Acrylic toric IOL achieves optimal visual outcomes

The lens helps to consistently correct sphere and cylinder.

by Daniel A. Black, MBBS, FRANZCO, FRACS

A great deal of discussion exists in our field about correcting higher-order aberrations, in particular spherical aberration.

However, I find it imperative to correct the lower-order aberrations of sphere and cylinder before attempting to correct higher-order aberrations. Toric IOLs provide a key tool to the modern cataract surgeon, and the key to the implantation of a toric IOL consists of two important factors: choosing the right lens and using the correct surgical technique.

Why aspheric toric IOLs?

Approximately one-third of all patients presenting for cataract surgery will benefit from correction of astigmatism with a toric IOL. A study by Ferrer-Blasco and colleagues analyzed the prevalence and presentation patterns of corneal astigmatism in 4,540 eyes of 2,415 cataract surgery candidates, revealing that 41% of eyes had astigmatism of more than 0.75 D before the patients underwent cataract surgery. Alternative methods for the treatment of pre-existing cylinder, such as incisional keratotomy and limbal relaxing incisions, are at a disadvantage because of their risks of complications (particularly associated with the cornea), the issue of regression as the incisions heal and the limited range of astigmatism that they can treat.

Meanwhile, toric IOLs are capable of providing a wider range of cylindrical correction, with a lower frequency of complications and better predictability than limbal relaxing incisions. While astigmatic keratotomy is practiced widely today, the superior visual results obtained with toric IOLs will ultimately lead to this procedure being relegated to history. Most significant for consideration is the issue of induced higher-order aberrations associated with corneal incisional surgery, including spherical aberration, coma, trefoil and quatrefoil.

The importance of correcting astigmatism must also be considered from the economic perspective of both the patient and the physician. Pineda and colleagues reported that the use of toric IOLs reduces expenditure on spectacles and contact lenses over a lifetime, which highlights another benefit of toric IOL implantation after cataract removal.

Lens asphericity is also an important aspect, which helps to improve post-operative visual performance and contrast sensitivity. Therefore, the aspheric toric IOL serves to prevent induction of spherical aberration and assists to achieve good visual outcomes with the advantage of correcting for sphere and cylinder. The T-flex aspheric toric IOL (Rayner Intraocular Lenses) provides just this, with the toric correction on the anterior optic surface and the aspheric correction and Amon-Apple Enhanced Square Edge on the posterior surface of the optic. The advantage of the lens lies in its ability to correct both astigmatism and sphere without inducing higher-order aberrations.

Optimizing visual outcomes

Implanting a toric IOL without regard to the proper surgical technique can lead to disappointment for the surgeon and the patient. It is important to note that instilling local anesthetic or dilating drops and anaesthetizing the cornea will disrupt the tear film; excellent biometry relies upon a perfect corneal reflection from the tear film, which must be obtained from a virgin corneal surface, i.e., before any eye drops are instilled.

In my practice, the decision to implant a toric lens is made if the keratometry is greater than 0.8 D. This equates to 1 D in the IOL plane. The amount and axis of astigmatism in the refraction are not used in calculating the toric correction; therefore, the keratometric astigmatism values are used.

Toric calculation can be performed using an online calculator provided by the IOL manufacturer. Personally, I use the Holladay IOL Consultant, which automatically calculates both the sphere and cylinder of the IOL, giving me accurate results every time.

Before surgery, the cardinal axis of the cornea should be marked with the patient erect in order to avoid axis errors associated with cyclotorsion when the patient is supine. This can be done a
number of ways; I find the Nuijts-Lane marker (ASICO) best for this process.

The steep axis of corneal astigmatism is then marked using a Gimbel Mendez marker (Mastel Precision), which is my preferred tool for this. The axis marked on the IOL will then be aligned with the steep corneal axis.

Next, the toric IOL must be implanted wholly within the capsular bag and have 360° of overlap of the optic by the capsulorrhexis, which is essential to obtain a consistent effective lens position of the IOL and to prevent the IOL rotating off axis. For this procedure, I use a Fujimoto capsulorrhexis marker (Duckworth & Kent) to provide consistency with capsulorrhexis size and centration. After implantation, it is essential to thoroughly remove the ophthalmic viscosurgical device from the anterior segment including behind the IOL, minimizing rotation of the lens postoperatively.

Toric IOLs are forgiving if slightly off axis. Noel Alpins, FRACO, FRCOphth, FACS, has said, "If a toric IOL is off axis by 10°, there will be a loss of effect of approximately 6%.”

One thing that is of great importance is that the labeling of toric IOLs made in Europe is different from IOLs manufactured in the U.S. IOLs from the U.S. are labeled with the spherical equivalent power and the toric power that is incorporated into that spherical equivalent. European lenses are labeled with the spherical power and the additional toric power in the steep axis.

IOL factors

The actual IOL that is to be implanted can have a significant impact on visual outcomes. The Rayner T-flex is a hydrophilic acrylic single-piece aspheric toric IOL with an optic size of 5.75 mm or 6.25 mm. The standard power range is +6 D to +30 D in 0.5 D increments for sphere and 1 D to 6 D in 0.5 D increments for cylinder.

The extended range is -10 D to +35 D and 1 D to 11 D in 0.5 D increments for sphere and cylinder, respectively.

Clinical experience

At the Sunshine Eye Clinic, our experience with the Rayner T-flex has been excellent, and the IOL has yielded excellent and stable visual outcomes without the adverse effect of higher-order aberrations.

Analyzing 226 consecutive cases, preoperatively the mean spherical error was 0.6 ± 2.9 D, with a range of -10.35 D to +8 D. Postoperatively the mean spherical error was 0.05 ± 0.5 D with a range of 0 D to 1.77 D. In total, there were six patients with a prediction error of more than 1 D.

Of these six cases, there was one with previous penetrating keratoplasty (prediction error 1.78 D) who had a preoperative keratometry average of 35.61 D with an axial length of 24.32 mm. There was one case of keratoconus (prediction error 1.07 D) in whom a +7.0 D sphere +6.0 D cylinder IOL was implanted. Two short eyes (prediction error 1.11 D and 1.14 D) with axial lengths of 21.72 mm and 22.04 mm, respectively, and there was one long eye (prediction error 1.13 D) with an axial length of 27.66 mm. Finally, there was a normal eye with an axial length of 22.97 mm and average keratometry of 45.40 D (prediction error 1.67 D).

The analysis of toric correction shows that preoperative astigmatism as measured by keratometry was a mean 1.7 ± 0.8 D with a range of 0.8 D to 5 D. Postoperatively, the astigmatism as measured by refraction was a mean 0.2 ± 0.3 D with a range of 0 D to 1.25 D.

Our experience with the Rayner T-flex has shown that this acrylic toric IOL in particular facilitates the correction of sphere and cylinder, providing accurate and reproducible results with no cases requiring re-rotation or any cases requiring explantation. To this day, I continue to implant Rayner T-flex in approximately one-third of patients and find that patients expect to have dependence upon spectacles minimized after cataract surgery, which can only be reliably achieved if both sphere and cylinder are consistently corrected. The Rayner T-flex has been invaluable in helping me to meet those expectations.

References:

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Disclosure: Dr. Black has no financial disclosures in any of the products mentioned in this article.