

# The Maturation of Keratorefractive Surgery

From discovery to awareness.

BY LEE T. NORDAN, MD



Now that the LASIK community has weathered several notable and very public litigations, I will, once again, opine on the topic of when to deem certain preoperative corneas unlikely to achieve a stable, successful LASIK outcome. Since my retirement from active practice several years ago, I have remained involved as an expert for the defense in two virtually identical lawsuits, both cases of LASIK performed on patients with preoperative BCVAs of 20/20 and nondescript, mildly “abnormal” topography.

## CORNEAL HEALTH

In a conversation during mid-March, Ron Bache, Vice President of Worldwide Marketing for Advanced Medical Optics, Inc. (Santa Ana, CA), shared with me some interesting statistics. As of early 2006, the percentage of surface corneal ablations (eg, PRK) performed for the initial correction of refractive error was approximately 50% and increasing among the European ophthalmologists he knows. The number was about 10% but also rising in the US. Some surgeons have developed significant concerns about the long-term safety of flap creation. I consider the formation of a LASIK flap to be extremely safe ... on the proper cornea.

In my opinion and experience, there is no significant incidence of corneal ectasia when LASIK is performed on a healthy cornea and a reasonable amount of corneal stroma is left untreated. I think that post-LASIK corneal ectasia shown by Orbscan automated topography (Bausch & Lomb, Rochester, NY) is likely an artifact associated with the machine. I base this assertion on my belief that placing a hard contact lens over the post-LASIK cornea will change the posterior-curvature result that the machine offers. The next question is, does this ectasia appear and then disappear? If the IOP remains the same, that possibility seems unlikely.

Nevertheless, a small but significant number of corneas develop ectasia after LASIK. In my experience, almost all of them are cases in which the cornea was abnormal (weaker than normal) prior to the creation of the flap.

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## DETERMINING WEAKNESS

Although I have held my current views concerning corneas with “subtle but abnormal topography” since around 2000, I do not think it was until about 2004 that the picture became clear and well reported enough that a noncorneal specialist should have been aware of many of these danger signs. The reasons for my assertion are numerous. First, some corneas with danger signs may have a successful postoperative result for several years. Second, one could only identify corneal pellucid marginal degeneration, as described in textbooks (pre-automated topography), when the disease was moderate or severe. It took a while for automated topography to identify very subtle disease and categorize it as a distinct entity from atypical keratoconus. Subtle corneal pellucid marginal degeneration will not be exposed by central pachymetry readings.

Up until around 2001, subtle cases of corneal pellucid marginal degeneration were diagnosed as a variant of keratoconus or received little attention, because the central cornea had no irregular astigmatism and the patient had a BSCVA of 20/20. For the majority of LASIK surgeons, common sense dictated that a central cornea capable of 20/20 UCVA preoperatively would remain so postoperatively, especially because the central pachymetry was normal. We now know that such is usually not the case.

Most corneal scholars now consider keratoconus and corneal pellucid marginal degeneration to be variants of the same disease process that have different locations. The primary site of keratoconus is slightly inferocentral, whereas the primary initial location for corneal pellucid marginal degeneration is generally inferior but toward

## NORDAN'S PERSPECTIVE

the limbus. In basic topographic terms, subtle keratoconus shows up as a red hot spot near the center of the cornea, whereas corneal pellucid marginal degeneration is a red hot spot a few millimeters lower, often with the characteristic appearance of a crab's claw. In both cases, the topography is clearly abnormal. The basic pathophysiology of these disease processes is still unknown.

### IMPLICATIONS

With a steep abnormal cornea, the IOP can cause a slight but significant degree of corneal ectasia. If the cornea is weakened further by the creation of a flap, the ectasia will progress, although it may take several years. Surgeons therefore should not create a LASIK flap on a cornea for which the topography is inexplicably abnormal, no matter how subtle the change.

The other danger sign is a thin cornea. Statistically, a thin central cornea is associated with tissue that is weaker than normal. That correlation is undeniable. Each LASIK surgeon must decide the acceptable lower limit of central corneal pachymetry. For me, it would be approximately 510 $\mu$ m. I believe that a central corneal thickness of 500 $\mu$ m or less is an example of forme fruste keratoconus and has a much higher likelihood of developing ectasia after LASIK. That some of these corneas may do well after the procedure does not change the facts that the risk of complications is much too high for LASIK and that a PRK-type procedure is much safer in the long term. Yes, corneal haze may be a risk of surface ablation (ameliorated by the use of mitomycin C), but that potential complication is far preferable to the need for a penetrating keratoplasty.

In order to diagnose subtle corneal pellucid marginal degeneration, LASIK screenings should include pachymetry in the four quadrants at the 7-mm optical zone, if dictated by the topography, as well as in the central cornea. If the inferior pachymetry reading is lower than the central reading, I would shy away from LASIK.

### CONCLUSION

I have no doubt that other opinions exist as to the danger signs associated with the creation of the LASIK flap. I suggest, however, that the factors I have presented are consistent with our profession's experiences and observations over the past 10 years of keratorefractive lamellar surgery. It has taken us more than half of this decade to learn the risk factors associated with a LASIK flap. Now, I believe that we should all be aware of them. ■

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