

Amount of Surgically Induced Astigmatism after Manual Small Incision Cataract Surgery

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Abstract: ***Purpose:** To assess the amount of surgically induced astigmatism after manual small incision cataract surgery. **Method:** A hospital based observational study done on 30 patients aged above 50 years, diagnosed with Senile Cataract undergoing manual small incision cataract surgery with a superior straight incision of 5.5-6.5mm. Corneal Curvatures measured using Bausch and Lomb Keratometer pre and post op day 1,4 and 6 weeks. Surgically Induced Astigmatism calculated using SIA calculator version 2.1, a free software program by Dr. Saurabh Sawhney and Dr. Ashima Aggarwal. **Results:** 21 patients (70%) had pre-op Against the rule Astigmatism and 9(30%) had With the rule Astigmatism with 36.6% patients between 0.5-1D. Surgically Induced Astigmatism at the end of 6 weeks is 1.13 ± 0.49 with a p-value of 0.015 **Conclusion:** This study concludes that superior straight incision of 5.5-6.5mm causes significant Surgically Induced Astigmatism, so better intra operative decisions can be taken regarding incision approach and size for improved post operative visual outcome.*

Keywords: Surgically Induced Astigmatism, Superior straight incision, Keratometer, MSICS

1. Introduction

- Cataract is the most common cause of avoidable blindness in the world^[1]
- MSICS has regained importance in modern day since it is a low cost, safe alternative that primarily uses easily sterilizable instruments
- Achieving the best uncorrected visual acuity and quick visual recovery are the goals of modern cataract surgery.
- The major goal of cataract surgery and the patient's primary demand is to achieve exceptional uncorrected visual acuity; nevertheless, surgically induced astigmatism (SIA) continues to be a barrier to this goal^[2]
- Surgically induced astigmatism (SIA) is defined as the flattening effect in that axis induced by an incision made on the cornea and influences the refractive outcomes of cataract surgery.

2. Literature Survey

- With regard to astigmatism, it was Ponder who first showed that an unwelcome consequence of cataract surgery was an alteration in corneal curvature. In the usual superior section for cataract extraction, a fairly regular "against-the rule" astigmatism usually results. This was noted by Donders(1864) and first accurately measured by Von Reasse and Woinow (1969). Treutler described the outcome following superior section for cataract extraction for 49 patients in 1900. He found that the vertical curvature flattened by a mean of 0.7 mm (3.75 D, up to 1.5 mm or 6.5 D) for 88% of patients, for 2% there was no change, and 10% there was an increase in curvature. His conclusion has been substantiated by subsequent workers
- **Introduction to Surgically Induced Astigmatism (SIA)-** Astigmatism is a refractive error characterized by an uneven curvature of the cornea or lens. In cataract surgery, especially *Manual Small Incision Cataract Surgery* (MSICS), surgically induced astigmatism (SIA) arises due to changes in the corneal shape following the incision and

healing process. Understanding the amount of SIA is essential for optimizing visual outcomes post-surgery

- **Factors Influencing Surgically Induced Astigmatism-** SIA following MSICS is influenced by several factors, including the size, site, and type of incision, as well as the wound construction technique. Superior and temporal incisions are the most commonly studied approaches. Superior incisions are associated with higher SIA due to eyelid pressure and proximity to the steep corneal meridian.
- **Comparison of Incision Sites-** Malik V et al (2012)^[3] compared the astigmatism following manual small incision cataract surgery in superior v/s temporal approach and found that SIA by superior incision was 48.28% more than by temporal approach showing that temporal approach has a better stabilization of refraction
- Incision size significantly affects SIA. Larger incisions (6–7 mm) result in greater SIA due to pronounced corneal changes.

3. Material and Methods

A hospital-based observational study with a sample size of 30 was carried out on patients admitted to Rajarajeswari Medical College and Hospital who were diagnosed with Senile cataract.

All cataract patients undergoing Manual Small Incision Cataract Surgery between the age of 50 and 80 with a superior straight incision of 5.5 to 6.5 mm in size with or without pre-existing astigmatism were included in the study.

- **Method of data collection:** The purpose of the study was explained to the patient and informed consent was obtained. History was taken focusing on details of diagnosis. Visual acuity was assessed using Snellen's chart, Anterior segment examination using slit lamp biomicroscopy, assessment of intraocular pressure using Non Contact Tonometer and patency of lacrimal duct will be assessed by syringing. Keratometry was carried out

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using Bausch and Lomb keratometer. Post operative assessment of keratometry readings was done on post operative day 1, 4 weeks and after completion of 6 weeks.

- SIA was calculated in every case using the SIA calculator version 2.1, a free software program by Dr. Saurabh Sawhney and Dr. Ashima Aggarwal.

4. Results

4.1 Based on Incision size

Table 1: Incision size

Size	Frequency	Distribution
5.0-5.5mm	8	26.6%
5.5-6.0mm	10	33.3%
6.0-6.5mm	12	40%

4.2 Based on Pre-operative distribution of Astigmatism- MEAN±SD is 0.83 ± 0.4

Table 2: Pre-operative Astigmatism

Astigmatism	Frequency	Distribution
0D	2	6.6%
0.25-0.5D	7	23.3%
>0.5-1.0D	11	36.6%
>1.0-1.5D	7	23.3%
>1.25-2.0D	3	10%

4.3 Based on changes in keratometry – Horizontal corneal meridian

Table 3: Horizontal corneal meridian

KH	MEAN±SD
Pre-op	44.24±1.12
Post-op day 1	44.56±1.07
Post-op 4 weeks	44.89±0.98
Post-op 6 weeks	45.03±1.14

4.4 Based on changes in keratometry- Vertical corneal meridian

Table 4: Vertical corneal meridian

KV	MEAN±SD
Pre-op	43.54±1.06
Post-op day 1	43.02±1.04
Post-op 4 weeks	43.28±0.91
Post-op 6 weeks	43.17±0.85

4.5 Based on Surgically Induced Astigmatism

Table 5: Surgically Induced Astigmatism

SIA	MEAN±SD	P-VALUE
POD-1	0.90±0.42	0.22
POD-4 weeks	0.92±0.50	0.19
POD-6 weeks	1.13±0.49	0.015

4. Discussion

- In the present study, the mean age of patients 60.64±5.4. This agrees with what is reported in many literature

sources that cataract remains a common condition among people in their fifth decades of life and beyond

- In our study, the incidence of pre-operative astigmatism was 90% which was comparable to 95% reported in Duke Elder study *et al* and 88% reported by Tariq Khan *et al*. The pre-operative With The Rule (WTR) was 20% and Against The Rule (ATR) was 70%.
- The Mean Pre-operative Astigmatism in our study was 0.83±0.4D, similar to a study by Rathi M *et al*^[2] which was 0.7 ± 0.613D and by Ferrer Blasco *et al*^[4] wherein it was 0.96±0.93
- The Mean±SD of post-operative KH at 6 weeks increased from 44.24 ± 1.12 to 45.03 ± 1.14
- The Mean±SD of post-operative KV at 6 weeks decreased from 43.54 ± 1.06 to 43.17 ± 0.85
- In our study, the Mean ±SD of Surgically Induced Astigmatism (SIA) at 6 weeks post surgery is 1.13±0.49 in other studies by Hazra S, *et al* it was 1.00, D Singh *et al*^[5] it was 1.12, V Sharma *et al*^[6] it was 1.36, Bhaskar Reddy *et al*^[7] it was 1.92
- A comprehensive study was done by Dodiya and Parmar^[8] in 2013 in which they studied the incidence of postoperative astigmatism after SICS and the mean SIA was 1.27 ± 0.84 D.
- Gokhale and Sawhney^[9] in their study, compared the astigmatism induced by a superior, supero-temporal and temporal incision in MSICS. They observed that the postoperative astigmatism was highest in the superior incision group (1.45 ± 0.94 D), with an SIA of about 1.28 D
- A meta-analysis conducted by Gupta and colleagues^[10] (2021) provided a kaleidoscopic view of SIA across different surgical approaches. They reported that MSICS with a superior incision typically induces a SIA of 1.5 to 2.0 D, a figure that beckons further inquiry into optimal incision placement.

5. Conclusions

Our study concludes that majority of the patients (90%) had Pre-operative Astigmatism with 70% having Against The Rule Astigmatism and 36.6% patients had pre-op astigmatism between 0.5-1.0D. The amount of Surgically Induced Astigmatism using a superior straight incision of 5.5-6.5mm at the end of 6 weeks is 1.13 and the p-value is 0.015 which is statistically significant (p < 0.05) showing it induces significant amount of astigmatism

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