

Videos available on:  
www.e-tjo.org

Access this article online

Quick Response Code:



Website:  
www.e-tjo.org

DOI:  
10.4103/tjo.tjo\_46\_19

# Intraoperative capsular marking for toric intraocular lens placement

Harinder Singh Sethi<sup>1</sup>, Mayuresh P. Naik<sup>2\*</sup>

## Abstract:

Preoperatively, the surgeon instills two drops of 0.5% proparacaine and then marks the 0° and 180° points at the limbus using a Gentian violet marker and 26G needle edge. Intraoperatively, after phacoemulsification and irrigation and aspiration of the cortex are complete, the surgeon inspects the previously marked 0°–180° points on the limbus. In case the steeper astigmatic meridian needs to be marked, a Mendez Ring is used and the meridian is marked using a Gentian violet marker and 26G needle edge. The desired markings (2 mm in length only) on the anterior lens capsule can be made using 26G needle bent at the bevel or using micro-vitreoretinal scissors. The toric intraocular lens (IOL) is then rotated in the bag in the desired meridian (customized-toric IOL in 0°–180° meridian and noncustomized toric IOL in steeper marked meridian), viscoelastic substance is aspirated and corneal wounds are hydrated.

## Keywords:

Axis markings, phacoemulsification, toric intraocular lense

## Introduction

Freedom from spectacles becomes a need and necessity for each and every patient after cataract surgery. Moreover, the most important hindering factor to achieving this goal is postoperative residual astigmatism. Even residual astigmatism of one-dimensional (1D) is enough to cause appreciable blurred vision and hamper postoperative patient-surgeon satisfaction.

Previous intraocular lenses (IOLs) could not facilitate astigmatic correction; partial correction could be afforded through limbal relaxing incisions (LRIs). Unfortunately, the LRIs can be used only for limited amounts of astigmatic correction and with unpredictable outcomes. This gave rise to the need to develop toric IOLs for a more predictably controlled correction of postoperative residual astigmatism.

The correction incurred by toric IOLs depends vastly on the power as well as on

its axis; and hence proper intraoperative IOL alignment is the key.<sup>[1,2]</sup> The IOL alignment and placement depends on the axis of preoperative astigmatism; hence, this axis needs to be delineated precisely for both intraoperative assistance and for postoperative refractive correlation to achieve the desired best-corrected visual acuity.<sup>[1,2]</sup>

We have developed a new technique for marking the desired axis of the toric IOL that can facilitate both intraoperative and postoperative precision with effortless ease.

## Technique

Preoperatively, the surgeon instills two drops of 0.5% proparacaine and then, marks the 0° and 180° points at the limbus using a Gentian violet marker and 26G needle edge.

In case of customized toric IOLs where the astigmatic marks of the IOL need to be placed in the horizontal axis, the same 0°–180° marked points on the limbus need to be replicated onto the anterior lens

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow\_reprints@wolterskluwer.com

**How to cite this article:** Sethi HS, Naik MP. Intraoperative capsular marking for toric intraocular lens placement. Taiwan J Ophthalmol 2020;10:298-301.

<sup>1</sup>Department of Ophthalmology, VMMC and Safdarjung Hospital,

<sup>2</sup>Department of Ophthalmology, HIMSR and HAH Centenary Hospital, New Delhi, India

**\*Address for correspondence:**

Dr. Mayuresh P. Naik,  
Room No. 3 of Eye  
OPD, 1<sup>st</sup> Floor of OPD  
Building, Department  
of Ophthalmology,  
HIMSR and HAH  
Centenary Hospital,  
Near GK-2, Alaknanda,  
New Delhi - 110 062, India.  
E-mail: mayureshpnaik@  
gmail.com

Submission: 22-04-2019  
Accepted: 01-10-2019  
Published: 02-12-2019

capsule [Video 1]. Alternatively, in noncustomized toric IOLs, where the astigmatic marks of the IOL need to be placed in the steeper meridian, this meridian is marked on the limbus using the 0°–180° marks as guide and then, this meridian is further replicated on the anterior lens capsule [Video 2].

Intraoperatively, after phacoemulsification and irrigation and aspiration of the cortex are complete, the surgeon inspects the previously marked 0°–180° points on the limbus. In case the steeper astigmatic meridian needs to be marked, a Mendez Ring is used and the meridian is marked using a Gentian violet marker and 26G needle edge.

The desired markings (2 mm in length only) on the anterior lens capsule can be made using 26G needle bent at the bevel or using micro-vitreoretinal scissors (MVR) scissors. The toric IOL is then rotated in the bag in the desired meridian (customized toric IOL in 0°–180° meridian and noncustomized toric IOL in steeper marked meridian), viscoelastic substance is aspirated and corneal wounds are hydrated.

Postoperatively, the next day, the pupils are dilated, the markings on the anterior lens capsule are examined, and the placement of the IOL in accordance with these markings is verified [Figure 1].

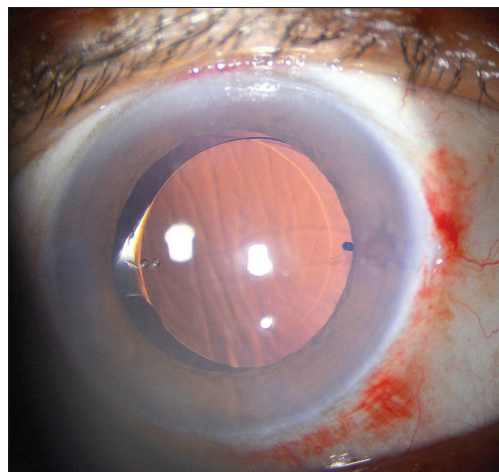
## Results

We have used this technique in 20 cases of uncomplicated phacoemulsification with >2D preoperative astigmatism. The markings on the anterior capsule were done in 10 cases with 26G needle bent at the bevel and 10 cases with MVR scissors.

Intraoperatively, the IOL was placed in the desired meridian using the markings on the limbus and the anterior lens capsule.

Postoperatively, the IOL was retained in the desired meridian in 18 cases. In two cases, there was rotation of the IOL away from the desired axis when examined in dilated slit-lamp retroillumination examination on the first postoperative day. These patients were taken back to the operation theater, the anterior chamber was reformed using viscoelastic substance, the IOL rotated to the desired meridian using the markings on the anterior capsule, viscoelastic substance aspirated, wound hydrated, and IOL position reconfirmed before wound hydration again.

The IOL was well placed, well centered in rest of the cases, and all patients had achieved postoperative refractive neutralization of their astigmatic status.



**Figure 1:** Postoperative slit-lamp retroillumination photograph depicting the anterior capsular markings coinciding with the marks of the toric IOL

## Discussion

Postoperative residual cornea astigmatism hinders our efforts to achieve the best possible postoperative visual acuity. Uncorrected corneal astigmatism can leave the patient with symptomatic blurred vision due to a proportionate manifest refractive cylinder postoperatively. Nontoric IOLs corrected only the spherical portion of the refractive error and thus led to the development and refinement of toric IOLs.

Toric IOLs have special markers on the nonvisual optical zone of the IOL that enable the surgeon to orient, align, and place the IOL according to the respective astigmatic correction. The surgeon rotates the IOL after placing it in the bag to orient its axis for desired postoperative results. A 3° misalignment from the desired axis can lead to a 10% loss of cylinder correction.<sup>[3]</sup> A 10° misalignment, one-third effect is lost and with 30° misalignment, the toric effect is completely lost.<sup>[3]</sup> This not only makes it imperative for the surgeon to precisely mark the axis of astigmatism preoperatively, but it would also be in the best interest of the patient and the surgeon if the mark would be available and persistent for postoperative comparison and follow-up.

With the advent of technological explosion, both manual and digital methods are available for toric IOL markings. Visser *et al.*<sup>[4]</sup> evaluated the accuracy of three-step ink marking procedure (reference axis marking, alignment axis marking, and IOL alignment) and also calculated the errors in toric IOL alignment using vector analysis. According to them, the three-step ink marker procedure led to a mean error of 5° in IOL placement, especially in higher cylinder power IOLs. Cha *et al.*<sup>[5]</sup> described the mapping method in which an anterior segment photograph was used to demarcate several reference vessel points and axis marking points as well as to calculate the actual lengths from the reference vessel points to the axis marking points.

Their method was reported to show less axis marking errors as compared to the conventional 3-6-9 o' clock and horizontal-axis-3-9 o' clock marking methods. Farooqui *et al.*<sup>[6]</sup> compared the preoperative bubble marker versus the pendulum marker and reported both to be equally comparable, simple, predictable, reproducible, and easy to perform. Popp *et al.*<sup>[7]</sup> compared four corneal marking methods, i.e., pendular marker, slit lamp-based marking, bubble marker, and tono-marker. The pendular marker showed the least horizontal deviation, and slit-lamp marker showed the least vertical deviation. They also noted that slit-lamp marker was the easiest to handle and pendular more difficult. Elhofi and Helaly<sup>[8]</sup> made a comparison between digital and manual marking for toric intraocular IOLs. They reiterated that the VERION facilitated both preoperative planning and intraoperative digital guidance and therefore resulted in comparatively less postoperative deviation toric IOL misalignment.

However, none of these techniques could enable the surgeon to assess the IOL orientation, placement, and alignment postoperatively with respect to the preoperative desired axis unless fresh corneal markings were done or compare it to the intraoperative IOL position at wound closure when the preoperative markings had faded away. Hence, we devised a simple technique to overcome these shortcomings and empower us to assess, compare, and correct the IOL position postoperatively. We performed all our preoperative markings in the sitting position to avoid cyclotorsion. Cyclotorsion of the eye from the upright to supine position is approximately 2°–4° on an average but can be up to 15° in individual patients.<sup>[9]</sup>

The advantages and practical applications of our technique are manifold. First, it is flexible and versatile as it can be done by any of the five instruments, namely 26G needle bent at the bevel, MVR scissors, intraocular RF knife cautery, Fugo blade capsulotome, and Vannas scissors. Second, while most techniques of axis-marking for toric IOL orientation, alignment, and placement make use of the cornea, our technique makes use of the anterior capsule of the lens. In fact in the true sense, our markings are most reasonable, most reliable, most replicable, and most resilient as they are placed closest to the final IOL position. Therefore, while the corneal markings may fade away as the corneal epithelium heals, our markings on the anterior capsule will be persistent and in fact become more prominent as the rest of the capsule undergoes fibrotic changes. Third, no other technique can enable the surgeon to assess or compare the postoperative IOL orientation and alignment in comparison to the preoperative intended placement. However, since our markings are on the anterior capsule, a simple dilated slit-lamp retroillumination examination will tell us whether the IOL is in the intended axis or has torped away

from the desired position. Fourth and most importantly, in those cases where there has been cyclotorsion of the toric IOL away from its intended axis of orientation on the first postoperative day, the patient can be simply taken back into the operation theater and the IOL can be easily rotated back in position using our capsular markings as guide to achieve astigmatic correction without the need for fresh markings whatsoever. Finally, the capsular markings would not fade neither disappear nor disintegrate with time and hence can be used in the long-term follow-up of refractive visual prognosis based on the regression or progression of corneal astigmatism. In case of long-term follow-up, when the patient may complain of deterioration of visual acuity, comparison of fresh corneal markings and the IOL markings, when compared with the capsular markings may give a hint toward capsular contraction, capsular phimosis, or capsular complex migration.

There are, however, two very important precautions that need to be borne in mind. A preoperative or intraoperative inadvertent iatrogenic zonular dialysis is a contraindication to the placement of a toric IOL and thereby is an absolute contraindication to the use of our technique. Second, a small nick on the anterior capsule could be the harbinger of an anterior capsular tear that can extend posteriorly leading to a posterior capsular rent. We have avoided this by limiting the dimensions of the markings to 2 mm only and by performing the capsular markings either after the cortical irrigation and aspiration is over or after the primary placement of the IOL but before rotating it in the desired axis.

Since the capsular markings can be done by as simple a thing as a 26G needle (used with insulin syringe), the availability of resources would not be a limiting factor even in developing countries. Considering that the only possible variable would be surgeon expertise and learning curve, we expect and hope that our technique of anterior-lens-capsular markings would definitely enable surgeons to accurately mark and precisely orient-align-place the toric IOL in the bag in their quest to achieve the desired best possible visual acuity.

## Conclusion

Anterior capsular markings play a very important role not only in the alignment-orientation-placement-centration of the toric IOL but also facilitate accurate postoperative refraction and follow-up visual prognosis of patients with preoperative astigmatism who have undergone uncomplicated phacoemulsification with an in-the-bag toric IOL.

## Ethical approval

This study is approved by IRB of Safdarjung Hospital. The approval number is IEC/IRB-01-18-589.

### Declaration of patient consent

Informed consent was obtained from all individual participants included in the study. The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

### Financial support and sponsorship

Nil.

### Conflicts of interest

The authors declare that there are no conflicts of interests of this paper.

### References

1. Khan MI, Ch'ng SW, Muhtaseb M. The use of toric intraocular lens to correct astigmatism at the time of cataract surgery. *Oman J Ophthalmol* 2015;8:38-43.
2. Kessel L, Andresen J, Tendal B, Erngaard D, Flesner P, Hjortdal J, *et al.* Toric intraocular lenses in the correction of astigmatism during cataract surgery: A systematic review and meta-analysis. *Ophthalmology* 2016;123:275-86.
3. Chang DF. Pearls on implanting the Staar toric IOL. *Br J Ophthalmol* 2001;85:1-126.
4. Visser N, Berendschot TT, Bauer NJ, Jurich J, Kersting O, Nuijts RM. Accuracy of toric intraocular lens implantation in cataract and refractive surgery. *J Cataract Refract Surg* 2011;37:1394-402.
5. Cha D, Kang SY, Kim SH, Song JS, Kim HM. New axis-marking method for a toric intraocular lens: Mapping method. *J Refract Surg* 2011;27:375-9.
6. Farooqui JH, Koul A, Dutta R, Shroff NM. Comparison of two different methods of preoperative marking for toric intraocular lens implantation: Bubble marker versus pendulum marker. *Int J Ophthalmol* 2016;9:703-6.
7. Popp N, Hirschschall N, Maedel S, Findl O. Evaluation of 4 corneal astigmatic marking methods. *J Cataract Refract Surg* 2012;38:2094-9.
8. Elhofi AH, Helaly HA. Comparison between digital and manual marking for toric intraocular lenses: A Randomized trial. *Medicine (Baltimore)* 2015;94:e1618.
9. Lin HY, Fang YT, Chuang YJ, Karlin JN, Chen HY, Lin SY, *et al.* A comparison of three different corneal marking methods used to determine cyclotorsion in the horizontal meridian. *Clin Ophthalmol* 2017;11:311-5.