Original articles

Comparison of astigmatism following manual small incision cataract surgery: superior versus temporal approach

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Abstract

Introduction: Now-a-days, all techniques of cataract extraction are meant for giving the best uncorrected visual acuity and early post-operative rehabilitation**.**

Purpose: To compare astigmatism induced by the superior and temporal section in manual small incision cataract surgery (SICS) in the Indian population.

Materials and methods: One hundred and ten eyes were taken. Eyes having a steeper vertical keratometry reading were assigned to the superior SICS group whereas eyes with a steeper horizontal keratometry reading were assigned to the temporal SICS group. Eyes with no astigmatism were randomly assigned to either of the two groups. Both the groups had 54 eyes each. Eyes in Group 1 underwent manual SICS with a superior tunnel and eyes in Group 2 underwent manual SICS with a temporal tunnel. The patients were examined on postoperative Day1, 1 week, 45 days, and 3 months. Uncorrected and best-corrected visual acuity was recorded, slit-lamp examination, auto-refracto-meter and keratometry examinations were done. **Statistics:** All calculations were performed using surgically-induced astigmatism (SIA) Calculator version 1.0, a free software program.

Results: In Group 2, only 35 eyes out of 54 completed the follow-up of 90 days. The mean SIA in Group1 was found to be 1.45 ± 0.7387 and in Group 2 it was 0.75± 0.4067. The z score applied was found to be 5.7143. This value was more than the standard value, i.e.2.58. The p value accordingly was < 0.001, which is highly significant. The SIA induced by the superior incision was 48.28 % more than by the temporal incision.

Conclusion: SICS with the temporal approach provides a better stabilization of the refraction with a significantly less SIA than superior approach.

Key-words: astigmatism, small incision cataract surgery, temporal section, SIA

Introduction

Senile cataract is most important cause of reversible blindness in India and other developing countries (Brian et al, 2001). Now-a-days, all techniques of cataract extraction are being modified to give best uncorrected visual acuity and early rehabilitation (Venkatesh et al, 2005). In the same race conventional Extra Capsular Cataract Extraction (ECCE) was improved to manual Small Incision Cataract Surgery (SICS) and Phacoemulsification. Phacoemulsification was then done with smaller and

Received on: 07.06.2011 Accepted on: 16.10.2011
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smaller incision i.e. 3.2-0.9 mm with use of foldable IOLs. But this resulted in the procedure becoming expensive with use of high end machines. Eventually, for developing countries like India, manual SICS was affordable and had encouraging results (Gogate et al, 2007). Since then various modifications have been tried. It has been seen that frown incision offers minimal astigmatism in SICS (Singer, 1991). Various techniques of nucleus delivery have also been described like visco-expression (Corydon et al 1991), hydro-expression (Brierley, 1993), sandwich technique (Bayramlar et al, 1999); modified fish hook technique (Henning et al, 2003), use of ACM (Blumenthal et al, 1987), irrigating cannula (Nishi, 1986), and 2 Sinskey hook method (Rao et al, 2005). But it was seen that uncorrected visual acuity was decreased to 6/60. This was mostly due to postoperative induced astigmatism (Yorston et al, 2002).

In normal healthy eyes stiff upper tarsal plate causes pressure on cornea i.e. plus cylinder at 90Ú. With increasing age this pressure gradually decreases resulting in against the rule astigmatism (Lyle, 1971). There have been previous studies comparing phaco and SICS (Gogate et al, 2007; Sameen, 2009). Reddy et al (2007) studied comparison of astigmatism induced by superior and temporal section in SICS in Indian population but it had a smaller group of 64 patients only. Gokhale et al (2005) compared astigmatism induced by superior, supero-temporal and temporal incision in manual SICS. This study was hence taken to evaluate results in a wider population group in Indian scenario.

Material and methods

This was a prospective hospital based study conducted between July 2009-10. All surgeries were conducted at a tertiary eye care centre by two experienced surgeons. A total of 108 eyes were taken. Eyes having a steeper vertical keratometry reading were assigned to superior SICS group whereas the eyes with a steeper horizontal keratometry reading were assigned to temporal SICS group on the assumption that some flattening of the meridian occurs on which incision is given. Eyes with no astigmatism were randomly assigned to either of the two groups. Both the groups had 54 eyes each. Eyes in Group 1 underwent manual SICS with superior tunnel and eyes in Group 2 underwent manual SICS with temporal tunnel.

Patients with significant cataract between 45-60 years of age, controlled for diabetes and hypertension and without any cardiovascular disease were taken. Patients with associated glaucoma, traumatic cataract, pseudo-exfoliation, corneal scarring or degeneration, macular degeneration, diabetic or hypertensive retinopathy, more than 5 diopters of ametropia and patients having oblique astigmatism were excluded. All patients were properly examined with visual acuity recording by Snellen's E chart. Slit-lamp bio-microscopy, non-contact tonometry and fundus examination with 90 D or 78 D was done for all patients. Astigmatism was measured by autorefractometer and keratometer. IOL power was calculated with contact A-scan biometry using SRK II formula.

Preoperative investigations like complete hemogram, random blood sugar, urine routine and microscopy was done. Topical moxifloxacin 0.3 % eye drops were instilled once in every 2 hours for 24 hours before surgery. Topical tropicamide 1 % and non-steroidal anti-inflammatory eye drops instilled every 15 min 1 hour before surgery.

Patients were operated under peribulbar anesthesia with 4 cc of 3:1 mixture of injection Xylocaine 2 % and Injection Abocaine (bupivacaine 0.5 %), through button hole dissection at lateral one third of lower conjunctiva. The superior rectus (bridle) suture was given in superior approach but none in temporal approach. Fornix based conjunctival flap was made and peritomy was performed. A 6.5 mm scleral tunnel 1.5-2.0 mm posterior to limbus was made.

A three-plane incision was created with a 15 degree blade and crescent blade. The vertical incision was given in frown shape at sclera, posterior to limbus and a crescent blade was used to dissect 1 to 2

mm into clear cornea to form a tunnel. Side port was made and anterior chamber was filled with Viscoelastic solution (Hydroxy Propyl Methyl Cellulose 2 %), and capsulorrhexis performed with cystitome made from 26 gauge needle. Entry into the anterior chamber was made with a sharp 3.2mm keratome to create a self sealing corneal valve. The internal opening was slightly more than the external one (upto 1 mm more) and made by the same 3.2 mm keratome to facilitate the delivery of nucleus. For hard and large nucleus, the incision was enlarged to 7mm. Hydro-dissection and delineation was performed with ringer-lactate solution. Hydrodissection was continued until the upper pole of the nucleus prolapsed out of capsular bag. Through the scleral tunnel, irrigating wire vectis was passed under the nucleus in the capsular bag, and the nucleus was delivered directly by pulling the vectis out slightly depressing the scleral side of incision. The cortical matter was aspirated with simcoe two way irrigation and aspiration cannula. In the presence of a Viscoelastic solution, a rigid posterior chamber 5.5 mm to 6.5 mm PMMA intraocular lens (as per the size of corneal wound) was implanted in the posterior chamber with the leading haptic facing obliquely underneath the anterior capsular rim. The IOL was positioned in the capsular bag with the help of a dialer. The Visco solution was removed from anterior chamber by irrigation with ringerlactate using Simcoe cannula. Corneal stromal hydration was performed at the wound edges and the wound was left unstitched as the corneal tunnel was self sealing. Sub-conjunctival injection Gentamicin 20 mg mixed with Dexamethasone 4mg was injected in the lower fornix. The eye was bandaged for 24 hours. Post-operative oral antibiotic and analgesic were given. Patients were examined on post-operative Day 1, 1week, 1.5 months (45 days) and 3 months (90 days). Uncorrected and best corrected visual acuity was recorded, slit-lamp examination, autorefractometer and keratometry examination were done.

All calculations were performed using surgically induced astigmatism (SIA) Calculator version 1.0, a free software program. Surgically induced astigmatism was calculated from pre and postoperative keratometric values as described by Holladay et al (1998). The suggested modifications of the rectangular coordinate method was programmed into a computerized spread sheet and used to calculate surgical astigmatism.

Results

Total of 108 eyes were operated. 54 eyes were in group1 (Superior incision). However in group 2, only 35 eyes out of 54 completed the follow up of 90 days. Distribution of patients according to age is mentioned in the table below.

Table-1
Patients' age

Age (years)	No of patients	% (n=89)
40-50	29	32.5
51-60	25	28
61-70	29	32.5
71-80	6	6.74

Out of 54 eyes in group 1, 29 were right eye and 25 were left eye. In group 2, there were 21 right eyes and 14 left eye. Distribution according to the eye operated and mean surgically induced astigmatism (SIA) in each type is described in the table below.

Table 2
Surgically induced astigmatism (SIA)

Incision location	Surgically induced astigmatism (SIA)	Number of patients
Superior	1.45 ± 0.7387	54
Temporal	0.75± 0.4067	35
Mean SIA	1.2 ± SD	108

The mean SIA in group 1 was found to be 1.45 ± 0.7387 and in group 2 was 0.75± 0.4067. Z score was applied to compare the two groups. It was found to be 5.7143. This value was more than standard value i.e.2.58. P value accordingly was < 0.001 which is highly significant. SIA induced by superior incision was 48.28 % more than temporal incision.

Surgically induced astigmatism in superior tunnel group was statistically not significant between right and left eyes. Same was the scenario with Tempo-

ral Incision group.

Discussion

Despite excellent facilities and skilled surgeons, people in the developing world are deprived of the visual benefits of the IOL because of inability to afford (Malik et al , 2003). The suture less manual extra capsular cataract extraction (ECCE) technique, the first choice alternative to Phacoemulsification, gives visual results equivalent to Phacoemulsification at lower expenses. Recent studies have shown that suture less ECCE is economical and has more benefits than conventional ECCE (Gogate et al, 2003).

Manual SICS is an alternative for phacoemulsification but the astigmatism is higher due to the larger size of incision. Burgansky et al have shown an increase in astigmatism with an increase in incision size (Burgansky et al, 2002). In their study by vector analysis, the mean induced astigmatism was 0.6 ± 0.3 D for 6 mm incision, 0.75 ± 0.67 D for a 6.5 mm incision and 1.36 ± 0.77 D for a 7 mm incision. Kimura et al have shown by vector analysis that surgically induced astigmatism is less with an oblique incision (1.02 ± 0.66 D) than with a superior incision (1.41 ± 0.72 D) (Kimura et al, 1999). Pre-existing astigmatism can be neutralized by changing site of incision.

The temporal location is farthest from the visual axis and any flattening due to the 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 forces are neutralized better with temporally placed incisions because the incision is parallel to the vector of the forces. With the rule astigmatism induced by a temporal incision is advantageous because most elderly cataract patients have preoperative against the rule astigmatism.

In study by Gokhale et al (2005), SIA vector in superior group was 1.28D, 0.2D in superotemporal and 0.37D in temporal group.Our study also showed similar results with superior group having SIA vector of1.45D and temporal group with SIA vector of 0.75D

Conclusion

SICS with temporal approach provides better stabilization of refraction with significantly less SIA than superior approach. The pre and postoperative complications are similar in both approaches.

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Source of support: nil. Conflict of interest: none