Original Research Article

A comparative study between superior, supero temporal and temporal incision for corneal astigmatism after small incision cataract surgery with PCIOL

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Abstract

Background: The purpose of modern cataract surgery is not only cataract extraction followed by IOL implantation but also to achieve best uncorrected visual acuity by reducing the pre-existing astigmatism and minimizing the SIA. In present study we compared corneal astigmatism after small incision cataract surgery with PCIOL between superior, supero temporal and temporal incisions at our tertiary hospital. **Material and Methods:** The present study was a prospective, randomized, comparative study of surgically induced astigmatism after small incision cataract surgery (SICS) with PCIOL. 50 patients each were randomly divided for SICS by superior, supero-temporal and temporal incision. **Results:** 50 patients each were randomly distributed for small incision cataract surgery with PCIOL by superior, supero temporal and temporal incisions. Age, gender, co-morbidities were comparable in all three groups. We analysed the net astigmatism keratometry reading taken preoperatively and at postoperative on 6th weeks. only were considered. The mean net SIA postoperatively was 0.69 ± 0.54 D. SIA was noted in increasing orders as temporal group (0.53 ± 0.36 D), supero-temporal group (0. .61 ± 0.45 D) and superior incision group (0.79 ± 0.61 D). **Conclusion:** Temporal and supero-temporal incisions cause less surgically induced astigmatism as compared to superior incisions. Temporal and supero-temporal incisions should be preferred for small incision cataract surgery with PCIOL to reduce post-operative corneal astigmatism.

Key Words: surgically induced astigmatism, SICS, temporal incision, superior incision, supero-temporal incision

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INTRODUCTION

Cataract is the most important and significant cause of bilateral blindness in senile age group, both in India as well as on a global scale. The purpose of modern cataract surgery is not only cataract extraction followed by IOL implantation but also to achieve best uncorrected visual acuity by reducing the pre-existing astigmatism and minimizing the SIA.[1] Conventional extracapsular cataract surgery (ECCE), MSICS, and phacoemulsification are the three most popular forms of cataract surgery in India and rest of the world. Manual small incision cataract surgery (MSICS) through a sclero-corneal tunnel has become a standard procedure with advantages of sutureless wound closure, less astigmatism and less cost, suited for rural population of India.[2] The various incisions which are used in manual SICS vary according to their site, dimensions, design and architecture. The site of incision can be superior or supero-temporal or temporal.[3] In all types of cataract surgeries the incisions which are made on the sclera give rise to scars, thus altering the curvature of the cornea. These scars cause corneal flattening along the meridian of the incision, i.e. the flattening of the cornea occurs ultimately at a direction of right angles to the direction of cataract incision, thus resulting in surgically induced

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astigmatism (SIA).[4] Significant astigmatism may be visually disabling causing diminution in visual acuity, glare, monocular diplopia, asthenopia and distortion. In present study we compared corneal astigmatism after small incision cataract surgery with PCIOL between superior, supero temporal and temporal incisions at our tertiary hospital.

MATERIAL AND METHODS

The present study was a prospective, randomized, comparative study of surgically induced astigmatism after small incision cataract surgery (SICS) with PCIOL. Study was conducted in the Department of Ophthalmology, I Q City College, Durgapur from July 2019 to June 2020 (1 year). Institutional ethical committee approval was obtained.

Inclusion criteria: Patients 35-80 years, diagnosed with cataract, with clinically normal cornea and willing to participate in the study.

Exclusion criteria: Patients with corneal degeneration / dystrophies. Patients with scleral diseases. Patients with connective tissue disorders. Patients unable to co-operate for pre and post -operatives keratometry. Traumatic and Paediatric patients.

Among 150 cases diagnosed to have cataract, patients were randomly divided for SICS by superior, supero-temporal and temporal incision. Each group had 50 cases assigned randomly. Written informed consent was taken from patients. Preoperative assessment included medical history, refractive history, visual acuity, intraocular pressure, sac syringing, and examination of anterior and posterior segments. A thorough posterior segment evaluation was done. The grading of nucleus was performed according to Lens Opacification Classification System III (LOCS III). Keratometry was performed preoperatively and postoperatively by using Bausch and Lomb Keratometer. Preoperative anaesthetic fitness was taken. SICS was done using 5.5.-6 mm long sclerocorneal tunnel (frown) with a self-sealing corneal valve was fashioned at 12o' clock position 1.5- 2mm posterior to the limbus for the superior type of SICS. For supero temporal the incision was made which was centered at 11'o clock position the right eye and 1'o clock position at left eye. The temporal incision was made at 9'o clock position in the right eye and 3'o clock position in the left eye. Patients were prescribed antibiotic-steroid eye drops every 2 hourly in tapering doses and advised to come for the further follow-up examinations. Slit lamp examination of the operated eye was done in each post operative visit to assess the wound approximation, depth of anterior chamber, clarity of anterior chamber and status of the fundus. Analysis of astigmatic cylinder restricted to corneal keratometry readings. Keratometry was repeated for all patients on 1st postoperative day, 1 week, 3 week and 6 week post operative visits and the surgically induced astigmatism was assessed. Surgically induced astigmatism (SIA) was calculated by using Holladay method of vector analysis using trigonometric functions. We have used a ''SIA Calculator 2.1'' version developed by Saurabh Sawhney[5] for calculating SIA for a given set of pre- and post-operative keratometric data. Data was collected in Microsoft excel sheet and analysed. Descriptive statistics such as percentages and mean were used. Comparative tests were applied to find out the significant difference between the superior, supero-temporal and temporal incisions

RESULTS

50 patients each were randomly distributed for small incision cataract surgery with PCIOL by superior, supero temporal and temporal incisions. Age, gender, co-morbidities were comparable in all three groups.

We analysed the net astigmatism keratometry reading taken preoperatively and at postoperative on 6th weeks. only were considered. The mean net SIA postoperatively was 0.69 ± 0.54 D. SIA was noted in increasing orders as temporal group (0.53 ± 0.36 D), supero-temporal group (0. .61 ± 0.45 D) and superior incision group (0.79 ± 0.61 D). Temporal and supero-temporal incisions cause less surgically induced astigmatism as compared to superior incisions.

Table 1: Distribution of astigmatism (pre-operative and post-operative)

Range of astigmatism (Diopters)	Superior Incision (n=50)		Supero-temporal Incision (n=50)		Temporal Incision (n=50)	
	Pre-operative	Post-operative	Pre-operative	Post-operative	Pre-operative	Post-operative
≤0.25-NIL	8 (16%)	12 (24%)	7 (14%)	18 (36%)	5 (10%)	16 (32%)
0.26-0.5	9 (18%)	11 (22%)	12 (24%)	10 (20%)	10 (20%)	13 (26%)
0.6-0.75	6 (12%)	6 (12%)	9 (18%)	7 (14%)	3 (6%)	6 (12%)
0.76-1	11 (22%)	8 (16%)	8 (16%)	6 (12%)	15 (30%)	4 (8%)
1.1-1.5	5 (10%)	6 (12%)	4 (8%)	4 (8%)	5 (10%)	6 (12%)
1.6-2.0	7 (14%)	4 (8%)	6 (12%)	3 (6%)	7 (14%)	2 (4%)
>2	4 (8%)	3 (6%)	4 (8%)	2 (4%)	5 (10%)	3 (6%)
Mean ± SD	1.62 ± 0.78 D	0.79 ± 0.61 D	1.78 ± 0.49 D	0.61 ± 0.45 D	1.64 ± 0.55 D	0.53 ± 0.36 D

In supero-temporal and temporal group, postoperative WTR astigmatism was common, while in superior group postoperative ATR was commonly noted.

Table 2: Comparison of type of astigmatism (pre-operative and post-operative)

Type of Astigmatism	Superior Incision (n=50)		Supero-temporal Incision (n=50)		Temporal Incision (n=50)	
	Pre-operative	Post-operative	Pre-operative	Pre-operative	Post-operative	Pre-operative
WTR	22 (44%)	13 (26%)	11 (22%)	21 (42%)	14 (28%)	31 (62%)
ATR	15 (30%)	26 (52%)	28 (54%)	22 (44%)	26 (52%)	12 (24%)
Neutral	13 (26%)	11 (22%)	11 (22%)	7 (14%)	10 (20%)	7 (14%)

Best corrected visual acuity(BCVA) at 6th week was better in supero-temporal and temporal group, as compared to superior group.

Table 3: Best corrected visual acuity(BCVA) at 4th week and 6th week

Best Corrected Visual Acuity	Superior Incision (n=50)	Supero-temporal Incision (n=50)	Temporal Incision (n=50)
6/6	12 (24%)	15 (30%)	13 (26%)
6/9	16 (32%)	22 (44%)	20 (40%)
6/12	16 (32%)	7 (14%)	12 (24%)
6/18	6 (12%)	6 (12%)	5 (10%)

DISCUSSION

Surprises in refractive errors after cataract surgery have become unacceptable in recent few years. As a result, cataract surgery has become refractive surgery offering improvements both in "best corrected" and "uncorrected" visual acuity. One aspect which has confounded the cataract surgeons is the postoperative induced astigmatism.[6] Uncorrected astigmatism causes blurred image, glare, monocular diplopia. Even with appropriate spectacle correction the meridional magnification may create distortion. The patients having preoperative astigmatism may experience difficulty adapting to axis shift induced by surgery. In small incision cataract surgery (SICS) the most common incision taken is the superior one than temporal site, which is farthest from the visual axis and less likely to affect corneal curvature. The alterations in corneal curvature in the early postoperative period are primarily attributable to the surgical procedure. In a general cataract population, approximately 10% of patients have astigmatism with greater than 2 D of cylinder, 20% have between 1 and 2 D, and 70% have less than 1D.[7,8] Similar results were noted in present study. Anku HR[9] noted that the mean surgically induced astigmatism (SIA) was 0.68D in temporal incisions, 0.96D in supero-temporal group and 1.5D in superior incision at the end of 6 weeks of cataract surgery. Temporal and supero-temporal incisions cause less surgically induced astigmatism as compared to superior incisions. There was no statistically significant difference in SIA between temporal and supero-temporal incisions. Similar results were noted in present study. While P Sumathi *et al...*,[10] noted that the mean net SIA postoperatively was within 0.9 D in all three groups but it was very minimal in temporal group(0.38+0.22D) when compared to superior(0.88+0.57D) and supero temporal group(0.57+0.58D) with a significant P value of <0.05. Supero temporal being better than superior and temporal the best of the 3 types. Another Indian study shows that there is no statistically significant difference in the mean pre-operative astigmatism in superior (0.85+/-0.75) and temporal incision (0.65+/-0.35) groups (p=0.907).[11] When the incision is located superiorly, both gravity and eyelid blink tend to create a drag on the incision. These factors are neutralized well with temporally placed incisions because the incision is parallel to vector of forces.[9] The flattening effect of temporal incisions depends on the magnitude and orientation of the preoperative corneal astigmatism.[12] Presently 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. Alam J *et al...*, analysed change in astigmatism in cases with WTR and noted that in superior incision group the mean astigmatism decreased from 1.15+/-0.6 to 0.70+/-0.5 post operatively and in the temporal incision group the mean astigmatism increased from 0.65+/-0.5 to 0.75+/-0.5 post operatively.[13] Thus in cases with WTR the superior incision showed an decreased in post-operative astigmatism while a temporal incision showed a minimal increase in astigmatism. [14] Similar results were noted in present study. Dr Srinivas M Ganagi *et al...*,[15] 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. Similar results were noted in present study. Superior incision has twice the astigmatic impact of temporal incision due to the fact that temporal limbus is further away from the visual axis than superior limbus. Placing the incision on the steepest meridian leads to a significant amount of corneal flattening in that meridian and a corresponding steepening in the opposite meridian.[16] The temporal incision has advantages over superior incision such as lesser surgically induced astigmatism and better exposure in deep-set eyes. However, it leads to increased chances of postoperative endophthalmitis compared to superior incision due to lack of the protection by the superior lid, and direct exposure to surroundings. Visual results, degree of postoperative refractive error, stability of

refraction, and long-term safety are the main criteria on which any cataract surgical technique should be evaluated. Decreased astigmatism and increased wound stability lead to better visual function and accelerated visual rehabilitation. A study comparing endothelial cell loss and surgically induced astigmatism among ECCE, MSICS, and phaco had found the induced astigmatism slightly more in MSICS than phaco but much less than ECCE.[17] It has been reported that irrespective of the site of incision, phaco results in lesser astigmatism and improved visual outcome with better quality of life.[18] 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. [19] Phaco needs more technical expertise and is a costly modality for the common mass, whereas SICS is an inexpensive alternative with comparable visual outcome.

CONCLUSION

Temporal and supero-temporal incisions cause less surgically induced astigmatism as compared to superior incisions. In patients with WTR the superior incision showed reduction in post-operative astigmatism while a temporal incision showed a minimal increase in astigmatism and vice-a-versa noted in ATR shift patients. Temporal and supero-temporal incisions should be preferred for small incision cataract surgery with PCIOL to reduce post-operative corneal astigmatism.

REFERENCES

1. Zawar SV, Gogate P. Safety and efficacy of temporal manual small incision cataract surgery in India. Eur J Ophthalmol. 2011 Nov-Dec;21(6):748-53.
2. Khanna R, Pujari S, Sangwan V. Cataract surgery in developing countries. Curr Opin Ophthalmol. 2011 Jan;22 (1): 10-4.
3. Gogate P, Deshpande M, Nirmalan PK. Why do phacoemulsification? Manual small-incision cataract surgery is almost as effective, but less expensive. Ophthalmology. 2007;114(5):965–968.
4. Hashemi H., Khabazkhoob M., Soroush S., Shariati R., Miraftab M., Yekta A.,(2016) The location of incision in cataract surgery and its impact on induced astigmatism. Curr Opin Ophthalmol. 2016 Jan;27(1):58-64
5. Sawhney S. Theoretical validity of vector analysis for aggregate astigmatic data. J Cataract Refract Surg 2002 Mar;28(3):385-6.
6. Venkatesh R, Das M, Prashanth S, Muralikrishnan R. Manual small incision cataract surgery in eyes with white cataracts. Indian J Ophthalmol 2005;53:l73-6.
7. Chen W, Zuo C, Chen C, Su J, Luo L, Congdon N *et al...* Prevalence of corneal astigmatism before cataract surgery in Chinese patients. J cataract Refract Surg 2013;39:188-92.
8. Hoffmann PC, Hutz WW: Analysis of biometry and prevalence data for corneal astigmatism in 23,239 eyes. J cataract Refract Surg 2010; 36:1479-85.
9. Dr.Anku H Raja, Dr.Ashish C Bharoliya, A retrospective study to compare surgically induced corneal astigmatism(SIA) after temporal, superotemporal and superior incisions in cataract surgry, International Journal Of Scientific Research, Volume : 5, Issue : 4, April 2016
10. P Sumathi, A Yogeswari, D Rajeshwari, A Shobana Priya. Corneal astigmatism after small incision cataract surgery with PCIOL – A comparative study between superior, supero temporal and temporal incision. MedPulse International Journal of Ophthalmology. February 2020; 13(2): 25-28.
11. Kavitha KNS , Kishore AK, Reddy GS, Jehan K. Comparative study of surgically induced astigmatism in superior versus temporal incision in small incision cataract surgery cases. Int J Res Med Sci 2015;3:3027-31.
12. Alpins N, Ong JK, Stamatelatos G. Asymmetric Corneal Flattening Effect After Small Incision Cataract Surgery. J Refract Surg. 2016 Aug 1;32(9):598-603.
13. Alam J, Bhattacharjya H, Roy A, Das R, Gupta S, Bhattacharya U, *et al...* A Comparative Study of Post-Operative Astigmatism in Superior versus Temporal Approach of Manual Small Incision Cataract Surgery". Journal of Evolution of Medical and Dental Sciences. 2014;3(26):7087-90.
14. Pawar VS, Sindal DK. A comparative study on the superior, supero-temporal and the temporal incisions in small incision cataract surgeries for post-operative astigmatism. Journal of Clinical and Diagnostic Research. 2012;6:1229-32.
15. Dr Srinivas M Ganagi,DrAadithBhaskar,DrSaritaGonsalves.Comparison of Post Operative Astigmatism in Superior Versus Temporal Incision in Manual Small Incision Cataract Surgery. p-ISSN: 2279-0861.Volume 15, Issue 12 Ver. III (December. 2016), PP 32-34
16. Umesh Harakuni, Shivanand Bubanale, Smitha K. S, Arvind L. Tenagi, Kshama K. K, Anju Meena, Kathyayini S. V, Abhinav Biala. "Comparison of Surgically Induced Astigmatism with Small Incision Cataract Surgery and Phacoemulsification". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 71, September 03; Page: 12354-12360.
17. George R, Rapauliha P, Sripriya AV, Rajesh PS, Vahan PV, Praveen S. Comparision of endothelial cell loss and surgically induced astigmatism following conventional extracapsular cataract surgery, manual small incision surgery and phacoemulsiP cation. Ophthal Epidemiol 2005;12:293-7.
18. Giansanti F, Rapizzi E, Virgili G, *et al...* Clear corneal incision of 2.75 mm for cataract surgery induces little change of astigmatism in eyes with low preoperative corneal cylinder. Eur J Ophthalmol 2006;16(3):385-393.
19. S.S Haldipurkar,Hasanain T Shikari ,VishwanathGokhale, Wound construction in manual small incision cataract surgery. Indian J ophthalmol:2009;57:9-13.

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