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Astigmatism Correction in Cataract Surgery with Foldable Toric IOL

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Abstract

Aim: To evaluate correction of pre-existing astigmatism after foldable Toric IOL implantation in patients undergoing cataract surgery. **Materal & Methods:** In this prospective observational study we included 10 eyes of 10 patients with astigmatism between 2.00D to 6.00D &undergoing cataract surgery. Phacoemulsification was performed with Toric IOL implantation through 2.8mm clear corneal temporal incision. Patients were examined post operatively for Uncorrected Visual Acuity (UCVA), Best Corrected Visual Acuity (BCVA) & residual refractive astigmatism. **Statistical Analysis:** Statistical analysis was performed by the SPSS program for Windows, ver.16.0.Continuous variables are expressed as mean ± SD, and categorical variables are presented as absolute numbers and percentage. For the statistical test, a p value less than 0.05 was taken to indicate a significant difference. **Results:** The UCVA was 6/9 or better in 90% of eyes. 80% eyes achieved 6/6 BCVA. The mean refractive cylinder corrected from -3.4 ± 1.4 D to -0.60 ± 0.27 D which was statistically significant. (p value=0.0001). **Conclusion:** Toric IOL implantation is an effective, safe surgical option to manage pre-existing corneal astigmatism during cataract surgery.

Keywords: Astigmatism, Cataract Surgery, Toric IOL

1. Introduction

Pre-existing corneal astigmatism is an important limiting factor for optimal results of cataract surgery in a significant number of patients. It has been estimated that 15% to 29% of patients with cataract have more than 1.50 dioptres (D) of pre-existing astigmatism[1,2] .

Pre-existing astigmatism continues to limit post-operative unaided visual acuity as standard IOL only correct spherical component. Treatment of astigmatism with toric IOL implantation has theoretic advantages over that of kerato refractive procedures, as it does not require additional corneal manipulation & are free from complications like pain, flap complications. Selective positioning of the phacoemulsification incision, corneal relaxing incisions, limbal relaxing incisions, lacks precision, are unpredictable, have limited range & can regress. Spectacles & contact lenses can correct astigmatism but are associated with cosmetic and lifestyle issues. Discovered by Shimizu et al.[3] in 1994, Toric IOL implantation is another valuable option for astigmatism correction in cataract patients.

The procedure of small incision cataract extraction and toric IOL implantation remains the same. Toric IOL

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implantation differs from traditional surgery in marking the proper axis on the cornea or limbus and implanting an IOL at that axis. One of the factors determining the uncorrected distance visual acuity is rotational stability of Toric lens within the bag. It is observed that cylindrical correction of toric IOL reduces by 3.3% for each degree of rotation & the toric power is lost entirely when rotation is 30° [4,5]. Cataract surgery is now commonly referred as refractive cataract surgery because of the shift to smaller incisions, the management of corneal astigmatism & accurate Intraocular Lens (IOL) power calculations. Incisions used for phacoemulsification induce less astigmatism as incision size decrease[6,7]. Correction of astigmatism offers the possibility of yielding better Uncorrected Visual Acuity (UCVA) in cataract patients.

This study describes clinical experience with a foldable, injectable toric IOL designed to correct both spherical and astigmatic components of aphakia.

2. Material and Methods

In our study we included 10 eyes of 10 patients who had senile cataract of varying grades. Informed consent was taken. The preoperative evaluation included assessment of best corrected visual acuity, slit lamp examination, applanation tonometry, fundoscopy. The amount of corneal astigmatism to be corrected was determined by automated keratometry.

All patients received toric IOL implantation during cataract surgery. Inclusion criteria included cataract, age between 50 and 80 years, and preoperative regular corneal astigmatism between 2.00 D to 6.00D. Exclusion criteria included preoperative astigmatism greater than 6.00 D, history of glaucoma or retinal detachment, corneal disease, previous corneal or intraocular surgery, abnormal iris, pupil deformation, macular degeneration or retinopathy, neuro-ophthalmic diseases, and history of ocular inflammation. Corneal topography was done in each patient to rule out irregular astigmatism. Intraocular lens cylinder power and alignment axis were calculated using an on linetoric IOL calculator program (www.acrysoftoriccalculator.com).

With the patient in an upright position, the corneal limbus was marked at the 0-degree and 180-degree positions with a sterile marker. On the surgical table, the steep corneal meridian was marked using a Marquez gauge with the aid of the preplaced reference points. All patients underwent phacoemulsification surgery through clear corneal 2.8mm temporal incision. The IOL axis was aligned with the marked steep corneal meridian.

All the surgeries were performed by same surgeon under topical anaesthesia. No additional procedure in the form of Limbal relaxing incision was performed in any case. All patients were discharged on topical steroid and antibiotic eye drops. The treatment was continued over 6 weeks. Postoperative assessment was made at 1 week, 1 month and 3 months, and uncorrected visual acuity, best corrected visual acuity and residual refractive astigmatism were recorded on each visit.

3. Statistical Analysis

Statistical analysis was performed by the SPSS program for Windows, ver.16.0.Continuous variables are expressed as mean ± SD, and categorical variables are presented as absolute numbers and percentage. For the statistical test, a p value less than 0.05 was taken to indicate a significant difference.

4. Results

The purpose of this study was to improve postoperative visual quality of patients and to evaluate effect of toric IOL implantation in the reduction of pre-existing corneal astigmatism.

Visual acuity

3 months postoperatively, the mean UCVA was 0.17 ± 0.13.The mean BCVA improved to 0.03 ± 0.07 (Tables 1, 2). The UCVA was 6/9 or better in 90% of eyes. 80% eyes achieved 6/6 BCVA. In one eye UCVA was 6/18 because of rotational instability of toric iol which improved to 6/9 after best correction.

Refractive outcome

It was measured in terms of residual postoperative astigmatism. There was a significant reduction in refractive astigmatism after toric IOL implantation. The mean preoperative astigmatism was reduced from -3.4 ± 1.4 D to -0.60 ± 0.27 D which was statistically significant (p=0.0001) (Figure 1).

5. Discussion

The toric IOLs are one of the surgical options to correct corneal astigmatism in patients undergoing cataract

Table 1. Patients Demographics

Parameters	Value
Patients	10
Mean age	62± 6.09 yrs
Sex(Male/Female)	6/4
Eyes(n)	10
Mean Preoperative sphere Range	0.78 ± 0.25 -1.00 to +1.25D
Mean Preoperative cylinder Range	-3.40± 1.41 -2.00 to -6.00D
Mean Preoperative Keratometry	K1 45.12 ± 1.82D K243.50 ± 2.93D

Table 2.

Parameter	Preoperative	Postoperative
UCVA(logmar)	-	0.17 ± 0.13
BCVA(logmar)	0.61 ± 0.17	0.03 ± 0.07
Refractive Sphere(D)	0.78 ± 0.25	0.45 ± 0.11
Refractive Cylinder(D)	-3.4± 1.4	-0.6 ± 0.27

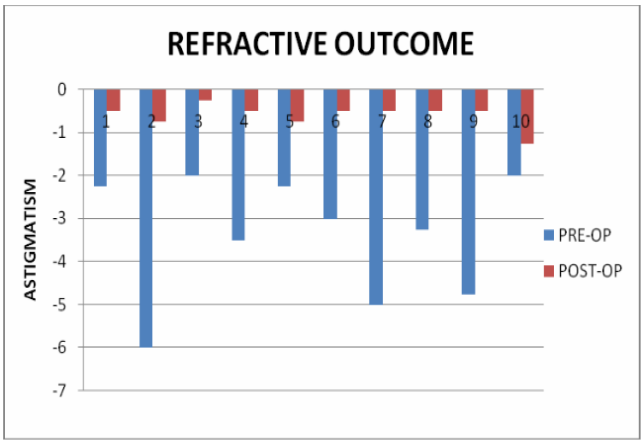

Figure 1. Changes in refractive astigmatism.

surgery. Toric IOLs allow correction of astigmatism without compromising the integrity of the cornea.

The post-operative astigmatism reduction (Figures 2 and 3) and visual acuity outcomes after toric IOL implant depend on several factors like preoperative astigmatism, accurate corneal astigmatism measurements, IOL axis placement & rotational stability. Accurate corneal astigmatism measurements are required to determine the actual amount of cylinder requiring correction and the spherical power of the IOL. Toric IOL calculation is made using a manufacturer IOL program that gives power of IOL & implantation axis.

In this prospective observational study we implanted a foldable toric IOL in 10 eyes of 10 patients with pre-existing corneal astigmatism between 2.00 D - 6.00D. In our study, after 3 months follow up,90% of patients achieved 6/9 or better UCVA. Similar results were seen in study by Noel J.C. et al.[8] who observed that more than 90% patients achieved a UCVA of 6/12 or better and almost 80% achieved a UCVA of 6/9 or better in eyes receiving toric IOL implantation. In a study by Sun et al.[9] 84% of eyes achieved 20/40 or better UCVA after Toric IOL implantation.

The study found a significant reduction in absolute residual refractive cylinder. (p=0.0001). Patients achieved 77% reduction in astigmatism. The mean preoperative astigmatism was reduced from -3.4 ± 1.4 D to -0.60 ± 0.27 D.

Till et al.[10] report 81% reduction after Toric IOL implantation (mean preoperative corneal astigmatism 2.11 ± 0.90 D). In another study by Chang,[11] the reduction was approximately 75% after toric IOL

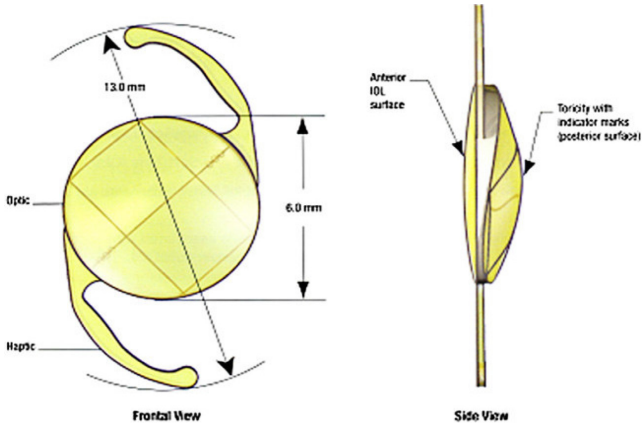

Figure 2. ToricIOL[8].

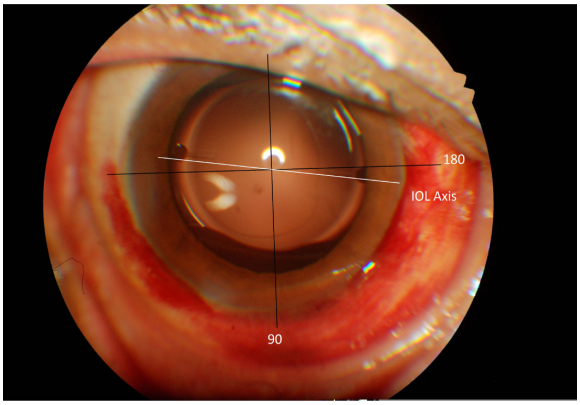

Figure 3. Toric IOL in situ.

implantation (mean preoperative refractive astigmatism 3.68 ± 1.38 D).

Except in one eye in which while implanting IOL leading haptic did not open inspite of all monouvers and IOL axis shifted by 10 degrees, all other surgeries went uneventful.

The results in our study conclude thattoric IOL implantation is an effective , safe surgical option to manage pre-existing corneal astigmatism during cataract surgery.

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