)

Parameter	SICS: Mean Change±SD	p	Sig.	Phaco: Mean Change±SD	p	Sig.
K1 (D)	-0.004±0.554	0.954	NS	-0.123±0.340	0.013	S*
K2 (D)	0.067±0.536	0.369	NS	0.020±0.536	0.795	NS
Mean K (D)	0.031±0.451	0.617	NS	-0.051±0.373	0.330	NS

NS = Not Significant; S* = Significant (p<0.05). Test used: Paired t-test. Change = Postoperative – Preoperative value.



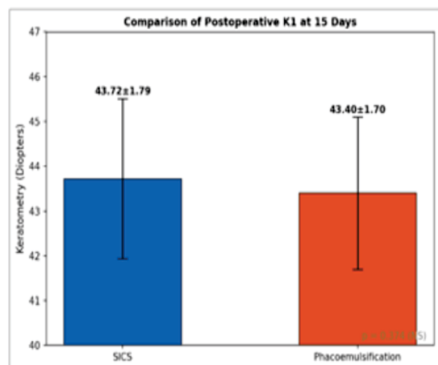
Preoperative Mean K Comparison between SICS and Phacoemulsification (Mean ± SD)

Postoperative Keratometry at 15 Days

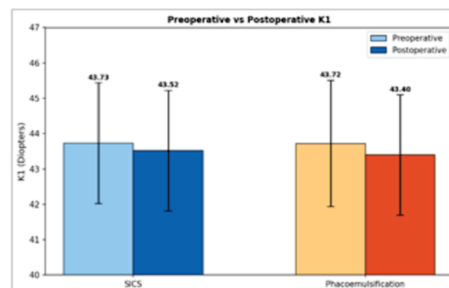
Table 2: Comparison of Postoperative Keratometry (15 Days) between SICS and Phacoemulsification Groups

Parameter	SICS Mean±SD	Phaco Mean±SD	p-value	Sig.
Postop K1 (D)	43.72±1.79	43.40±1.70	0.374	NS
Postop K2 (D)	44.62±1.60	44.15±1.66	0.116	NS
Postop Mean K (D)	44.17±1.67	43.77±1.66	0.222	NS
Postop Corneal Astigmatism (D)	0.89±0.59	0.75±0.46	0.364	NS

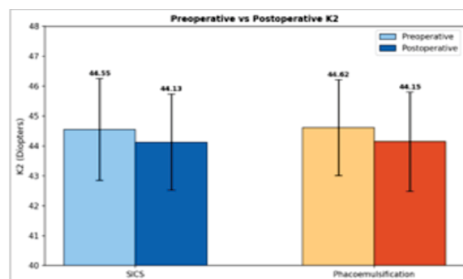
NS = Not Significant. Test used: Mann-Whitney U test. Values expressed as Mean ± SD.



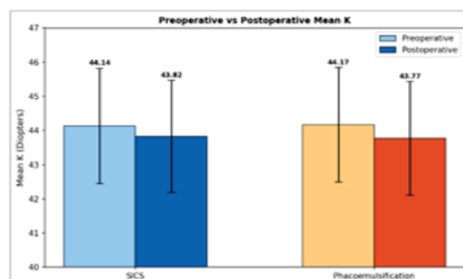
Postoperative K1 at 15 Days: SICS vs Phacoemulsification (Mean ± SD)



Preoperative vs Postoperative K1: SICS and Phacoemulsification (Mean ± SD)



Preoperative vs Postoperative K2: SICS and Phacoemulsification (Mean ± SD)



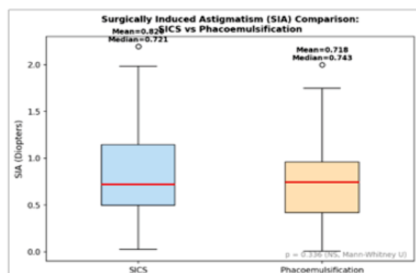
Preoperative vs Postoperative Mean K: SICS and Phacoemulsification (Mean ± SD)

Surgically Induced Astigmatism (SIA)

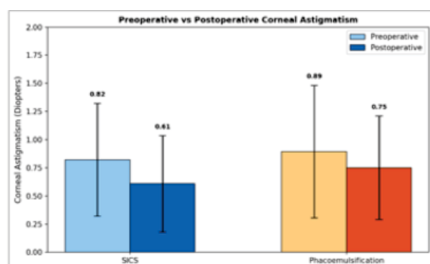
Table 4: Surgically Induced Astigmatism (SIA) by Vector Analysis – SICS vs Phacoemulsification

Group	Mean±SD (D)	Median (D)	p-value*	Significance
SICS	0.820±0.501	0.721	0.336	NS
Phacoemulsification	0.718±0.442	0.743	—	—

*Mann-Whitney U test used for inter-group comparison. NS = Not Significant. SIA calculated using Jaffe-Clayman vector method.



Surgically Induced Astigmatism (SIA): SICS vs Phacoemulsification (Boxplot with Mean)



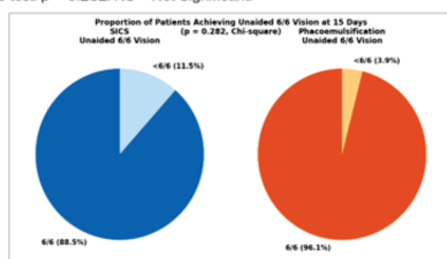
Preoperative vs Postoperative Corneal Astigmatism: SICS and Phacoemulsification

Visual Outcomes at 15 Days

Table 5: Proportion of Patients Achieving 6/6 Unaided Vision at 15 Days – SICS vs Phacoemulsification

Group	6/6 Vision (%)	<6/6 Vision (%)	p-value
SICS	88.5%	11.5%	0.282
Phacoemulsification	96.1%	3.9%	—

Chi-square test: $p = 0.282$. NS = Not Significant.

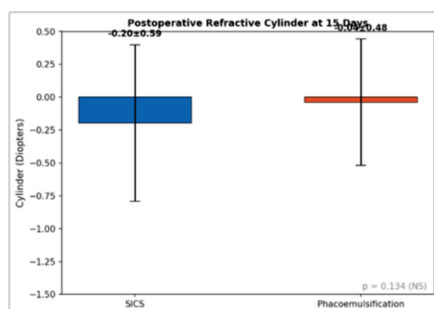
Proportion of Patients Achieving Unaided 6/6 Vision at 15 Days (Chi-square $p = 0.282$)

Postoperative Refraction

Table 6: Postoperative Refraction (Sphere and Cylinder) at 15 Days – SICS vs Phacoemulsification

Parameter	SICS Mean±SD	Phaco Mean±SD	p-value	Sig.
Postoperative Sphere (D)	-0.019±0.097	0.000±0.000	0.163	NS
Postoperative Cylinder (D)	-0.197±0.595	-0.039±0.481	0.134	NS

NS = Not Significant. Test used: Mann-Whitney U test. Values expressed as Mean ± SD.



Postoperative Refractive Cylinder at 15 Days: SICS vs Phacoemulsification

RESULTS

A total of 104 eyes was included with 52 eyes undergoing phacoemulsification and 52 eyes undergoing 3mm superotemporal SICS.

Both groups were comparable in preoperative K1, K2 and statistically significant difference was noted in preoperative corneal astigmatism with SICS showing higher values.

Postoperative Keratometry: No significant difference was found between groups in postoperative K1 and K2 or corneal astigmatism at days confirming comparable corneal stability

CONCLUSION

Based on statistical analysis both 3mm superotemporal SICS and phacoemulsification cataract surgery are comparable in terms of postoperative keratometry, Surgically induced astigmatism, refractive outcomes and visual rehabilitation.

A high proportion of patients achieved unaided 6/6 visual outcomes in both groups with no statistically significant difference support the conclusion that 3mm superotemporal SICS is an effective, viable, safe and cost efficient alternative to phacoemulsification cataract surgery.

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