Correcting Astigmatism After Glaucoma Surgery

Employing excimer laser photoablation, toric IOLs, and limbal relaxing incisions.

BY ERIC D. DONNENFELD, MD

One of the more common challenges of dealing with patients after glaucoma surgery is the management of their astigmatism. The sclerectomy, cautery, and sutures of a trabeculectomy all may induce cylinder. Certainly, this problem is less important than the vision-threatening implications of glaucoma. However, from the patient’s perspective, astigmatism and its consequences (ie, glare, halos, and reduced visual acuity) are a major concern.

For this reason, the ophthalmologist’s ability to treat astigmatism after glaucoma surgery is key to maximizing patients’ satisfaction and their quality of vision. Although glaucoma surgery may induce higher levels of cylinder than cataract surgery, the basic principles of astigmatic management apply to both. Many techniques are available. I strongly advocate excimer laser photoablation for its accuracy and toric IOLs for their simplicity and safety. Limbal relaxing incisions (LRIs) are a third extremely important tool for glaucoma surgeons.

MEASURING CYLINDER

Prior to treating astigmatism, the first step is to make certain the cylinder is stable for at least 1 month after all sutures are removed in the steep axis. Tight sutures may induce significant astigmatism that will degrade over time and become a moving target. The next step is to accurately measure the amount of cylinder to be treated. It is prudent to wait 1 month after conventional cataract surgery and 3 months after trabeculectomy before contemplating refractive surgery.

Topography, keratometry, and refraction can all be helpful in assessing cylinder. I generally start with topography. I prefer placido disc technology and find topography very helpful for determining the magnitude and axis of astigmatism after cataract surgery with monofocal IOLs. Additionally, topography provides a visual display of corneal regularity and is important for identifying irregular astigmatism, forme fruste keratoconus, and clinical keratoconus.¹ These disorders are relative but often absolute contraindications to incisional and ablative refractive surgery. I treat asymmetric bowtie astigmatism with asymmetric LRIs. This asymmetry can only be seen on topography. Keratometry is also helpful for determining the magnitude and axis of astigmatism. For phakic patients and patients with toric IOLs in place, I rely on the clinical refraction, because lenticular astigmatism—both phakic and pseudophakic—is as important to the patient as corneal cylinder and it cannot be measured by topography or keratometry. The amount of preoperative astigmatism will determine the most appropriate corrective surgical approach.

TORIC IOLs

Patients with cataracts after glaucoma surgery can benefit from cataract surgery, which may lower their IOP. Toric IOLs are an elegant way to treat up to 3.00 D of astigmatism, and higher-powered lenses will be available soon. Glaucoma is not a contraindication to using a toric IOL, even if the patient has visual field loss.

One of the most important issues in the placement of toric IOLs is ensuring their proper alignment. Rotation of the lens off axis will reduce the effective astigmatic correction; malrotation of 15º reduces the astigmatic correction by about 50%. Cycloptorsion may occur when the patient is supine, so it is best to mark the operative eye when the patient is sitting up straight prior to the start of surgery. Additionally, manufacturers have developed different lens designs to limit rotation after implantation.
Because lenses with plate haptics may rotate less than IOLs with loop haptics, I favor the AcrySof IQ Toric IOL (Alcon Laboratories, Inc., Fort Worth, TX).2 When performing any astigmatic surgery on patients undergoing a cataract procedure, the ophthalmologist must take into account cylinder induced by the cataract incision. This incision changes the axis of the final cylinder and often affects the magnitude of the astigmatism as well. An extremely helpful Web site, acrysoftoriccalculator.com, allows the surgeon to enter the preexisting keratometry, the cataract incision’s location, and cylinder induced by the incision. The Web site then performs vector analysis to provide the final predicted axis and magnitude of astigmatism and recommends the correct toric IOL and the axis where it should be placed (Figure 1).

LRIs

Background
Intraoperative aberrometry with ORange (WaveTec Vision, Aliso Viejo, CA) has significantly increased the accuracy of my outcomes with toric IOLs and LRIs. The latter are inexpensive, safe, and easy to perform, and they do not preclude future excimer laser photoablation. In my experience, more than 50% of cataract surgery patients have 0.50 D or more of astigmatism. For those with a spherical equivalent of plano, an LRI is an optimal treatment option and can be easily performed without the risk of inducing hyperopia or other complications associated with excimer laser photoablation. I use LRIs to treat 1.50 D or less of astigmatism. Using incisions to treat more than 2.00 D of cylinder is less precise, destabilizes the cornea, increases the risk of postoperative dry eye disease, and can induce higher-order aberrations. In patients who are not candidates for toric IOLs, I will debulk the cylinder with an LRI and then postoperatively treat the residual refractive error with excimer laser photoablation.

For preexisting astigmatism, LRIs can easily be performed in the OR. There are several nomograms for correcting small amounts of cylinder that have been developed by notable surgeons such as Douglas D. Koch, MD2; Louis D. “Skip” Nichamin, MD3; and James P. Gills, MD.4 These nomograms are adjusted for age and cylindrical axis, making them detailed and complex and giving the impression that the procedure is extremely precise and unforgiving. In my opinion, this simply is not the case. LRIs are as much an art as they are a science. It is best to practice techniques and develop one’s own nomogram to achieve consistent results. I myself have devised a very simple nomogram that works extremely well (Figure 2).

In the OR
The OR is the best place to start doing LRIs, which can be performed during routine cataract surgery. Again, it is important to remember that patients’ preexisting cylinder is not the only thing to consider when performing LRIs. Surgically induced cylinder is equally important. Vector analysis is required to calculate the new magnitude and axis of cylinder to be treated. I use the Web site lricalculator.com to enter preexisting keratometry values, the axis, and cylinder induced by my
cataract incision (Figure 3). This site will calculate the resultant cylinder and axis and create a surgical plan using either the Donnenfeld or Nichamin nomogram that can be printed and brought to the OR for use as a template for treatment.

For novice LRI surgeons, I suggest using peribulbar anesthesia to facilitate the procedure. I make LRIs at the beginning of cataract surgery because I prefer a firm eye, one in which the cornea has not been thinned by dehydration under the operating microscope. With a preset diamond knife, I make the arc in the clear cornea 0.5 mm from the limbus. While in the OR, I use my preoperative corneal topography or 1rIcalculator.com printout, which I turn upside down to determine where to place the incisions. I grasp the eye with a 0.12 calibri forceps, 180° away from the incision. I enter the eye with my diamond knife, hold it for 1 second to make certain I have achieved full depth, and then extend the cut to exactly the length that is required. For most cases, I use a preset diamond knife with a depth of 0.6 mm.

At the Slit Lamp

I recently designed a preset diamond knife with Accutome, Inc. (Malvern, PA), that has a 15° angulation, making it ideal for use at the slit lamp as well as in the OR. For the slit-lamp procedure, I anesthetize the eye with lidocaine gel. I use a phoropter to confirm the incision’s axis, and I operate on this axis exactly as I would under an operating microscope. I make certain that the patient’s head is forward, as I come from the side, and create one incision to achieve 0.50 to 0.75 D of correction. After this 30-second procedure, patients walk away seeing better that day. Postoperatively, I prescribe prednisolone acetate 1% and gatifloxacin 0.5% four times daily for 5 days.

EXCIMER LASER PHOTOABLATION

LASIK or PRK are options in cases of residual or induced astigmatism after glaucoma surgery. Laser refractive surgery can safely eliminate much higher orders of astigmatism than the other methods discussed. LASIK involves suction on the eye that generates extremely high IOP, which can rarely lead to extrusion of the intraocular contents. For this reason, it is important to allow enough time for adequate corneal healing after the initial cataract surgery before proceeding with this procedure. For patients with a history of trabeculectomy and/or those with visual field loss, I generally prefer PRK because it does not increase IOP. Surgeons should understand, however, that patients may require 1 or 2 months of treatment with topical corticosteroids to prevent haze after PRK, therapy that can induce IOP spikes in steroid responders. To reduce the need for steroids, I recommend the use of mitomycin C 0.02% for 15 seconds in glaucoma patients having PRK. I apply mitomycin C with a Weck-Cel sponge (Medtronic ENT, Jacksonville, FL) to the corneal stroma, making certain it does not touch the limbal stem cells. After 15 seconds, I wipe off the mitomycin C with a dry Weck-Cel sponge and then apply copious irrigation.

CONCLUSION

The astigmatism induced by glaucoma surgery can be a significant problem for many patients. With the use of modern refractive surgical techniques and technology, surgeons can now improve these patients’ refractive outcomes safely and effectively. I believe managing cylinder in glaucoma patients will become more popular in the future due to patients’ rising expectations and the availability of new technologies to improve the accuracy of refractive surgery.

Eric D. Donnenfeld, MD, is a professor of ophthalmology at NYU and a trustee of Dartmouth Medical School in Hanover, New Hampshire. Dr. Donnenfeld is in private practice with Ophthalmic Consultants of Long Island in Rockville Centre, New York. He is a consultant to Alcon Laboratories, Inc., and WaveTec Vision. Dr. Donnenfeld may be reached at (516) 766-2519; eddoph@aol.com.