CAN FEMTOSECOND FLAPS ELIMINATE ECTASIA?

Residual bed thickness is one of the most important risk factors.

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Ectasia is perhaps the most devastating late postoperative complication of LASIK. Since it was described by Seiler and Quurke in 1998,1 many studies have been published in efforts to predict the risk and the possibility of post-LASIK ectasia occurrence before surgery is performed, and every known measure and precaution to avoid or at least minimize this possibility has been considered. There are many factors that contribute to the risk of post-LASIK ectasia and also many factors that can jeopardize corneal integrity and strength after LASIK. However, the presence of a sufficiently thick residual stromal bed after refractive surgery is probably the most widely accepted among these risk factors.2

It has recently been proposed that a high percentage of tissue altered (PTA) is the main risk factor for the development of ectasia after LASIK in corneas with normal preoperative topography.3 This measure is derived from the formula $PTA = \frac{\text{flap thickness} + \text{ablation depth}}{\text{central corneal thickness}}$. In further work studying the relationship of ablation depth to PTA in post-LASIK ectasia, Santhiago and colleagues concluded that flap thickness had more impact than ablation depth.4

MOST IMPORTANT RISK FACTOR

These findings should make every LASIK surgeon pause to consider the importance of LASIK flap creation in nullifying or at least reducing the risk of postoperative ectasia. This crucial step is probably the most important risk factor in this regard.

Use of a mechanical microkeratome to create LASIK flaps has been demonstrated to result in a wide disparity in accuracy and reproducibility of flap thickness.5 Reinstein and colleagues studied a probability model of the inaccuracy of residual stromal thickness (RST) prediction in an attempt to reduce the risk of ectasia after LASIK. Their model revealed that, given a target RST of 250 µm and using published statistics on flap thickness, the probability of leaving an RST of less than 200 µm ranged from less than 0.01% to 33.6%.6

The case with mechanical microkeratomes is even more complex, however. The morphology of flaps created by mechanical microkeratomes plays a role just as important as flap thickness. In some published cases of post-LASIK ectasia, the authors failed to demonstrate an abnormally thick flap that could explain the unexpected ectatic outcome. A meniscus shape with a deeper peripheral cut has been shown to result in a higher loss of corneal biomechanical properties.7 This is an important additional imperfection of mechanical microkeratome flaps that can add to the probability of ectasia risk.

SAFER FLAP CREATION

In the modern era of femtosecond laser technology, flap creation using these platforms is safer, especially when it comes to evaluating the issue of reducing or eliminating the risk of ectasia. The major advantages of femtosecond laser flap creation compared with mechanical microkeratome flap creation include the following:

- Reduced incidence of flap complications (eg, buttonholes, epithelial abrasions, short and irregular flaps);
- Greater surgeon choice of flap diameter, thickness, side-cut angle, hinge position, and length;
- Increased precision with improved flap safety and thickness predictability; and
- Capability of cutting thinner flaps to accommodate thin corneas and high refractive errors.8-13

Flaps created with the femtosecond laser are planar in architecture,10 in contrast with most microkeratome flaps, which have been shown to possess significant variability in thickness profile.14 This is important, as uniformity and high precision of flap thickness can reduce errors of residual stromal bed prediction—one of the highest risk factors in any ectasia risk scoring system.
CONCLUSION

I believe that performing laser-assisted sub-Bowman keratomileusis with a thin stromal flap maximizes residual stromal bed thickness and preserves as much as possible the biomechanical stability of the cornea.

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It may be that laser-assisted sub-Bowman keratomileusis with a thin stromal flap can maximize residual stromal bed thickness and preserve as much as possible the biomechanical stability of the cornea. Femtosecond laser platforms allow us to achieve this goal in a safe and fully controlled manner.