

# The Shortcomings of LRIs

The procedure is most predictable for less than 3.00 D of astigmatism.

BY JOHN F. DOANE, MD

Interest in limbal relaxing incisions (LRIs) is increasing, as more surgeons start implanting presbyopia-correcting IOLs. The reduction of corneal astigmatism to 0.50 D or less is felt by most surgeons to be a necessity for patients to achieve acceptable UCVA with either accommodating or multifocal IOLs. From a surgical standpoint, LRIs compete with laser vision correction for addressing corneal astigmatism. The “red tape” associated with laser vision correction can be a tremendous hassle for the IOL surgeon who does not perform laser procedures. This form of correction is expensive and requires a second surgical setting. LRIs, however, are inadequate in certain instances.

## IRRATIONAL EXUBERANCE

As with RK, surgeons can push the use of LRIs too far (Figure 1). Although some ophthalmologists assert that these incisions can correct up to 4.00 D of astigmatism or even higher when combined with more central (7- to 8-mm optical zone) astigmatic keratotomy, most surgeons feel 2.50 to 3.00 D is the upper limit of correction for LRIs. PRK or LASIK is probably more predictable for treating higher amounts of corneal astigmatism.

## MISPLACEMENT OF THE LRI'S AXIAL MERIDIAN

If a surgeon loses the proper meridional alignment under the operating microscope, very complex astigmatic refractions may occur such as nonorthogonal astigmatism. A more typical error is when a surgeon performs the astigmatic correction 90° away from where it should be placed, which will usually double the amount of astigmatism in the original axis.

## OVER- AND UNDERCORRECTIONS

With LRIs, a reasonable goal is to reduce the corneal cylinder to 0.50 D or less. In my opinion, it is probably better to under- versus overcorrect an astigmatic error. The causes of overcorrection include incisions that are too deep, too central, or too long. The causes of undercorrection include incisions that are too shallow, too

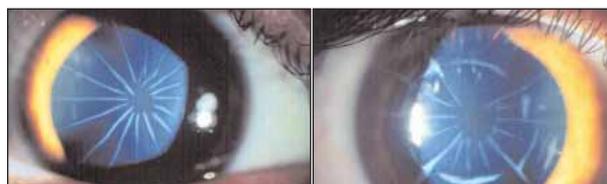


Figure 1. The surgeon pushed the limits of LRIs in these two eyes to their detriment. Most ophthalmologists believe that LRIs can treat 3.00 D of corneal astigmatism at most.

short, or, more commonly, too peripheral to have an effect. *Undercorrections* are defined as residual astigmatism magnitude in the original meridian, and *overcorrections* typically are defined as residual astigmatism 90° away from the original meridian. With a flipped astigmatic axis, it is advisable not to chase one's tail by performing LRIs in the new meridian (Figure 1). I recommend that surgeons wait for the refraction to stabilize and then reduce the astigmatism with excimer laser ablation.

## HOW LRIs WORK

The mechanism of action for LRIs is to increase the arc length in the steep or short axis of the cornea.

In my experience, the steep meridian of the astigmatism usually determines the success of the LRI procedure. Treating with-the-rule astigmatism (steep vertical meridian) is more predictable and stable than against-the-rule astigmatism (steepest horizontal meridian), in which the LRIs tend to gape for a much longer period than those oriented across the vertical meridian of the cornea. In my experience, post-operative dry eye symptoms are more common with against-the-rule versus with-the-rule LRIs of the same length. This finding is likely analogous to severing the horizontal nerve plexi with a superior hinge versus only severing one horizontal plexus for a nasal hinge in LASIK.

There are a few nuances regarding patients requiring LRIs that are worth reviewing. I advise surgeons to be cautious with the hyperopic patient who needs against-the-rule LRIs. The placement of the main cataract entry wound superior-

ly in a clear corneal fashion can induce significant astigmatism, because a small corneal diameter is common in hyperopic eyes. If a hyperopic patient with a small corneal diameter presents needing an LRI to treat against-the-rule astigmatism, I recommend a scleral tunnel incision either temporally or superiorly so the entry into the anterior chamber is as peripheral as possible. The scleral tunnel incision will make the main incision as astigmatically neutral as possible. The smaller the optical zone, the greater the impact on the induction of astigmatism than a larger optical zone. Therefore, a temporal clear corneal incision will induce less astigmatism than a superior clear corneal incision, because the point of entry into the anterior chamber is farther out with a temporal approach than a superior approach. Surgeons can expect that, with a temporal clear corneal incision one will flatten the meridian about 0.50 D or conversely steepen the vertical meridian an additional 0.50 D. Due to this effect, if a patient has greater than 0.50 D of with-the-rule astigmatism preoperatively, I will perform LRIs. If the patient has 0.75 D or less of against-the-rule astigmatism preoperatively, performing a temporal clear corneal incision should correct it.

Surgeons must double-check their comparisons of the steep axis on keratometry versus topography. In addition, it can be helpful to draw a picture of where they plan to make the LRIs. This drawing should be available for viewing in the OR when the surgeon is sitting at the 12-o'clock position so that he does not lose proper anatomic orientation. He can invert the topography at the time of surgery in order to confirm the orientation is correct.

### PACHYMETRY

Corneal pachymetry is an important variable. I find that a 600- $\mu$ m blade works well for most LRIs. I recommend that surgeons use an adjustable blade, however, if the central cornea is thinner than 500  $\mu$ m or thicker than 600  $\mu$ m or if the peripheral cornea has age-related thinning.

An eye with a central corneal thickness of 650  $\mu$ m and a normal endothelium probably has a peripheral cornea that is much thicker than in the average eye. In this instance, a 600- $\mu$ m LRI may produce little-to-no astigmatic effect, although an adjustable-depth incision on the order of 650  $\mu$ m may give a nearly perfect result. Conversely, if the cornea is normal on topography but the central pachymetry is 500  $\mu$ m, a 550- $\mu$ m setting on the LRI blade will likely achieve excellent results, whereas a 600- $\mu$ m setting may lead to an overcorrection.

### CONCLUSION

Incisional keratotomy is a learned skill. I recommend adhering to one type of system, starting conservatively, mastering the system, and then refining the technique. Most surgeons have found that LRIs are most predictable for less than 3.00 D of corneal astigmatism, with success achieved more often with with-the-rule, oblique, and then against-the-rule astigmatism. I advise the enhancement of LRIs, if needed, with an excimer laser. Finally, the basic goal of an LRI (for the patient, surgical staff, and surgeon) is to leave the patient with 0.50 D or less of astigmatism. It is best to undercorrect the patient's vision rather than flip the axis. ■

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