



Original Research Article

Comparative study of surgically induced astigmatism following small incision cataract surgery with incision placed in superior and temporal meridian

Aparna Mandal¹, Piyali Sarkar^{2,*}, Payal Manna²¹Dept. of Ophthalmology, RG Kar Medical College, Kolkata, West Bengal, India²Dept. of Ophthalmology, Calcutta National Medical College, Kolkata, West Bengal, India

ARTICLE INFO

Article history:

Received 06-02-2020

Accepted 10-02-2020

Available online 30-09-2020

Keywords:

SICS

SIA

Incision site

ABSTRACT

Background: Cataract surgery now a days has become a refractive surgery. It not only improves the vision, but also provides good unaided visual acuity (VA). Sutureless small incision cataract surgery (SICS) induces minimum astigmatism. It also helps in early rehabilitation by faster stabilisation of post-operative refraction.

Objective: The aim of this prospective observational study was to compare the Surgery induced astigmatism (SIA) and VA following manual SICS with superior and temporal incisions.

Materials and Methods: Consecutive 100 patients in the age group of 40 -70 years with cataract having VA < 6/18, having no ocular comorbidities were included in the study. After proper evaluation, 50 patients underwent manual SICS with superior scleral incision and rest 50 with temporal incision. Post operative astigmatism was measured at 4th and 8th weeks. Best corrected VA was checked at 8th week. SIA was calculated at 4th and 8th week post operatively.

The statistical analysis was done with the help of SPSS 18 statistical analysis software, measuring p value, mean and standard deviation.

Results: The mean SIA in superior and temporal SICS at 4th week was 1.06±0.41 DCyl and 0.75±0.36 DCyl respectively (p=0.000) and at 8th week was 0.99±0.31 DCyl and 0.64±0.32 DCyl respectively (p=0.000). The difference of SIA at 4th and 8th week in both the techniques was statistically insignificant. 41 patients with superior incision and 43 patients with temporal incision had VA of 6/6 at 8th post operative week. VA was 6/9 in 6 patients with superior incision and 3 patients with temporal incision. Whereas, VA was 6/12 in 3 patients with superior incision and 4 patients with temporal incision at 8th post operative week. VA at 8th post-operative week in both the techniques were comparable.

Conclusion: SIA in temporal SICS is significantly lesser than that in superior SICS whereas VA in both the techniques is excellent and comparable.

© 2020 Published by Innovative Publication. This is an open access article under the CC BY-NC license (<https://creativecommons.org/licenses/by-nc/4.0/>)

1. Introduction

Modern cataract surgery aims not only the improvement of vision, but it also provides a good unaided visual acuity (VA). Post operative astigmatism is one of the obstacles in achieving good visual acuity without spectacles after cataract surgery.¹ Correcting astigmatic error and control of surgically induced astigmatism (SIA) are now an integral part of cataract surgery.

Small incision cataract surgery (SICS) has become a boon, as it has been said that smaller incision and no suture induce minimal astigmatism.² Sutureless SICS, has significantly reduced the post operative astigmatism. It also helps in early rehabilitation by stabilizing the post operative refraction.

There are several variables which affect the amount of surgically induced astigmatism. These are mainly, location (corneal, limbal or scleral), direction (superior, temporal or supero-temporal), width, depth and shape of the incision. The depth of incision has been reported to have little

* Corresponding author.

E-mail address: drpsar@yahoo.co.in (P. Sarkar).

influence on the amount of induced astigmatism³. On the other hand, location and direction of wound has a significant effect on the outcome. With the rule astigmatism is produced when the corneal curvature is steepest in vertical meridian. Conversely, against the rule astigmatism is present when the steepest meridian of cornea is horizontal. Superior meridian incision produces greater 'against the rule astigmatism'. It is found more in elderly patients. Whereas, temporal incision produces 'with the rule astigmatism'. It results in better uncorrected visual acuity. This study aims at comparing the surgical outcome in respect to SIA and VA with superior and temporal scleral incision in manual small incision cataract surgery (MSICS).

2. Aims and Objectives

This prospective observational study was done to compare the SIA and VA following MSICS with superior and temporal incisions.

3. Materials and Methods

Subjects of study were selected from consecutive operable cataract patients attending outpatient department of Calcutta National Medical College & Hospital, Kolkata, West Bengal from April 2015 to March 2016.

Patients in age group of 40-70 yrs with cataract having VA < 6/18 were included in the study. Pre-existing corneal opacity, macular disorders, optic nerve diseases, cataract with pterygium, glaucoma and complicated cataract were excluded from the study. 100 cases were selected and divided randomly into two groups of 50 patients in each. One group underwent SICS with superior 6-6.5 mm frown incision and the other had temporal 6-6.5 frown incision. The two groups were then subdivided into two age wise groups. one group was of age 40-55 years and the second group was of age 56-70 years.

Preoperative assessment of the patients was done. VA was tested using Snellen's chart or E chart depending upon the patient's ability. A thorough anterior segment evaluation was done by using slit lamp biomicroscope. Direct and indirect Ophthalmoscope were used to examine the fundus. Ultrasonography B scan was used to evaluate the posterior segment where media opacity obscured the view. Both direct and consensual pupillary reactions were tested in each eye separately. Intraocular pressure was measured by applanation tonometry and the patency of nasolacrimal passage was checked. Biometry was done to measure the power of the Intra ocular lens. Modified Sanders Retzlaff and Kraff (SRK 2) formula was used. Bausch and Lomb kerametry was done to measure the pre and post operative astigmatism.

Post operative corneal astigmatism was measured at 4th and 8th post operative week. Best corrected VA was checked at 8th post operative week. Surgically induced

astigmatism(SIA) was calculated at 4th and 8th post operative week. All calculations were performed using SIA calculator version 2.1, a free software programme.

The statistical analysis was done with the help of SPSS 18 statistical analysis software, measuring p value, mean and standard deviation.

4. Results

Out of 100 patients in the study, 50 underwent manual SICS with superior temporal incision and rest of the 50 patients with temporal incision. There were 35 male and 65 female patients. Among them, 23 were in the age group of 45-55 years and 77 in the age group of 56-70 years. 14 patients (45-55yrs) and 36 patients (56-70yrs) underwent SICS with superior incision whereas, 9 patients (45-55years) and 41 patients (56-70years) with temporal incision. 7 males and 7 females (45-55 yrs) and 12 males and 24 females (56-70yrs) underwent superior SICS. 1 male and 8 females (45-55yrs) and 15 males and 26 females (56-70years) underwent temporal SICS. The mean SIA at 4th week were 1.06+/-0.41 DCyl and 0.75+/-0.36 DCyl in superior and temporal incisions respectively. The difference is statistically very significant (p<0.01). The mean SIA in superior and temporal SICS at 8th week were 0.99+/-0.31 DCyl and 0.64+/-0.32 DCyl respectively. The difference is statistically significant (p<0.01). The difference of mean SIA at 4th and 8th weeks in both superior and temporal incisions are statistically insignificant (p value =0.339 and 0.088 respectively).

The mean SIA in males and females in superior incision is 0.93+/-0.55 DCyl and 0.85+/-0.50 DCyl respectively (p value=0.09). The mean SIA in males and females in temporal incision is 0.72+/-0.33 DCyl and 0.64+/-0.32 DCyl respectively (p value=0.09). The difference in both the cases is statistically insignificant (p>0.05).

The mean SIA in superior SICS in the 40-55 years age group was 1.04+/-0.87 DCyl whereas, in 56-70 age group was 0.87+/-0.48 DCyl (p value=0.137). The mean SIA in temporal SICS in the age groups 40-55 years and 56-70 years were 0.58+/-0.35 DCyl and 0.64+/-0.33 DCyl respectively. The difference in both the cases were statistically insignificant (p>0.05).

The VA was 6/6 in 41 patients, 6/9 in 6 and 6/12 in 3 patients who underwent superior SICS. VA was 6/6 in 43 patients, 6/9 in 3 and 6/12 in 4 patients of temporal SICS group. The VA of superior and temporal SICS at 8th post operative week is comparable.

Table 1: Showing of gender distribution of superior & temporal SICS

| Incision | Male | Female |
|----------|------|--------|
| Superior | 19 | 31 |
| Temporal | 16 | 34 |

Table 2: Showing age wise distribution of superior & temporal SICS

| Incision | Age 45-55yrs | Age 56-70yrs |
|----------|--------------|--------------|
| Superior | 14 | 36 |
| Temporal | 9 | 41 |

Table 3: Showing age and gender wise distribution in superior SICS

| Gender | Age 40-55 yrs | Age 56-70 yrs |
|--------|---------------|---------------|
| Male | 7 | 12 |
| Female | 7 | 24 |

Table 4: Showing age and gender wise distribution in temporal SICS

| Gender | Age 40-55yrs | Age 56-70yrs |
|--------|--------------|--------------|
| Male | 1 | 15 |
| Female | 8 | 26 |

Table 5: Showing mean SIA in superior & temporal SICS (4th week)

| Incision | SIA | p value | Degree of Freedom |
|----------|-------------|---------|-------------------|
| Superior | 1.06 ± 0.41 | 0.000 | 49 |
| Temporal | 1.75 ± 0.36 | | |

The difference is Statistically very significant (as p-value is <0.01)

Table 6: Showing mean SIA in superior & temporal SICS (8th week)

| Incision | SIA | p value | Degree of Freedom |
|----------|-------------|---------|-------------------|
| Superior | 0.99 ± 0.31 | 0.000 | 49 |
| Temporal | 0.64 ± 0.32 | | |

The difference is Statistically very significant (as p-value is <0.01)

Table 7: Showing mean SIA in Superior SICS at 4th & 8th week

| Incision | SIA | p value | Degree of Freedom |
|-------------------------------|-------------|---------|-------------------|
| Superior 4 th week | 1.06 ± 0.41 | 0.339 | 49 |
| Superior 8 th week | 0.99 ± 0.31 | | |

The difference is Statistically insignificant (as p-value is >0.05)

The difference is Statistically insignificant (as p-value is >0.05)

Difference is Statistically insignificant (as p-value is >0.05)

Difference is Statistically insignificant (as p-value is >0.05)

Table 8: Showing mean SIA in temporal SICS at 4th & 8th week

| Incision | SIA | p value | Degree of Freedom |
|-------------------------------|-------------|---------|-------------------|
| Temporal 4 th week | 0.75 ± 0.36 | 0.088 | 49 |
| Temporal 8 th week | 0.64 ± 0.32 | | |

Table 9: Showing SIA of male & female patients in superior SICS

| Gender | SIA | p value |
|--------|-------------|---------|
| Male | 0.93 ± 0.55 | 0.749 |
| Female | 0.85 ± 0.50 | |

Table 10: Showing SIA of male & female patients in temporal SICS

| Gender | SIA | p value |
|--------|-------------|---------|
| Male | 0.72 ± 0.33 | 0.09 |
| Female | 0.64 ± 0.32 | |

Table 11: Showing age wise SIA in superior SICS

| Age | Sup SIA | p value |
|-----------|-------------|---------|
| 40-55 yrs | 1.04 ± 0.87 | 0.137 |
| 56-70 yrs | 0.87 ± 0.48 | |

Difference is Statistically insignificant (as p-value is >0.05)

Table 12: Showing age wise SIA in Temporal SICS

| Age | Temp SIA | p value |
|-----------|-------------|---------|
| 40-55 yrs | 0.58 ± 0.35 | 1.000 |
| 56-70 yrs | 0.64 ± 0.33 | |

Difference is Statistically insignificant (as p-value is >0.05)

Table 13: Showing VA of superior & temporal SICS

| Incision | VA - 6/6 | VA - 6/9 | VA - 6/12 |
|---------------|----------|----------|-----------|
| Superior (50) | 41 | 6 | 3 |
| Temporal (50) | 43 | 3 | 4 |

VA of superior and temporal SICS at 8th postoperative week is comparable.

5. Discussion

While phacoemulsification remains the more advanced and technically superior method of cataract surgery, it is not always appropriate either from a cost perspective or in case where the density of the cataract is concerned. MSICS is a good alternative to Phacoemulsification. It retains most of the advantages of phacoemulsification giving visual results equivalent to phacoemulsification at a lower cost and it is appropriate for a developing country. The surgery is cheap, fast, safe and easy to learn. It needs fewer resources.

However, the larger incision used in MICS induces greater SIA than Phacoemulsification.³ High astigmatism is an important cause of poor UCVA after cataract surgery.⁴

It was found that SIA changed according to the site of incision like superior, temporal & supero-temporal.⁵ The SIA is basically corneal astigmatism. As the temporal location is farthest from the visual axis, any flattening due to the wound is less likely to affect the corneal curvature at the visual axis.⁶

When the incision is located superiorly, both gravity and eyelid blink tend to create a drag on the incision, these forces are neutralized better with temporally placed incisions because the incision is parallel to the vector of the forces.

The wound stabilizes and hence also the astigmatism by 6 weeks after surgery⁷ therefore, 8 weeks is taken as the end point of this study.

In the present study, the mean SIA values of superior & temporal SICS is calculated with standard deviation and compared amongst themselves. It is found that the SIA in temporal SICS is lower than that in superior SICS both at 4th & 8th week.

At 8th week, mean SIA in temporal incision group is 0.64 ± 0.32 , & in superior incision the value is 0.99 ± 0.31 . The difference is statistically very significant (p-value < 0.01).

At 4th week, mean SIA in temporal incision group is 0.75 ± 0.36 , & in superior incision the value is 1.06 ± 0.41 . This difference is also statistically very significant (p-value < 0.01).

But among the individual incision group difference of mean SIA between 4th week & 8th week, the values are statistically insignificant.

In this study it is found that in both groups postoperative VA is excellent & comparable. In superior SICS 82% of operated cases have got VA of 6/6, and in temporal SICS 86%.

Anders, Pham et al. (1997), showed in their study that the mean SIA in temporal incision was (0.64 ± 0.22 DCyl) which was less than after incision in 12 O'clock position (0.98 ± 0.40 DCyl).⁸ Which is similar to the finding obtained in the present study.

In a study conducted by Gokhale NS and Swahney S (2005), the mean SIA in temporal incision group was $0.67 \text{ D} \pm 0.65$ which is comparable to this study, whereas in superior incision, the mean SIA in present study (0.98 ± 0.40)D and by Gokhale NS and Sawhney S, it was $1.45 \text{ D} \pm 0.94$ DCyl.⁹ Their values of mean SIA for superior incision groups are more than that in the present study, but comparison of SIA between these two incision groups are comparable to this study.

Another study conducted by Renu M Magdum, Abha Gahlot, Rupali D. Maheshgauri, Khevna Patel, superior

incision induced a mean SIA of 0.95 ± 0.68 DCyl and in temporal incision group, the mean was $0.62 \text{ D} \pm 0.72$ DCyl.¹⁰ It is comparable to this study.

In superior SICS among the male patients, the mean SIA is (0.93 ± 0.55 DCyl) and in female patients the mean SIA is (0.85 ± 0.50 DCyl). In case of temporal SICS, the value of mean SIA is (0.72 ± 0.35 DCyl) for males and (0.64 ± 0.32 DCyl) for females. In both the cases the values are statistically insignificant (p-value > 0.05).

In superior SICS, the mean SIA in 40-55 yrs age group is (1.04 ± 0.87 DCyl) & in 56-70 yrs age group value is (0.87 ± 0.48 DCyl). The difference of mean SIA of these two groups are statistically insignificant (p-value > 0.05).

In temporal SICS the age wise distribution in 40-55 yrs age group, the mean SIA is (0.58 ± 0.35 DCyl) and in 56-70 yrs age group, the value is (0.64 ± 0.33 DCyl). The difference of mean SIA of these two groups are also statistically insignificant (p-value > 0.05).

The present study shows that there is no significant difference of SIA in the superior and temporal incision group according to the age and gender. But as the sample is very small so anything can't be concluded.¹⁰

This study is done with the aim to compare the SIA following MSICS by superior incision with that following the same operation by temporal incision. Supero-temporal incision has been reported to show better result in comparison with that in superior incision.⁹ There have been more studies based on the superior versus temporal incision than superior versus supero-temporal incision. Though I have not included the comparison of SIA between superior & supero-temporal SICS in this study, but the future scope is still open to do the work on that in coming days.

In this study, it has been found that the SIA in temporal SICS is significantly lesser than that in superior SICS, whereas visual outcome with both the techniques are excellent and comparable.

6. Conclusion

So overall from this study, it is found that the SIA in temporal SICS is significantly lesser than that in superior SICS whereas VA in both the techniques is excellent and comparable.

In conclusion, it can be said that a temporal approach is preferred to a superior approach in doing MSICS as it produces lesser SIA.

7. Source of Funding

None.

8. Conflict of Interest

None.

References

1. Jurowski P. Reasons of postoperative astigmatism. *Klin Oczna*. 2003;105:82–5.
2. Malik KPS, Goel R. Small incision catSmall incision cataract surgery: An introduction in Manual of Small incision Cataract Surgery. An introduction in Manual of Small incision Cataract Surgery. 1st ed. New Delhi: CBS Publishers & Distributors; 2003.
3. Ravindran R, Aravind H, Minu M. Relevance and clinical significance of SICS (Manual Phaco) in Modern Cataract Surgery. In: Garg A, Fry L, Tabin G, Guitierrez-Carmona F, editors. *Clinical Practice in Small Incision Cataract Surgery*. United Kingdom; 2004.
4. Yorston D, Foster A, Wood M, Foster A. Does prospective monitoring improve cataract surgery outcomes in Africa? *Br J Ophthalmol*. 2002;86:543–7.
5. Holladay JT, Dudeja DR, Koch DD. Evaluating and reporting astigmatism for individual and aggregate data. *J Cataract Refract Surg*. 1998;24(1):57–65.
6. Kimura H, Kuroda S, Mizoguchi N, Terauchi H, Matsumura M, Nagata M. Extracapsular cataract extraction with a sutureless incision for dense cataracts. *J Cataract Refract Surg*. 1999;25(9):1275–9.
7. Berger BB, Emery JM, Peyman GA. The Lens, cataract and its management. In: In peyman, Sanders and Goldberg(ed): *Principles and practice of Ophthalmology*. vol. 1. India: Jaypee Bros; 1987. p. 393.
8. Anders N, Pham DT, Antoni HJ, Wollensak J. Postoperative astigmatism and relative strength of tunnel incisions: A prospective clinical trial. *J Cataract Refract Surg*. 1997;23(3):332–6.
9. Gokale NS, Sawhney S. Sawhney Reduction in astigmatism in manual SICS through change of incision site. *Indian J Ophthalmol*. 2005;53(3):201–3.
10. Magdum RM, Gahlot A, Maheshgauri RD, Patel K. A comparative study of surgically induced Astigmatism in superior and temporal scleral incision in manual small incision cataract Surgery. *Natl J Med Res*. 2012;2(4):497–500.

Author biography

Piyali Sarkar Associate Professor

Payal Manna Post Graduate Trainee

Cite this article: Mandal A, Sarkar P, Manna P. Comparative study of surgically induced astigmatism following small incision cataract surgery with incision placed in superior and temporal meridian. *Indian J Clin Exp Ophthalmol* 2020;6(3):333-337.