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To Correlate Corneal Astigmatism with 2.2 mm and 2.8 mm Clear Corneal Incision During Phacoemulsification in Different Steep Meridians

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ABSTRACT
Comparison of post operative change in corneal astigmatism with 2.2 mm and 2.8 mm clear corneal incision given at steep meridian in phacoemulsification. 160 eyes of 160 patients were included in the study and were divided randomly into two groups according to the preexisting astigmatism and further divided into two sub-groups depending on corneal incision size. Detailed history was followed by visual Acuity and Ocular examination proper (Adnexa, conjunctiva, cornea, Anterior chamber, iris, pupil and lens). Detailed slit lamp was done to grade the cataract as cortical cataract, nuclear sclerosis, Posterior subcapsular cataract. IOP and best corrected visual acuity were also assessed. Pre operative keratometry and A scan were also done. On placing the incision at steep meridian there was a significant decrease in corneal astigmatism. The making of the incision in the steepest meridian causes corneal flattening in that meridian to reduce astigmatism.

INTRODUCTION

Cataract is one of the leading causes of curable blindness worldwide in the developing world accounting for approximately three-fourths of this type of blindness[1]. Astigmatism is a visually disabling refractive error affecting general population, especially those with cataract[2].

It is a refractive condition that occurs due to unequal curvatures of the cornea and the crystalline lens, decentration or tilting of the lens or unequal refractive indices across the crystalline lens[3] and in some cases alterations of the geometry of the posterior pole. In general, nearly 35-40% of the cataract patients have astigmatism >1.0D and 19-22% have astigmatism >1.5D[4-5].

Factors which affect postoperative visual acuity outcome in terms of astigmatism are preexisting corneal astigmatism, surgically induced astigmatism and post operative astigmatism. The visual outcome of surgery is mainly attributed to degree of post operative astigmatism which In turn depends on the type, length and position of incision and also on the method of wound closure. It has been proposed that by placing the incision on steep meridian cause reduction in surgically induced astigmatism. Placing the incision on steep meridian causes flattening in that meridian and a corresponding steepening in the opposite meridian to reduce the astigmatism[6-7]. Presently, standard coaxial phacoemulsification can be performed through a 2.8-3.2 mm incision. Corneal refractive changes following cataract surgery are related to the location and size of the corneal incision. Smaller incision has advantages of manipulating the cornea with minimal stress and injury to the surrounding tissues[8-10]. Thus giving an optically and morphologically better incision and better optical outcomes[11]. A significantly better control of astigmatism has been demonstrated related to the reduction in corneal incision size for over 3 mm to less than 2 mm resulting in a reduction in surgically induced astigmatism (SIA) and corneal aberrations[8-10].

MATERIALS AND METHODS:

Studybtype and design: This was a prospective, randomized comparative study.

Inclusion criteria: Patients aged between 50 and 80 years Patients with senile cataract with preoperative corneal astigmatism in range of 0.5-1.75D
Willing for follow up for 1 month.

Exclusion criteria: Pateints with oblique and irregular corneal astigmatism Patients with ocular surface disease like dry eye, corneal degeneration, pterygium, etc.Patients with post refractive surgery. Patients with cataract other than senile cataract like traumatic cataract, subluxated cataract, etc. Patients not giving informed consent were excluded from the study. This study comprised 160 eyes of 160 patients who underwent uneventful phacoemulsification using clear corneal incision on steeper axis. All the patients who satisfy the inclusion criteria were included in the study. The patients were enrolled into the study and written informed consent was taken from them by the investigator. Data regarding demographic parameters such as age, sex, occupation and address were noted on a predesigned proforma by the investigator at the time of first visit. Detailed history of following symptoms was noted

- H/O Diminution of vision RE/LE, Duration, Gradual/Sudden, Progression/static, Distant/Near vison, Painful/Painless.
- Watering
- Redness
- Discharge
- H/O wearing glasses
- H/O D.M, Hpyertension

History was followed by ocular examination that included

- V.A with Snellen's chart
- Ocular examination proper (Adnexa, conjunctiva, cornea, anterior chamber, iris, pupil and lens)
- Slit lamp examination to grade cataract
- Applanation tonometry
- Best corrected visual acuity
- Retinoscopy
- Ophthalmoscopy
- Pre operative keratometry
- A scan biometry
- Blood pressure
- Random Blood Sugar

All the patients were randomly divided into two groups according to the preexisting astigmatism and further divided into sub-groups according to size of clear corneal incision given

Group 1: Patients with vertical steep meridian (with the rule astigmatism (with steep axis at 70-110° i.e., 90±20°) in which superior clear corneal incison was given either pf 2.2 mm (sub-group A) or 2.8 mm size (sub-group B).

Group 2: Patients with horizontal steep meridian (against the rule astigmatism (with steep axis at either 160-180 or at 0-20°) in which temporal clear corneal incision was given either 2.2 mm (sub-group C) or 2.8 mm size (sub-group D). During the time of surgery,

Table 1: Comparison of pre-op parameters wrt Incision site in group 1

	Incision size			
Pre-operative	N	Mean	SD	p-value
Pre-op BCVA				
sub-group A (2.2 mm)	40	1.200	0.260	0.162
Sub-group B (2.8 mm)	40	1.28	0.27	0.162
ΔK				
Sub-group A (2.2 mm)	40	0.810	0.330	0.403
Sub-group B (2.8 mm)	40	0.750	0.330	0.403

Unpaired 't' test

depending on the steeperaxis, superior incision was marked or temporal incision was marked preoperatively. A clear corneal incision was made with either 2.2 and 2.8 mm keratome. The amplitude of preoperative astigmatism and postoperative astigmatism was calculated from the difference in keratometric values in the steeper meridian and flatter meridian (Table 1).

RESULTS

The table depicts that mean pre operative BCVA in 40 patients of sub-group A (2.2 mm incision size) of Group I was 1.20±0.26 logMAR whereas the mean pre operative BCVA in 40 patients of sub-group B (2.8 mm incision size) of Group I was 1.28±0.27 logMAR. This difference was not statistically significant with p-value = 0.162. The table also depicts that the mean preoperative corneal astigmatism in 40 patients of sub-group A (2.2 mm incision size) was 0.81±0.33 D whereas the mean preoperative corneal astigmatism in 40 patients of sub-group B (2.8 mm incision size) was 0.75±0.33 D (Table 2).

This difference was not statistically significant with p-value = 0.403. The above table depicts that the mean pre operative BCVA in 40 patients of sub-group C (2.2 mm incision size) was 1.24±0.26 logMAR wheras the mean pre operative BCVA in 40 patients of sub-group D (2.8 mm incision size) was 1.20±0.26 logMAR. This difference was not statistically significant with p-value = 0.538. The table also shows that the mean preoperative corneal astigmatism in 40 patients of sub-group C (2.2 mm incision size) was 0.85±0.33 D whereas the mean preoperative corneal astigmatism in 40 patients of sub- group D (2.8 mm incision size) was 0.78±0.32 D. This difference was not statistically significant with p-value
=0.311 (Table 3).

The above table depicts that the mean preoperative BCVA of sub-group A was 1.20±0.26 logMAR while post operatively after 1 month the mean BCVA was 0.08±0.10 logMAR. This change was statistically significant with p-value <0.001. The mean preoperative BCVA of sub-group B was 1.28±0.27 logMAR while post operatively after 1month the mean BCVA was 0.10±0.13 logMAR. This change was statistically significant with p-value < 0.001. The mean preoperative corneal astigmatism of sub-group A was

Table 2: Comparison pf pre-op parameters w.r.t incision size in group 2

	Incision size			
Pre-operative	N	Mean	SD	p-value
Pre-op bcva				
Sub-group C (2.2 mm)	40	1.24	0.26	0.538
Sub-group D (2.8 mm)	40	1.20	0.26	0.538
ΔK				
Subgroup C (2.2 mm)	40	0.85	0.26	0.311
Sub-group D (2.8 mm)	40	0.78	0.26	0.311

Unpaired "t" test

Table 3: Changes in parameters within different incision size categories in group 1 Sub-Group A (incision size 2.2 mm)

Parameters	N	Mean	SD	p-value
Pre-op BCVA	40	1.20	0.26	<0.001
BCVA at 1 month	40	0.08	0.10	<0.001
ΔK	40	0.81	0.33	<0.001
K at 1 month	40	0.24	0.20	<0.001

Unpaired "t" test

Table 4: Sub-Group B (incision size 2.B mm)

Parameter	N	Mean	SD	p-value
Pre-Op BCVA	40	1.28	0.27	<0.001
BCVA at 1 month	40	0.10	0.13	<0.001
ΔK	40	0.75	0.33	<0.001
K at 1 month	40	0.34	0.30	<0.001

Unpaired "t" test

Table 5: Changes in parameters within different incision size categories in Group 2 sub-group C (2.2 mm)

Parameter	N	Mean	SD	p-value
Pre-op BCVA	40	1.24	0.26	<0.001
BCVA at 1 month	40	0.05	0.10	<0.001
ΔK	40	0.85	0.33	<0.001
K at 1 month	40	0.26	0.27	<0.001

Table 6: Sub-group D (2.B mm)

Parameter	N	Mean	SD	p-value
Pre-op BCVA	40	1.20	0.26	<0.001
BCVA at 1 month	40	0.09	0.10	<0.001
ΔK	40	0.78	0.32	<0.001
K at 1 month	40	0.38	0.29	<0.001

0.81±0.33 D which postoperatively after 1 month decreased to 0.24±0.20 D. This decrease in mean corneal astigmatism was statistically significant with p-value<0.001 (Table 4).

The mean preoperative corneal astigmatism of sub-group B was 0.75±0.33 D which postoperatively after 1 month decreased to 0.34±0.30 D. This decrease in mean corneal astigmatism was statistically significant with p-value<0.001 (Table 5).

The above depicts that that the mean preoperative BCVA of sub-group C was 1.24±0.26 logMAR while post operatively after 1 month the mean BCVA was 0.05±0.10 logMAR. This change was statistically significant with p value <0.001. The mean preoperative BCVA of sub-group D was 1.20±0.26 logMAR while post operatively after 1month the mean BCVA was 0.09±0.10 logMAR. This change was statistically significant with p-value <0.001.

The table also shows that the mean preoperative corneal astigmatism of subgroup C was 0.85±0.33 D which postoperatively after 1 month decreased to 0.26±0.27 D. This decrease in mean corneal astigmatism was statistically significant with p-value<0.001. The mean preoperative corneal astigmatism of sub-group D was 0.78±0.32 D which

postoperatively after 1 month decreased to 0.38±0.29 D. This decrease in mean corneal astigmatism was statistically significant with p-value<0.001.

CONCLUSION

The present study was conducted on 160 eyes that underwent Phacoemulsification. The patients underwent Phacoemulsification with clear corneal incision of size 2.2-2.8 mm at either vertical steep meridian (Group I) or horizontal steep meridian (Group II) depending on the magnitude of pre-existing astigmatism. The following conclusions were drawn from the study. On placing the incision at steep meridian there was a significant decrease in corneal astigmatism. The making of the incision in the steepest meridian causes corneal flattening in that meridian to reduce astigmatism. In Group I (vertical steep meridian) with superior 2.2 mm size (sub-group A) clear corneal incision there was a significant postoperative change in corneal astigmatism compared to preoperative corneal astigmatism ($p<0.001$). Similarly, with superior 2.8 mm size (sub-group B) clear corneal incision there was a significant postoperative change in corneal astigmatism compared to preoperative corneal astigmatism ($p<0.001$). In Group II (horizontal steep meridian) with temporal 2.2 mm size (subgroup C) clear corneal incision there was a significant postoperative change in corneal astigmatism compared to preoperative corneal astigmatism ($p<0.001$). Similarly with temporal 2.8 mm size (sub- group D) clear corneal incision there was a significant postoperative change in corneal astigmatism ($p<0.001$).

There was no statistically significant difference in post operative corneal astigmatism between 2.2-2.8 mm at vertical steep meridian ($p = 0.077$). There was no statistically significant difference in post operative corneal astigmatism between 2.2 mm and 2.8 mm at horizontal steep meridian($p = 0.075$). Although there was more decrease in postoperative mean corneal astigmatism with 2.2 mm size incision than 2.8 mm size incision in both Groups I-II but this difference was not significant.

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