

## SURGICALLY INDUCED ASTIGMATISM AFTER 2.8 MM TEMPORAL AND NASAL CLEAR CORNEAL INCISIONS IN PHACOEMULSIFICATION CATARACT SURGERY OF SAME PATIENT

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**ABSTRACT: PURPOSE:** To evaluate and compare the surgically induced astigmatism in phacoemulsification cataract surgery after 2.8 mm temporal and nasal clear corneal incision of same patient. **MATERIAL AND METHOD:** This prospective study comprised a consecutive case series of 60 eyes. Eyes from 30 patients with phacoemulsification those were implanted with a 6.00 mm foldable intraocular lens through a 2.8 mm horizontal clear corneal incision (temporal in the right eye, nasal in the left eye). **RESULTS:** The outcome measures were surgically induced astigmatism (SIA) and uncorrected visual acuity (UCVA), at 1 and 3 months post-operatively. At 1 month the mean SIA was 0.81 D. for the temporal incision and 0.92 D for nasal incision (P = 0.139) at 3 months the mean SIA was 0.53 D for temporal incision and 0.62 D for nasal incision (P = 0.309). The pre-operative parameters i.e. (UCVA), mean keratometry & keratometric cylinder between these groups were comparable. There was no statistically significant difference found between three groups pre-operatively. **CONCLUSION:** After cataract surgery using 2.8mm temporal and nasal horizontal corneal incision, the induced corneal astigmatic changes was similar in both incision groups. Especially in Asian eyes, both temporal and nasal incisions (2.8 mm or less) would be equally favourable for astigmatism neutral cataract surgery

**KEYWORDS:** Nasal Incision, Surgically induced astigmatism, temporal incision, phacoemulsification.

**INTRODUCTION:** The aims of modern Cataract surgery are rapid visual rehabilitation and the best uncorrected visual acuity (UCVA) possible with minimal post-operative astigmatism. Modern cataract surgery techniques allow rapid visual recovery but surgical induced astigmatism (SIA). Is a common obstacle to achieving an excellent UCVA. SIA is related to the type, length and location of the incision, and the suture closure technique

Previous studies concluded that nasal locations induced greater refractive changes than temporal regions, and temporal incision induced the smallest SIA, therefore temporal approach is a popular method in modern phacoemulsification cataract surgery. On the other hand, recent evidence suggests that a small (from 2.8 mm to 3.00 mm) clear corneal incision (CCI<sub>s</sub>) induce little refractive changes. Furthermore locating the incision temporally in the right eye and nasally in the left eye might be comfortable for right handed cataract surgeons who prefer to work on 120° clock Position (superior approach). This study compared the effect on SIA of 2.8 mm temporal and nasal CCIs, in cataract surgery of same patient using the superior approach.

**MATERIAL METHODS:** This prospective study included 60 eyes of 30 consecutive patients with bilateral senile cataract. The patients were scheduled to undergo separate bilateral cataract surgery with interval of 30-45 days between procedures.

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### The studies were divided into two Groups:

Group-I (30) eyes – 2.8 mm horizontal clear corneal incision temporal in right eye.

Group- II I (30) eyes –2.8 mm horizontal clear corneal incision nasal in left eye.

### Inclusion Criteria:

- Age related senile cataract (up to NS-3).
- No active ocular or systemic diseases.
- Patient willing for follow up for 3 months.
- Keratometric astigmatism <1.00 D (WTR).

### Exclusion Criteria:

- Patient with previous ocular surgeries (corneal, refractive, trabeculectomy, pterygium, excision etc.)
- Avg. corneal thinning disorder.
- Patient with higher grade of nuclear sclerosis.
- Patient with keratometric astigmatism >1.00 D.
- Patient with ocular pathology which may cause poor post-operative outcome (glaucoma, ARMD, pterygium).

**Pre-Operative Evaluation:** All eyes underwent a complete ophthalmic examination pre-operative and post-operatively at 1 month and 3 month.

- Written informed consent was obtained from each patient.
- History of presenting complaints and past medical history.
- Uncorrected visual acuity (UCVA) was estimated using standerized snellerns chart at 6 meter distance.
- Best corrected visual acuity (BCVA) was estimated using standerized snellern's chart at 6 meter distance after best refractive correction.
- Near vision evaluation, slit lamp examination fundus examination and applanation tonometry was done.
- Manual keratometry was done by keratometer (baush & lomb) and IOL power calculation by A-Scan (Biomedix).

### Investigation done:

- Random blood sugar
- Urine albumin & sugar
- BP & ECG

One day before the surgery antibiotic eye drops were instilled 4 times. Preoperative mydriasis was achieved with instillation of tropicamide and phenylephrine combination eye drops & flurbiprofen eye drops.

**Surgical Procedure:** All operations were performed by a single experienced surgeon using the same technique and peribulbar anesthesia in all cases.

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The surgeon sat in the superior position three- step CCIs were made with a 2.8 mm disposable blade. Temporal CCIs and nasal CCIs were used in all right and left eyes respectively. The depth of the first cut “a precut” was approximately one third of the cornea depth; the tunnel length was 1.50 mm to 1.75 mm after injecting sodium hyaluronate Capsulorrhexis (5.00 mm in diameter), a side port incision and hydro dissection were performed after phacoemulsification and cortex removal, a 1- piece foldable acrylic intraocular lens (TEC NIS -1 piece intraocular lens IOL AMO) was then inserted at the conclusion of surgery.

- Patient were advised for caution during early postoperative period and not to rub or apply successive pressure to their operated eyes.
- Topical antibiotic drops (Moxifloxacin 0.5%) every 6 hrs per day for 4 weeks.
- Topical steroid drops (Prednisolone acetate1%) every 6 hrs per day for 2 weeks and then tapered over next 4 weeks.
- Topical NSAID drops (Flurbiprofen 0.03%) every 6 hrs per day for 4 weeks.
- Topical cycloplegic (Tropicamide 1%) twice a day for 1 weeks.

A routine post operative evaluation were assessed for all patient on 1 month & 3 month including UCVA, BCVA, slit lamp examination fundus evaluation, intraocular.

Pressure (IOP), SIA was calculated by vector analysis using the Holladay-cravy- Koch. formula. A paired wilcoxon signed ranked test was performed to determine if there was significant effect on induced astigmatism depending on the incision location (temporal & nasal) an intra-individual comparison of the 2 groups was considered significant of  $P < 0.05$ .

**RESULTS:** Each group contained 30 bilateral cases. The mean age of the patient at the time of the baseline was  $66.2 \pm 7.6$  years there was 17 men a 13 woman the preoperative corneal astigmatism in both groups ranged from 0.0 to 1.00 D. the level of pre-operative astigmatism was similar in the two groups ( $0.71 \pm 0.43$ ) temporal incision group ( $0.58 \pm 0.53$  in nasal incision group  $P = 0.100$ ).

**Table 1:** Lists the change in the mean corneal astigmatism over time. Total astigmatism between temporal and nasal incision group was not different. Corneal astigmatism of the temporal incision group was unchanged whereas corneal astigmatism of the nasal incision group increased slightly, but the change in the nasal group was not significant.

	Total astigmatism (mean $\pm$ SD) <sup>†</sup> (n=30)		P value*
	Temporal incision	Nasal incision	
Pre-operative	0.71 $\pm$ 0.43	0.58 $\pm$ 0.53	0.100
Post-operative			
1 month	0.78 $\pm$ 0.67	0.88 $\pm$ 0.52	0.397
3 month	0.64 $\pm$ 0.44	0.78 $\pm$ 0.64	0.178

\*Wilcoxon signed ranked test, <sup>†</sup>SD: Standard deviation

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**Table 2:** Surgically –induced mean astigmatic changes by vector analysis using the Holladay-Cravy-koch formula.

	Surgical induced astigmatism (mean±SD) <sup>†</sup> (n=30)		P value*
	Temporal incision	Nasal incision	
Post-operative			
1 month	0.81±0.64	0.92±0.53	0.139
3 month	0.53±0.39	0.62±0.48	0.309

\*Wilcoxon signed ranked test, <sup>†</sup>SD: Standard deviation

Table 2 Show the surgically – induced astigmatic change at 1 and 3 months post-operatively calculated by vector analysis using the Holladay- cravy-Koch-method. The mean SIA in the temporal and nasal CCI group at 1 month was 0.81+0.64 and 0.92+0.53 respectively.

The SIA of the temporal and nasal group decreased to 0.53 + 0.39 and 0.62 + 0.48 at 3 month respectively but the difference in SIA between the groups was not significant.

**DISCUSSION:** Group I (Phaco / 2.8 mm/ temporal) in the current study, surgical induced astigmatism after phacoemulsification in group (1) (temporal group) at 1 month was 0.81 ± 0.64

Mohammed Pakravan et al <sup>1</sup>reported figure was 0.73±0.46 D. Kohnen and associate<sup>2</sup> reported SIA figure was 0.62±0.48 2 weeks post-operatively, SB ar equet, Edward at al<sup>3</sup> reported SIA of 0.74 D. at 6 weeks temporal incision: G Rainer<sup>4</sup> reported SIA 0.9 D. at 1 month in temporal incision Ermis at al<sup>6</sup> reported that horizontal component of SIA after superotemporal incision was significantly higher than superotemporal incision (P<.05) Vertical component of SIA between two groups were not significantly different (P>.05), Weiyh Chen wl<sup>7</sup> reported. 83 D. SIA in 3.5 mm temporal CCIs.

In our study SIA 3 months after surgery was .53±0.39/ Mohmmad Pakravan et al<sup>1</sup> reported figure 0.63±0.3 D: Kohnen and associate<sup>2</sup> reported SIA figure was 0.47±0.32 D. at 6 month: S. Barequet, Edward at al<sup>3</sup> reported 0.71 D. at 12 months : G Rainer<sup>4</sup> reported SIA 0.7 D. at 3 month SJ roman<sup>5</sup> repoted 0.69D of SIA and 0.98D of post-operative astigmatism after one year Ermis at al<sup>6</sup> reported no significant difference in SIA between superotemporal incision in right eye and superonasal incision in the left eye after one year WeiYda at al <sup>7</sup> reported.58 D at 12 week.

#### Phacoemulsification Surgery (Group 2) Phaco / Nasal

In current study, SIA 1 month after Phacoemulsification cataract surgery was 0.92±0.53 Moh. Pakravan et al <sup>1</sup>reported 1.79±0.55 D at 4 week in nasal CCsI: Kohnen<sup>2</sup> at al reported SIA of 1.55±0.84 D. at 2 week in nasal incision gp. Barequet<sup>3</sup> et al reported 1.65 D. at 6 week in nasal incision. G .Rainer 4 at al reported 1.2 D at each observation in superolateral group Wein YH<sup>7</sup> report 0.6 D at 3 weeks.

In our study SIA 3 month after Phacoemulsification cataract surgery was 0.62±0.48 Moh. Pakravan et at<sup>1</sup> reported 1.05±0.56 at 6 months in nasal incision Gp.: Kohnen at et<sup>2</sup> reported SIA of 1.05±0.57 D.at 6 months : Barequet et al<sup>3</sup> reported SIA of 1.41 D. for nasal incision S. at 12 months. SJ Roman<sup>5</sup> at al report 1.52D of SIA and 1.36D of post operative astigmatism in superior gp Ermis<sup>6</sup> tells

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no significant difference in SIA between two groups WeinYh7 reports 0.58D at 12 weeks post-operatively(  $p > 0.05$ )

The main aim of this study was to compare the SIA caused by 2.8 mm temporal and nasal incision for each individual the study was designed to avoid inter – individual variations.

In this study a 2.8 mm corneal incision was used and the effects on the SIA and corneal astigmatism of the temporal CCI in the right eye and nasal CCI in left eye were compared over at 3 month follow-up. The UCVA in the 2 types of incision were also compared both the SIA and UCVA were similar between the temporal and nasal CCI<sub>s</sub> pre-operatively and Post- operatively.

Recently, the size of the corneal incision has become gradually smaller, and previous studies indicated that a smaller incision is associated with earlier refraction stabilization and a reduced magnitude and variability of SIA. Although an astigmatic axis shift is affected by size, location and shape of the incision, it was reported that the incision size has a major impact on SIA. The appropriate size for a self- sealing corneal incision is 2.8-3.0 mm and the allowable limit of the keratometric shift for refraction and visual rehabilitation is approximately 0.5 D. this can be achieved with a 2.8 mm incision with the introduction of micro- incision (2.2 mm or less) it is now possible to minimize the SIA compared to larger incision. This means that in the future there will be no need to consider the incision location, temporally and nasally.

In modern cataract surgery, the considering factors for optimum UCVA are surgical experience, pre-existing corneal astigmatism, biometry prediction, and induced

Astigmatism. Currently surgical complications and biometry prediction errors are rather low. Induced astigmatism shows a diminished tendency. In the present study, SIA following both 2.8 mm temporal and nasal CCI were similar, approximately 0.5 D. the induced corneal astigmatic change would be minimal with the introduction of micro incision cataract surgery therefore induced astigmatism may not be a limiting for our improved UCVA. Both temporal and nasal horizontal incision (2.8 mm or less) are suitable for astigmatism –neutral cataract surgery, especially in Asian eyes.

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