A Clinical Study to Compare the Accuracy of Digital and Manual Marking for Toric IOL Alignment

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ABSTRACT

Introduction: Cataract surgery now a days is a refractive surgery. For cataract patients with regular astigmatism, toric IOL (Intraocular lens) provide the potential for better uncorrected visual acuity than they ever had. The prevalence of corneal astigmatism more than 1.5 dioptres (D) ranges between 15% and 30% as reported by different studies. The aim of the present study was to compare the clinical outcome of digital and manual marking for toric IOL alignment.

Material and Methods: The present study is randomized controlled trial study carried out at tertiary eye care hospital at Bareilly to find out residual astigmatism in patients in whom toric IOL were implanted in period from January 2016 – December 2016.

Outcome measures: The best corrected visual acuity along with residual astigmatism was noted. Degree of rotation of IOL post-operatively was also noted.

Results: During our study, there was no statistical difference between the two marking techniques and both of them induced almost similar amount of error.

Conclusion: We found in our study that both the marking techniques produced almost similar results. Instead of going for newer techniques which are very costly these techniques produce comparable results.

Keywords: toric marking, residual astigmatism, toric overlay, digital marking.

INTRODUCTION

For surgeons though toric lenses pose a challenge because even small errors in an IOL position may significantly affect the patient's uncorrected visual acuity more so than they would with a spherical IOL. 'For every one degree of error in a toric IOL rotational alignment there is a 3.3% decrease in correction of astigmatism.[1-6]

There are several methods for treating coexisting astigmatism in patients undergoing cataract surgery. These methods include steep meridian incision,[7,8] opposite clear corneal incisions[9-11], toric intraocular lens (IOL)[12-14] and limbal or corneal relaxing incisions.[14-16] Nowadays, femtosecond laser platforms can improve the precision of corneal incisions.[17-19]

Significant errors may be introduced into the process of toric IOL implantation at various steps. These are preoperative measurement errors. Incorrect placement of the IOL. Failure to take into account the impact of surgically induced astigmatism. For example by tilting the patients head during preoperative corneal topography (In sitting position to account for cyclotorsion.) Manual placement of reference mark on the peripheral cornea (including smearing of ink, thick broad markings, parallax error, scratching of patients cornea.etc) In addition the surgeon must consider the impact of posterior corneal astigmatism and healing process.

The numerous systems are used during toric IOL implantations to provide for accurate estimation and alignment of the lenses. These are single free hand mark and simple toric reference markers, to slit lamp based methods which include alignment by narrow slit beam and marking by gentian violet pen, Nd YAG laser[20] and various axis markers.[21]

New techniques to improve the accuracy of toric IOL alignment have become available.Osher[22] described an iris fingerprinting technique, in which a preoperative detailed image of the eye is obtained and the alignment axis is drawn. A printout of this technique is used during surgery to align the toric IOL based on iris characteristics. A second technique to align toric IOL is by intraoperative wavefront aberrometry.[23] This device is connected to the operating microscope and enables intraoperative measurement of residual refraction. A third device, the surgery Guidance SG 3000 system (Sensomotoric Instruments GmbH),uses real time eye tracking based on iris and blood vessel characteristics.

A new system called the TORIC MAX(Marking Accuracy Expertise)system with its VTA(virtual Toric Align)software has been developed recently by an Indian manufacturer (Appasamy Associates).The inputs for these software includes entire patient database entry along with the IOL power measurements of the eye undergoing from an A scan device, inputs and outputs of any IOL manufacturers toric calculator which are to be exported to the VTA software module by the click of a button.

The aim of the present study was to compare the clinical outcome of digital and manual marking for toric IOL alignment.

MATERIAL AND METHODS

Present study was done in Rohilkhand Medical hospital (Tertiary Eye Care Centre) from January 2016-December 2016. A total of 30 patients undergoing phacoemulsification with astigmatism greater than 2.0 Dcyl irrespective of age based on inclusion exclusion criteria were included in this study. Certificate from ethical review committee was taken before conducting this study. All patients enrolled in the study were explained the procedure and were made to sign an informed consent. All cases were performed by the same surgeon. All confirmed cases were grouped into two categories on a randomized basis. A total of 15

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cases were included in group A and same number in group B. All cases were performed by same surgeon. All patients signed an informed consent.

Inclusion criteria: Randomly 30 patients who came in OPD with cylinder greater than 2 dcyl were included in the study.

Exclusion criteria: Cases with ocular complications like amblyopia, maculopathy, glaucoma and uveitis were excluded. Also cases with intraoperative complications that compromised the toric IOL position were excluded.

The first group (A) included 15 eyes and digital marker was used. In second group (B) included 15 eyes with manual slit lamp assisted preoperative marking was done. Preoperative workup is very important. Manual keratometry and topography done. In group (A) prior to the marking, the eye was anaesthesized with 0.5% paparacaine drops. The patient was seated in upright position and made to fixate at a distant target. Bubble marker (figure 1 and 2) was used for marking the reference marks for identifying the 3,6, and 9 o'clock position on the limbus. The bubble should be in between the two vertical lines, it indicated that the 3 and 9 wedges of the marker were truly horizontal, A special gentian violet pen was used to ink the wedges. The marker was gradually advanced towards the eye while the examiner ensured the bubble was in the central position when the wedges make contact with the limbus. In group B manual marking using slit lamp was done. Here slit lamp assisted marking of the horizontal meridian of the eye was done. The eye was marked while the patient was sitting upright and fixing with other eye at a distant target to avoid cyclotorsion. The second step is intraoperative aligning a second device with angular graduations to the horizontal marks (figure 1 and 2). Then the desired toric axis was marked using a gentian violet surgical marking pen. Main incision made along the steep axis. Side incision made. Hydrodissection and hydrodilineation done after doing capsulorrhexis. Bimanual I/A done. Toric IOL implanted in the capsular bag. Viscoelastics removed from under the IOL. Along with the dots the IOL is aligned along the axis.

STATISTICAL ANALYSIS

Microsoft Office 2007 was used for the statistical analysis. Descriptive statistics like mean ab SD were used for interpretation of data.

RESULTS

The mean age of the first group (with digital marking was 59.8±15.01 years (n=15,range 32-83 years).The mean age of the second group was 50.5±9.5 years (n=15,range 40-60 years). The mean preoperative corneal astigmatism for the first group was 3.27±1.79D (range from 2.0-6.0D). For the second group by manual method it was 2.75±0.75D(range from 2.0 -3.5). there was no statistically significant difference between the two groups.

The mean postoperative uncorrected distant visual acuity (UCDVA) for the first group was 6/9 and for the second group was 6/6(p). There was no relation with the method used in (UCDVA). It was due to two myopic eyes in first group which could be corrected to only upto 6/12.

The mean postoperative residual refractive cylinder for the first group was _0.25±0.5 (ranging from ±0.25—1.25D) representing 88% of reduction in the astigmatism from preoperative levels.

Figure-1 and 2: Manual marker and digital or bubble markers

The mean postoperative residual refractive cylinder for the second group was 0.35±0.33 (ranging from 0.00—1.5D) showing 90% reduction in astigmatism from preoperative levels.

The mean postoperative toric misalignment for the first group was 2.5°±1.5°(range from 0-4°)and for the second group was 3.5°±2.5°(range from 0-6°) In one case of second group redialling of lens was done where rotation of lens was more than 10°.

DISCUSSION

Toric IOL implantation during cataract surgery allows treating coexisting corneal astigmatism. Reduction of residual postoperative refractive astigmatism improves UCDVA after the cataract surgery. Villegas[24] et al mentioned that correcting corneal astigmatism of <0.50D does not improve visual outcome after the cataract surgery.

The toric IOL has marks that indicate the flat meridian (plus cylinder axis). Precise alignment of the toric IOL during surgery is the most important step in achieving the desired effect of the calculated astigmatism correction. When the toric IOL is misaligned or rotates postoperatively, there is a reduction in its effect of the planned axis of alignment and introduction of a new astigmatism in another axis. Approximately there is 3%to 3.5% residual astigmatism for every 1° of toric IOL rotation. This means that with 30° of rotation there is 100 % of residual astigmatism but on a different axis.[25]

In the current study manual marking was done using gentian violet pen and slit lamp or sometimes 11 number blades was used to mark the toric axis preoperatively. As regards the included patients of the two groups, there was no statistically significant difference in their age, sex, composition and preoperative corneal astigmatism levels. As regards the refractive outcome, both groups showed marked reduction of preoperative astigmatism around with no statistically significant difference between the two groups. The reported percentage of patients with postoperative residual refractive astigmatism <0.5D after toric IOL implantation represented 25% to 100% of the cases.[26-27] In both the groups postoperative residual astigmatism ranged between 0.5D to -1.0 D.

The digital marking group and manual group postoperatively showed mean toric IOL misalignment as 2.0° and 2.2° respectively. Only in one case there was rotation of IOL greater

than 10 degrees which was taken for dialling again. The reported mean postoperative toric IOL misalignment ranged from 2.5 to 4 D.[28-30]

CONCLUSION

Accurate alignment of the toric IOL is important to achieve the desired astigmatism correction. In our study both digital and manual system of marking showed almost equal results in regard with residual astigmatism and toric IOL misalignment. Last but not the least instead of going for newer techniques which are very costly both the above techniques provide comparable and satisfactory results.

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