Limbal Relaxing Incisions

BY ROBERT J. CIONNI, MD; HARRY B. GRABOW, MD;
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Whether called limbal relaxing incisions (LRIs), peripheral corneal relaxing incisions, *or* paired peripheral astigmatic incisions, *no other treatment is as straightforward to implement and has a risk/benefit ratio that so strongly favors the benefits. At my ambulatory surgery center, we perform these incisions in 20% of our cataract surgeries. We use LRIs to treat cylinder of +0.75 to +1.25 D and, depending on the circumstances, up to +1.75 D. Generally, however, we rely on toric lenses or a combined approach of toric IOLs and LRIs to treat greater than +1.25 D of astigmatism.*

It is important to mark the eye prior to performing the LRI. Because the oblique muscles may rotate the globe significantly, surgeons should mark the 90° or 180° axis while the patient is upright and fixating on a distant target. We use the Bakewell BubbleLevel (Mastel Precision, Inc., Rapid City, SD) for this purpose (Figure 1). We ink the instrument with a disposable marker to prevent cross-contamination.

For this month's column, I asked four surgeons who use LRIs to share their technique.

—William J. Fishkind, MD, section editor

(Courtesy of Mastel Precision, Inc.)

Figure 1. The Bakewell BubbleLevel has a small level that assists in aligning the marks at the 0° to 180° axis.

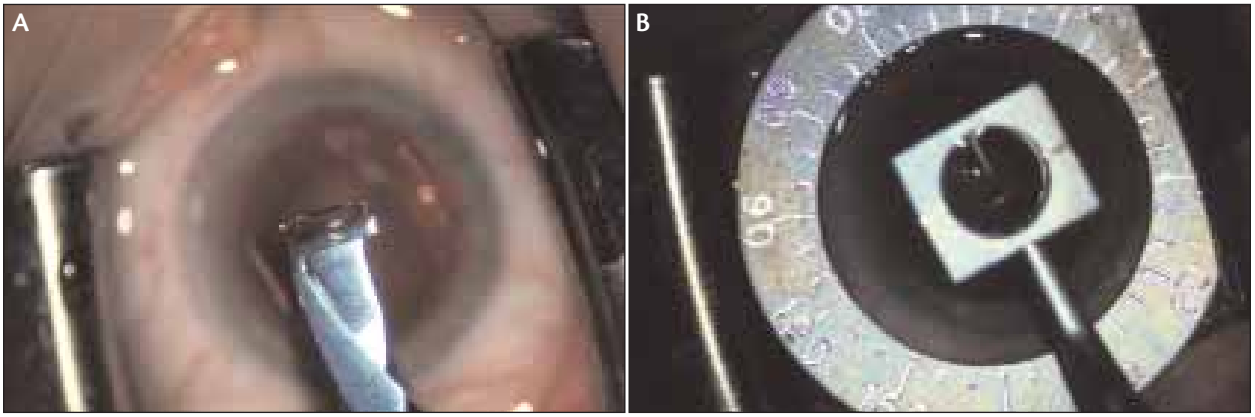
ROBERT J. CIONNI, MD

Cataract surgery is a refractive procedure: in each case, the surgeon makes an effort to achieve the desired refractive outcome. If a patient has 0.75 D of corneal astigmatism or more, I therefore offer to reduce it. In cases involving the implantation of a presbyopia-correcting IOL, I perform LRIs at the time of cataract surgery. For eyes receiving a monofocal IOL, I select an aspheric toric IOL unless it is unavailable in the power needed. If the residual cylinder expected following a toric IOL's implantation is greater than 0.75 D, I will perform LRIs to further reduce the astigmatism. If the patient does not want to be responsible for the additional cost of a toric IOL but desires astigmatic reduction, I will offer LRIs but charge a fee for the service. Due to the better predictability and stability with toric IOLs, I have found it rare for a patient to choose an LRI over a toric IOL, despite the lower total cost for an LRI procedure.

I create the LRIs at the beginning of the cataract surgery. I rely on the calculator found at http://www.lricalculator.com (Abbott Medical Optics Inc., Santa Ana, CA) to determine the LRI treatment. I prefer to use the Donnenfeld nomogram available on the Web site and a set blade depth of 600 µm. I mark the horizontal and vertical reference meridians while the patient is upright, preferably at the slit lamp. With the patient positioned under the microscope, I mark the axis and arc length planned using the Mastel Axis Marker System (Mastel Precision, Inc.). I then apply Viscoat (Alcon Laboratories, Inc., Fort Worth, TX) to the corneal surface and place the Mastel Marking Ring/Stabilizer (Mastel Precision, Inc.) so that the back guard of my diamond blade can run along the stabilizer to create a perfect arc when pressed firmly into the cornea. My goal is to place the LRIs just anterior to the limbal blood vessels, because any bleeding into the incisions will limit their effect. In eyes with significantly anterior limbal vessels, the incisions therefore may be more central than expected, so I shorten their length somewhat to avoid an overcorrection, particularly in cases of with-the-rule astigmatism.

HARRY B. GRABOW, MD

I perform LRIs with cataract surgery as well as on-cornea astigmatic keratotomy (AK) and the implantation of toric IOLs. I perform almost exclusively temporal clear



(Courtesy of Harry B. Grabow, MD.)

Figure 2. The Feaster 3-mm straight diamond AK blade (A). Marking for on-cornea AK (B).

corneal incision cataract surgery through a 2.8-mm coaxial phaco incision, which induces from zero to 0.50 D of with-the-rule cylinder.

If the preoperative keratometric astigmatism is regular and 1.00 D or greater, I will usually try to reduce it. For with-the-rule or oblique-axis cylinder, I will either implant a toric IOL or perform AK with a straight 3-mm Feaster diamond blade (Rhein Medical Inc., Tampa, FL) set to approximately 90% of the corneal thickness (Figure 2) as determined by pachymetry (Pentacam Comprehensive Eye Scanner, Oculus, Inc., Lynnwood, WA). The number and optical zones of the incisions are based on the keratometric cylinder and the patient's age; the axis of the incisions is determined by topography. For preoperative against-the-rule astigmatism that does not qualify for a toric IOL, I use a diamond LRI blade that is preset at 550 µm (Figure 3). The LRI incision is intralimbal with an average arc length of 30° to 45°, depending on the amount of cylinder. A paired AK may be performed 180° away. I can then place the phaco incision through the temporal LRI.

(Courtesy of Harry B. Grabow, MD.)

Figure 3. The surgeon creates an LRI with the diamond blade preset at 550 µm.

BRETT W. KATZEN, MD

I am a big proponent of performing LRIs to enhance the outcome of cataract surgery. I have been doing this procedure for over 10 years, and I find it essential to maximizing patients' satisfaction with multifocal IOLs while keeping things relatively simple.

I favor the nomogram created by Eric Donnenfeld, MD, for its simplicity and effectiveness. I perform corneal topography to rule out pathologies and to help with placing LRIs, because astigmatism is not always regular or symmetrical and longer incisions can be made when appropriate. I tape the topographic map upside down on my microscope for readability.

Using the vertical meridian, I mark the eye preoperatively while the patient is seated in order to avoid problems related to cyclotorsion. I recommend using what I call an *idiot-proof knife*. I like the AE-8132 (ASICO LLC, Westmont, IL). It has accurate fixed settings, and I mostly use 0.55 mm. This double-edged keratome can pass in both directions while providing me with excellent visualization as I cut. I like to place my incisions on an unopened globe (prior to phaco surgery) for consistent firmness and, thus, incisional depth.

I suggest using a favorite fixation forceps—in my case, a Kremer Fixation Forceps (Rumex International Co., St. Petersburg, FL) from my RK days. It securely holds the eye, and I can obtain a firm, consistent pressure for tactile feedback. I make the incision at the limbus. Although corneal incisions are more effective, they can sometimes leave irregularities (gape) that the patient will feel. I place the diamond blade into the limbus such that the knife points to the center of the globe. It is important to make the cut in one deliberate motion.

KEVIN M. MILLER, MD

I routinely make peripheral corneal relaxing incisions as part of my Astigmatic Management service. My tip is to keep the nomogram simple. I use one that is easy to commit to memory.

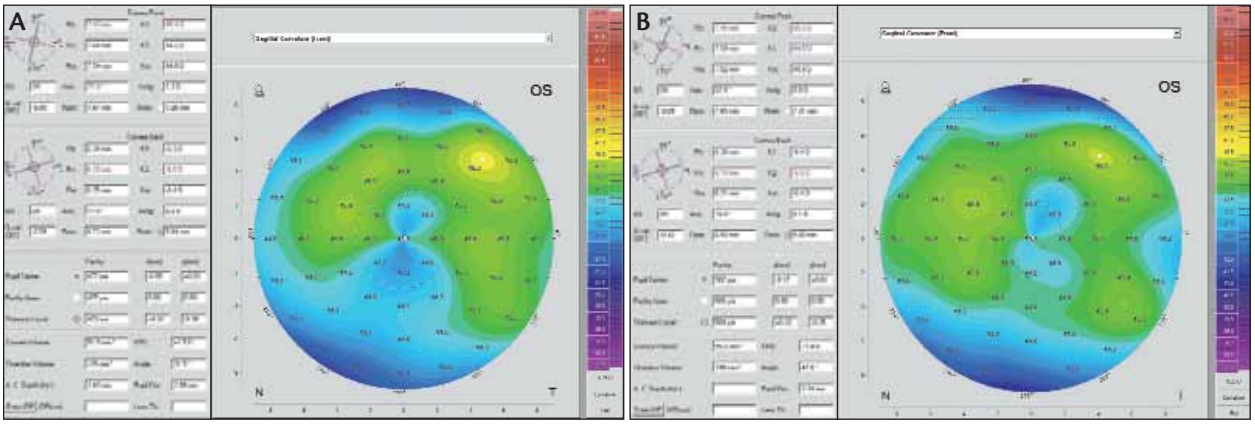
To start, I determine the amount and axis of corneal astigmatism by obtaining a corneal topography map using the EyeSys 3000 Corneal Analysis System (EyeSys Vision, Houston, TX) or the Pentacam. I determine my approach to management from the simulated keratometry values reported by the topographer.

In cases of symmetric bowtie astigmatism, I make paired incisions in the steep corneal meridian that are as long in clock hours as the cornea is steep in diopters. The maximum length is 3 clock hours for both incisions to achieve 3.00 D of correction. I place the phaco tunnel inside one of the peripheral corneal relaxing incisions. The nomogram is self-adjusting in that incisions will be longer in the horizontal meridians than the vertical meridians for the same attempted correction, because corneal diameter is greater horizontally.

A two-step phaco incision is approximately 1 clock hour in length. For 1.00 D or less of corneal astigmatism, all I do is place the phaco incision on the steep axis. Two of my recent cases serve as examples.

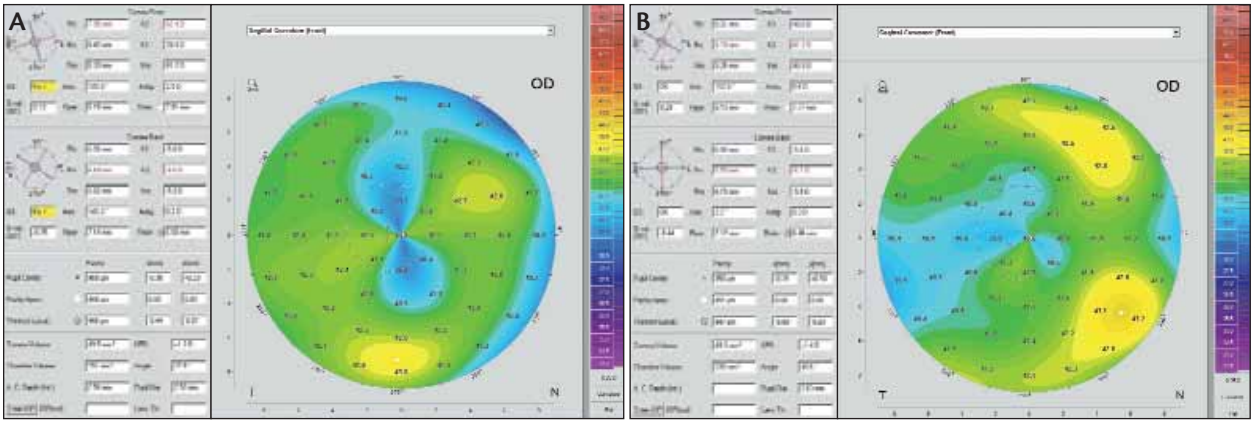
Patient 1 had 1.30 D of simulated keratometric astigmatism in the 167° to 347° meridian in her left eye (Figure 4A). I decided to be conservative and place a two-step phaco incision in the 347° meridian in the hope of decreasing her astigmatism by 0.50 D. Her postoperative astigmatism was 0.80 D at 157° (Figure 4B). I achieved exactly 0.50 D of correction.

Patient 2 had 2.50 D of simulated keratometric astigmatism in the 16° to 196° meridian of her right eye (Figure 5A). She did not want a toric IOL. I made a pair of 2-clock-hour peripheral corneal relaxing incisions,



(Courtesy of Kevin M. Miller, MD.)

Figure 4. Preoperative topography with the Pentacam showed 1.30 D of simulated keratometric astigmatism (A). Postoperatively, topography showed 0.80 D of residual astigmatism (B).



(Courtesy of Kevin M. Miller, MD.)

Figure 5. Preoperative topography with the Pentacam showed 2.50 D of simulated keratometric astigmatism (A). Postoperatively, topography showed 0.60 D of residual astigmatism (B).

one in the nasal 20° meridian and another in the temporal 200° meridian in the hope of decreasing her astigmatism by 2.00 D. I placed the phaco tunnel in the relaxing incision at 200°. Postoperatively, the patient had 0.60 D of astigmatism at 63° (Figure 5B). I achieved 1.90 D of correction. ■

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