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COMPARISION OF SURGICALLY INDUCED CORNEAL ASTIGMATISM BETWEEN VARIOUS INCISIONS IN PATIENTS UNDERGOING MANUAL SMALL INCISION CATARACT SURGERY AT TERTIARY CARE HOSPITAL.

Ophthalmology

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ABSTRACT

Background:- Cataract surgery is considered as one of the most successful treatments in all of medicine. Astigmatism following cataract surgery is one of the cause for poor vision following surgery. With continued advancements in techniques and technology, cataract surgery has evolved into a refractive procedure rather than simply a surgical treatment of cataract. **Purpose:-** To compare the surgically induced astigmatism following various incision in manual small incision cataract surgery. **Materials and methods:-** 150 patients who underwent manual small incision cataract surgery in one eye were studied in total. All these patients were randomly assigned to any of three groups. Each group had 50 patients. The patients in group A underwent MSICS by superior scleral incision, the patients in group B underwent MSICS by supero-temporal scleral incision, the patients in group C underwent MSICS temporal scleral incision. Keratometry was done for the patients pre-operatively and on postoperative day 1,2nd week, 4 th week and 6th week. **Results:-** The mean SIA in superior, supero-temporal and temporal group is 0.63 ± 0.42, 0.50 ± 0.31, 0.38 ± 0.27 respectively. The mean astigmatism was lower in temporal group than superior and supero-temporal group. The BCVA in all three groups were WHO grade I in 93%, 94%, and 95% of the patients respectively. **Conclusion:-** The amount of astigmatism in temporal group was less when compared to superior and supero-temporal group. MSICS which is done by supero-temporal and temporal approach provides a better quality of vision than the superior approach due to a significantly less SIA.

KEYWORDS

SIA; superior incision; superotemporal incision; astigmatism

BACKGROUND

Cataract is one of the most common cause of visual impairment in the world. According to the World Health Organisation (WHO), 47.8% of blindness all around the world are because of cataract, which accounts for 17.7 million blind people.[1,2] In India, 80% of the blindness is due to cataract.[3,4] The mainstay of the management of cataract is surgery. Phacoemulsification and manual small incision cataract surgery (MSICS) are the most commonly done procedures. There is a large volume of cataract backlog in our country, mainly among the suburban and rural population. Phacoemulsification is considered as the goldstandard surgical procedure for cataract.[5] However, MSICS has emerged as a popular procedure of choice in the surgical treatment of cataract as it is less expensive and is as effective as phacoemul sification.[6] In developing countries like India, manual SICS is the most favoured method, as the Phaco machinery is expensive and it requires maintenance. Also, there is a steep learning curve.[7] The main aim of the cataract surgery is to provide a good vision quantitatively as well as qualitatively and an early visual rehabilitation.

Corneal astigmatism is associated with cataract surgery since the first limbal incision was made. Recent progress in cataract surgery had heightened patient expectations of outcomes. Good postoperative vision without spectacles is considered the norm. Thus control of postoperative astigmatism is key in meeting these expectations.[8] The concept of surgically induced astigmatism has added an entirely unique dimension to cataract surgery with emphasis more focused on the refractive aspect of the surgery in the present era.

Over the years, a better understanding of various preoperative and intra operative determinants of surgically induced astigmatism has made it possible to actually plan out the surgical intervention and their modifications according to preoperative state of astigmatism in order to achieve minimum possible postoperative astigmatism.[9] The purpose of modern cataract surgery is not only cataract extraction followed by IOL implantation but also to reduce or correct existing refractive error or astigmatism. Preexisting astigmatism is present in over 60% of all patients scheduled for cataract surgery.

The visual outcome of any cataract surgical technique can be assessed in terms of the residual refractive error which has a spherical and an astigmatic component. The spherical component depends on the lens power and can be pre-decided before surgery. It is the surgically induced astigmatism (SIA) which forms a major obstacle in achieving good unaided visual acuity.[10,11] SIA necessitates spectacle use post operatively for good visual rehabilitation which is not desirable by most of the patients in view of the cost and convenience thereby leading to patient dissatisfaction. But with the current improvements in the technique of MSICS and better training of ophthalmologists, SIA in this group of patients is also on a decrease. If this is the case then MSICS can boldly be described as an excellent alternative to phacoemulsification in developing countries where the burden of cataract blindness is still high.

Hence the aim of study is to compare superior, supero-temporal and temporal scleral incisions in manual small incision cataract surgery to reduce post operative astigmatism for good post operative visual recovery.

Objectives of the study:

This study was aimed to analyze the surgically induced corneal astigmatism by superior, superotemporal, temporal scleral incisions and to determine its visual outcome in manual small incision cataract surgery.

Methodology

This is a randomized, prospective study of 150 cataract cases conducted at Department of Ophthalmology, Mandya Institute of Medical Sciences, Mandya between April 2018 – March 2019. Among 150 cases, 50 cases underwent SICS with superior scleral incision and 50 cases underwent SICS with super-temporal scleral incision and 50 cases underwent temporal scleral incision, all being operated by a single surgeon. All the cases were evaluated and managed at our hospital. All the cases were admitted one day before the surgery.

All the patients received ciprofloxacin oral antibiotic 500 mg BD a day prior to surgery which was continued for 3 days postoperatively. Topical antibiotic was used preoperatively and xylocaine test dose was given one day prior to the surgery. Preoperative mydriasis was achieved using tropicamide 0.5% and phenylephrine 5% eye drops.

All the patients received peribulbar (6-7cc) anesthesia of lignocaine 2% with or without adrenaline with hyaluranidase. Surgical procedure - After preparing the eye for surgery, superior rectus bridle suture was placed for superior and supero-temporal incision group and lateral rectus suture for temporal incision group, fornix based conjuctival flap was taken down to bare sclera. A straight scleral incision of about 6.5 mm was placed 2 mm behind the limbus using 11 No. B.P blade and it was centered at 12 o' clock, 1.30 o' clock & 3 o' clock for superior, superotemporal & temporal incision respectively. Sclero corneal tunnel was formed with beveled up crescent blade up to 1 mm inside the clear cornea. Side port was made at 3 o'clock hours away from the

main incision. Anterior capsule was stained with trypan blue in case of mature cataract, viscoelastics was injected into anterior chamber and continuous curvilinear capsulorrhexis was done through the side port. Anterior chamber entry was done through the main incision using 3.2 mm keratome. The internal opening was made 1-2 mm larger than the external opening, thorough cortical cleaving hydrodissection was done using 26 gauge cannula and nucleus was prolapsed into the anterior chamber. Nucleus was delivered by sandwich technique using wire vectis and Sinskey hook. Anterior chamber was maintained throughout the procedure by injecting viscoelastics into anterior chamber. After delivering the nucleus, remaining cortex was aspirated using Simcoe I & A cannula, sub incisional cortex was aspirated through side port. A posterior chamber PMMA single piece lens of 6 mm (overall 12.5 mm) optics was inserted in the bag and remaining viscoelastic was removed. Anterior chamber was reformed with BSS through side port and sealed by stromal hydration. Main wound was checked for any leakage and then conjunctival flap is closed, subconjunctival injection of dexamethasone and gentamycin was given and eye was patched

Post operative work up

Follow up Evaluation done on Day1, 1st week, 4th week and 6th week post operatively. Antibiotic-steroid drops 1 hourly then tapered in about 4-6 weeks. Cycloplegics and oral NSAIDS were given as per requirement.

Uncorrected visual acuity was checked on the day 1, both uncorrected and Best corrected visual acuity (UCVA &BCVA) were checked in the subsequent followups. Refraction and keratometry was done at each follow up. Cases with 70-110 axes were considered as WTR astigmatism, cases with 160-20 axes were considered ATR astigmatism and other than these axes were excluded from the study. Data was collected and compared with regard to pre operative and post-operative astigmatism.

Statistical Analysis

The Statistical Package for Social Science {SPSS} Version 20 will be used for Data Analysis Mean, median, and SD are used to describe quantitative data. Qualitative data are summarized using frequency and percentage

RESULTS

A randomized, prospective, comparative study of post operativastigmatism following superior, superotemporal and temporal scleral incision in manual small incision cataract surgery was conducted at Mandya Institute of Medical Sciences, Mandya. 150 cases were studied, of which 50 cases underwent superior scleral straight incision and 50 cases underwent superotemporal scleral straight incision and remaining 50 cases underwent temporal scleral incision.

Table 3- Pre-op Visual Acuity

Pre-op VA	Superior	Supero-temporal	Temporal	Total
PL+ve -CFCF	7 (14%)	7(14%)	9 (18%)	23(15.3%)
CF1/2 mt -3mt	10(20.0%)	10 (20.0%)	13(26.0%)	33(22.0%)
CF 31/2 mt-51/2 mt	22(44.0%)	17(34.0%)	15(30.0%)	54(36.0%)
>6/60	11(20.0%)	16(32.0%)	13(26.0%)	40(26.7%)
Total	50(100.0%)	50(100.0%)	50(100.0%)	150(100.0%)

Table 4 – Pre-op Astigmatism

Astigmatism	Superior	Supero-temporal	Temporal	Total
ATR	18(36%)	22(44%)	36(72%)	76(50.6%)
WTR	27(54%)	20(40%)	13(26%)	60(40%)
NA	5(10%)	8(16%)	1(2.0%)	14(9.4%)
Total	50(100.0%)	50(100.0%)	50(100.0%)	150(100.0%)

In our study, 18 (36%) cases in SI had ATR astigmatism preoperatively, 27(54%) patients had WTR astigmatism and 5(10%) patients had no astigmatism preoperatively.

In STI group 22(44%) patients had ATR astigmatism, 20(40%) patients had WTR astigmatism and 8(16%) patients had no astigmatism preoperatively. In temporal group 36(72%) had ATR astigmatism, 13(26%) had WTR astigmatism and 1(2%) had no astigmatism preoperatively.

Astigmatism Distribution In Three Group Of Patient Studied

Astigmatism	Pre-operative	Post-op day1	Post-op II week	Post-op 4th week	Post op 6th week
Superior (n=50)					
• ATR	18(36%)	30(60%)	28(56%)	31(62%)	38(76%)
• WTR	27(54%)	18(36%)	22(44%)	19(38%)	11(22%)
• NA	5(10%)	2(4%)	0(0%)	0(0%)	1(2%)
Supero Temporal(n=50)					
• ATR	22(44%)	28(56%)	34(68%)	29(58%)	8(16%)
• WTR	20(40%)	22(44%)	16(32%)	21(42%)	40(80%)
• NA	8(16%)	0(0%)	0(0%)	0(0%)	2(4%)
Temporal (n=50)					
• ATR	36(72%)	21(42%)	16(32%)	15(30%)	5(10%)
• WTR	13(26%)	26(52%)	31(62%)	32(64%)	43(86%)
• NA	1(2%)	3(6%)	3(6%)	3(6%)	2(4%)
P value	0.087+	0.166	0.001**	0.002**	<0.001**

Mean Post-operative Astigmatism

Astigmatism (mean ± SD)	Pre – operative	Post –op 6th week
Superior		
• ATR	0.53 ±0.30	0.79 ± 0.46
• WTR	0.93 ±0.58	0.52 ± 0.35
Supero-temporal		
• ATR	0.66±0.37	0.50 ± 0.35
• WTR	0.70 ± 0.52	0.52 ± 0.31
Temporal		
• ATR	0.63 ± 0.35	0.31 ± 0.43
• WTR	0.50 ± 0.34	0.58 ± 0.35

In superior incision group, the mean ATR in post-operative 6th week was 0.79 ± 0.46 with 0.26D increase from the mean pre-op astigmatism, the mean WTR in post-operative 6th week was 0.52 ± 0.35 with reduction of 0.52 D with good visual recovery in these patients. The visual recovery fluctuated with fluctuation in the amount of astigmatism. In supero-temporal incision group, the mean ATR in post-operative 6th week was 0.50 ± 0.35 with 0.16 D decrease from the mean pre-op astigmatism, the mean WTR in post-operative 6th week was 0.52 ± 0.31with reduction of 0.20 D. In temporal incision group, the mean ATR in post-operative 6th week was 0.31 ± 0.43 with 0.32 D decrease from the mean pre-op astigmatism, the mean WTR in post-operative 6th week was 0.58 ± 0.35with increase in astigmatism of 0.08 D

Residual Amount Of Astigmatism At 6 Weeks

Residual amount of astigmatism	No of patients
0.5 D	91 (60%)
0.51-1 D	45 (30%)
1.25-1.50	13 (8.6%)
2 D	1 (0.6%)

In our study 91(60%) patients had residual astigmatism of 0.5 D or less, 45 (30%) patients had 0.51- 1 D, 13 (8.6%) patients had 1.25-1.50 D, and one patient had 2 D of residual astigmatism. In most of the cases the increase in amount of residual astigmatism is due to lack of on-axis incision.

Surgically Induced Astigmatism

Surgically Induced Astigmatism	Superior	Supero-temporal	Temporal
Mean ± SD 6th week post-op	0.63 ± 0.42	0.50 ± 0.31	0.38 ± 0.27

After 6 weeks post-operatively, the mean SIA in Superior Incision group was 0.63 ± 42 D and in Supero-temporal Incision group the mean SIA was 0.50 ± 0.31D and in temporal group the mean SIA was 0.38 ± 0.27 D. The difference in three groups was found to be statistically significant ($p<0.005$). The mean SIA is less in patients with temporal scleral incision when compared to superior and supero-temporal incision.

Comparison Of Post-op Visual Acuity

In temporal incision early rehabilitation of visual recovery is due to the fact that temporal incision is farther from visual axis than the superior

incision & any flattening due to wound is less likely to affect the corneal curvature at the visual axis.

Table 14 – Ucva At 6th Week Post-op

WHO GRADES	Superior (%)	Supero – temporal(%)	Temporal (%)	WHO recommendation (%)
GRADE I (GOOD)	78	80	76	85
GRADE II (BODERLINE)	20	18	24	10
GRADE III (POOR)	2	2	0	5

VISUAL ACUITY	Post-op Day 1	Post –op 2nd week	Post op-4th week	Post –op 6th week
Superior (n=50)				
6/6-6/9	6(12%)	12(24%)	14(28%)	20(40%)
6/12-6/18	11(22%)	12(24%)	16(32%)	19(38%)
6/24-6/36	15(30%)	18(36%)	15(30%)	8(16%)
6/60	10(20%)	5(10%)	3(6%)	2(4%)
< 6/60	8(16%)	3(6%)	2(4%)	1(2%)
Supero-temporal(n=50)				
6/6-6/9	9(18%)	14(28%)	21(42%)	25(50%)
6/12-6/18	11(22%)	12(24%)	15(30%)	15(30%)
6/24-6/36	17(34%)	12(24%)	6(12%)	6(12%)
6/60	9(18%)	8(16%)	5(10%)	3(6%)
< 6/60	4(8%)	4(8%)	3(6%)	1(2%)
Temporal (n=50)				
6/6-6/9	13(26%)	15(30%)	24(48%)	28(56%)
6/12-6/18	9(18%)	15(30%)	10(20%)	10(20%)
6/24-6/36	13(26%)	10(20%)	12(24%)	11(22%)
6/60	10(20%)	8(16%)	4(8%)	1(2%)
< 6/60	5(10%)	2(4%)	0(0%)	0(0%)
P value	0.344	0.044	0.002	<0.001

Visual acuity was recorded and graded according to the WHO grading, to see whether it fulfils the WHO recommendations of overall cataract surgery outcome. 78% in superior incision, 80% in supero-temporal incision and 76% in temporal group had good visual acuity. 2% in superior and supero-temporal group had poor visual acuity.

Table 15– Bcva At 6th Week Post-op

WHO GRADES	Superior (%)	Supero – temporal(%)	Temporal (%)	WHO recommendation (%)
GRADE I	93	94	95	95
GRADE II	5	4	10	5
GRADE III	2	2	0	5

The BCVA at 6th week post-op was 93% for superior, 94% for supero-temporal and 95% for temporal group, which meets the WHO recommendations.

DISCUSSION:

Astigmatism following cataract surgery is most undersirable, since it reduces the effectiveness of the procedure. Any kind of ammetropia—myopia, hypermetropia or astigmatism present after the surgery is annoying to the patient, especially if the astigmatism is more than 2.5 D. Because, even when fully corrected this amount of astigmatism causes blurring of the image, leads to distortion of images and produces monoocular diplopia. All these produces asthenopic symptoms, and the patient may remain unconvinced.65

The pre-operative incidence of astigmatism in our study was 91% with a mean pre-operative astigmatism of about 0.74 D. Majority (50.6 %) of the people showed ATR astigmatism. After 6th week post-operatively in superior incision group, the mean SIA was 0.63 ±0.41 D with reduction of 0.11 D when compared to pre-operative astigmatism, the induced astigmatism was less in this group when compared to the other studies. In supero-temporal group it was 0.50 ± 0.31 D wit reduction of 0.19 D, whereas in a study 83 conducted by Gokhale NS and Sawhney S (2005), the mean SIA in supero-temporal incision group was 0.51 + 0.49 D which was comparable to our study, and in temporal group it was 0.38 ± 0.27 D with reduction of 0.21 D. There is a difference in astigmatic correction in all the three groups.

In our study the visual acuity at post-operative day-I, 34% of the patient in superior, and 40% in supero-temporal and 44% in temporal group had good visual acuity according to WHO recommendation. This was not statiscally significant. After 6th week 84 post-operatively, 78% of the patient in superior, 80% in the supero-temporal and 76% in the temporal group had good visual acuity. The more percentage of patients in the supero-temporal group had attained good visual acuity when compared to the other two groups.

CONCLUSION

The astigmatism following cataract surgery is a troublesome consequence. The amount and type of astigmatism induced depends on the size, shape, location of the incision and effect of sutures on the incision. SICS with the supero-temporal and the temporal approaches provides a better quality of vision due to the significantly less SIA than the superior approach. But the supero-temporal incision has the advantages of both the locations and so it is better than the temporal incision.

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