

# Ectasia Without Risk Factors

Does this really occur, and can it be avoided?

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**C**orneal ectasia is a progressive bowing forward and thinning of the cornea that can diminish UCVA and BCVA. Its occurrence after LASIK can be a serious complication, and its cause is not always completely apparent.

## WHO IS AT RISK?

### Recognized Factors

Previous studies<sup>1-9</sup> suggest that ectasia primarily occurs in patients who have demonstrable preoperative risk factors or rarely in association with complications from the surgery. Several risk factors may predispose patients to post-LASIK ectasia, including a preoperative pachymetry  $<500\mu\text{m}$ , calculated residual bed  $<250\mu\text{m}$ , steep corneas or high attempted corrections for myopia, signs suggestive of keratoconus, forme fruste keratoconus or pellucid marginal degeneration on topography or other imaging modalities, multiple retreatments, and surgical/flap complications.

### Post-LASIK Cases

Anecdotally, cases of ectasia have occurred following LASIK for which the surgeons have, even retrospectively, been unable to identify any recognizable preoperative risk factors. We attempted to determine the incidence and characteristics of cases where ectasia occurred in the absence of any of the risk factors mentioned earlier. We polled ophthalmologists who participate on Kera-net, ASCRS-net, and the ISRS/AAO's ISRSnet Internet bulletin boards (between April and October 2003) in order to collect cases that might satisfy rather rigid criteria for the "absence of identifiable risk factors."

Data collected regarding the eyes in our study<sup>10</sup> have been submitted for publication elsewhere. However, we can

relate that a significant number of patients developed post-LASIK ectasia without any of the aforementioned recognizable risk factors. We believe that most surgeons would have performed surgery on any of these patients because the surgeons would have no reason to anticipate postoperative ectasia.

Ectasia occurred with several different types of excimer lasers and microkeratomes. All preoperative central corneal pachymetries were greater than  $500\mu\text{m}$ . Calculated residual stromal bed thickness was greater than  $250\mu\text{m}$  in every case. Following LASIK, all cases demonstrated increasing myopia and astigmatism as well as a progressive loss of both UCVA and BCVA. Many eyes required rigid gas permeable contact lenses for visual rehabilitation, and one required penetrating keratoplasty.

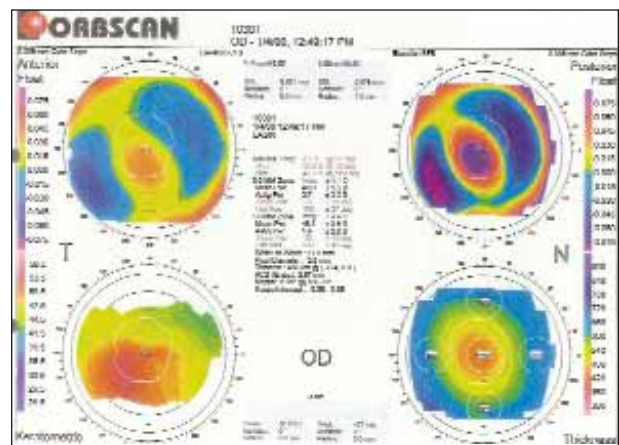


Figure 1. An Orbscan II (Bausch & Lomb, Rochester, NY) study reveals characteristic signs of post-LASIK ectasia.

### A TYPICAL LASIK CANDIDATE?

A 41-year-old male was corrected to 20/20 with a preoperative manifest refraction of  $-7.25 +0.75 \times 115$  in his left eye. He had keratomeries of  $42.6 \times 96$  and  $40.7 \times 6$ . His preoperative ultrasonic pachymetry was  $556\mu\text{m}$ . Preoperative topography of his left eye demonstrated mild with-the-rule astigmatism without inferior corneal steepening. His right eye was similar to his left.

The patient underwent uneventful LASIK in his left eye, using a CB microkeratome (Moria, Antony, France) fitted with a  $130\text{-}\mu\text{m}$  head and a “-1” ring. Ablation was carried out with a Technolas 217C laser (Bausch & Lomb) with a calculated ablation depth of  $119\mu\text{m}$ . His intraoperative pachymetry measured  $416\mu\text{m}$ . His calculated residual stromal bed was  $307\mu\text{m}$ .

At 1 month postoperatively, a manifest refraction of  $-2.25 +0.75 \times 004$  yielded 20/20 visual acuity. The patient's BCVA with  $-5.00 +4.00 \times 025$  was 20/30 8 months postoperatively. A diagnosis of ectasia was made at that time. An Orbscan (Bausch & Lomb) analysis 17 months after surgery revealed inferior corneal steepening consistent with ectasia (Figure 1). The patient was fitted with a rigid gas permeable lens in his left eye, that left him with 20/30 vision.

### POSSIBLE ETIOLOGIES FOR ECTASIA

In order to avoid ectasia in patients without apparent risk factors, it is important to ascertain possible reasons for its occurrence.

Although all eyes in our study had calculated residual stromal beds thicker than  $250\mu\text{m}$ , only one eye had intraoperative pachymetry. We estimated residual stromal bed thickness by subtracting the labeled microkeratome head thickness and the theoretical laser ablation depth from the preoperative pachymetry. There are several sources of error in this calculation. Several studies<sup>11-14</sup> have demonstrated a wide distribution for flap thicknesses cut by many types of microkeratomes. It is not always safe to assume that a microkeratome will cut its labeled head thickness. Additionally, factors such as dehydration of the bed, variation in tissue ablation at different stromal depths, and fluctuations in pachymetry measurements add to flap-thickness uncertainty.

The limitations of our diagnostic technologies may make forme fruste keratoconus difficult to diagnose. For example, asymmetry of the astigmatic bowtie on topography, classically seen with forme fruste keratoconus, may be mimicked by keratoconjunctivitis sicca or can be a normal variant.

Some cases may be the result of biomechanical instability within the cornea itself that makes it unable to withstand the insult of LASIK. As Piccoli<sup>15</sup> discussed, corneas that have the same thickness may not have the same

strength. LASIK surgeons currently do not have the capability to recognize corneas that may have a decreased tissue density or tissue that is less than structurally sound.

Age may also be an important factor. Keratoconus often presents clinically in subjects in their midteens. If the age of onset of keratoconus follows its normal distribution, a small number of subjects will not become keratoconic until their early twenties. Because LASIK is often performed on patients who are 21 years old, there will be a small subset of the LASIK population who will develop keratoconus later on as a function of their eyes' natural predisposition to do so. Instead, these patients will develop ectasia after LASIK, and the refractive surgery blamed.

In comparing our patients to Randleman's study<sup>2</sup> of ectasia patients, we found that ours were significantly younger by a margin of more than 14 years. They may represent (in part) those who were predisposed to developing ectasia because they may have developed keratoconus even without LASIK.

### LIMITATIONS OF THE STUDY

This is a retrospective case series in which different surgeons performed LASIK surgeries with various techniques and equipment. In order to identify more definitively the characteristics of a patient who may unexpectedly develop ectasia postoperatively, a prospective study using a standardized surgery and technique would be more useful. Additionally, only one of our enrolled patients had his intraoperative pachymetry recorded. This makes it difficult to rule out thick flaps as a source for ectasia. It is also possible that some patients may have corneas biomechanically predisposed to developing ectasia.

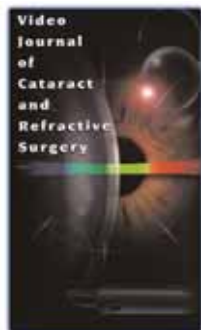
### CONCLUSIONS AND RECOMMENDATIONS

In addition to eliminating patients with the risk factors mentioned earlier from undergoing LASIK surgery, there may be other pertinent considerations in order to prevent ectasia. First, when calculating the residual stromal bed thickness, it is important to take into account the possible wide range of flap thicknesses achieved with mechanical keratomes. In patients who have borderline pachymetry, surface ablation or the use of the Intralase FS laser (Intralase Corp., Irvine, CA) to make the flap may be advisable. Second, surgeons should utilize intraoperative pachymetry both before and after cutting the flap when performing LASIK. This technique can detect a thick flap, which might be an indication for modifying or cancelling an ablation that would further weaken the thinned stromal bed. Lastly, young patients must be carefully considered, because some may have ectatic predispositions that would become manifest if given more time. ■

# VIDEO JOURNAL OF CATARACT AND REFRACTIVE SURGERY

PRESENTED BY ROBERT H. OSHER, MD

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The *Video Journal of Cataract and Refractive Surgery* completed its 20th year with two entertaining and instructive programs. The third issue of 2004, entitled "Complication Management," began with "Complications of Microphacoemulsification" by Robert H. Osher, MD. Next, Robert J. Cionni, MD, reviewed the clinical signs of reverse pupillary block and how to manage this situation. John C. Hart, Jr., MD, demonstrated the differential

diagnosis and management of zonulopathy and emphasized the diagnosis and management strategies. A remarkable case of capsular herniation was presented by Jihad Chabani, MD, of Spain. "Visualizing Vitreous With 11-Deoxy Cortisol" was presented by Yuichi Kaji, MD, from Japan. Robert Osher, MD, emphasized the importance of proper silicone tip alignment in order to avoid posterior capsular rupture. Fernando Trindade, MD, from Brazil reminded viewers that the Simcoe tip can be invaluable, while Virgilio Centurion, MD, from Brazil presented a difficult case of endophthalmitis. Another group of Brazilians, Drs. Lake, Casanova, Barros, Malta, and Freitas, showed several cases of Descemet's detachment. The program concluded with an unusual case of intraocular bleeding presented by I. Howard Fine, MD.

The fourth issue featured video highlights from around the world. Takayuki Akahoshi, MD, from Japan began the program with a video entitled "Knuckle Up," winner of both the ESCRS and ASCRS competitions. Robert Osher, MD, introduced a series of new signs in cataract surgery. H. Burkhard Dick, MD, from Germany, Suresh Pandey, MD, from Australia, and Liliana Werner, MD, from the US collaborated to produce an award-winning film entitled "Foldable Capsular Rings: The Next Generation." Drs. Prieto, Cabral, Silva, Ferreira, Feijóo, and Esperancinha from Portugal showed a video entitled "Big Subluxation of Lens in Young Children: Our Big Bad Wolf." French surgeon Gilbert Serpin, MD, demonstrated a "Loaded IOL," featuring a new anti-inflammatory delivery system. The issue closed with another award-winning video produced by Tobias Neuhann, MD, and Karl Brasse, MD, from Germany entitled "Posterior Chamber Verisyse Lens Implantation to Correct Aphakia Without Capsular Support."

The *Video Journal of Cataract and Refractive Surgery* is published quarterly by Robert H. Osher, MD. The hour-long program is available on CD-ROM, DVD, and multiple video formats. For more information, contact Dena Back at [dback@cincinnatiye.com](mailto:dback@cincinnatiye.com) at the Cincinnati Eye Institute or call (513) 984-5133 ext. 3239.

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