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KEY WORDS: Surgically induced astigmatism, phacoemulsification, superior clear corneal incision, temporal clear corneal incision.

ASTIGMATIC OUTCOME OF SUPERIOR VERSUS TEMPORAL CLEAR CORNEAL INCISION IN PHACOEMULSISFICATION

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ABSTRACT

Aims: To compare surgically induced astigmatism after phacoemulsification with foldable intraocular lenses between superior clear corneal and temporal clear corneal incision.
Settings and Design: Prospective study carried out in a tertiary health care centre in North India.
Methods and Material: 100 patients underwent phacoemulsification through clear corneal incision, and were randomly assigned to undergo surgery either through temporal approach or through superior approach (50 in each group). Pre and postoperative visual acuity and astigmatism was analyzed in each group and the surgically induced astigmatism was compared between the two groups.
Results: In the superior incision group, BCVA of 6/6 was attained by 80% patients as compared to 84% in the temporal incision group. Mean preoperative astigmatism was 0.89% D in the superior incision group which changed to 1.035D postoperatively. Whereas in the temporal incision group mean preoperative astigmatism was 0.745D which changed to 0.575D postoperatively. The mean surgically induced astigmatism in the superior incision was 1.08D and that in the temporal incision group was 0.43D.
Conclusion: Temporal clear corneal incisions induced less astigmatic change as compared to superior clear corneal incisions and hence are more suitable for astigmatically neutral eyes as well as those with low preoperative astigmatism.

INTRODUCTION

Cataract is the commonest cause of preventable blindness in the world. Cataract surgery is the only effective treatment modality for cataract and has progressed over the years from intracapsular cataract extraction which rendered the patient aphake to extracapsular cataract extraction and optical rehabilitation with intraocular lens implantation. The continual improvisations in the intraocular lenses from rigid PMMA to present day foldable lenses has permitted a reduction in the incision size from 8 to 10 mm in conventional extracapsular cataract surgery to 1 mm or even less with present day phacoemulsification.

Cataract surgery is today treated as a refractive surgery, with cataract surgeons today hoping to achieve 6/6 or better visual acuity with spectacle independence for distant vision. The cataract surgeon, hence, has to think ahead of his times and ensure emmotropic visual rehabilitation to his patient.

The main determinants of the refractive state of the eye following phacoemulsification and IOL implantation are IOL power and postoperative astigmatism.1 with accurate IOL power calculation been possible nowadays, postoperative astigmatism has remained the only obstacle to the achievement of good uncorrected visual acuity after cataract surgery. Postopeative astigmatism is a very complex clinical problem, the main influence being preoperative astigmatism as well as incision location, construction, length, suturing techniques and wound healing. 2

The introduction of the technique of phacoemulsification has revolutionized cataract surgery phacoemulsification is done through two approaches, superior or temporal. In both the approaches, the incision can be placed on clear cornea, limbus or sclera, the site strategically affecting the surgically induced astigmatism, occurring postoperatively. The fact that the surgically induced astigmatism is directly proportional to the size of the incision and inversely proportional to the distance from the limbus has given rise to the concept of the astigmatic funnel. This funnel has a base of 3-3.5 mm at the limbus and gives rise to minimal astigmatism of 0.25 D and is considered astigmatically neutral for all practical purposes. The funnel as it moves away from the limbus and all incisions made therein are astimgatically neutral. 3

Dr. Fine IH developed the clear corneal incision wherein the anterior limit is positioned anterior to the limbal vascular arches.4 The clear corneal lip acts as a one-way valve, imparting self sealing characteristics to the incision.5 The clear corneal incision has many advantages e.g. It can be performed under topical anaesthesia, without the need for bridle suture and conjuctival flap formation, hence shortening the surgical time.

Tunnel being shorter, intraoperative visibility is facilitated.
Decreased incidence of iris prolapse as well as hyphaema.
Protection of the eye from epithelial ingrowth.

The present study was undertaken to evaluate and compare the astigmatic impact of the superior and temporal clear corneal incisions in phacoemulsifications.

Subjects and Methods

This prospective study was conducted in a tertiary care ophthalmic institute from March 2010 to September 2011. The study comprised of 100 patients who underwent phacoemulsification with foldable IOL implantation through clear corneal route: 50 assigned to undergo the procedure through superior incision and the other 50 through temporal approach. Patients having traumatic or complicated cataract, corneal scarring, corneal opacities, corneal edema, irregular pterygium as well as those who had a history of previous ocular surgery were excluded from the study. Patients who underwent any intraoperative compliation were also excluded from the study. After a complete preoperative evaluation, patients were taken up for surgery.

Using all aseptic precautions, a clear incision was made 2mm inside the limbus with a 2.8mm keratome; superior incision was made at 12 O'Clock while as temporal incision was made at 2 O'Clock. Divide and conquer method of nucleus fragmentation, bimanual irrigation aspiration and foldable IOL implantation was carried out in all cases. The clear corneal wound was sealed by hydration. All the patients were operated upon by a single surgeon.

Post operative follow up visits were carried out at 1st POD, 1st Week, 3rd week and 6th week. Post operative assessment

included visual acuity, retinoscopy and keratometry. Surgically induced keratometry was calculated from preoperative and postoperative keratometry.

Results

In the superior incision group, 25 patients (50%) were males and 25 patients (50%) were females. In the temporal incision group, 26 patients (52%) were males and 24 patients (48%) were females. Age distribution of the patients revealed that in the superior incision group, mean age was 58.6 years ± 8.4 years (range:43 to 79 years), with maximum (20 patients i.e. 40%) patients being in the age group of 51-60 years. In the temporal incision group, maximum i.e. 20 patients (40%) were also in the age group of 51-60 years. However, the mean age of patients was slightly higher, i.e 61.3±8.2 (range: 47 to 76 years). This difference was not found to be statistically significant (p=0.103). Majority i.ie. 23 patients (46%) had a preoperative visual acuity less than FC 3 mts in the superior incision group, 20 patients (40%) had a visual acuity between 6/60 to FC 3 mts and only 7 patients (14%) had a visual acuity better than 6/60. In contrast, majority i.e 23 patients (46%) in the temporal incision group had preoperative visual acuity in the range of 6/60-FC 3mts, 20 (40%) had visual acuity less than FC 3 and 7 patients (14%) had visual acuity better than 6/60.

Postopeative BCVA of 6/6 was achieved by 40 (80%) patieints in the superior group and 42 (84%) in the temporal group whereas 10 patients (20%) had a BCVA of 6/9 in the superior versus 8 (16%) in the temporal incision group. This difference was not found to be statistically significant (p=0.604) (Table 1).

Mean preoperative astigmatism was 0.89 D in the superior incision group and 0.745 D in the temporal incision group. The difference in the preoperative astigmatism between the two groups was not found to be statistically significant (Table 2). Postoperatively, mean astigmatism was calculated to be 1.035 D in the superior incision group and 0.575D in the temporal incision group. This difference was found to be statistically significant (p=0.001) (Table 3).

Comparison of the preoperative and postoperative astigmatism in the superior incision group (chart 1) and in the temporal incision group (chart 2) gave us the surgically induced astigmatism (Table 4). The mean surgically induced astigmatism (SIA) in the superior incision group was 1.08D and that in the temporal incision group was 0.43 D. This difference was found to be statistically significant (p=0.001). Further analysis revealed that out of the total 50 patients in the superior incision group, 31 patients (60%) had surgically induced astigmatism of the against the Rule type, 19 patients (38%) had SIA of with the Rule type. No SIA was seen in 1 patient (2%). In the temporal incision group, out of the 50 patients, 26 (52%) had a SIA of the WTR type and 18 (36&) had SIA of the ATR type. 6 (12%) patients had no SIA. This difference was also found to be statistically significant (p-0.014).

DISCUSSION

The mean postoperative astigmatism in our study was found to be more in the superior incision group as compared to the temporal incision group, the difference being statistically significant. Since the optical centre is usually shifted a little nasally, the temporal incision is excepted to induce less astigmatism. Similar results were found by Marek et al with mean postoperative astigmatism of 0.96D±0.43 in the superior and 0.54 D±in the temporal incision group.[5]

Our study proves that surgically induced astigmatism is more with superior incision. The proximity of the superior incision site to the visual axis as well as the added drag caused by blinking and gravity may be responsible for the increased astigmatism. The induced vector in the temporal incisions essentially counters these forces, hence les surgically induced astigmatism. Similar results have been found by Simsek et al, in their study. Upper eyelid pressure on the superior corneal incision is thought to be mechanism for the induced against the rule astigmatism. Overall, clear corneal incisions were found to minimally affect astigmatism, especially when placed temporally.6 Marek et al concluded similar results from their study and infact found that 2.8mm clear corneal temporal approach is more beneficial than a superior incision of the same width, because of the scale of SIA.

In our study, the superior incision group had an SIA of ATR type in 60% patients, WTR type in 38% and no SIA in 2% patients. In the temporal incision group, SIA of WTR type was seen in majority of patients (52%) followed by ATR type in 36% and no SIA in 12% patients. Roman S and Ullern M in their comparative study of SIA induced by superior and temporal approach phacoemulsification, found that the mean surgically induced astigmatism was 0.98 diopter in the superior incision group and 0.58 in the temporal incision group. The surgically induced astigmatism was found to be against the rule for a superior location an with the rule for temporally located incision. They concluded that superior incision rarely allows to reach a minimum postoperative astigmatism as with temporal location.[7]

Comparable results were obtained by Park C. Y, Roy S Chuck, Prabjot Channa et al, in their study comprising of 125 eyes. The location of the main incision (2.8 mm clear corneal) was selected to be either superior, superior-nasal, superior-temporal, nasal or temporal. They found that the greatest postoperative astigmatism was seen in corneas with the high preoperative astigmatism and superior location of the main incision. The temporal incision was shown to produce the lowest value of SIA. This shows that a temporal incision can reduce and quickly stabilize surgically induced astigmatism. Temporal clear corneal incisions seem to achieve the goal of minimizing surgically induced astigmatism. Temporal limbus being farther from the visual axis than the superior limbus, hence induces less astigmatic effect.

Temporal clear corneal incision is evidently better than superior clear corneal incision in minimizing surgically induced astigmatism. It is the incision which is more popularly used today as compared to a superior clear corneal incision. [8]

The knowledge of the induced astigmatism by variations in the location of clear corneal incision, can be used to minimize the surgically induced astigmatism. In cases of preoperative WTR astigmatism, the incision should be placed in the steep meridian i.e the 12 O'Clock position so that the preoperative astigmatism can be neutralized. Similarly, the preoperative ATR astigmatism can be better neutralized by placing the incision at the temporal site. The minimal amount of SIA in case of temporal incision phacoemulsification also makes it patients with no preoperative astigmatism.

Table

Table 1 Postoperative Visual acuity

Postop BCVA	Superior		Temporal		p-value
	N	%	N	%	0.604 (NS)
6/6	40	80	42	84	
6/9	10	20	8	16	

Table 2 Preoperative Astigmatism

Preoperative Astigmatism (diopters)	Superior		Temporal		p-value
	N	%	N	%	0.730 (NS)
Nil	6	12.0	3	6.0	
0.25-0.50	4	8.0	6	12.0	
0.50-0.75	12	24.0	13	26.0	
0.75-1.00	2	4.0	7	14.0	
>1.00	26	52.0	21	42.0	

Table 3 Preoperative Astigmatism

Postoperative astigmatism	Superior		Temporal		p-value
	N	%	N	%	0.001 (sig)
Nil			4	8.0	
0.25-0.50	6	12.0	16	32.0	
0.50-0.75	4	8.0	21	42.0	

0.75-1.00	4	8.0	4	8.0	
>1.00	36	72.0	5	10.0	

Table 4 Surgically induced Astigmatism

Surgically induced	Superior		Temporal		p-value
	N	%	N	%	0.001 (sig)
Nil	1	2.0	6	12.0	
0.25-0.50	9	18.0	18	36.0	
0.50-0.75	9	18.0	13	26.0	
0.75-1.00	6	12.0	10	20.0	
>1.00	25	50.0	3	6.0	

CHARTS

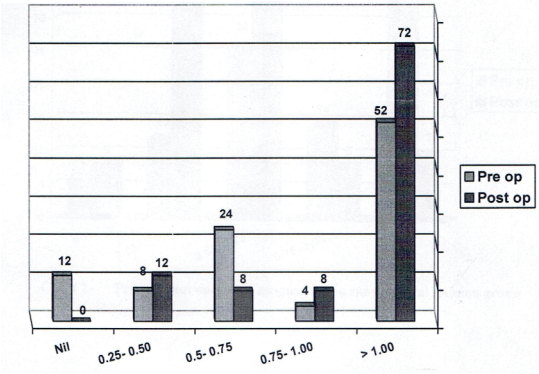

Chart 1- Pre and postoperative astigmatism in the superior incision group

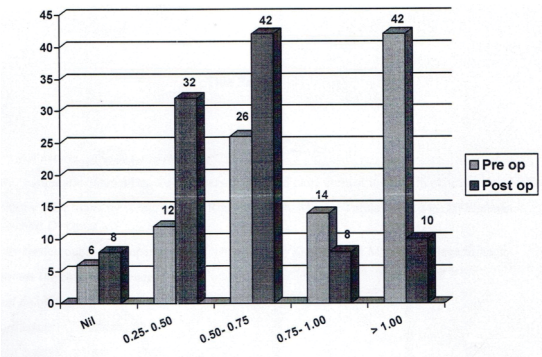

Chart 2- Pre and post operative astigmatism in the temporal incision group

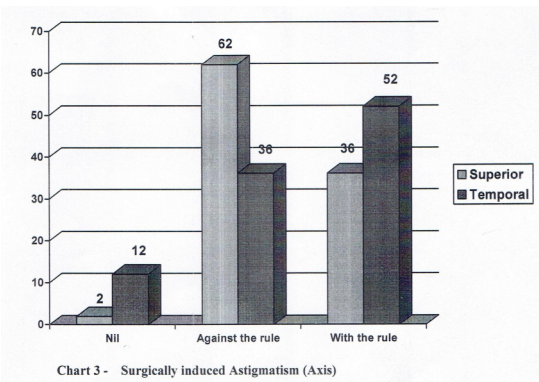

Chart 3 - Surgically induced Astigmatism (Axis)

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