Correction of pre-operative astigmatism by on-axis clear corneal incision in Phacoemulsification

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The two main determinants of the refractive state of the eye following phacoemulsification and intraocular lens implantation are IOL power and surgically induced astigmatism

(SIA). Factors such as wound location and architecture are important predictors of SIA.1-2 Studies on the use of 3.5-mm to 4-mm corneal incisions in phacoemulsification have led to the conclusion that superior and nasal locations induce greater refractive changes than temporal corneal incision,3-4 and this effect could be intentionally used by the surgeon to reduce or treat preexisting astigmatism.5 Recent evidence indicates that a small 2.8-mm clear corneal incision induces little refractive change, at least in eyes with low preoperative corneal cylinder, regardless of incision site.6 However, a retrospective study describes larger changes induced by superior rather than temporal 2.8-mm incision, which had been considered nearly astigmatism neutral. 7 This study compares the short and intermediate term astigmatic outcomes of temporal versus superior clear corneal on-axis phacoemulsification incisions.

METHODS

This prospective clinical trial included a consecutive series of 60 patients with senile cataracts with 30 patients scheduled for Phacoemulsification with foldable IOL with a superior incision (group A) & 30 patients with temporal incision (Group B). Inclusion criterion was astigmatism of upto 1D . Exclusion criteria consisted of previous ocular surgery, presence of corneal pathology, pseudoexfoliation and astigmatism (WTR or ATR) exceeding 1 diopter (D). Patients with diabetes mellitus, connective tissue disease and those taking systemic steroids were also excluded. All procedures were performed at Subharti Medical College, Meerut, India by a single experienced surgeon using the same technique under topical anesthesia.

Based on the axis of the cylindrical component of refractive error according to keratometric reading, superior (for with-the-rule astigmatism) or temporal (for against-the-rule astigmatism) a triplanar, 2.8 mm horizontal corneal Incision was constructed . First a half-depth perpendicular groove incision was made using a 15° stab knife followed by lamellar dissection 2.0 mm into clear cornea by using a sharp crescent knife, entry is made with the help of a disposable 2.8mm keratome. After phacoemulsification and cortex removal, a 6 mm hydrophobic acrylic foldable IOL was inserted using an injector system, the anterior chamber was formed and the wound was checked for leakage and left unsutured.

Postoperative examinations were conducted 1, 2, 7 and 28 days, and 6 months after the procedure. Uncorrected visual acuity and best corrected visual acuity (BCVA) were measured and keratometry was performed at each followup visit. Main outcome measures included keratometric astigmatism and SIA calculated by the vector analysis formula using the Holladay-Cravy-Koch formula. Data were compared between the two study groups using Mann-Whitney and t-tests with statistical significance set at 5%.

RESULTS

Overall 60 eyes of 60 patients including 34 (56.7%) female and 26 (43.3%) male subjects with mean age of 64.6 ± 9.2 (range 52-85) years underwent clear corneal phacoemulsification and intraocular lens implantation . The two study groups did not differ significantly in terms of age . Consequently 30 eyes underwent temporal phacoemulsification and 30 eyes underwent superior phacoemulsification.

Mean preoperative keratometric astigmatism was 0.80±0.28 D in the superior and 0.68±0.29 D in the temporal group (P=0.08). SIA at 1 week, 4 weeks and 6 months postoperatively was 0.96±0.17 D versus 0.75±0.15 D (P<0.001), 0.83±0.12 D versus 0.69±0.11 D (P<0.001), and 0.73±0.15 D versus 0.51±0.10 D (P<0.001) in the superior versus temporal groups respectively. In both groups the amount of SIA at sixth months was much lower than the initial visit (P<0.001).Mean keratometric

astigmatism at 6 months postoperatively was 0.07±0.03 D versus 0.17±0.12 D. Despite the significant differences in keratometric and surgically induced astigmatism, BCVA was comparable in both the study groups.

DISSCUSION

Patients undergoing cataract surgery expect clear vision and less dependence on spectacles.

To attain this goal, one important consideration is reduction of astigmatism. Different methods have been used to correct pre-existing astigmatism during cataract surgery. The simplicity and usefulness of clear corneal on-axis incisions cannot be assessed without considering the other options of astigmatic correction in cataract surgery. Astigmatic keratotomy, is an alternative which entails drawbacks such as glare sensation, diplopia and fluctuation of refractive error due to proximity of the incisions to the center cornea. In addition, it requires preoperative pachymetry and use of a diamond knife.8 Corneal relaxing incisions are another method for correction of pre-existing corneal astigmatism. However, this method also suffers from limitations such as requiring pachymetry and use of a diamond knife.9 Implantation of toric IOLs is another option, however these lenses are expensive and their implantation requires additional skills; moreover, postoperative rotation remains a major drawback. Excimer laser ablation may also be used to correct residual or induced astigmatism after cataract surgery. Major concerns include the cost of the procedure, limited number of centers equipped with excimer machines, adverse effects specific to excimer laser surgery such as loss of BCVA, flap related complications, night vision disturbances and regression.10Tejedor J,et al reported that Temporal corneal incisions created less surgically induced astigmatism than those placed superiorly ,mean degree of surgically induced astigmatism was <0.25 diopters for temporal incisions & between 0.25 to 0.75 diopters for superiorly placed incisions. The results obtained in the current study are in a marginally higher range than previously reported.11

CONCLUSION

Keeping in mind the expected degree of corneal astigmatism created by 2.8mm keratomes will allow surgeons who use this size incision to estimate the effect of the incision itself on the corneal curvature. When patients have pre-existing astigmatism and it is desired to minimize the degree of postoperative astigmatism, performing surgery in the steep meridian can be beneficial. Knowledge of these principles is also useful in the preoperative assessment and surgical decision-making when using toric intraocular lenses. In conclusion, clear corneal on-axis incisions are useful for correcting mild to moderate pre-existing astigmatism during cataract surgery. Employing this technique during routine phacoemulsification using a 2.8mm mm incision does not require additional instruments and therefore can be performed without altering the surgical setting.

To summarise, in eyes with mild to moderate astigmatism , on-axis CCI phacoemulsification lead to partial to complete correction. Hence it can be utilized as a simple tool to correct mild to moderate astigmatism & also provides excellent UCVA.

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