Original Article

To Evaluate the Difference in Astigmatism on Keratometry Resulting from Temporal and Superior Corneal Incisions During Phacoemulsification

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ABSTRACT

Objective: To compare the average change in keratometry's medically induced astigmatism between corneal incisions made laterally vs laterally for phacoemulsification.

Study Design: Randomized Controlled Trial

Place and Duration of Study: This study was conducted at the Department of Ophthalmology, Khyber Institute of Ophthalmic Sciences HMC, Peshawar. From 21-07- 2022 to 21-01-2023.

Methods: A cohort of 140 individuals diagnosed with cataracts were assigned to two groups using a random allocation procedure. Patients in group A had a superior corneal incision, whereas patients in group B underwent a temporal incision for phacoemulsification. The keratometry values at baseline and follow-up were collected to calculate the average change in astigmatism between baseline and follow-up.

Results: Across the whole study population, the mean age of the patients was 49.6 + 5.3 years. Patients in group B had a mean age of 50.4 + 4.9 years (p 0.04), compared to 48.9 + 5.8 years in group A. When the sample was divided into groups based on gender, group A had 82.9% men and 17.1% women, whereas group B had 74.3% men and 25.7% women (p 0.217). Group A's mean BMI was 24.9 + 3.8 kg/m2, whereas Group B's mean BMI was 25.2 + 3.7 kg/m2. In groups A and B, the mean baseline BCVA was 0.8 + 0.2 and 0.8 + 0.2, respectively (p 0.858). On keratometry, group A's mean baseline astigmatism was 0.2 + 0.06D, whereas group B's was 0.1 + 0.07 (p 0.614). According to keratometry, group A's mean follow-up astigmatism was 1.2 + 0.2D, whereas group B's was 1.1 + 0.2 (p 0.836). According to keratometry, group A's astigmatism changed by 1.0 + 0.17D and group B's by 1.0 + 0.2 (p 0.707).

Conclusion: In groups with corneal versus temporal incisions, we did not observe a statistically significant difference in the mean change in astigmatism before and after phacoemulsification. We recommend conducting more research with larger sample sizes and accounting for confounders that may have an impact on patients' surgically induced astigmatism following phacoemulsification, as our study was conducted with a smaller sample size and did not account for effect modifiers.

Key Words: Senile Cataract, phacoemulsification, temporal incision superior corneal incision, astigmatism, keratometry.

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INTRODUCTION

Cataracts cause most blindness worldwide. About 17.6 million people worldwide have bilateral cataracts, which cause 39% of blindness.

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51.5% of avoidable blindness in Pakistan is cataract-related[1].About 3,560,000 Pakistanis have cataract-related visual impairment, and 570,000 are blind[2]. Phacoemulsification is seldom utilized in poor countries like Pakistan, where cataract surgery is the norm, since it needs more sophisticated surgical training and expensive equipment. MSICS, a feasible alternative to phacoemulsification, is becoming increasingly popular in poor countries like Pakistan because to its early wound stability, minimum astigmatism, low complication rate, and affordability5. Because of its speed and bloodlessness, phacoemulsification via a clean corneal incision is the preferred cataract treatment. Most doctors have always had postop SIA (surgical-induced astigmatism). Better strategies provide greater SIAs than temporal ones6. Small (6 mm) and medium (6.5 mm) incisions induced the least

SIA7 compared to large (7 mm). Chevron incisions minimize SIA8 compared to straight and frown incisions. The corneal or keratometric SIA9 is the vector difference between preoperative and postoperative astigmatism. A study found that the mean SIA on the first, seventh, twenty-first, and forty-five postoperative days for temporal incision was 1.05 (±0.58) D, while for superior corneal incision, it was 0.75 (±0.58) D, 0.81 (±0.54) D, 0.88 (±0.49) D, and 0.91 (±0.47) D10. Current study compares mean SIA of temporal vs. superior corneal incisions for phacoemulsification after cataract surgery[11]. After a thorough literature search, we decided to conduct this study since there were few local data on the impact of phacoemulsification incisions on SIA and other outcomes. The surgeon must also decide how to avoid SIA from worsening during phacoemulsification[12]. This study will compare the SIA of superior and temporal corneal incisions for phacoemulsification locally. Locally, the study's results will provide first-hand evidence for research implications and policy recommendations[13].

METHODS

Each group's sample size was 70 based on the following hypotheses: Mean difference in SIA before and 21 days after surgery for the temporal group; 1.13 ± 0.56D mean difference in SIA before and 21 days after surgery in the group with superior incisions; 0.88 ± 0.49D Level of confidence: 95% Test power: eighty percent. The method of sampling used is consecutive (non-probabilistic) sampling.

Inclusion Criteria:

- All patients with cataracts are admitted for phacoemulsification.
- Adults with age above 40 to 65 years.
- Patients with baseline astigmatism equal to or less than 0.25D.
- Either gender.

Exclusion Criteria:

- Children with cataracts.
- Patients with a history of chronic glaucoma on medical records.
- Patients with blast injuries on history.
- Any history of ocular or refractive surgery in the past.
- The above-mentioned conditions act as confounders and if included will introduce bias in the study results.

Data Collection: CPSP research committee authorized the project. All OPD/ER cataract patients with baseline astigmatism of 0.25D or less were studied. All patients gave consent after being informed of the study's purpose and advantages. All patients had a thorough history, ophthalmologic exam, slit lamp, fundoscopy, gonioscopy, and ultrasonographic biomicroscopy. The lottery divided all patients into two groups. Group A patients got temporal and group B superior corneal incisions during phacoemulsification. One CPSP fellow ophthalmologist with at least five years of experience phacoemulsified all patients. On day one after surgery, all patients received nepafenac and post-phacoemulsification medication. Each patient received 0.1% Nepafenac eye drops three times a day for three months. After 21 days, astigmatism was measured before and after surgery using repeat keratometry. Data was input into a pre-designed proforma. To reduce confounders and bias in study, exclusion criteria were meticulously followed.

Statically analysis: Data was analyzed with SPSS 20. Mean+SD was computed for age, BMI, baseline visual acuity, baseline astigmatism, and follow-up astigmatism. Category factors like gender were computed by frequency and percentage. An independent sample T-test was performed to assess the mean change in astigmatism scores between two groups, with a p-value < 0.05 considered significant To assess effect modification, mean astigmatism change was stratified by age, BMI, baseline visual acuity, and gender using chi-square test with p-value < 0.05. All findings were shown in tables and graphs.

RESULTS

This research included 140 patients with age-related cataracts. Patients were randomly divided into two groups by lottery. Group A had a temporal phacoemulsification incision, whereas Group B received a superior corneal one. Research group patients averaged 49.6 + 5.3 years old. B patients averaged 50.4 + 4.9 years old (p 0.04), whereas A patients averaged 48.9 + 5.8. Table 1 compares aged groups in both groupings. Group A comprised 82.9% men and 17.1% women, whereas Group B had 74.3% and 25.7% (p 0.217). See Table 2. Group A had a mean BMI of 24.9 + 3.8 kg/m2 and group B 25.2 + 3.7. Mean baseline BCVAs for A and B were 0.8 + 0.2 (p 0.858).

Table No. 1: Comparison of age categories in both groups (n = 70 each)

	Incision Groups		p value
	Superior corneal incision	Temporal incision	
40-50 years	40	35	
Age Categories	57.1%	50.0%	
> 50-60 years	30	35	
	42.9%	50.0%	0.397
	70	70	
Total	100.0%	100.0%	

Tables 3 and 4 indicate BCVA and BMI baselines. Keratometry indicated average baseline astigmatism of 0.2 + 0.06D for group A and 0.1 + 0.07 for group B (p

0.614). Keratometry indicated group A's mean follow-up astigmatism was 1.2 + 0.2D and group B's 1.1 + 0.2 (p 0.836). Keratometry indicated group A's astigmatism changed by 1.0 + 0.17D and group B's by 1.0 + 0.2 (p 0.707). The following tables show both groups' mean astigmatism change by age, gender, BMI, and baseline BCVA.

Table No. 2: Comparison of gender between both groups (n = 70 each)

	Incision Groups		P value
	Superiorcorneal incision	Temporal incision	
Male	58	52	0.217
Gender	82.9%	74.3%	
Female	12	18	
	17.1%	25.7%	
	70	70	
Total	100.0%	100.0%	

Table No: 3: Gender Wise Stratification of Change In Astigmatism

Gender	Incision Groups	Mean	SD	P value
Male	Superior corneal incision	.9957	.16418	0.596
	Temporal incision	1.0135	.18606	
Female	Superior corneal incision	1.1500	.17321	0.038
	Temporal incision	1.0028	.18588	

Table No: 4: Bmi Wise Stratification of Change In Astigmatism

BMI (kg/m^2)	Incision Groups	Mean	SD	P value
195-25	Superior corneal incision	1.0361	.18921	0.110
	Temporal incision	.9621	.17508	
> 25-29.9	Superior corneal incision	.9864	.14734	0.295
	Temporal incision	1.0333	.16574	
> 29.9-32.5	Superior corneal incision	1.0458	.17896	.722
	Temporal incision	1.0773	.23808	
	Temporal incision	1.0071	.15024	

DISCUSSION

Cataract surgery has advanced. From ancient coaching to intracapsular to phacoemulsification cataract surgery. Without correction and prompt deployment, surgically induced astigmatism is the largest postoperative visual rehabilitation challenge. Surgeons tried hard to make SIA-reducing incisions[13]. Cataract surgery results depend on incision, method, type, mechanism, and IOL. Because they are better than sutured limbal incisions and scleral tunnels[14], self-sealing transparent corneal incisions are popular globally. Clear corneal incisions reduce inflammation and discomfort. Compared to scleral tunnels, clear corneal wounds speed cataract surgery and recovery. SIA after surgery varies on wound location, size, architecture, surgeon position, and comfort. A little incision accelerates visual healing and lowers SIA. Several investigations compared astigmatism to tiny superior, superonasal, superotemporal, and temporal incisions. Phacoemulsification incision on the steepest corneal axis after cataract surgery may correct corneal architectural astigmatism. For astigmatism above 1 diopter, toric IOLs and peripheral corneal relaxing incisions worked. Modern cataract surgery reduces corneal astigmatism, improving vision. Incisions may modify corneal astigmatism, thus curvature must be checked before and after surgery. Both groups exhibited similar preoperative SIAs. Fair SIA scores were provided to patients. Poor eyesight increases SIA[15]. 60 temporal and nasal clean corneal eyes. Both groups assessed UCVA and BCVA 1 and 3 months post-surgery. At 3 months, group A had a mean UCVA of 0.25±0.30 while group B had 0.17±0.15[16]. Astigmatic results of temporal vs. nasal clear corneal incisions in phacoemulsification cataract surgery. Temporal patients had 30.00% WTR, 50% ATR, and 20% no astigmatism before surgery, whereas nasal patients had 40%, 25%, and 35%. A 6 mm foldable IOL and 3 mm temporal and nasal clear corneal incisions were used for 1.2D[17] phacoemulsification. They said temporal incision lessened SIA than nasal. After one month, the temporal group had a mean SIA of 0.81±0.64 D, whereas the nasal group had 0.92±0.53 D. The temporal group saw a decrease in SIA to 0.53±0.39 D after 3 months, whereas the nasal group had 0.62±0.48 D. Moon[14] examined incision size, astigmatism efficiency, and stability. Three groups of 2.5, 3, and 3.5 mm self-sealing corneal lesions were examined. 1.05 D, 0.84 D, and 0.95 D were the SIA means for 2.5, 3.0, and 3.5 mm. 3.0 mm incisions were lowest SIA[18] compared 2.75 mm temporal clean corneal incisions to the superior technique in 146 eyes. The temporal corneal incision was less SIA than the superior clear. A prospective randomized trial compared temporal and on-axis clean corneal incisions for SIA following phacoemulsification in mild to moderate astigmatism.

Temporal SIA was 0.34 D and on-axis 0.63 D at 2 months. Conclusion: clean corneal temporal incision decreased SIA more than axis. SIA was compared for temporal and superior 2.8 mm clean corneal incisions. The temporal group had a mean SIA of 0.63±0.28 D, whereas the superior group had 1.00±0.54 D, with significant differences ($p<0.05$). A 2.8 mm clean corneal temporal approach outperformed a comparable superior incision[19]. examined how corneal wound size affects medically produced astigmatism following unsutured temporal clear corneal incisions and phacoemulsification. Compare 2.5 and 3.5 mm wounds. Vector analysis using Alpin's approach calculated SIA. At 2.5 mm incision, the mean SIA was 0.84±0.53 D, whereas at 3.5 mm, it was 1.19±0.81 D. 3.5 mm has a higher mean SIA. Vector analysis showed a mean 6-week SIA of 1.17 D and 12-month SIA of 1.04 D. The incision greatly impacted SIA[20]. At 6 weeks, temporal incisions averaged 0.74 D and nasal 1.65 D. These levels dropped to 0.71 D and 1.41 D after 12 months. Say clean corneal incisions are tempting but hazardous. Endothelial cell loss, uneven astigmatism, and poor wound healing were drawbacks. Similar SIA changes (-0.15—0.32 D and 0.10-0.27 D) were discovered by another author. They only discovered statistically significant but modest clinically meaningful SIA differences between superior and 8 o'clock incisions.[21,22] We detected significant parameter SIA differences between nasal and temporal and superior and temporal incisions, in addition to Giasanti et al.'s superior-nasal difference. Superior-temporal difference confirmed by Marek et al.

CONCLUSION

Astigmatism did not alter significantly before and after phacoemulsification in corneal and temporal incision groups. Our study had a small sample size and did not account for effect modifiers, so we recommend more studies with larger sample sizes and confounders that may affect surgically induced astigmatism in phacoemulsified patients.

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Author's Contribution:

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