What Is Astigmatism? A Review

Numerous options exist to correct all types of astigmatism.

BY JUSTIN SCHWEITZER, OD

We have all had patients in our clinics asking us if they have “stigmatism,” “stigmata,” or “a stigmatism.” Astigmatism is a condition that many patients misunderstand. What can be even more confusing to patients are all the options available to correct their astigmatism. This article reviews the various types of astigmatism including corneal, lenticular, and posterior corneal, and reviews the ways that astigmatism can be treated, including nonsurgical and surgical treatment options.

**ASTIGMATISM TYPES**

**Anterior Corneal Astigmatism**

Anterior corneal astigmatism can be classified as with-the-rule (WTR), against-the-rule (ATR), oblique, or irregular astigmatism. Manual keratometers and corneal topographer are tools used to classify astigmatism. Studies have shown that WTR astigmatism is more common in younger patients, but that, over time, WTR astigmatism shifts to ATR astigmatism. Irregular and oblique astigmatism are less common. Irregular astigmatism occurs when the principal meridians are not 90° apart, and it can cause significant decreased vision. Conditions such as Salzmann nodular degeneration, pterygium, epithelial basement membrane dystrophy, keratoconus, corneal ectasia, corneal scars, and ocular surface disease often induce irregular astigmatism.

**Posterior Corneal Astigmatism**

Recent research has shown the importance of posterior corneal astigmatism in surgical correction with toric IOLs. If only anterior corneal astigmatism is accounted for and posterior corneal astigmatism is not, eyes can be under- or overcorrected. Unlike anterior corneal astigmatism, posterior corneal astigmatism is typically oriented WTR and does not drift horizontally (ie, toward ATR) with age. Currently, there is no one piece of equipment that can accurately measure posterior corneal astigmatism. Technologies will continue to evolve to make measurement of posterior corneal astigmatism more precise.

**Lenticular Astigmatism**

Astigmatism that is seen in a patient’s manifest refraction but is not measured on the anterior cornea by manual keratometry or corneal topography is classified as lenticular astigmatism. Astigmatism occurs due to variations in the curvature of the lens.

**TREATMENT OPTIONS**

**Spectacle Lenses and Contact Lenses**

Advances in spectacle lens design technology allow the correction of low and high amounts of astigmatism without compromising optics. Aspheric spectacle lens
designs in combination with high-index lens materials can create a lens that is thin and light and provides exceptional optics.

Advances in soft toric contact lens designs and materials have improved optics, improved stability, and a wider range of parameters compared to soft toric lenses of the past. This offers practitioners many choices in fitting patients with astigmatism. Recent studies have suggested that patients with regular astigmatism achieve visual acuity comparable to spectacle lenses when fitted with toric soft contact lenses.3

Specialty contact lenses are needed at times to correct astigmatism that cannot be completely corrected by spectacle lenses or soft contact lenses. The most common use for these lenses is in irregular astigmatism. These lenses are surgically placed either between the cornea and the iris (Visisyse) or just behind the iris (Visian ICL) without removing the natural lens.

**Laser Refractive Surgery**

LASIK and PRK can correct up to 5 D of corneal astigmatism, and sometimes even higher amounts. Patients with some residual astigmatism after cataract surgery may have the option of astigmatism correction with LASIK or PRK.

**Astigmatism Correction During Cataract Surgery**

Limbal relaxing incisions (LRIs) can correct up to 3.50 D of astigmatism, but they are commonly used to correct up to 2.00 D. Many surgeons prefer to use LRIs to reduce small amounts of astigmatic error and toric IOls for larger amounts. The LRI procedure has become more predictable with the introduction of software improvements and laser cataract surgery. The depth and placement of incisions is based on many patient factors, including age, intraocular pressure, and corneal rigidity.

Toric IOls have the ability to correct 1.00 D to slightly more than 4.00 D of astigmatism, and these lenses provide the potential for better uncorrected acuity than patients have had previously. The challenge with toric lenses is that even small errors in IOL positioning may lead to residual astigmatism that can significantly affect a patient's uncorrected acuity. The residual astigmatism can be corrected by IOL rotation, LASIK or PRK, LRIs, glasses, or contact lenses.

**Phakic IOls**

The Visian ICL (STAAR Surgical) and Verisyse (Abbott Medical Optics) phakic IOls can be part of the vision correction solution for patients with moderate to severe myopia and astigmatism. These lenses do not incorporate astigmatic correction, but, after correction of the patient's myopia, LASIK or PRK can be performed to correct the astigmatism. These lenses are surgically placed either between the cornea and the iris (Verisyse) or just behind the iris (Visian ICL) without removing the natural lens.

**Refractive Lens Exchange (RLE)**

RLE, also referred to as a clear lens exchange or refractive lensectomy, is an alternative for patients with refractive error who may not be candidates for LASIK or PRK. In the RLE procedure, the clear crystalline lens is replaced with an IOL. Patients who have astigmatism can have a toric IOL or an accommodating toric IOL implanted to correct their vision. The demand for RLE procedures is on the rise, but disagreement remains among eye care providers regarding which patients are right for the procedure and whether the risks of intraocular surgery are worth taking.

**CHOOSING THE RIGHT PROCEDURE**

A discussion with the patient to determine whether he or she is seeking independence from spectacles or contact lenses will lead the eye care provider and patient down the correct path. If no pathology such as a cataract is present, spectacles, contact lenses, LASIK or PRK, phakic IOls, and RLE are all options to correct astigmatism. If a cataract is present, the patient's degree of astigmatism will determine whether LRIs or a toric IOL implant should be considered. The wide array of options available to correct astigmatism allows all types of astigmatism to be addressed and corrected.

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