

The Complications of Astigmatic Correction

What could go wrong with toric IOLs and corneal relaxing incisions?

BY ROBERT M. KERSHNER, MD, MS, FACS

In 1994, I coined the term *keratolenticuloplasty* to reflect what we accomplish by simultaneously reshaping the cornea through relaxing incisions and implanting an IOL to correct refractive error. Arcuate corneal incisions can flatten the steep meridian and treat astigmatism (Figure 1). Two FDA-approved toric IOLs (the STAAR Toric IOL [STAAR Surgical Company, Monrovia, CA] and the Acrysof Toric IOL [Alcon Laboratories, Inc., Fort Worth, TX]) are available to neutralize patients' astigmatism predictably (Figure 2).

Unfortunately, complications with toric IOLs and astigmatic keratotomy (AK) can and do occur. Being prepared to recognize and handle these potential problems optimizes surgical outcomes.

TORIC IOLs Measurement

Surgery can only correct what is measured beforehand, so check and recheck the preoperative measurements. With a toric lens implant, it does not matter if the astigmatism is corneal or posterior, as long as it is not lenticular. Regular astigmatism on a

single meridian is correctable. Irregular astigmatism, keratoconus, corneal scars, and higher-order aberrations are best left alone. Attempting surgical correction may result in an undesirable postoperative result and an irregular cornea that cannot be treated.

Target Correction

In every case, aim to under- rather than overcorrect the cylindrical power. It is always possible to perform additional surgery if necessary, but it can be difficult to reverse what has already been done.

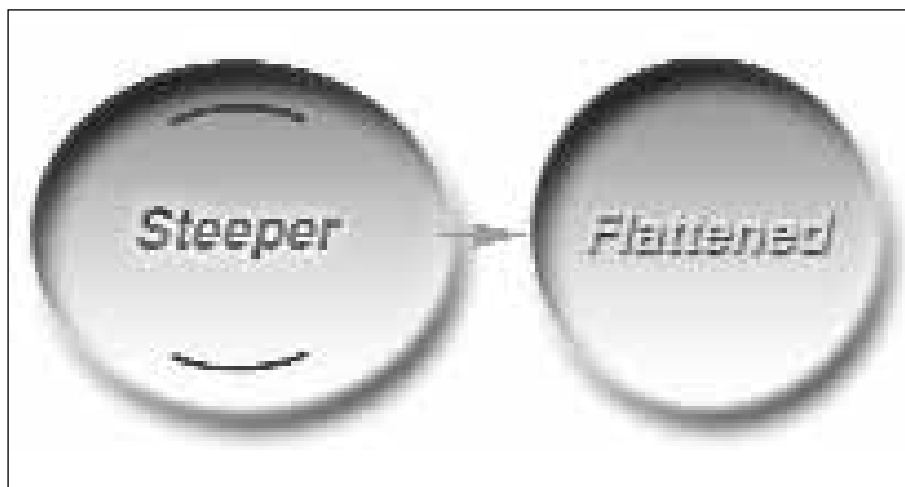
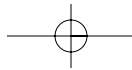


Figure 1. Arcuate astigmatic incisions accurately placed on the steep meridian can predictably flatten the cornea.



COVER STORY

Surgery

Even with accurate measurements, if the toric IOL is not implanted on the proper meridian or it moves off axis during the postoperative period, the patient's visual acuity will be worse after surgery. Some surgeons have been concerned that the one-piece, plate-haptic STAAR silicone IOL is prone to postoperative rotation. My studies and those of other ophthalmologists¹ have demonstrated that this problem may occur in fewer than 6% of cases. Fortunately, the early postoperative manipulation of the IOL's optic to the proper meridian is usually simple. To reduce the likelihood of off-axis migration, some surgeons have suggested implanting the STAAR Toric IOL with the anterior torus against the posterior capsule. Choosing the TL model, which is 11.2mm versus the 10.8-mm TF model, may also reduce the incidence of postoperative rotation.

The torus of the Acrysof Toric IOL is on the posterior surface of the optic. The stickier acrylic material may be less prone to movement than silicone, which could make this IOL less likely to rotate. Future studies will be necessary to demonstrate if this is the case.

AK

Construction

Incisions into the cornea, the most powerful refracting surface in the eye, are always refractive in nature and unforgiving. Proper construction is essential to ensure the best functional and refractive effect.²⁻¹² Pay careful attention to the incisions' creation and avoid manipulating them. Poorly constructed astigmatic incisions can result in irregular astigmatism, scarring, corneal aberrations, and a compromised visual result.

In order to avoid obscuring their size and proper location, make the incisions while the cornea is dry. The



Figure 2. Toric IOLs implanted along the steep meridian can neutralize preexisting astigmatism.

most common error of inexperienced surgeons is to use a keratome that does not allow them to construct incisions of the proper length and depth. Corneal incisions longer than 3.2mm will induce unpredictable flattening and alter the refractive power of the central cornea. Because these large incisions usually do not seal well on their own, they can result in gaping, excessive denervation, corneal dry spots, and scarring. Incisional lengths of 3mm or less are more likely to seal appropriately and to deliver predictably the proper degree of flattening. Keep incisions small. It is better to add one rather than have an excessively long incision that can do things you do not want.

“Flattening the cornea in one meridian induces astigmatism 90° away from the incision.”

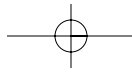
The standard, disposable, steel keratomes used for scleral tunnel incisions do not work well for clear corneal astigmatic incisions. Only sharp keratomes can atraumatically incise the cornea. Many surgeons prefer the unrivaled sharpness of diamond blades. Because their cutting edges can be as thin as 1µm, these knives can pass through the corneal lamella smoothly and easily to create an incision that is as sharp as a paper cut.

Location

Where you place corneal relaxing incisions is just as important as how you make them. Prior to surgery, highlight in the chart the position of the patient's steepest corneal meridian. Carefully evaluate the patient's preoperative astigmatism and take the printed topography into the OR with you. The rule is to know where the actual meridian of the astigmatism is before making the incision on the steepest plus meridian. If not sure about the location and magnitude of the astigmatism to be corrected, refract the patient in plus cylinder and compare the result with the corneal topographic map.

Flattening the cornea in one meridian induces astigmatism 90° away from the incision. Do not make the patient's vision worse. Placing the clear corneal incision anywhere but on the steep meridian will result in unhappiness.

I do not like true limbal relaxing incisions (LRIs), because they have less effect for a given incisional length when they are placed far from the central cornea. LRIs must be longer than arcuate, clear corneal incisions for any given length in order to produce the same effect on



the corneal curvature. The larger these incisions become, the more likely they are to induce unwanted effects. If placed nasally or temporally, LRIs effectively denervate the cornea. In an elderly patient, denervation can produce an anesthetic cornea, severe dry eye, and corneal breakdown. Smaller, arcuate incisions produce more effect with less surgery.

If not performed closer than the 7-mm optical zone with respect to the cornea's optical center, if not of the correct depth, and if not placed at the correct location, the arcuate AK is less risky than LRIs. Arcuate incisions are easier to perform and produce more flattening with less surgery. When learned well and applied accurately, the time-tested techniques of AK produce more predictable outcomes.^{3,4,8,13}

CONCLUSION

Corneal astigmatic incisions, with or without toric and presbyopia-correcting IOLs, can provide complete refractive correction for each patient. While fueling the demand for ocular procedures, aging baby boomers have high expectations for any refractive procedure. Surgeons therefore must be able to provide accurate astigmatic correction with each and every procedure. ■

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