Original article:

Post-operative Corneal Astigmatism in Superior vs Temporal straight scleral incisions after Manual Small Incision Cataract Surgery (MSICS)

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ABSTRACT

Purpose: To Study the post-operative corneal astigmatism in superior and temporal straight scleral incisions after manual small incision cataract surgery (MSICS) in senile cataracts at rural tertiary care hospital.

Materials & Methods: A hospital based comparative, observational study of 40 eyes with uncomplicated senile cataract was carried out. The study group was randomly divided into two groups of 20 each to eliminate the treatment selection bias. Each patient underwent MSICS with PMMA posterior chamber intraocular lens (PCIOL) implantation with either superior or temporal scleral incisions which were 6 mm in length and 1.5 mm from the limbus. Apart from history & clinical examination, pre-operative keratometry readings were recorded using a manual keratometer (Bausch and Lomb). During Post-operative followup, keratometry readings were recorded at 1st post-operative day and at 6 Weeks. Amplitude of surgically induced astigmatism (SIA) was calculated using SIA calculation software version 2.1.

Results: At 6 weeks post operatively, out of 20 patients in superior scleral group 15 (75%) had ATR astigmatism and 5 (25%) had WTR astigmatism while in the temporal group, 12(60%) had WTR astigmatism and 8(40%) had ATR astigmatism. The mean surgically induced astigmatism (SIA) in the temporal incision group was significantly less than that in the superior incision group (p<0.001).

Conclusion: This study shows that temporal scleral incision in MSICS produces less postoperative astigmatism as compared to superior scleral incision and the pre-existing against the rule astigmatism which is commonly seen in elderly patients gets nullified through temporal incision but the same gets worsened with a superior incision.

Keywords: Manual small incision cataract surgery; temporal incisions; surgically induced astigmatism.

Introduction

Cataract is the most important and significant cause of blindness in senile age group, both in India as well as in the world.¹ Surgery is the only definitive treatment for cataract. All techniques of cataract extraction are meant for giving the best unaided visual acuity and early post-operative rehabilitation. In addition to improving visual acuity (VA), one of the goals of modern cataract surgery is to reduce induced astigmatism, a factor that may reduce VA and affect the quality of vision². Hence cataract surgery has come to be thought of as a refractive surgery in today’s time. While phacoemulsification remains the more advanced and technically superior method of cataract surgery, it is not always appropriate either from a cost perspective or the density of the cataracts involved³. Small incision manual extracapsular techniques (SICS), the first choice alternative to phacoemulsification, retains most of the advantages of phaco giving equivalent visual results at lower cost. However, the larger incision used induces greater astigmatism than
phacoemulsification. Post-operative astigmatism has remained the only obstacle to the achievement of good unaided visual acuity after cataract surgery. Surgically induced astigmatism (SIA) calculates the magnitude and axis of postoperative induced astigmatism by various methods introduced by Alpins and Goggin, Holladay et al., and many others. Postoperative astigmatism is affected by various factors such as preoperative astigmatism, location, type, size, closure, and healing of the surgical incision, amount of scleral cautery performed, type of suturing material used and its placement, position of IOL, and postoperative use of steroids, and all these have effects on corneal curvature. In our study, we have observed the effect of one of these factors, surgical incisions taken at two different sites i.e., superior and temporal on pre-existing astigmatism and the amount of surgically induced astigmatism (SIA) along with visual outcome by both the incisions.

**Materials and Methods**

This is a hospital based comparative, observational study involving 40 eyes of 40 patients who underwent Manual Small Incision Cataract Surgery (MSICS) with Posterior Chamber Intraocular Lens (PCIOL) implantation between September 2015 to July 2017. Ethical committee approval was obtained before starting the study. Patients were randomly divided into two groups. GROUP A included those who underwent MSICS with PCIOL implantation through a SUPERIOR straight scleral incision and GROUP B had those that underwent the same through TEMPORAL straight scleral incision. A written informed consent was obtained from all the patients included in the study. The inclusion criteria was all patients of age 50 years & above of either sex with senile cataract undergoing MSICS with PCIOL implantation at Pravara Rural Hospital, Loni. While the exclusion criteria were patients with congenital and developmental cataracts, complicated cataracts, pre-existing corneal opacities, uveitis, glaucoma, posterior segment anomalies and other such conditions which independently cause limitation of vision.

Preoperative assessment included visual acuity, intraocular pressure, sac syringing, and examination of anterior and posterior segments. A thorough posterior segment evaluation was done with 90 D. Keratometry was performed preoperatively and postoperatively by using Bausch and Lomb Keratometer. SRK II formula was used to calculate the IOL power. All surgeries were done under peribulbar anesthesia. The incision architecture was similar in the 2 groups. A 6 mm scleral straight incision, 1.5 mm from the limbus was made with a number 15 Bard Parker blade. A funnel shaped sclerocorneal pocket incision was created with a crescent knife. One side-port was made 90 degrees apart of the scleral tunnel with a 15 degree angulation knife. With a 2.8 keratome, the anterior chamber was entered 1.5 mm into the clear cornea and the internal incision was enlarged sideways to 8 mm. A single piece PMMA IOL of 6mm optic size and 12.5 mm total size was implanted into the capsular bag. No sutures were taken. Postoperatively, topical antibiotic-steroid eye drops were administered frequently and then gradually tapered over the next six weeks. Patients were thoroughly examined on post op day 1 and at 6 weeks. At each visit, visual acuity, anterior segment examination, fundoscopy and keratometry were done. SIA (Surgically Induced Astigmatism) was calculated from this data using the...
SIA Calculator version 2.17, a free software programme approved by All India Ophthalmological Society (AIOS). Data was analyzed using Chi square test, paired t test and quantitative analysis.

Results

In this study, 40 eyes of 40 patients satisfying the inclusion exclusion criteria were included. These patients were randomly divided into 2 groups. Group A included 20 patients undergoing MSICS with PCIOL implantation through a superior straight scleral incision while Group B included 20 patients undergoing the same through a temporal straight scleral incision.

Table No.1: Age and Sex distribution:

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Group A (n=20)</th>
<th>Group B (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>50-60</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>60-70</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>&gt;70</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>12(%)</td>
<td>8(%)</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>65.08±7.97</td>
<td>67.62±8.03</td>
</tr>
</tbody>
</table>

Table No.2: Comparison of Astigmatism in both groups

<table>
<thead>
<tr>
<th>Pre Op</th>
<th>Post Op</th>
<th>Chi- square test value</th>
<th>‘p’ value and significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATR</td>
<td>WTR</td>
<td>ATR</td>
<td>WTR</td>
</tr>
<tr>
<td>No. of cases (%)</td>
<td>No. of cases (%)</td>
<td>No. of cases (%)</td>
<td>No. of cases (%)</td>
</tr>
<tr>
<td>Group A</td>
<td>13(65%)</td>
<td>7(35%)</td>
<td>15(75%)</td>
</tr>
<tr>
<td>Group B</td>
<td>14(70%)</td>
<td>6(30%)</td>
<td>7(35%)</td>
</tr>
</tbody>
</table>

Table No.3: Comparison of SIA in group A & group B

<table>
<thead>
<tr>
<th>SIA</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative Day 1 Mean ± SD</td>
<td>Postoperative 6 Weeks Mean ± SD</td>
</tr>
<tr>
<td>Group A</td>
<td>0.63±0.38</td>
</tr>
<tr>
<td>Group B</td>
<td>0.43±0.23</td>
</tr>
</tbody>
</table>
Table No.4: Comparison of Visual Acuity in group A and group B

<table>
<thead>
<tr>
<th>Visual Acuity</th>
<th>Preoperative Mean ± SD</th>
<th>Postoperative Day 1 Mean ± SD</th>
<th>Postoperative 6 weeks Mean ± SD</th>
<th>Paired ‘t’ test value, ‘p’ value and significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>1.36±0.36</td>
<td>0.53±0.16</td>
<td>0.46±0.15</td>
<td>7.89, p=0.001, significant</td>
</tr>
<tr>
<td>Group B</td>
<td>1.36±0.38</td>
<td>0.27±0.13</td>
<td>0.20±0.15</td>
<td>9.78, p=0.001, significant</td>
</tr>
</tbody>
</table>

Discussion

The term “refractive cataract surgery” has come to represent a reality for today’s cataract patients. In order to achieve excellent visual results, the effect of astigmatism on postoperative vision must be minimized. Today’s cataract incisions provide better control of surgically induced astigmatism, either by using temporal approach to produce “astigmatically neutral” surgery or by using on-axis incision to induce astigmatism at the steep axis to counteract pre-existing astigmatism.

SIA and post-operative unaided visual acuity were the main aim of this study, we also compared the groups with regard to age, sex and laterality of the eyes operated. All were statistically not significant. Astigmatism was assessed by using pre and post-operative keratometry readings and SIA was calculated with SIA calculator version 2.17.

The temporal location is farthest from the visual axis and any flattening due to the wound is less likely to affect the corneal curvature at the visual axis. When the incision is located superiorly, both gravity and eyelid blink tend to create a drag on the incision. These forces are neutralised better with temporally placed incisions because the incision is parallel to the vector of the forces. With the rule astigmatism induced by a temporal incision is advantageous because most elderly cataract patients have preoperative against the rule astigmatism.

On comparing the type of astigmatism postoperatively, we found a significant change to with the rule (WTR) astigmatism or neutralisation of the pre-existing against the rule astigmatism after temporal scleral incision and to against the rule (ATR) astigmatism in the superior scleral SICS.

Malik et al. compared superior sclera incision to temporal sclera incision in SICS. They reported a mean SIA of 1.45 (±0.7387) D in a superior incisional SICS. Ranier and associates documented ATR astigmatism of 0.41 D between postoperative day 1 and 4.4 years with a superior 4-mm scleral incision.

Another study by Dr Srinivas M Ganagi et al found lesser post-operative astigmatism and better visual acuity was seen in those with temporal straight incision as compared to those who underwent manual SICS with superior scleral straight incision.

Study by Bhaskar Reddy et al found that incisions placed temporally tend to decrease the against the rule astigmatism mostly prevalent in the adult population due to the absence of the lid tone in both phaco and MSICS.

In a study by Gokhale et al (2005), SIA vector in superior group was 1.28D, 0.2D in superotemporal and 0.37D in temporal group. In our study similar results were seen with superior
group having SIA of about 0.79±0.33Dand temporal
group with SIA of 0.36±0.21D. There was a
significant difference in the SIA among both the
groups at POD 1 and at 6 weeks. This further resulted
in a better post-operative unaided visual acuity in the
temporal incision group which was 0.20±0.15 as
compared to the superior incision group which was
found to be 0.46±0.15. The difference in the unaided
visual acuity in both groups were found to be
significantly different at POD1 and at 6 weeks.
The change in the corneal curvature is responsible for
SIA and the astigmatic refractive error. Uncorrected
astigmatism can cause blurred images and glare\(^1\). This
might have contributed to the significant
difference in post-operative unaided visual acuity in
the groups.

**Conclusion**

To conclude, temporal scleral incision in
MSICS produces lesser surgically induced
astigmatism as compared to superior scleral incision
and the pre-existing against the rule astigmatism
which is commonly seen in elderly patients gets
nullified through a temporal incision while the same
gets worsened with a superior incision leading to
better post-operative unaided visual acuity with a
temporal incision. However, these findings can be
further cemented by conducting a study at a larger
scale with a bigger sample size.

**Limitation**

A smaller sample size along with the observational
nature of the study were our limitations.

**References**

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