

# Outcome of Pre-existing Corneal Astigmatism after Phacoemulsification by Scleral Tunnel Incision

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## ABSTRACT

**Aim:** To measure post-surgical astigmatism induced by scleral tunnel incision

**Type of study:** Quasi-experimental

**Sampling technique:** Non-Randomized consecutive sampling

**Materials and methods:** This quasi-experimental study was performed on 90 eyes of 90 patients of cataract reporting at Eye Department, Combined Military Hospital (CMH), Lahore from Sep 2011 to June 2012 who had pre-existing corneal astigmatism. They were managed by phacoemulsification with scleral tunnel incision to extract cataract and correct astigmatism.

**Results:** Induced refractive change caused by scleral tunnel incision and effect on pre-operative astigmatism was minimal keeping minimum level of significance

**Conclusion:** Scleral tunnel incision is an effective technique to maintain astigmatic neutrality.

**Keywords:** Astigmatism, scleral tunnel incision, phacoemulsification, with the rule astigmatism

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## INTRODUCTION

Scleral and corneal incisions both form the basis of some degree of corneal flattening in the meridian (or axis) on which they are executed, with analogous steepening in the perpendicular meridian, termed "surgically induced astigmatism". Placido's disc, corneal topography, keratometry and scanning slit topography can be employed to measure astigmatism.

1. Final postoperative astigmatism and refraction can be affected by choice of suture material.
2. Size, location and shape of the incision.
3. Incisions on the superotemporal meridian provoke a smaller amount of astigmatic change than those on the superior meridian<sup>1</sup>. It has been postulated that in cataract clear corneal incisions<sup>2</sup>:
  - A superior incision is suggested for at least 1.5D of astigmatism
  - A temporal incision for an astigmatism of less than 0.75D
  - A nasal incision would be effective for 0.75D astigmatism.

The requirement for a larger incision to lodge rigid IOLs was partially trounced by the growth of posteriorly placed scleral tunnel incisions<sup>3</sup>. However there are certain conditions in which scleral tunnel incision must be avoided. For example, it should be avoided in glaucoma patients as disruption of the conjunctiva may also fiddle with the success of

ensuing glaucoma drainage surgery<sup>4</sup>. Also, if a patient has a functioning trabeculectomy, then a clear corneal incision (CCI) steers clear of an incision of the conjunctiva and the jeopardy of detriming the drainage bleb. However, a scleral tunnel is a must if a phacotrabeculectomy is being performed.

Data has suggested that endothelial cell thrashing may be lesser when phacoemulsification is executed through an STI<sup>5</sup>. (sclera tunnel incision). It is consequently a superior technique in patients with deprived endothelial reserve, for example those with Fuchs' endothelial dystrophy or subsequent to a penetrating corneal graft.

In this technique, a scleral tunnel is created to get to anterior chamber. No incision is carved on cornea. Thus SIA (surgically induced astigmatism) remains nominal. A scleral-pocket incision (SPI), being farther from the cornea, has a lesser amount of impact on varying corneal curvature than do limbal and clear corneal incisions (CCI). In addition, the silhouette of the scleral incision also establishes its effect on corneal curvature. A curved limbus-parallel SPI will cause more flattening at that meridian than a straight incision; and the frown<sup>6</sup> or suspension-bridge<sup>7</sup> curved SPI has even less impact and may be astigmatically neutral.

Studies available in literature have compared various locations and sizes of incisions with the magnitude of astigmatism produced. The incision used for cataract surgery has three basic functions: the comfort in performing surgery, minimum induction of astigmatism, safety and leakage-tight nature of the incision. Some surgeons use incisions posterior to limbus, i.e., at sclera and others use incisions

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anterior to the limbus, i.e., clear corneal incisions. The low post-operative astigmatism, early recovery of ocular surface anatomy and absence of direct damage to the cornea go in favour of the use of small self-sealing sclero-corneal tunnel incision.

## MATERIAL AND METHODS

It is a randomized control trial being conducted on 90 patients at combined Military Hospital, Lahore for a period of 6 months. Sampling technique was non-probability consecutive sampling. All those patients included in this study were with in the age group of 40 – 75 years, uncomplicated immature senile cataract, operated by the same surgeon patients who have completed all the postoperative visits with the necessary investigations during the 12 weeks follow up period. Patients with the age <40 – >75 yrs, with previous history of ocular trauma, with complicated cataract, having immature cataract associated with other ocular diseases or systemic diseases like diabetes & hypertension, with intra-operative & post-operative complications, with preoperative astigmatism more than 2 Diopters were excluded from the study.

**Methods:** The complete pre-operative evaluation of the patients include

- History and general examination
- Visual Acuity assessment and Refraction
- Anterior Segment Examination
- Fundus Examination
- A – Scan biometry
- Keratometry

**History and general examination:** Records with clear details of the name, age, sex, date of admission, history regarding the development of cataract and operation and discharge were taken for analyzes. Records with full description of the general physical examination of the patients along with normal blood pressure and blood sugar levels, who underwent the surgical procedure were taken for analyzes.

**Visual Acuity assessment and Refraction:** Visual acuity was documented both with and without glasses. A Snellen's chart with good illumination was used for this purpose. In case of illiterate patients, the 'E' Chart was used to record the visual acuity. The patients were made to read the chart at 6 meters unilaterally. If they were unable to appreciate the letters at this distance the patients were moved closer to the chart until they could appreciate the top most letters. If they were unable to do the test his ability to count finger was determined. Refraction was done with the streak retinoscope at a distance of 1 meter. The spherical and the required cylindrical

correction were administered. Preoperative refraction was done in all cases.

**Anterior segment examination:** All cases underwent thorough anterior segment examination under slit lamp biomicroscopy. A watchful examination of the lids, orbit, conjunctiva and cornea was carried out in every case and positive findings were documented. Anterior chamber depth was noted. Iris was examined and any abnormality was made note of. The site, shape and the reaction of the pupil were recorded. The presence of cataract along with its maturity was estimated after full papillary dilatation. Intraocular pressure was measured in all cases preoperatively using a goldmann applanation tonometer.

**Fundus examination:** A detailed fundus examination was done with the direct/indirect ophthalmoscope. It was done preoperatively in all patients as a routine. Any patients with fundus pathology detected were discarded from the study.

**Keratometry:** Keratometry was done for all patients by using RK-F1 Canon Auto Refracto-Keratometer in the greatest & least meridian of cornea.

**Post-operative evaluation:** Slit lamp examination of the operated eye was carried out on each of the postoperative visits. Keratometry was repeated for all patients on 6weeks post-operative visit and the astigmatism assessed and compared with pre-operative astigmatism.

The patients were examined on first postoperative day, instructed to use antibiotic steroid drops in tapering doses and advised to come for the first follow up after 1 week and then after 5weeks . Refractive correction was given at the end of 6weeks

### Data analysis procedure:

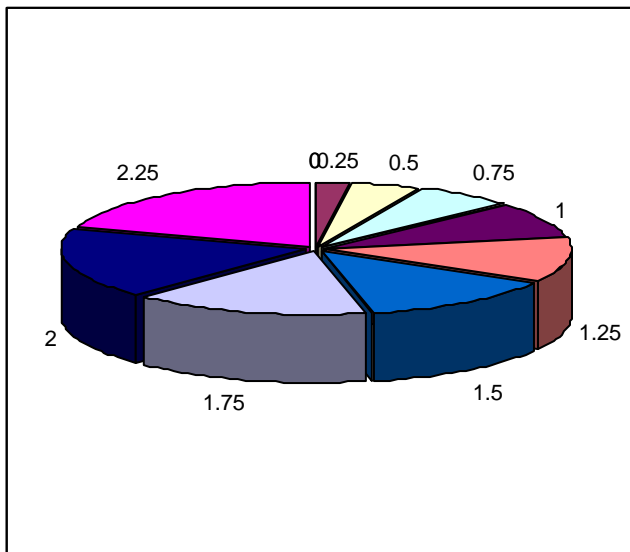
- Data was analysed using SPSS-17 on computer.
- Descriptive statistics were used to calculate mean and SD for pre-operative and post-operative astigmatism in both groups A and B.
- Paired sample t-test was employed to compare pre-operative and post-operative astigmatism within each group at a confidence interval of 95%.
- Independent sample t-test was used to compare post-operative change in corneal astigmatism at 1 month in group A with group B at a confidence interval of 95%. A p-value of  $\leq 0.05$  was considered statistically significant.
- Frequency and Percentages were calculated for age, gender and laterality of the eye.

## RESULTS

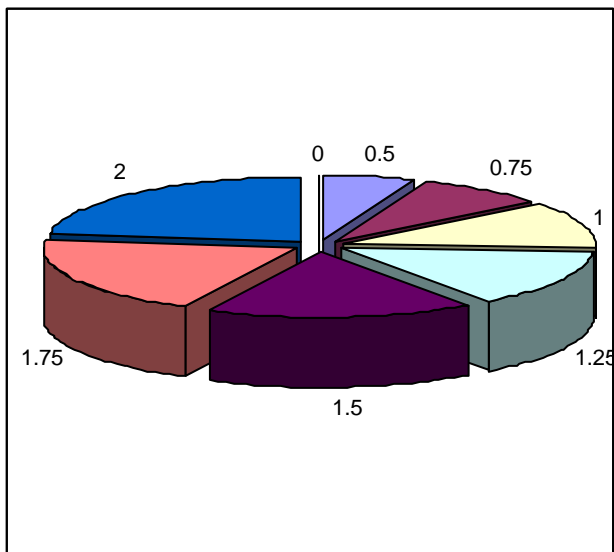
Ninety eyes were included in this study which underwent sclera tunnel incision at steep axis and its effects on post-operative refractive status were

recorded. 50% of the patients were males while 50% were females (Table 1). Mean age of the patients was  $64.10 \pm SD 12.27$  years. By applying paired samples t-test, mean pre-operative astigmatism in diopters was calculated as  $0.76 \pm SD 0.53$ , while post-operative mean astigmatism came out to be  $1.26 \pm SD 0.37$ , keeping value of significance at minimum, as shown in Table 2. Net difference in pre-operative astigmatism brought about by incision at steep axis came out to be  $-0.49 \pm SD 0.43$  diopters. The incision was therefore, found out to be effective in maintaining astigmatic neutrality; thus providing a better post-operative visual acuity.

Preopsclerel



Postopsclerel



Netsclerel

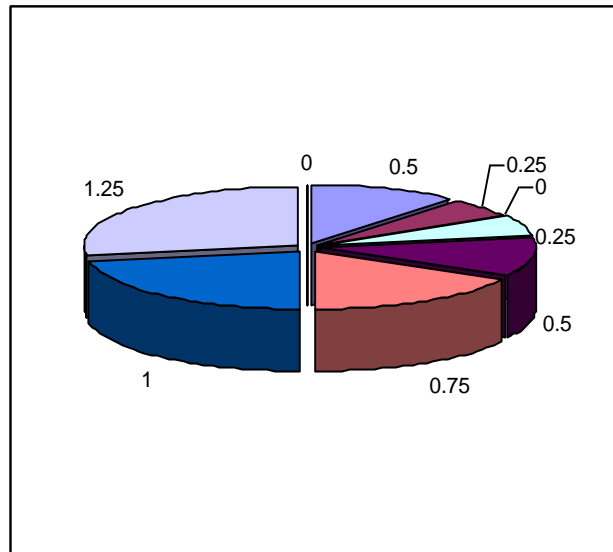


Table 1: Gender of the patients (n=90)

	Frequency	%age
Male	45	50
Female	45	50

Table 2: Astigmatic shift by scleral tunnel incision

	Astigmatism (Diopters)	Standard deviation (Diopters)
Pre-operative	0.76	$\pm 0.53$
Post-operative	1.26	$\pm 0.37$
Net	-0.49	$\pm 0.43$

DISCUSSION

The hypothesis of this study was that the mean post-operative astigmatism induced by scleral tunnel incision is minimal and can be called as astigmatically neutral. The results were consistent with the hypothesis and revealed that post-surgical astigmatic change with scleral tunnel is minimal and a comparison of mean astigmatic shift goes in favour of scleral tunnel incision in a statistically significant manner.

Studies available in literature have compared various locations and sizes of incisions with the magnitude of astigmatism produced. The incision used for cataract surgery has three basic functions: the comfort in performing surgery, minimum induction of astigmatism, safety and leakage-tight nature of the incision. Some surgeons use incisions posterior to limbus, i.e., at sclera and others use incisions anterior to the limbus, i.e., clear corneal incisions. The low post-operative astigmatism, early recovery of ocular surface anatomy and absence of direct damage to the cornea go in favour of the use of small self-sealing sclero-corneal tunnel incision. The positive points of a clear corneal incision include a

shorter tunnel length, an entry point anterior to limbus, doing away with cautery and the option of topical anesthesia with minimal bleeding<sup>8</sup>. It is also claimed that locating the incision as far behind as possible from the limbus maximizes the distance of optical centre of the cornea leading to lesser astigmatism. While in the case of clear corneal incision, since the incision is placed anteriorly, there is an increased magnitude of post-operative astigmatism<sup>9</sup>. Our study falls in the domain of studies conducted to measure the impact of site of incision on post-surgical astigmatism. One view is that temporal and superotemporal incisions result in only small astigmatic changes; while nasal, superonasal and superior incisions would lead to induction of a relatively larger amount of astigmatism<sup>10</sup>.

Keeping in view the tremendous importance that post-surgical astigmatism holds in post-surgical visual outcome of the patient, we decided to prove the effectiveness of scleral tunnel incision.

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