VOLUME 13, NUMBER 8 • AUGUST 2009

# REFRACTIVE EYECARE®

SPECTACLES, CONTACT LENSES, AND CORNEAL AND LENTICULAR REFRACTIVE SURGERY FOR PRACTICE GROWTH

INSIDE



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## Managing Post-LASIK Ectasia

*Peter S. Hersh, MD*

**Corneal ectasia is a devastating sequel to LASIK, but now most patients can be treated, and functional vision restored, without resort to a corneal transplant.**

Cornea ectasia—characterized by progressive thinning and steepening of the cornea, irregular astigmatism, and loss of best spectacle-corrected visual acuity (BSCVA)—is a rare, but serious, complication of LASIK. Although exact statistics are unknown, the incidence of corneal ectasia following LASIK has been reported as about 1 in 2,500.[1] We can expect the incidence to decline as the risk factors for ectasia become more clearly defined. The condition usually presents between 6 and 24 months after surgery; by 24 months after surgery, 75 to 80% of patients who will eventually develop ectasia have been identified.

**FIGURE 1 Dr. Hersh uses corneal collagen crosslinking to physically strengthen the cornea in a patient with post-LASIK ectasia.**

Loss of uncorrected visual acuity is the first clue that a problem is present, and this is typically the symptom that brings ectasia patients back to their eyecare provider's office. Compared with a postsurgical regression effect or natural increase in myopia, progressive decrease in spectacle corrected visual acuity may represent a corneal ectasia that has advanced to the point of becoming symptomatic.

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## Diagnostic Clues

When a post-LASIK patient presents with decreased visual acuity, the examiner needs to perform a meticulous refraction, looking especially for increased myopia and/or cylinder. It is important to note changes in manual keratometry, particularly corneal steepening or changes in the appearance of the mires. Corneal topography analysis will show typical changes of corneal steepening accompanied by irregular astigmatism. Changes in the wavefront analysis, especially increasing higher order aberration (particularly vertical coma), may be suggestive of corneal ectasia, especially if changes are progressive over time. Serial pachymetry that shows a decrease in corneal thickness over time is also suggestive of an ectatic process.

### CORNEAL ECTASIA

- ☑ Rare (1 in 2,500) but serious post-LASIK complication
- ☑ Progressive condition characterized by:
  - — Corneal steepening
  - — Irregular astigmatism
  - — Loss of best spectacle-corrected visual acuity
- ☑ Presents 6 to 24 months post-surgery
- ☑ Typically diagnosed after patient reports loss of visual acuity
- ☑ Clinicians should look for:
  - — Increased myopia or increased cylinder
  - — Changes in keratometry readings (particularly changes in corneal mires or corneal steepness)
  - — Changes in wavefront analysis (especially increasing higher order aberrations)
  - — Decrease in pachymetry over time

Our group has been reviewing patient data from the Reichert® Ocular Response Analyzer® with David Luce, PhD. We are attempting to determine whether the device can detect changes in corneal biomechanics that are either predictive of corneal ectasia before surgery or diagnostic of it after surgery. Ideally, data from this device will show us patients who are susceptible to, or have subclinical, ectasia prior to surgery.

Although further study is needed, it is an exciting prospect, as the existence of predictive biomechanical indices would allow us to better identify at-risk patients preoperatively and also diagnose postoperative corneal ectasia earlier. While early diagnosis was a small advantage prior to the advent of collagen crosslinking, with this technology, which has the potential to halt ectatic progression, there is significant incentive to diagnose and treat this condition as early as possible. Indeed, if it becomes possible to spot at-risk patients with the Ocular Response Analyzer before LASIK, it might even allow treatment with collagen crosslinking before the onset of significant visual deterioration from keratoconus itself.

## Restoring Vision

There are two goals in the management of corneal ectasia: stopping progression and restoring visual acuity. The loss of visual acuity can be quite frightening for patients, as well as deeply frustrating, since these are patients who chose LASIK specifically to obtain excellent vision without correction. Therefore, restoring or getting close to patients' preoperative BCVA is a key component to successful ectasia management. We now have several options to restore visual acuity, and, in most patients, we can do this without a corneal graft. Patients generally find this news reassuring, as they may have heard or read that corneal ectasia can only be treated with a corneal transplant.

Our primary tool for improving BCVA is contact lens fitting. The most effective options are: rigid gas permeable (GP) contact lenses, hybrid contact lenses (which have a GP center surrounded by a hydrogel "skirt"), and specialty keratoconus lenses (which are designed to accommodate a corneal protuberance). With the exception of certain custom-made lenses, soft lenses do not mask the irregular astigmatism and so don't provide these patients with adequate acuity.

Other modalities that can improve vision in these patients include corneal ring segments (eg, Intacs®) and conductive keratoplasty (CK). Corneal ring implants—Intacs and, outside of the US, the Ferrara Ring—can frequently improve corneal topography and reduce visual distortion caused by corneal ectasia. The goal of implanting these devices is to regularize the ocular surface topography in order to obtain a more comfortable and effective contact lens fit or better spectacle corrected visual acuity. For patients who are contact lens intolerant, corneal implants may obviate the need for corneal transplantation.

## The Intacs Procedure

Intacs 150-degree inserts are placed within channels made with

### CLINICAL PEARLS

- **Monitor serial refraction and topography over time in all post-LASIK patients**
- **Print out color topography and compare to raw data (keratoscopic rings or other)**
  - **Confirms that topography is correct**
  - **Gives surgeon feeling for regularity of corneal contour**
- **Have full armamentarium of treatments available**
- **Most cases can be treated without corneal grafting**
- **Reassure patients that there are treatment options available**
  - **Use artwork to show patients exactly what is going on in the eye**
  - **Use drawings or visual aids to show how treatment modalities fix the problem**
  - **Let patients try trial contact lens in the office—even without a full fitting, most patients will gain some visual acuity, as well as a sense of relief**

either a manual dissector or an IntraLase™ femtosecond laser. The inserts come in three thicknesses: 250, 300, and 350 microns. The inserts are generally placed to create an optical zone of approximately 7 mm. Placed within the mid-peripheral corneal stroma, the rings diminish the height and steepness of the corneal cone, essentially causing secondary flattening of the central cornea and improvement in corneal optical irregularity.

### TREATMENT OPTIONS FOR CORNEAL ECTASIA

- ☑ Contact lenses
  - — GP, hybrid, or specialty keratoconic
  - — Most effective options to improve visual acuity
- ☑ Corneal inserts
  - — Intacs in US and Ferrara ring abroad
  - — Goal is to normalize corneal topography
  - — Cause secondary flattening of central cornea
  - — Angle of corneal rings can be selected to reduce astigmatism
- ☑ Conductive keratoplasty
  - — Off-label use in corneal ectasia
  - — Placed below bulge to centralize steep area of cornea
  - — Can mitigate against-the-rule astigmatism
  - — Can be used in conjunction with corneal inserts
- ☑ Collagen crosslinking
  - — Used abroad for several years
  - — Uses UV light and riboflavin to induce covalent crosslinks
  - — Physically strengthens cornea
  - — Subject of multicenter clinical trial in US
  - — Early results indicate efficacy
  - — Underlines importance of early detection

Placement of the inserts can affect corneal astigmatism, so the incision site should be selected based on refractive, keratometric, and topographic astigmatism. The incision site is typically placed at the steep corneal axis. Two corneal inserts can be implanted in a symmetric pattern or, in some cases, a single insert may be placed below the steep area to improve the corneal topography.

In some of these patients, CK can also be used. Approved by the FDA for the treatment of hyperopia and presbyopia, CK can be used on an off-label basis to steepen a flatter hemimeridian. If placed below the steep area in an ectatic patient, CK by itself can help center the steep area and thereby regularize the topography. CK can also be used adjunctively with corneal inserts to minimize astigmatism. For pellucid-style topography (sagging cones), CK can be effective in mitigating against-the-rule astigmatism.

## Corneal Crosslinking

As noted above, the second arm of ectasia management is preventing further progression of the disease. Until recently, we had no means to do this effectively, but a new therapy, corneal collagen crosslinking (CXL), is being used successfully abroad and has shown early promise in a US multicenter clinical trial.[2] CXL uses riboflavin plus 365-nm ultraviolet light to induce covalent crosslinks amongst corneal collagen fibers (Figure 1). The goal of treatment is to strengthen the cornea (making it physically stiffer) in order prevent further biomechanical deformation.

The US study in which we are participating, run by R. Doyle Stulting at Emory Eye Center, is looking at the safety and effectiveness of CXL for progressive keratoconus and corneal ectasia following LASIK. Early results, as well as longer-term results from overseas where the therapy has been used for several years, indicate that the treatment is effective in limiting progression of ectasia.

### THE BOTTOM LINE

**Corneal ectasia is a rare but serious complication of LASIK. In the condition, the cornea thins and deforms, bulging outward. This irregular steepening leads to a reduction in both uncorrected and best spectacle-corrected visual acuity. Restoring vision centers around fitting patients with GP, hybrid, or specialty keratoconus contact lenses. These lenses create a more regular corneal surface, thereby improving visual acuity. Corneal inserts and CK can help to restore visual acuity by flattening the corneal bulge and regularizing the cornea, respectively. The only treatment that can limit progression of corneal ectasia—collagen crosslinking—is currently the subject of a multicenter clinical study in the US, the early results of which are promising. The upshot is that we can now help our ectasia patients regain functional vision, typically without a corneal transplant.**

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