Original article

Comparison of preoperative and postoperative corneal astigmatism after phacoemulsification through a 2.8mm clear corneal temporal incision.

Joshi SN[1], Pant M[2], Rijal S[3], Bhattarai D[4]

[1]B P Koirala Lions Centre for Ophthalmic Studies, Institute of Medicine, Kathmandu, Nepal

[2]Department of Ophthalmology, Om Hospital and Research Center (P) Ltd., Kathmandu, Nepal

[3]Children's Hospital for Eye, ENT and Rehabilitation Services (CHEERS), Bhaktapur, Nepal

[4]School of Optometry and Vision Science, Queensland University of Technology, Australia

Corresponding Author: Dr. Sagun Narayan Joshi

Email: sagun.j3@gmail.com

Abstract

Introduction: Phacoemulsification with foldable intraocular lens implantation through clear corneal incision has become common surgical approach for cataract surgery because it produces minimal surgically induced astigmatism and provides best postoperative visual acuity. This study thus aims to compare the preoperative and postoperative corneal astigmatism and to compare the postoperative change in keratometric astigmatism between right and left eyes after temporal 2.8 mm clear corneal incision phacoemulsification cataract surgery and implantation of foldable intraocular lenses.

Methods: A prospective study included 31 patients with bilateral senile cataract who had undergone sutureless, 2.8mm clear corneal incision phacoemulsification cataract surgery with foldable intraocular lens implantation. Keratometry was recorded preoperatively and 4 weeks postoperatively using Nidek automated keratometry. A paired sample t-test was performed to compare the preoperative and postoperative corneal astigmatism.

Results: Mean age of the population was 63.39±9.705 years (range: 49 to 83 years). Before surgery, mean corneal astigmatism in right and left eye was 0.92 ± 0.58D and 0.85 ± 0.61D respectively. After the surgery, mean astigmatism in right eye was 0.97 ± 0.51D and in left eye was 0.97 ± 0.48D. There was no statistically significant difference in preoperative and postoperative keratometric astigmatism of both eyes. (RE: p-valve 0.427; LE: p-valve 0.188)

Conclusion: Temporal clear corneal incision is quite stable and has minimal effect to corneal astigmatism.

Keywords: Cataract, Clear Corneal Incision, Corneal Astigmatism, Phacoemulsification

Introduction

Cataract is defined as loss of transparency of the natural lens which causes gradual and progressive loss of vision, if untreated, can lead to blindness. It is the leading cause of avoidable blindness in the world which could be treated with several surgical approaches[1]. Of them, phacoemulsification is the most preferred technique[1,2]. Phacoemulsification cataract extraction with foldable intraocular lens (IOL) implantation provides rapid and stable optical recovery, best possible uncorrected visual acuity, minimal postoperative complications and increased patient satisfaction[3-6]. Nowadays, cataract surgeries by phacoemulsification through clear corneal incision (CCI) have become the preferred method because it is less time consuming and doesn't require cauterization or wound suturing which leads to increased safety, decreased pain, inflammation and surgically induced astigmatism[5,7]. Cataract surgery with IOL implantation is consequently considered as refractive surgery which should optimize the final visual outcome and decrease the spectacles dependence by minimizing the postoperative astigmatism8. Postoperative visual acuity is primarily affected by pre-existing and surgically induced astigmatism (SIA)[4,8]. Smaller incision is associated with less surgically induced change in corneal counter[3]. SIA is influenced by type of surgery, size, shape, site of the incision and suture use[5-7,9]. CCI has been widely reported to produce minimal SIA[9].

Different studies have shown that the incision placed

on the steep corneal axis can correct small amount of astigmatism depending upon the location of the axis. Temporal corneal incision induces less corneal astigmatism than superior, nasal, and oblique incision because it causes no upper eyelid pressure over the incision and the intraocular pressure (IOP) valve effect over the incision resulted in fast healing[5,9-13]. Also, 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[12].

The aim of this study is to compare preoperative and postoperative corneal astigmatism and to compare the postoperative change in keratometric astigmatism between right and left eyes after temporal 2.8 mm CCI phacoemulsification cataract surgery.

Methods

This prospective study included 31 patients with bilateral senile cataract who had underwent sutureless, 2.8mm CCI phacoemulsification cataract surgery with foldable IOL implantation. The cases were collected from June 2015 to December 2015. All surgeries were performed by same surgeon at a private eye clinic. Informed consent was obtained from each patients and study adhered to the tenets of the Declaration of Helsinki.

Patients with a history of previous ocular surgery or disease that affected corneal refraction such as pterygium, corneal scar were excluded. In addition, patients with oblique or irregular astigmatism were excluded.

All eyes were examined by digital autokerato-refractometer (Nidek ARK 560A) preoperatively and four weeks postoperatively. IOL power calculation was performed using A-scan ultrasonography for axial length measurements.

In all cases, pupil was dilated using a 1% tropicamide and 2.5% phenylephrine hydrochoride eye drop before the surgery. An anterior 2.8mm CCI was made temporally with 2.8 mm keratome blade in all the cases. A two-step CCI was made and anterior chamber was entered 2 mm from the site of the initial incision in all the cases. A 1mm CCI was made at 2 clock hours to the left of corneal incision as a side port. Single piece foldable IOL was implanted into a capsular bag with the help of an injector system.

All patients were treated postoperatively with a combination of 1% prednisolone acetate two hourly for the first week and then six hourly over the three subsequent weeks and ofloxacin 0.3% six hourly from the day of surgery for four weeks.

Follow up evaluation of astigmatism was performed. Corneal astigmatism is determined by simple subtraction of vertical power with horizontal power. Change in keratometric cylinder was calculated by scalar method, in which preoperative astigmatism is directly subtracted from postoperative astigmatism. If postoperative astigmatism is less than pre-operative astigmatism, change in astigmatism is denoted with negative sign and if postoperative astigmatism is greater than pre-operative astigmatism, change in astigmatism is denoted with positive sign.

All data were entered in SPSS version 20.0 (IBM Corp, Armonk, NY, USA) for analysis. A paired sample t-test was performed to compare the preoperative and postoperative corneal astigmatism. Pearson correlation coefficient was calculated to correlate change in astigmatism after cataract surgery in right and left eye. A p-value ≤ 0.05 was considered statistically significant.

Results

Among 31 patients, 20 were female and 11 were male. Mean age of the population was 63.39±9.705 years (range: 49 to 83 years). Mean preoperative corneal astigmatism in right and left eye was 0.92 ± 0.58D and 0.85 ± 0.61D respectively. Mean postoperative astigmatism was 0.97 ± 0.51D in right eye and 0.97 ± 0.48D in left eye. There was no statistically significant difference in preoperative and postoperative keratometric astigmatism of both eyes. (Table 1)

Table 1. Mean preoperative and postoperative corneal astigmatism in right and left eye.

Mean preoperative and postoperative corneal astigmatism			
	Total astigmatism (mean±SD)		P value*
	Preoperative	Postoperative	
Right eye	0.92 ± 0.58D	0.97 ± 0.51D	0.427
Left eye	0.85 ± 0.61D	0.97 ± 0.48D	0.188

*Paired sample t-test, SD: Standard deviation

In right eye, 12 patients had less, 1 patient had equal and 18 patients had greater postoperative astigmatism than preoperative astigmatism. In left eye, 12 patients had less and 19 patients had greater astigmatism than preoperative astigmatism.

Mean change in keratometric astigmatism in right and left eyes were 0.08 ± 0.36D and 0.11 ± 0.47D respectively.

Change in corneal astigmatism after surgery for right and left eyes was found to be significantly correlated (r=.52, p = .003). (Figure 1)

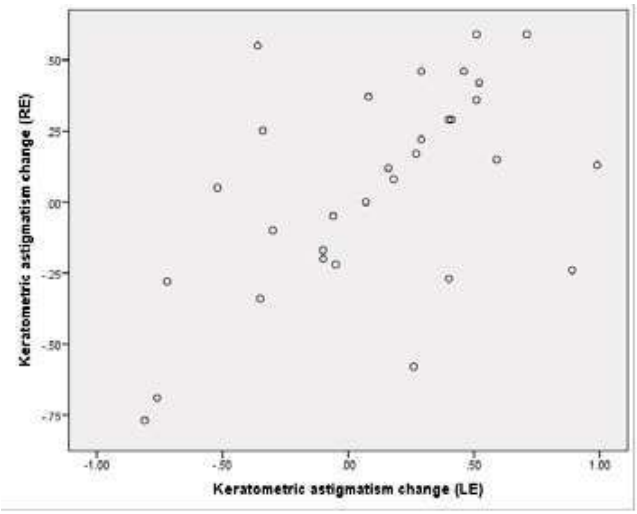

Figure 1. Correlation between change in corneal astigmatism after surgery for right and left eye.

Discussion

In our study, all cataract surgeries were performed by the same surgeon and was intended to compare the corneal astigmatism of right and left eyes of same patient who had underwent temporal CCI of 2.8mm size.

Mean age of patients in our study was 63.39 ± 9.705 years (range: 49 to 83 years) which was taken into account because people of this age group commonly has against the rule (ATR) astigmatism[4]. When the preoperative corneal astigmatism is significant, incision can be placed on the steeper corneal meridian to reduce overall postoperative astigmatism[4]. In young people, usually cornea is steeper in its vertical meridian, i.e. with the rule (WTR) (horizontal negative cylinder). With the advancing age there is a shift to ATR astigmatism (horizontal positive cylinder) [4] therefore, WTR astigmatism induced by a temporal incision is advantageous[12,13]. A study was conducted by Ermis SS et al.5 has nearly similar age group (mean: 64.3 years) of patients. Other studies conducted by, Masnec-Paskvalin S et al.[7], Yoon JH et al.[14] , Simsek S. et al[10], Huang FC et al.[15], and Barequet IS et al.[9] has mean age of 66, 66.2, 66.45, 67.6, and 73 years respectively.

In our study, mean preoperative corneal astigmatism in right and left eye was 0.92 ± 0.58D and 0.85 ± 0.61D respectively which is not statistically significant (p-value 0.304). Also, mean postoperative astigmatism after 1 month in right and left eye was nearly similar i.e. 0.97 ± 0.51D and 0.97 ± 0.48D respectively (p-value 0.912). Corneal astigmatism in left eye was increased slightly greater than right eye postoperatively but there was no statistically significant increase in corneal astigmatism in both eyes. (RE: p-valve 0.313; LE: p-valve 0.179)

Yoon JH et al.[14] had conducted a similar research in right eye in which preoperative and postoperative corneal astigmatism was 0.71 ± 0.43D and 0.78 ± 0.67D respectively which was also not statistically significant. Another study done by Pakravan M et al.[16] in right eye shows preoperative and postoperative astigmatism of 0.63 ± 0.48D and 0.73 ± 0.46D respectively which shows similarity with our findings. Whereas, a study conducted by Barequet IS et al.[9] in right eye shows significant increase in keratometric astigmatism from preoperative 0.78 ± 0.70D to postoperative 1.20 ± 1.07D.

Simsek S. et al.[10] had conducted a similar study in left eye which shows increase in corneal astigmatism from 0.65 ± 0.20D preoperatively to 0.93 ± 0.26D postoperatively. Temporal incision was given in both eyes in a study by Yongqi H et al.[17] also shows significant change in corneal astigmatism in which preoperative and postoperative astigmatism was 0.89 ± 0.42D and 1.56 ± 0.94D respectively.

Various other studies in which superotemporal incision was given shows slight to significant increase in astigmatism after surgery. A study conducted by Ermis SS et al.[5] and N. S et al.[3] depicts preoperative astigmatism 0.82 ± 0.40D and 0.72 ± 0.57D, and postoperative astigmatism 0.93 ± 0.51D and 1.06 ± 0.83D respectively. Anwar et al.[4] had also found increase in corneal astigmatism following superotemporal incision in both with-the-rule (WTR) and against-the-rule astigmatism (ATR) group. Preoperative astigmatism in WTR and ATR group was 0.83D and 0.76D respectively whereas, postoperative astigmatism in both group was 1.10D.

In our research, change in corneal astigmatism was calculated by simple subtraction of preoperative from postoperative astigmatism. If postoperative astigmatism is less than preoperative astigmatism, it is denoted by negative sign and if postoperative astigmatism is greater than preoperative astigmatism, it is denoted by positive sign. Mean change in keratometric astigmatism in right and left eyes were found to be 0.08 ± 0.36D and 0.11 ± .47D respectively which shows there is no significant difference in change in astigmatism after temporal incision in both eyes. A study conducted by Huang FC et al.[15] suggest there was slight reduction in mean keratometric value (-0.12 ± 0.78) after surgery. A study conducted by Anwar et al.[4] shows mean increase in astigmatism postoperatively, 0.27 in WTR astigmatism group and 0.34 in ATR astigmatism group.

Conclusion

A 2.8mm temporal clear corneal incision has minimal effect to corneal astigmatism when followed up over a month and effect of temporal incision in right and left eyes is almost equal. In this study, corneal astigmatism change was calculated directly with simple subtraction method but to find out change in corneal astigmatism which is caused by surgery, a further studies are needed which will calculate surgically induced astigmatism after surgery.

Conflict of interest: None declared

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