ORIGINAL ARTICLE

A COMPARATIVE STUDY OF SURGICALLY INDUCED ASTIGMATISM IN SUPERIOR AND TEMPORAL SCLERAL INCISION IN MANUAL SMALL INCISION CATARACT SURGERY

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ABSTRACT

Aim: To evaluate the amount and type of surgically induced astigmatism in superior and temporal scleral incision in Manual Small Incision Cataract Surgery (MSICS).

Material and Methods: A prospective randomized comparative study was carried out in 100 cases of senile or pre-senile cataract. All the patients underwent MSICS under peribulbar anaesthesia. The patients with very hard cataract were excluded so as to keep the incision size uniformity (6-6.5mm). 50 cases received superior scleral incision and 50 cases received temporal scleral incision. Post operative astigmatism was studied in both groups using Bausch & Lomb Keratometer on 1st day, 7th day, 6th week and 3rd month.

Results: After 3 months of surgery, out of 50 patients in superior scleral incision group 74% patients had ATR astigmatism and 16% patients had WTR astigmatism whereas in temporal scleral incision group 56 % of the patients had WTR astigmatism and 36 % had ATR astigmatism. The mean surgically induced astigmatism (SIA) in temporal incision group was significantly less than the superior incision group after 3 months postoperatively ($t=2.33$, $p<0.05$).

Conclusion: This study reveals that temporal approach MSICS produces less postoperative astigmatism and has manifold advantages over superior incision MSICS with excellent visual outcome.

Keywords: MSICS, Surgically Induced Astigmatism (SIA), Superior scleral incision, Temporal scleral incision

INTRODUCTION

Post operative astigmatism has remained the only obstacle to the achievement of good uncorrected visual acuity after cataract surgery[1]. Small incision cataract surgery (SICS) through a sclerocorneal tunnel has come as a boon as it has been demonstrated that smaller the incision, lesser the number of sutures and valvular construction of wound would induce minimal astigmatism [2]. Manual small incision cataract surgery (MSICS) has emerged as a popular technique in the last decade and it has been possible to deliver quality surgery to the masses in developing countries. Recent progress in cataract surgery has heightened patient's expectations of outcome. Good postoperative vision without spectacles is considered the norm. Thus control of postoperative astigmatism is the key in meeting these expectations[3]. With the advent of suture less small incision cataract surgery, the amount of surgically induced astigmatism (SIA) has significantly reduced & also postoperative refraction stabilizes early.

Several variables exist in creation of the wound for the cataract, such as location (corneal versus scleral), direction (superior, temporal or oblique), width, depth and shape. The evolution and refinement of small incision cataract surgery have almost diminished controversies regarding the width and shape of incisions [4]. The depth of the incision has been reported to have little influence on the amount of induced astigmatism [5]. On the other hand, the location and the direction of the wound can still have a significant impact on surgical outcome.

Cataract surgery can be performed through corneal or scleral incision, which can be placed in either superior or temporal position. Surveys have revealed that most surgeons prefer to make incisions on the sclera because of vascular region, stability & rapid healing [6]. This study compared the surgical outcome in superior and temporal scleral incision in MSICS.

MATERIAL AND METHODS

This was a prospective study of 100 consecutive cases of cataract. All the patients were examined thoroughly and selected for cataract surgery as per a standard protocol.

Inclusion criteria: Only those cataract cases with senile and presenile cataract admitted for surgery at Tertiary Care Centre, Pune.

Exclusion criteria: Patients with corneal surface irregularities or opacities, traumatic cataract, glaucoma, uveitis, brown/hard cataract, any previous intraocular surgery and patients on systemic steroids.

A thorough ocular examination was done with slit lamp and preoperative Keratometry was done with Bausch & Lomb Keratometer. The cases were operated by 03 different surgeons. The technique was MSICS with posterior chamber intraocular lens implantation under peribulbar anaesthesia. The variable was the site of scleral incision. 50 cases received superior scleral incision and remaining 50 cases received temporal scleral incision.

After preparing the eye for surgery, fornix based conjunctival flap was taken at superior or temporal limbus and gentle cautery was done. A frown shaped scleral incision of about 6-6.5mm was placed 2mm behind the limbus superiorly or temporally. Dissection of sclerocorneal tunnel was done with crescent up to 1.5mm inside the cornea. A side port was made at 10', 7' or 1' o clock position. Viscoelastic was injected into anterior chamber and a continuous curvilinear capsulorrhexis approximately 5 mm was done with cystitome through side port. Then the sclerocorneal tunnel was completed using 3.2mm keratome and extended to 6-6.5mm. The internal corneal opening was made 1-2mm larger than external opening. Thorough hydrodissection was done and nucleus was prolapsed into the anterior chamber and viscoelastic was injected in front and behind the lens nucleus. Lens nucleus was delivered out using sandwich technique using vectis and Sinskey Hook. Remaining cortical matter was removed with Simcoe cannula and 6mm optic (overall 12.5mm) PMMA single piece posterior chamber lens was inserted in the capsular bag. The remaining viscoelastic was aspirated and the anterior chamber was reformed with BSS through the side port. The main wound was checked for any leakage, then conjunctiva was closed using cautery. Sutures were not used for any eye & no attempt was made to modify the pre-existing astigmatism.

Any case requiring suturing of the tunnel was excluded from the study.

Post-operative treatment included topical steroid and antibiotic combination for a week followed by only topical steroid in a tapering dose for 5 weeks in both the groups. Patients were examined on first post-operative day and later as per the schedule. At each visit visual acuity, keratometry and refraction were done at day 1, day 7, after 6 weeks and 3 months. The patients were finally examined for residual surgically induced keratometric astigmatism and final prescription of corrective spectacles given at that time. Complications in the course were noted and treated accordingly. The results of two groups were compared with regard to post operative astigmatism.

RESULTS

In this study, a total of 100 eyes were operated for cataract by MSICS. 50 eyes were operated by superior scleral incision and 50 by temporal scleral incision. There was no significant difference between the superior and temporal incision group in age, sex, preoperative keratometric astigmatism and corrected visual acuity.

Table 1: Preoperative Astigmatism

Type of Astigmatism	Superior incision	Temporal incision	Total
WTR	21 (42%)	17(34%)	38 (38%)
ATR	26 (32%)	30 (60%)	56 (56%)
No astigmatism	3 (6%)	3 (6%)	6 (6%)
Total	50	50	100

Table 2: Post operative change in astigmatism with preoperative WTR astigmatism in superior and temporal incision

Type of incision (cases)	Post operative change in astigmatism	1st Day	7th Day	6th Week	3rd Month
Scleral Incision (21)	Increased	17	13	9	5
	Decreased	1	5	11	14
	Same	3	3	1	2
Temporal Incision (17)	Increased	12	11	11	12
	Decreased	1	3	5	4
	Same	4	3	1	1
	Chi Square test (x2)	1.29	0.25	2.05	8.44
	p Value	>0.05	>0.05	>0.05	p<0.05

There was a gradual decrease in the amount of WTR astigmatism in superior incision group from 1st post operative day to 90th post operative day, whereas in temporal incision group there was gradual increase in the amount of WTR astigmatism from 1st post operative day to 90th post operative day.

Table 3: Post operative change in astigmatism in patients with preoperative ATR astigmatism in superior and temporal incision groups

Type of incision (cases)	Postoperative change in astigmatism	1st day	7th day	6th week	3rd month
Superior Incision (26)	Increased	25	20	20	21
	Decreased	0	4	3	3
	Same	1	2	3	2
Temporal incision (30)	Increased	11	8	3	3
	Decreased	14	20	25	25
	Same	5	2	2	2
	Chi Square test	21.94	15.60	29.92	30.66
	P Value	<0.0001	<0.0001	<0.0001	<0.0001

On the first post-operative day, there was a highly significant difference between both the groups with preoperative ATR astigmatism and a gross increase in the amount of astigmatism was observed in superior incision group than temporal group(x^2=21.94, p<0.0001). On the 7th day, there was statistically significant difference in amount of astigmatism in the both the groups (x^2=15.60, p<0.0001). After 6 weeks post operatively, the difference in the amount of reduction in ATR astigmatism in both groups was statistically significant(x^2 = 29.92, p<0.0001). After 3 months post operatively, there was no difference in the amount of astigmatism observed after 6 weeks and 12 weeks post operatively in temporal incision group in ATR patients.

Table 4: Type of post-operative Astigmatism

Type of post op astigmatism	Superior Incision	Temporal Incision	Total
WTR	8(16%)	29(56%)	36
ATR	37(74%)	18(36%)	55
NA	5(10%)	4(8%)	9
Total	50	50	100

It has been observed in the present study that superior incision causes more ATR shift than the WTR, as the incision on the superior meridian causes flattening of the vertical meridian and steepening of the horizontal meridian leading to more ATR shift post operatively, where as in temporal incision the shift of astigmatism was more towards WTR (56%) though pre operatively only 34% has WTR and flattening of horizontal meridian and steepening of the vertical meridian leading to more WTR shift. This is advantageous as most of the patients in older age will have ATR.

Table 5: SIA mean with duration

Surgically Induced Astigmatism (D)	Superior incision (Mean±SD)	Temporal Incision (Mean+SD)	't'	P value
1st day	2.02 ± 0.69	1.1 ± 0.79	6.19	<0.0001
7th day	1.39 ± 0.65	0.83 ± 0.73	4.01	<0.001
6th week	1.09 ± 0.66	0.72 ± 0.79	2.49	<0.05
3rd month	0.95 ± 0.68	0.62 ± 0.72	2.33	<0.05

In the present study, superior incision group showed mean SIA more on the first day (2.02D ± 0.69) compared to temporal incision group (1.1D ± 0.79) which was statistically significant. On the 7th day there was reduction in the mean SIA in both the groups, in superior incision group mean astigmatism being 1.39D ± 0.65 and in temporal incision group, the mean SIA being 0.83D ± 0.73 which was found to be statistically significant. After 6 weeks there was still further reduction of mean SIA in both groups. In superior incision group, mean SIA was 1.09D ± 0.66 and temporal incision group the mean SIA was 0.72D ± 0.79 and the difference between the groups was statistically significant.

After 3 months the mean SIA in superior incision group was 0.95D ± 0.68 and in temporal incision group the mean was 0.62D ± 0.72, Even after 3 months, the difference between two groups was found to be still statistically significant.

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 the density of the cataracts involved[7]. MSICS is the first choice alternative to phacoemulsification- retains most of the advantages of "phacoemulsification" giving visual results equivalent to phacoemulsification at a lower cost and it is the surgery for the masses and appropriate for a developing country. The surgery is cheap, fast, safe and easy to learn and needs fewer resources. However, the larger incision used induces greater astigmatism than phacoemulsification[8]. High astigmatism is an important cause of poor uncorrected visual acuity after cataract surgery[9]. In view of these findings, this study was done with the aim to compare the SIA between MSICS by superior scleral incision and temporal scleral incision.

Among 50 superior incision group patients, 21 (42%) had preoperative WTR astigmatism, 26 (52%) had preoperative ATR astigmatism and 3 (6%) had no preoperative astigmatism. Among 50 temporal incision group patients, 17 (34%) patients had preoperative WTR astigmatism, 30 (60%) patients had ATR astigmatism and 3 (6%) patients had no preoperative astigmatism. In the present study, preoperative

astigmatism was present in 94% of patients with average astigmatism of 0.70 D.

In this study, on the first post-operative day there was a significant difference in the amount of astigmatism between both the groups with higher astigmatism in superior incision group. However, the astigmatism gradually reduced in both groups by 6th week but the difference in SIA between both groups was statistically significant ($t=2.49$, $p<0.05$). However, after 90 days not much reduction in astigmatism was noted in both groups. This shows that most of the astigmatic stabilization occurred by 6 weeks and after that negligible amount of variation occurs.

The result of this study is consistent with previous reports [10, 12] that, temporal incision induces small amount of WTR astigmatism and gives early visual rehabilitation to the patients within 6 weeks. This could be due to the fact that temporal location is farther from the visual axis than superior location and any flattening due to 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 factors are neutralized well with temporally placed incision because the incision is parallel to the vector of forces[11].

Post operatively at the end of 3rd month in superior incision group, majority of the patients (74%) had ATR astigmatism and only 8 (16%) of the patients had WTR astigmatism. This is because incision on the vertical meridian causes flattening of the vertical meridian and steepening of the horizontal meridian leading to ATR shift. In temporal incision group, majority of the patients (56%) had WTR astigmatism as the incision on the horizontal meridian n causes flattening in that meridian and steepening along the vertical meridian leading to WTR shift. The temporal incision has a neutralizing effect on preoperative ATR astigmatism which is advantageous because most elderly cataract patients have preoperative ATR astigmatism. The type of astigmatism post operatively after 3 months in superior incision group is ATR (74%) and in temporal incision group it is WTR (56%). This is comparable with other studies [12]. Gokhale NS, Sahney S[12], in their study concluded that the superior incision resulted in more ATR shift where as temporal incision resulted in WTR shift.

In present study, mean SIA in temporal incision group was 0.62 D $\pm$ 0.72. In a study conducted by Gokhale NS and Swahney S (2005)[12], the mean SIA is temporal incision group was 0.67 D $\pm$ 0.65 which was comparable to our study, whereas in superior incision, the mean SIA in present study was 0.95 D $\pm$ 0.68 and in study by Gokhale NS and Sawhney S, it was 1.45 D $\pm$ 0.94. Their results for superior incision group were not similar to present study.In a study by Haldipurkar et al, superior incision induced 1.2 D ATR astigmatism which is close to our study (0.95 D $\pm$ 0.68)[13].

CONCLUSION

Temporal approach MSICS produces less postoperative astigmatism and has manifold advantages over superior incision MSICS with excellent visual outcome. A simple modification in incision placement produces comparable results to other sophisticated procedures and hence offers a way to attain better surgical outcome with limited resources available in most of the setups. However, superior incision still remains the choice due to convenience and protective effect of upper lid, and high SIA induced by it may prove useful when aimed at reducing preoperative corneal WTR astigmatism.

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