

Point/Counterpoint: LASIK Versus Su

A surface ablation surgeon considers performing LASIK.

BY WILLIAM T. TRATTLER, MD

In 2006, wavefront-guided surface ablation procedures provide excellent visual results with a much lower rate of haze and postoperative pain than in the past.¹ In my practice, patients undergoing surface ablation typically see 20/25 to 20/40 uncorrected on postoperative day 1 with a low degree of discomfort. The downside of surface treatments is the delay in visual recovery (4 to 5 days). Nonetheless, its overall excellent results and positive safety profile have led to an increase in the volume of surface ablation in the US to around 16.7% of all laser refractive surgery in the second quarter of 2006, as noted by D. Harmon of Market Scope LLC (written communication, September 2006).

Although the vast majority of my patients are willing to go through the slower healing process with surface ablation, it would be helpful for certain patients to be able to obtain quicker visual recovery with nearly the same safety and quality of vision that is available with surface ablation. During the past few years, better screening methods, better devices for making flaps, and better perioperative and postoperative pharmacologic regimens have helped improve the overall results with LASIK. Recently, Stephen Slade, MD, of Houston, introduced a new concept called sub-Bowman's keratomelieusis, which is essentially a thin, planar, small-diameter flap created by the Intralase FS laser (Intralase Corp., Irvine, CA). Sub-Bowman's keratomelieusis has demonstrated excellent visual results and a high degree of safety.² John Marshall, PhD, of London supports this concept as one that may preserve corneal structural integrity.³

RECENT IMPROVEMENTS IN LASIK

Dry Eye

Great postoperative outcomes with any refractive procedure are not guaranteed. During the past few years, significant improvements in the treatment options for dry eye have enhanced LASIK's results. The condition is a common pre-

existing state in patients considering refractive surgery, with 50% of contact lens wearers reporting dry eye symptoms.⁴ Moreover, some surgeons have found that close to 37% of patients without preexisting dry eye will develop symptoms 6 months after LASIK.⁵ Investigators have determined that, following LASIK, there is a progressive loss of conjunctival goblet cells, which are important to the eye's production of the mucins that help improve the tear film's quality.⁶

Research on Restasis (Allergan, Inc., Irvine, CA) has shown that its topical application can triple the density of goblet cells in dry eye patients in just 6 weeks.⁷ Two studies found that the addition of this agent to the perioperative drug regimen can improve visual results as well as reduce dry eye after LASIK.^{8,9} The positive impact of Restasis on refractive results is not too surprising, because earlier research showed that preexisting dry eye is a risk factor for a regression of effect.¹⁰

Corneal Flaps

Perhaps the biggest improvement, in my opinion, in the delivery of LASIK during the past 5 years has been the introduction of technology to reduce flap-related complications. The Intralase laser produces planar flaps of a consistent thickness and avoids many uncommon but problematic complications such as buttonholes or irregular flaps. A study that compared the wavefront-guided ablations on eyes with flaps created with various technologies revealed that eyes treated with the Intralase laser obtained faster visual recovery, better uncorrected vision, and better contrast sensitivity compared with eyes treated with mechanical microkeratomes.¹¹

Ectasia

There is still controversy as to whether a specific preoperative corneal thickness is a risk factor for post-LASIK ectasia. At present, no studies have shown that a preoperative pachymetry reading of 500 μ m or under in patients with normal corneal topographies increases their risk for ectasia.

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Surface Ablation

The procedure has a faster healing rate and fewer complications than LASIK.

BY JOHNNY L. GAYTON, MD

Toward the end of 2000, my colleagues and I started questioning the wisdom of performing LASIK. We noticed that many of our patients were not “20/happy” despite a UCVA of 20/20 after LASIK. They complained of significant glare at night and dry eyes. Several patients had ectasia. After the incidence of dry eye and ectasia increased, I started seeking safer methods of laser vision correction.

What appealed to me was Dr. Massimo Camellin’s method of performing alcohol-assisted surface laser treatment with preservation of the epithelial flap.¹ He first presented this at the ASCRS annual meeting in 1999. As my practice was making the transition from LASIK to LASEK, a cluster of mycobacterial infections occurred in our LASIK population. This outbreak was evaluated by Emory Eye Center in Atlanta and the Centers for Disease Control and Prevention without a source’s ever being found. This epidemic convinced us to stop performing LASIK entirely, and we converted to 100% surface ablation.

Thus far, we are very pleased by our results with surface ablation. Our patients have fewer complications and a higher quality of vision compared with our LASIK patients. It is well documented that surface-treated eyes have less risk of dry eye, ectasia, and vitreoretinal problems.²⁻⁶ Additionally, surface ablation poses no risks related to the stromal flap, because the procedure does not require the creation of one.

COMPLICATIONS FROM LASIK

Damage to Corneal Sensory Nerves

What concerns me most about LASIK is the damage the procedure causes to the sensory nerve trunks. It is well known that a sensory nerve is cut during LASIK that may or may not recover. When this nerve does regrow, it generally does not function as well as it did preoperatively.^{7,8}

According to Perez-Gomez and Efron, a total disappearance of the subepithelial nerve fiber bundle occurred 1 month after LASIK.⁹ Erie et al reported that the recovery of corneal subbasal nerve density after LASIK was markedly prolonged in comparison to PRK.⁷ At 2, 3, and 5 years after PRK, the subbasal nerve density was not significantly different than before PRK. In contrast, even 3 years after LASIK, there was a 34% decrease in the nerve’s thickness.

In a comparison of the rate of corneal nerve regeneration in post-LASIK and post-LASEK patients, the former experienced a reduction in corneal sensitivity and fewer nerve fibers 6 month postoperatively versus preoperatively. The LASEK patients experienced no change from baseline.¹⁰

Wu et al evaluated the recovery of corneal sensitivity following LASEK for myopia.¹¹ According to the study’s results, the recovery of corneal sensitivity began 1 month after LASEK and was complete by 3 months in eyes treated for low-to-moderate myopia and by 6 months in eyes treated for high myopia. These findings lend support to my contention that eyes that undergo LASEK heal whereas those treated with LASIK do not.

Corneal Weakness

According to John Marshall, PhD, of The Rayne Institute at St. Thomas’ Hospital in London, LASIK severs 40 to 50 times more collagen fibers than surface treatment depending on the depth of the cut. Dr. Marshall maintains that LASIK is less stable in the long term than surface procedures, because the former causes more corneal weakening. He states that, “when a flap is cut, there is an immediate change in the stress in the structure. When the flap is replaced, the volume of the system is almost restored, but the compromised mechanical status remains unchanged.”¹² Not only do LASIK ablations cut deeply, but they also sacrifice the most

precious part of corneal structural strength that has the densest lamellae.

Experience with penetrating keratoplasty and RK has demonstrated that, once a corneal collagen fiber is cut, it remains that way forever. Consequently, corneal incisions never fully heal. In fact, it is well known that a traumatic dislocation of the flap can occur years after LASIK. There was a case report of a traumatic dislocation of the stromal flap 47 months post-LASIK.¹³ According to Harry W. Flynn, Jr, MD, of the Bascom Palmer Eye Institute in Miami, LASIK patients having a scleral buckle are at risk for a dislocation of the LASIK flap when the buckle is tightened.¹⁴ This information confirms that the flap does not adhere very well to the stromal bed.

A refractive surgery problem that is avoided entirely with surface treatment is flap complications. The frequency of this difficulty is reported to be in the range of 0.3% to more than 9%. We know that the incidence of flap-related complications is decreasing with newer technology.¹⁵ But it is important to note that the occurrence of flap-related complications with surface treatment is zero. Surgeons have lifted LASIK flaps, however, for the purpose of an enhancement many years postoperatively. This ability supports the work of Schmack et al¹⁶ at Emory University in Atlanta. They reported that the strength of the flap bed's interface only recovers to approximately 2.4% as strong as a normal corneal stroma. The strength at the corneal stroma's edge, however, is approximately 25%.¹⁶

Ectasia has been reported after both myopic and hyperopic LASIK as well as after PRK. LASIK significantly impacts the biomechanical strength of the cornea. Park and Kim reported that 24 rabbit eyes that underwent LASIK suffered from an absence of wound healing.¹⁷ Yee found that ectasia is 30 times more prevalent after LASIK than after surface ablation.¹⁵ Stulting estimated the incidence of ectasia is approximately one in every 3,000 LASIK cases.¹⁸ It could be that we are only seeing the tip of the iceberg in regard to ectasia. What can we expect of patients who are 40 to 50 years after LASIK?

According to the National Institute for Clinical Excellence report, the primary problem with LASIK is the long-term risk of corneal ectasia.¹⁹ When a government entity warns the public about the risk of something, it is important that the medical community take it seriously.

Bahar et al²⁰ reported that the use of wavefront-guided PRK to treat patients with abnormal corneas to be safe and effective. The efficaciousness of this treatment means that not only is surface treatment less likely to cause keratoectasia, but it may be used to treat abnormal corneas. LASIK for hyperopia has been shown to cause ectasia as well.

ADDITIONAL BENEFITS OF SURFACE ABLATION

Besides avoiding the aforementioned LASIK complications, surface treatment offers numerous advantages. Without a stromal flap, surface procedures induce fewer higher-order aberrations. Surgeons are also able to treat superficial scars and anterior basement membrane disease in conjunction with the refractive procedure.²¹ Patients receiving LASEK or another surface treatment have fewer unwanted visual phenomena at night, smaller starbursts, and better contrast sensitivity than patients having LASIK.^{22,23}

Surface treatment is also an option for an enhancement after other procedures. I have used it following LASIK, RK, retinal detachment surgery, and previous surface procedures. Lifting a LASIK flap and performing an enhancement can lead to ectasia, because collagen fibers in the bed (which is providing support to the cornea) are being treated. Because the stromal flap provides little-to-no support for the cornea, performing a surface enhancement on the LASIK flap is much less likely to induce corneal ectasia. Using a full optical zone when dealing with a patient whose LASIK involved a small stromal flap eliminates complications from recutting. It also does not redamage sensory nerve trunks and virtually eliminates the risk of epithelial ingrowth following enhancements because ingrowth is due to lifting the LASIK flap.

According to Stephen Slade, MD, of Houston, there may be advantages in performing surface laser treatments in some eyes, such as a patient with a thin cornea who also requires a larger optical zone. This type of patient may need a deeper ablation and so may not be a candidate for LASIK with traditionally thicker flaps.²⁴ Another PRK candidate may be someone who has an eye with anterior basement membrane dystrophy because the surface treatment may help the dystrophy. PRK patients may not sacrifice visually when compared to traditional LASIK patients, once a PRK eye is healed after several months.

CONCLUSION

In exchange for a slower recovery and some postoperative discomfort, patients reduce their risk of both short- and long-term complications when they choose surface treatment over LASIK. In addition, they benefit from a higher quality of vision following surface ablation. Furthermore, their eyes will truly heal unlike with LASIK. ■

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Nevertheless, many surgeons offer surface ablation rather than LASIK to this group of patients. They also often recommend a surface procedure to patients with mildly abnormal corneal topography (not severe enough to be considered forme fruste keratoconus).

Although these changes in patient selection have probably reduced the incidence of post-LASIK ectasia, a major improvement in LASIK is surgeons' routine measurement of intraoperative pachymetry. This step is important because it can identify LASIK flaps that are thicker than anticipated, a rare but serious problem. I recently shared a case report of two patients who had undergone LASIK on the same day by the same surgeon.¹² Both developed post-LASIK ectasia and were later found to have LASIK flaps in excess of 200µm. Because the surgeon did not perform intraoperative pachymetry, he had not discovered that the microkeratome was cutting deeper than expected.

CONCLUSION

For the past 4 years, I have performed surface ablation almost exclusively, because it provides my patients with the possibility to achieve the best quality of vision with the lowest risk of postoperative problems.¹ Now, however, I am considering increasing my use of LASIK in carefully selected patients, especially those who require rapid visual rehabilitation, because recent results with thin, small-diameter, planar LASIK flaps have shown excellent visual outcomes. By planning to pretreat patients with Restasis as well as utilize the latest laser flap-creating technology, I look forward to

returning to LASIK in a setting that will provide my patients with a high quality of vision in addition to a lower risk of post-LASIK issues than in the past. ■

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