

TORIC IOL ROTATION: HYPOTHESES, MISTAKES, AND OPPORTUNITY



An analysis of our experience with the postoperative rotation of toric IOLs.

BY GILLES LESIEUR, MD, AND PAUL DUPEYRE, MSC

Astigmatism is one of the main factors affecting vision quality. Around 30% of cataract surgery candidates have greater than 1.00 D of corneal astigmatism.^{1,2} In a large, cross-sectional study in Western China, the amount of corneal astigmatism was between 0.25 and 1.25 D in 53.71% of eyes, 1.25 D or higher in 39.06% of eyes, and lower than 0.25 D in 7.23% of eyes.³ Based on these statistics, we believe that toric IOLs should be implanted in at least 30% and up to 80% of patients undergoing refractive cataract surgery if the cost is not a problem and if keratometry readings are accurate.

In 2020, 73% of the IOLs implanted in our practice were toric lenses, but optimizing vision quality with these IOLs can be challenging. In this article, we share our experience and how our approach has evolved since we began using toric IOL technology in 2010 (scan the QR code to read about the evolution of our experience with toric IOLs).

In 2017, we conducted a retrospective study of 407 eyes that received a toric IOL (AT Torbi 709MP, Carl Zeiss Meditec) in our practice in 2016. Mean preoperative total corneal astigmatism was 1.24 D (standard deviation [SD] ± 0.74), and mean postoperative refractive astigmatism was 0.17 D (SD ± 0.29). The Figure shows the cumulative percentage of the postoperative refractive cylinder (unpublished data, 2017).

The mean results were good, but we were concerned about postoperative rotation of the toric IOL in the capsular bag, which reduced the amount of astigmatism corrected. In some instances, we had to realign the toric IOL. Based on the data,

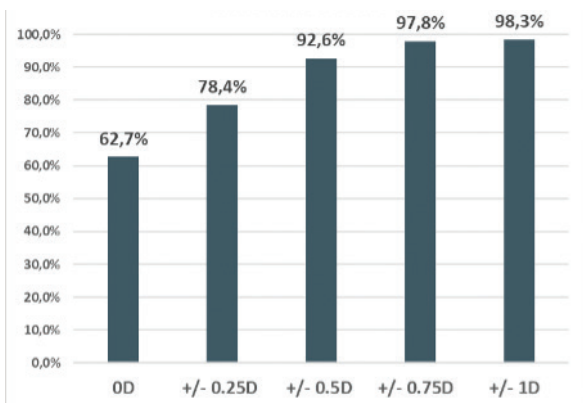


Figure. The cumulative percentage of the postoperative refractive cylinder in 407 eyes implanted with the AT Torbi 709MP at the Centre IRIDIS in 2016.

we wanted to look for a way to stabilize toric IOLs, so we decided to consider the correlation between the capsular bag size and the white-to-white (WTW) distance.

THE WTW HYPOTHESIS

Promising findings. After a 1-year analysis of the biometric parameters of the eyes in which toric IOLs had rotated the most, we realized that rotation occurred as frequently in long eyes as it did in short eyes. Erb-Eigner et al⁴ reported a correlation between the WTW corneal diameter and capsular bag size, so we decided to implant a larger-diameter 11.4-mm toric IOL (Ankoris, Beaver-Visitec International) in eyes with a larger WTW distance (≥ 12 mm). In eyes with a WTW distance that was less than 12 mm, we implanted an 11-mm-diameter toric IOL (AT Torbi 709MP, Carl Zeiss Meditec).

The results of our analysis suggested that WTW measurements could be correlated with postoperative rotation of a toric IOL. Mean rotation was 3.7° ($\pm 5.3^\circ$) with the AT Torbi 709MP and 6.7° ($\pm 5.4^\circ$) with the Ankoris.

During this time, we also initiated a retrospective comparative analysis of the stability of two IOLs of the same design and material (26% hydrophilic acrylic toric IOL) but with different optics—a multifocal (FineVision Toric POD-FT, Beaver-Visitec International) and a monofocal (Ankoris). A swept-source OCT feature on the IOLMaster 700 (Carl Zeiss Meditec) allowed us to obtain accurate and repeatable measurements of the total keratometry.

Table 1 shows the rotation values of the two IOLs in our analysis (unpublished data, 2019). We found a marked reduction in rotation by an average 4.25° with the multifocal toric. Based on these data, we concluded that IOLs with a nonpolished diffractive zone are generally more stable in the bag, which supported findings reported by Vandekerckhove in 2018.⁵

Invalidated hypotheses. In a 2020 article, we reported better absolute astigmatism prediction error results when true keratometry was measured rather than estimated.⁶

To confirm our WTW hypothesis, we used an 11-mm diameter toric (AT Torbi 709-MP) in eyes with a large WTW corneal diameter (≥ 12 mm) and a larger-diameter 11.4-mm toric (Ankoris) in eyes with a small WTW corneal diameter (< 12 mm). We implanted 45 Ankoris IOLs in eyes with a small WTW corneal diameter and found that the lens rotated to a greater degree in these eyes than when it was implanted in eyes with a large WTW corneal diameter (Table 2). We therefore concluded that WTW was not a good predictor of postoperative IOL rotation, and our hypothesis was invalidated (unpublished data, 2020).

TABLE 1. POSTOPERATIVE ROTATION OF FINEVISION TORIC AND ANKORIS IOLS

	FineVision Toric Rotation	Ankoris Rotation
Eyes	148	259
Mean	2.39°	6.64°
SD	2.35°	6.31°
Median	2°	5°
Min	0°	0°
Max	13°	37°

Abbreviations: Max, maximum; Min, minimum; SD, standard deviation

TABLE 2. POSTOPERATIVE ROTATION OF ANKORIS IOL DEPENDING ON THE WTW VALUE

WTW	≥ 12 mm	< 12 mm
Eyes	259	45
Mean	6.64°	8.38°
SD	6.31°	7.97°
Median	5°	6°
Min	0°	0°
Max	37°	34°

Abbreviations: Max, maximum; Min, minimum; SD, standard deviation; WTW, white-to-white

TABLE 3. POSTOPERATIVE ROTATION ANALYSIS OF FOUR TORIC IOLS IMPLANTED AT CENTRE IRIDIS

	AT Torbi	Ankoris	Synthesis Toric (Cutting-Edge)	Lucidis 124MT
Eyes	285	259	30	113
Mean	3.93°	6.64°	16.2°	2.77°
SD	5.36°	6.31°	19.96°	2.55°
Median	2°	5°	6.5°	2°
Min	0°	0°	0°	0°
Max	39°	37°	74°	11°

Abbreviations: Max, maximum; Min, minimum; SD, standard deviation

We set out to find another reason for IOL rotation. A retrospective analysis of a large sample of eyes implanted with a toric IOL in our practice showed no correlation between postoperative rotation and preoperative biometric parameters or between postoperative rotation and axial length (unpublished data, 2020).

A SUCCESSFUL APPROACH

At the end of 2020, we began implanting an unpolished extended depth of focus toric IOL (Lucidis MT, Swiss Advanced Vision) that is available in two diameters, 10.8 mm (Lucidis 108MT) and 12.4 mm (Lucidis 124MT). We hoped that the

large diameter and unpolished surface of these IOLs would optimize their stability.

We noted some rotation and decentration with the small-diameter 10.8-mm IOL, so we began using the larger-diameter 12.4-mm lens and achieved impressive results. We found a median rotation of 2° at 3 months postoperatively with this IOL (n = 113). In 50% of eyes analyzed, this IOL rotated by 2° or less and never more than 11°.7

We found that the large diameter of the 12.4-mm IOL caused anterior capsular contraction syndrome in some eyes, so we enlarged the diameter of the capsulorhexis to 5.5 mm and opted for the 10.8-mm IOL in short eyes (axial

length < 21.5 mm) and eyes with a WTW corneal diameter of less than 11 mm.

Table 3 compares the postoperative rotation of the four toric IOLs we analyzed over the years.

CONCLUSION

Evolutions in technology, total keratometry measurement, and patient care (including optimizing the corneal surface before biometry) provide the opportunity to expand the pool of candidates for toric IOLs to up to 80% of patients. Unfortunately, the toric IOLs available today cannot meet the visual needs of all of these patients because postoperative rotation remains a key issue.

Finding a truly stable IOL is no easy task, yet it is crucial to correct astigmatism. Years of analysis, successes, and mistakes have shown that the diameter of the IOL and an unpolished surface can increase IOL adhesion to the capsular bag and, therefore, reduce postoperative rotation. Postoperative rotation, however, can still occur with these factors accounted for. Developing a smart and simple IOL that can completely correct presbyopia and toricity is the next frontier. ■

- Hoffmann PC, Hütz WW. Analysis of biometry and prevalence data for corneal astigmatism in 23,239 eyes. *J Cataract Refract Surg.* 2010;36(9):1479-1485.
- Khan M, Muhtaseb M. Prevalence of corneal astigmatism in patients having routine cataract surgery at a teaching hospital in the United Kingdom. *J Cataract Refract Surg.* 2011;37(10):1751-1755.
- Ma W, Zuo C, Chen W, et al. Prevalence of corneal astigmatism in patients before cataract surgery in Western China. *J Ophthalmol.* 2020;6.
- Erb-Eigner K, Hirschschall N, Hackl C, Schmidt C, Asbach P, Findl O. Predicting lens diameter: ocular biometry with high-resolution MRI. *Invest Ophthalmol Vis Sci.* 2015;56(11):6847-6854.
- Vandekerckhove K. Rotational stability of monofocal and trifocal intraocular lenses with identical design and material but different surface treatment. *J Refract Surg.* 2018;34(2):84-91.
- Lesieur G. Microincision cataract surgery with implantation of a bitoric intraocular lens using an enhanced program for intra ocular lens power calculation. *Eur J Ophthalmol.* 2020;30(6):1308-1313.
- Lesieur G. Refractive and visual outcomes of a new extended depth of focus (EDOF) intraocular lens. Paper presented at: 39th Congress of the European Society of Cataract and Refractive Surgery; October 8-12, 2021; Amsterdam, Netherlands.

PAUL DUPEYRE, MSC

- Centre IRIDIS, Albi, France
- Financial disclosure: None

GILLES LESIEUR, MD

- Centre IRIDIS, Albi, France
- Member, *CRST Europe* Editorial Advisory Board
- g.lesieur@centre-iridis.fr; Twitter @gilleslesieur
- Financial disclosure: Consultant (Carl Zeiss Meditec); Royalties (Beaver-Visitec International, Rumex Instrumentation)