

Toric IOL properties

by Cynthia Matossian, MD, FACS

fied plate haptic lens built on the Crystalens platform. Together, these four IOLs now give us a much more robust range of options for astigmatism.

Rotational stability

For me, stability of the lens over time is one of the most important requirements for a toric IOL. Rotational misalignment reduces the effectiveness of the cylinder correction,¹ making it less likely that patients will reduce their dependence on spectacles—the reason they choose a premium IOL in the first place.

In 2010, the American National Standards Institute (ANSI) issued guidelines for rotational stability for toric IOLs. ANSI guidelines specify that 90% of eyes should have an axis rotation of ≤ 5 degrees between consecutive visits spaced at least three months. Both the Tecnis and Trulign torics meet these tough standards. The STAAR and AcrySof lenses were approved prior to the standards, but product information suggests that neither meets the ANSI standards. Between 77% and 88% of eyes implanted with the AcrySof toric lenses (depending on the model) rotated ≤ 5 degrees, although the data were reported for longer intervals of non-consecutive visits.² Some authors have reported excellent early postoperative stability with the STAAR toric,³ but others have shown it to be less stable than the AcrySof Toric.⁴

Power range

For a patient who needs a toric lens, a major consideration after stability is whether the lens is available in the sphere and cylinder powers

needed. The AcrySof Toric currently has the widest range of toricity, with seven cylinder powers from which to choose. The Tecnis Toric has the widest range of sphere powers and the next-best cylinder coverage, with four toric powers. Ideally, we want to choose a lens that will reduce the patient's astigmatism to <0.50 D. For those with higher astigmatism, I will consider combining limbal relaxing incisions (LRIs) with a toric IOL.

Spherical aberration correction

It has been recognized that aspheric IOLs offer the best visual quality in patients with positive spherical aberration, particularly with regard to mesopic contrast sensitivity. For non-toric IOLs, most surgeons choose an aspheric lens; we should offer our astigmatists nothing less. I have been impressed that correcting spherical aberration to as close to zero as possible results in sharper image quality.⁵ Therefore, I evaluate corneal SA during my preoperative assessment and try to choose the IOL that will most closely compensate for the patient's corneal SA. In most of my cases, this will be a Tecnis Toric. Like all the lenses on the Tecnis platform, it has $-0.27 \mu\text{m}$ of SA, balancing out the $+0.27$ in the average eye undergoing cataract surgery. But actual measurements are valuable, because in some patients, the $-0.17 \mu\text{m}$ SA compensation of the AcrySof Toric or even one of the non-aspheric IOLs may bring that particular eye closer to zero SA.

Index of refraction and chromatic aberration

A number of IOL optical qualities, including the index of refraction, surface reflectance, and chromatic

aberration, are interrelated. Chromatic aberration (CA) is the dispersion of visible light into its component wavelengths. Higher CA means that different color wavelengths reach a given focal point at different times, reducing visual quality. However, CA is usually expressed in terms of a material's Abbe number, which is a measure of that material's reduction of chromatic aberration. A higher Abbe number (usually associated with a lower index of refraction) means less dispersion of light, lower CA and better quality of vision. Both the STAAR and Tecnis Toric IOLs have very high Abbe numbers.

Range of vision

Patients who opt for a premium lens of any type have very high expectations for uncorrected vision and reduced spectacle dependence, so we want to provide them with high quality uncorrected distance vision at minimum. As described above, I have been impressed with the optics of the Tecnis Toric in achieving this goal.

A toric IOL typically precludes presbyopia correction, unless we aim for a monovision target. The Trulign Toric, based on the Crystalens accommodating IOL, does provide a broader range of vision than other toric options. Like the Crystalens, it offers very good intermediate vision; the near acuity is less consistent or predictable, so I usually talk to patients about an improved range of vision with this lens, with an expectation that they will need to wear mild reading glasses.

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With four toric IOLs in the U.S. market, surgeons should look closely at a variety of factors before selecting the best option for astigmatic patients

For a long time, U.S. surgeons had only two available toric IOLs to offer astigmatic patients: the one-piece acrylic AcrySof Toric (Alcon, Fort Worth, Texas) and the silicone plate-style STAAR Toric (STAAR Surgical, Monrovia, Calif.). Historically, the plate-style lenses had some challenges with rotational stability so my personal experience in recent years was limited to the one-piece acrylic. In the past year, I have been able to add two new options to my toric armamentarium. The Tecnis Toric (Abbott Medical Optics, Santa Ana, Calif.) is another one-piece acrylic IOL, built on the well-established aspheric Tecnis platform. The Trulign Toric (Bausch + Lomb, Rochester, N.Y.) is a modi-

	SA correction	Refractive index	Abbe number
Alcon AcrySof Toric	-0.20	1.55	37
AMO Tecnis Toric	-0.27	1.47	55
B+L Trulign	0.00	1.43	not available
STAAR Toric	0.00	1.41	not available
Crystalline lens	+0.27 (average)	1.41	47

Optical characteristics of toric IOLs

Ease of implantation

One reason for the appeal of one-piece lenses like the AcrySof and Tecnis IOLs is that they are traditionally easy to insert and position. The Tecnis Toric has relatively stiffer haptics that let it open in a controlled fashion. A nice feature is that it can be rotated clockwise or counterclockwise. This reduces intraoperative manipulation and allows fine-tuning of the axis position without having to dial the IOL close to 180 degrees if I miss my mark initially.

The Trulign has an entirely different delivery system, of course. Many surgeons feel that it is technically more challenging. The capsulorhexis must be sized perfectly. The lens can't be vaulted anteriorly or positioned too far posteriorly and the anterior chamber must be absolutely stable, so implantation of this lens does require a certain degree of skill. Surgeons who are comfortable implanting the Crystalens will be comfortable implanting the Trulign as well. The inserter for this lens also requires a larger incision (2.85 mm) than either of the one-piece lenses.

We are fortunate to have four toric IOL options now in the U.S. market. These are all good lenses; cataract surgeons should understand the features and relative advantages of each in order to best meet the visual needs of our astigmatic patients.

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