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CLINICAL STUDY TO EVALUATE THE INFLUENCE OF INCISION SITE (SUPERIOR VS SUPEROTEMPORAL) ON POSTOPERATIVE ASTIGMATISM IN MANUAL SMALL INCISION CATARACT SURGERY

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ABSTRACT

Introduction: Small incision cataract surgeries may be performed using various surgical incisions, namely, superior, supero-temporal and temporal. Each method has its own advantages and disadvantages. Supero-temporal incision is considered the best as it produces least induced astigmatism. The purpose of this study was to compare the postoperative induced astigmatism in superior and superotemporal incision group in small incision cataract surgery.

Material &Method- This study was conducted on cataract surgery patients admitted in M.R.A Medical College, Ambedkarnagar. Fifty patients were selected for study, out of which 30 received superior and 20 received superotemporal incision. Preoperative keratometric and post operative 6 weeks keratometric readings were analysed.

Results-Superior incision is better for with the rule astigmatism and worst for against the rule astigmatism, while superotemporal incision is equally good for both with the rule and against the rule astigmatism.

Conclusion-Superotemporal incision is better than superior as it produces least astigmatism with good visual acquity.

Key words: SICS, WTR, ATR, Astigmatism,Keratometry,Phacoemulsification

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INTRODUCTION

The cornea and lens both act as a strong convex lens.Out of total diopteric power of eye i.e 60D, contribution of cornea is 43.5D. As cornea is responsible for a large proportion of refractive power of eye, so the alteration in corneal curvature significantly affects the refractive state of eye. Cornea is somewhat elliptical with horizontal diameter (≈11.7 mm) slightly more than vertical (≈10.6) in anterior surface, while posteriorly vertical and horizontal diameter (≈11.7mm) are equal. Anterior radius of curvature (≈7.8 mm) is more than posterior radius of curvature (≈6.5 mm). The corneal thickness is more in periphery (0.7-0.9 mm) than in centre (0.49-0.56 mm).Astigmatism is a known complication of cataract surgery. Surgically induced astigmatism can adversely affect postoperative visual status of the patient. The factors responsible are incision size, shape, site, distance from limbus, depth, suturing, scleral cauterization and use of topical steroids.Astigmatism is a type of refractive error in which rays of light focus on two planes. It may be due to variation in shape of cornea (caused by difference in radius of curvature of principle meridians of cornea), lens (partially dislocated lens or toric lens) or because of some retinal (fundal coloboma, posterior staphyloma) or orbital pathology (tumors).In healthy people upto 95% of eyes have some degree of naturally occurring astigmatic error. The incidence of post-

surgical astigmatism >2D may be as higher as 25-30%.Astigmatism can be divided into congenital and acquired varieties. Acquired type may be secondary to certain disease (e.g. pterygium, ptosis) or as a result of surgery (e.g. cataract surgery, glaucoma surgery, squint surgery, keratoplasty, or traumatic repair of a wound).People with >0.5 to 0.75D of astigmatism usually requires some degree of optical correction. Astigmatic error of 1 to 2D may reduced uncorrected visual acquity to 20/30 or 20/50 whereas astigmatic error of 2 to 3D may correspond to visual acquity between 20/70 to 20/100. Normally vertical curvature of cornea is more steep while horizontal curvature is more flat. Astigmatism is further divided in to regular and irregular type. In regular type principle meridian of maximum and minimum curvature are at 90º to each other while in irregular type they are not 90º to each other. Regular astigmatism is divided further in to with the rule (WTR) and against the rule (ATR) type. In WTR type vertical meridian is more steep while in ATR type horizontal meridian is more steeper. In children and younger age, astigmatism is usually WTR while in older age astigmatism is usually ATR due to effect of gravity and pressure of lid, the vertical meridian become flatter than horizontal meridian.Astigmatism may degrade vision or cause asthenopic symptoms by several mechanism. Uncorrected astigmatism creates a blur image, through the circle of least confusion. It may also produce glare and monocular diplopia. Simple myopia & simple hyperopia allows clear vision at some areas in visual range while compound astigmatism may not allow clear focus at any distance. Younger patients may partially compensate hyperopic astigmatism through accommodation, which is lost in poeudophakic or aphakic state, older patients may experience difficulty in adapting to axis shifts induced by surgery. Regular astigmatism is treated with spectacle, contact lens or refractive surgery while irregular astigmatism treated with hard contact lens or refractive surgery only. The modern cataract surgery which evolved from extracapsular surgery was done by Jacques Daviel [1]. Kratz [1] developed self sealing scleral tunnel incision, later McFarland [2] was the first to do sutureless surgery and Ernest [3]developed sclera tunnel incision with internal corneal lip and later on Charles Kelman [4] revolutioned the cataract surgery by advent of phacoemulsification. The above advents decrease all complications of surgery to minimal. [5] The two main objective of modern day cataract surgery are to achieve rapid visual recovery and minimal surgically induced astigmatism to produce a spectacle free vision. Phacoemulsification has now become a routine procedure for cataract surgery in most part of world but as it is more costly, need expertise and more technical assistance is required. So in order to obtain advantage of a self sealing sutureless incision at low cost, surgeons in developing world perform manual small incision cataract surgery (SICS) as an alternative. As it gives equally good results, cheap and affordable by all. As SICS commonly done in developing countries like India, the visual outcome is hampered by surgically induced astigmatism. Thus site, shape, size and depth of incision is as important factor responsible for postoperative astigmatism. So by monitoring parameter of incision site the postoperative astigmatism can be reduced, thus increasing the visual outcome. With this background this study was undertaken to study the induced astigmatism producedafter manual SICS and to compare the astigmatism induced by a superior & super temporal incision in manual SICS.

MATERIAL AND METHODS

The present experimental study was conducted on patients admitted in Department of Ophthalmology at M.R.A Medical College, Ambedkarnagar during the year 2014-2016, who underwent the cataract surgery.

Patients included in the study were-

- Patients with immature/mature/hypermature senile cataract.
- Patients of age group 25-75 years, irrespective of sex.
- Patients of preoperative astigmatism <2 D with good fixation.

Patients excluded were-

- Previous intraocular surgery
- Significant corneal opacity

- Patient of traumatic injury to eyeball
- Patients of squint
- Patient of preoperative astigmatism >2D.

Preoperative Evaluation: Preoperative evaluation of visual acquity, slit lamp examination, ophthalmoscopy, tonometry, syringing & conjuctival smear was done. Routine blood investigation for sugar, HIV&HBsAg screening was done. Preoperative keratometry was done to know preoperative astigmatism(WTR/ATR), IOL power calculation done by A-scan. With all aseptic precaution small incision cataract surgery(SICS) was done in peribulbaranaesthesia.

All the patients were subdivided into two groups:
Group-A: Receive- Superior incision, & Group-B: Receive- Supertemporal incision,

A 6-6.5mm curved frawn shaped incision was given 1.5-2 mm behind the limbus with blade no.15, just perpendicular to sclera upto 1/3rd to ½ of sclera thickness

Postoperative Care & Follow Up:

The patients were discharged next day and advised to follow up every week for six weeks. In every visit thorough slit lamp examination & ophthalmoscopy was done. Visual Acquity test was done every week and after 6 weeks, Keratometry was done 1 week postoperatively , 6 weeks postoperatively.

Preoperative and 45th postoperative day keratometric readings and analysis of study. Amplitude of preoperative and postoperative astigmatism was calculated from difference in keratometric value in steeper and flatter meridian using plus cylinder notation.

Astigmatism is considered as a vector with magnitude equal to this value directed toward steeper meridian, e.g. keratometry value of 43.5×90° and 44×180° would empty astigmatism of 0.5

Statistical analysis: The data obtained from the current study was entered into Microsoft Excel for analysis and evaluation. Chi-squared test was used to study association between two variables. Paired and unpaired t-test was used to find if any significant difference existed in two means. Pearson correlation coefficient was used to study relation between two continuous variables.

Ethical Clearance and Consent- The study was approved by the Institutional Ethics Committee on Human Reasearch at MRA Medical College, AmbedkarNagar, U.P. Informed consent was taken from all the subjects undergoing surgery for willingness to participate in the current study. Only those subjects consenting for participation were included in the study.

RESULTS

In this study 50 patients of cataract were choosen for manual small incision cataract surgery (SICS).Out of which 30 patients were males & 20 patients were females of age group 40-70 yrs. (Table 1) About 2/3rd of patients i.e. 30(60%) having ATR, approx 1/3rd patients i.e.14(28%)were having WTR & rest 6 patients (12%) had spherical cornea. (Table 2) All the patients randomly divided in two groups (group A- received superior incision, group& B- received superotemporal incision).

Table-1: Age wise distribution of patients

Age group (in years)	Male	Female	*X^2	P Value
40-50	4	4	2.734	0.434
51-60	14	4		Yate´s
61-70	10	11		corrected
>70	02	1		
Total	30	20		

*Chi-Square test use

Table-2: Genderwise distribution of patients with pre operative & post operative astigmatism

Astigmatism	Preoperative		Postoperative	
	Male	Female	Male	Female
WTR	07	07	0	03
ATR	20	10	2	17
Spherical	03	03	0	0
Total	30	20	30	20
X^2	0.561		0.056	
P value (Yate's Corrected)	0.755		0.813	

*Chi-Square test use

Table-3: Genderwise pre-existing(pre operative) & Induced astigmatism (post operative)

Astigmatism(D)	Preoperative		Postoperative	
	Male	Female	Male	Female
≤0.5 >0.50-≤1.0 >1.0-≤1.5 >1.5	12 10 08 00	10 05 03 02	01 04 11 14	01 08 01 10
Total	30	20	30	20
X^2	1.49		6.50	
P value,(Yate´S Corrected)	0.685		0.090	

*Chi-Square test use.

Table 4: Mean keratometric readings pre & post op according to incision type

S.N	Kemetry K1/K2	Mean preoperative Astigmatism(±SE)	Mean postoperative Astigmatism(±SE)	Mean difference (±SE)	P-value
A-Type of incision:SUPERIOR					
N=	K1	43.96±0.24	42.99±0.24	0.90.07	<0.001
	K2	44.21±0.22	45.28±0.21	1.07±0.12	<0.001
B-Type of incision:SUPEROTEMPORAL					
N=	K1	44.21±0.21	44.18	0.04±0.19	<0.841
	K2	44.60±0.22	44.39±0.25	0.21±0.21	<0.326

Table 5:Post operative change in astigmatism (induced) by type of incision given

Pre existing Astigmatism A-Type of incision :Superior	Mean preoperative Astigmatism (±SE)	Mean post operative Astigmatism (±SE)	Mean difference (±SE)	P-value
Spherical (N=3)	0	1.50±0.14	1.50±0.14	0.009(S)
WTR(N=8)	0.78±0.23	1.71±0.19	0.93±0.22	0.004(S)
ATR(N=19)	0.72±0.11	2.64±0.21	1.92±0.13	0.001(S)
B-Type of incision: Superotemporal				
Spherical (N=3)	0	0.67±0.08	0.67±0.08	0.015(S)
WTR(N=6)	0.75±0.11	1.04±0.11	0.29±0.04	0.001(S)
ATR(N=11)	1.11±0.13	1.14±0.09	0.03±0.11	0.839(NS)

Table-6: Postoperative visual acquity after 6 weeks

Visual acquity	Superior group						Superotemporal group					
	WTR		ATR		Spherical		WTR		ATR		Spherical	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
6/6-6/9 6/12-6/18 6/24-6/36	06 02 -	75 25 -	07 12 -	37 63 -	02 01 -	67 37 -	05 01 -	83 17 -	08 03 -	73 27 -	03 - -	100 - -
Total	08		19		03		06		11		03	

In this study maximum patients having astigmatism <1D i.e.37 patients(74%),followed by astigmatism of 1-1.5Di.e.11 patients(22%) and minimum patients were have >1.5D i.e.2patients(4%). (Table 3) In superior incision group out of 30 patients 8 had WTR& 19 had ATR astigmatism,3 had spherical cornea. In superotemporal group out of 20 patients 6 had WTR& 11 had ATR astigmatism,3 had spherical cornea.

In Group-A (Superior incision)- Out of 30 patients, 8 had WTR preoperative astigmatism (mean preoperative astigmatism was 0.78±0.23 D). After incision postoperative shift is ATR with mean postoperative astigmatism is 1.71±0.19D, so induced astigmatism in WTR patients is ≈0.93D±0.22, 19 patients have ATR astigmatism(mean preoperative astigmatism was 0.72±0.11 D) postoperative Shift is again ATR with mean postoperative astigmatism of 2.64±0.21D so induced astigmatism is 1.92±0.13D.The remaining 3 patient of spherical cornea after receiving incision postoperative shift is ATR with mean postoperative astigmatism of 1.5±0.14D, so induced astigmatism is ≈1.5±0.14D.

In Group-B (superotemporal incision)- out of 20 patients, 6 had WTR preoperative astigmatism with mean preoperative astigmatism of 0.75±0.11D, after incision shift is ATR with mean postoperative astigmatism of 1.04±0.11D, so induced astigmatism in WTR, patients is ≈0.29±0.04D. 11 had ATR preoperative astigmatism with mean preoperative astigmatism of 1.11±0.13D, after incision shift is WTR with mean postoperative astigmatism of 1.14±0.09D, so induced astigmatism in ATR, patients is ≈0.03±0.11D. The remaining 3 patient of spherical cornea after receiving incision postoperative shift is ATR with mean postoperative astigmatism of 0.67±0.08D, so induced astigmatism is 0.67±0.08D. (Table 5)

Postoperative visual acquity was maximum (6/6-6/9) if patient of WTR was given superior incision (≈75%) & worst if patient of ATR was given superior incision 6/12-6/18 (63%). In superotemporal incision maximum patients had visual acquity in range of 6/6-6/9 (WTR-83%,ATR-73%) & few patients had visual

acquity 6/12-6/18 (WTR-17%,ATR-27%). (Table 6)

DISCUSSION

This study indicates that for patients of WTR superior incision is better (induced astigmatism is 0.93±0.22D) than ATR (induced astigmatism is 1.92±0.13D). While superotemporal incision is better both for either WTR(induced astigmatism is 0.29±0.04D) or ATR(induced astigmatism is 0.03±0.11D) patients, as it produces minimum induced astigmatism for both groups. On taking average value, superior incision produces induced astigmatism of +1.42±0.29D, Superotemporal incision produces induced astigmatism of +0.16 ±0.08D .Thus superotemporal incision does not significantly change the keratometric readings.

Postoperative visual acquity is maximum (6/6-6/9) if patient of WTR given superior incision (≈75%) & worst if patient of ATR given superior incision 6/12-6/18 (63%). In superotemporal incision maximum patients have visual acquity range of 6/6-6/9 (WTR-83%,ATR-73%) & few patients have visual acquity 6/12-6/18 (WTR-17%,ATR-27%).

Results of our study are comparable to the observations made by Kimura et al. [6] Their study has shown that surgically induced astigmatism is less with an oblique incision (1.02±0.66D) than with a superior incision (1.41±0.72D). In this study superior incision induced astigmatism of +1.42±0.29D, while superotemporal incision induced astigmatism of +0.16±0.08D. So superotemporal incision was better than superior incision.

Akura et al [7] evaluated result of a modified self scaling incision of 6.3-7.0 mm for correcting pre-existing astigmatism. In the 6.0-7.0 mm BENT frown incision group mean flattening was minimal through out 6 months follow up. Relatively large flattening was observed in eyes with 6.0-7.0 mm steep axis incision of superior arcuate, temporal arcuate, superior frown and temporal frown with mean of 1.03, 0.79, 0.64 and 0.52D at 6 months. In the present study superior incision cause induced astigmatism of +1.42±0.29D, while superotemporal incision causes induced astigmatism of +0.16±0.08D.

Gokhale et al [8] studied the change of incision site in the superior, superotemporal and temporal groups. The amplitude of preoperative astigmatism was similar and around 0.5D in the three groups. The amplitude of postoperative astigmatism was higher is superior incision (1.45±0.94) than in superotemporal (0.43±0.27).

The Surgically-induced astigmatism induced by the superior incision was 48.28 % more than by the temporal incision in a study conducted by Malik et al.[9] In another study by Vinay et al[10], on comparing the surgically induced astigmatism (SIA) between superior and super temporal incision types in small incision cataract surgery, it was found that SIA was statistically less in super temporal type.

In my study superior incision cause induced astigmatism of +1.42±0.29D, while superotemporal incision causes induced astigmatism of +0.16±0.08D.

CONCLUSION

The pre-existing astigmatism can be minimize or corrected by modification of type of incision (superior/ superotemporal).

Superotemporal incision causes least flattening of corneal curvature, followed by superior incision.

Superotemporal incision is astigmatism more neutral for both WTR or ATR patients, so better than superior incision.

This is a well known fact that postoperative astigmatism, whether being pre-existing or surgically induced remains a big limiting factor in achieving optimal postoperative visual acquity. By simple modification of incision site during surgery pre-existing astigmatism can be taken care off. Likewise variation in size, shape and type of incision can minimize surgically induced astigmatism.

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