

# Presbyopia-Correcting IOLs and Preexisting Astigmatism

Meet and exceed your presbyopia-correcting IOL patients' expectations with an astigmatism correction strategy.

BY JASON E. STAHL, MD

**P**resbyopia-correcting IOLs are a wonderful technology we can provide to our presbyopic patients.

Whether used during refractive lens exchange (RLE) or cataract surgery, presbyopia-correcting IOLs require extreme precision, as they treat both ametropia and presbyopia. Patients requesting presbyopia-correcting IOLs have high expectations that require the surgeon to achieve emmetropia (ie,  $\pm 0.25$  D) every time. This need for precision has renewed our attention to preoperative biometry to maximize the accuracy of IOL power calculations.

Presbyopia-correcting IOLs also require surgeons to have a strategy for astigmatism correction. In my experience, as little as 0.75 D of astigmatism degrades visual quality and may leave a patient symptomatic with visual blur, ghosting and halos. Surgical correction of astigmatism is now a necessity. Because a toric presbyopia-correcting IOL platform is not yet available, surgeons must combine corneal refractive procedures (ie, limbal-relaxing incisions [LRIs], LASIK and PRK) with presbyopia-correcting IOLs to achieve the desired outcome.

## ON THE STEEP MERIDIAN

These incisions provide a safe, effective and practical approach for reducing  $\leq 3.50$  D of preexisting

Pre- LASIK		Post- LASIK	
Lens #2 -ReSTOR Procedure: Std Phaco MFG ACD: 5.02		Lens #2 -ReSTOR Procedure: Std Phaco MFG ACD: 5.02	
<u>IOL</u>	<u>Pred. Ref.</u>	<u>IOL</u>	<u>Pred. Ref.</u>
23.50	0.77	23.50	0.87
24.00	0.42	24.00	0.52
<b>24.50</b>	<b>0.06</b>	<b>24.50</b>	<b>0.16</b>
25.00	-0.31	25.00	-0.20
25.50	-0.68	25.50	-0.57

Figure 1. Holladay II IOL Report: Pre-LASIK and post-LASIK report, demonstrating no significant change in IOL power of +24.50 D for the patient, prior to RLE surgery.

astigmatism. Paired 600- $\mu$ m deep arcuate incisions are placed at the limbus — on the steep meridian — at the time of lens replacement surgery. LRIs have several advantages over more centrally placed astigmatic keratotomy (AK): they are easier to perform and more forgiving than AKs; they have less tendency to induce irregular astigmatism; and there is a less likelihood of shifting in the resultant axis of cylinder. When paired LRIs are kept  $\leq 90^\circ$  of arc length, they exhibit a consistent 1:1 coupling ratio (ie, amount of flattening that occurs in the incised meridian, relative to the amount of steepening that results  $90^\circ$  away) that elicits little change in spherical equivalence.

Therefore, no alteration in the calculated lens power is needed.

Corneal topography is best used to determine the pattern, amount and location of astigmatism. Additionally, topography can detect subtle corneal pathology that would contraindicate the use of LRIs (eg, forme fruste keratoconus). Refractive cylinder may be influenced by lenticular astigmatism, which is eliminated after removal of the crystalline lens, so surgeons should use topography and keratometry when treating astigmatism.

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When planning the incisions, consult a nomogram that includes age modifiers (eg, Gills or Nichamin nomograms) to determine the appropriate arc length of the LRIs. Review the cylinder axis location on the corneal topography map; if there is a significant disparity between the keratometry and corneal topography (ie,  $\geq 30^\circ$ ), you may elect to defer the LRIs until the refraction stabilizes after lens replacement surgery. It is critical to properly center the LRIs over the steep corneal meridian since an axis deviation will result in a reduction in desired effect. Our clinic reported significant cyclotorsion when patients move from an upright to a supine position.<sup>1</sup> Therefore, while the patient is upright, I recommend placing an orientation ink mark at the limbus (ie, 6:00 or 12:00 position) to help identify the steep axis more accurately.

## LASER VISION ENHANCEMENTS

When planning presbyopia IOL surgery in a patient with a high level of preexisting astigmatism (ie,  $>3.00$  D), a bioptics approach (ie, IOL and laser vision enhancement) may be needed. LRIs alone are unlikely to correct the astigmatism completely. Significant residual astigmatism in patients with presbyopia-correcting IOLs will result in suboptimal vision, necessitating the need for a short interval before laser enhancement.

There are different strategies for these planned laser vision enhancements. The first is to perform the presbyopia-correcting IOL surgery followed by PRK (4 to 6 weeks postop) or LASIK (12 weeks postop). The second approach is to create the LASIK flap 1 to 2 weeks

before presbyopia-correcting IOL surgery, followed by lift flap LASIK enhancement 4 weeks later. The final approach is to perform LASIK or PRK to reduce the astigmatism before presbyopia-correcting IOL surgery. The last provides the patient with the best functional vision immediately following presbyopia-correcting IOL implantation. Since the preoperative data for IOL calculations are available, determining the IOL power after LASIK or PRK is not difficult. If needed, additional laser treatment could further enhance the patient's vision.

A perfect time to use the third approach (ie, laser vision correction followed by presbyopia-correcting IOL surgery) is when the patient has a high level of hyperopic astigmatism. A mixed astigmatism laser ablation is performed first to reduce the astigmatism without significantly changing the average keratometry or spherical equivalence. Minimal to no change in IOL power is needed when compared with pre-LASIK/PRK calculations. For example, a 53-year-old female presented with a manifest refraction OD of  $+6.75-5.00 \times 145 = 20/20$  with average keratometry reading of 41.38 D. Conventional LASIK was performed treating  $+2.50-5.00 \times 145$ . One month postop, the refraction was  $+4.50-1.50 \times 145 = 20/20$ , with average keratometry of 41.20 D. Refractive lens exchange with paired 60° LRIs at axis 55 was performed with insertion of a  $+24.50$  D Restor IOL (Alcon Laboratories, Fort Worth, Texas), which was the same power calculated prior to LASIK (Figure 1). One month following RLE with Restor, the patient's UCVA distance was 20/20 and UCVA near was 20/25 with a refraction of  $+0.25$  sphere.

## CONCLUSION

Presbyopia-correcting IOLs are currently the most exciting advancement in cataract and refractive surgery. Patients demand and expect great results with presbyopia-correcting IOLs. The challenges that surgeons face in meeting these expectations require extreme precision, not only when performing IOL power calculations but also when dealing with preexisting or residual astigmatism. Developing a strategy for astigmatism correction will help surgeons meet or even exceed presbyopia IOL patient expectations. ■

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