Surface Ablation Alternatives

A comparative study of PRK and Epi-LASIK shows clear advantages for Epi-LASIK; a second study examines the pros and cons of retaining or discarding the epithelial flap.

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In recent years, surface ablation has improved to the point that more surgeons and patients are willing to accept it as an alternative to LASIK. In our clinic, although LASIK is still the leading method for surgical correction of refractive error, we have pursued various methods of surface ablation with great interest.

Currently, our preferred surface ablation method is Epi-LASIK. My colleagues and I have performed approximately 1,400 Epi-LASIK procedures thus far, including 200 in which the epithelial sheet or flap was discarded.

We were very pleased with our initial Epi-LASIK results, but questions remained about its efficacy compared to traditional PRK. We also wondered whether it is necessary to preserve the epithelial sheet in Epi-LASIK. To answer these questions, two separate prospective studies were conducted.

PRK vs. Epi-LASIK

In the first study, we compared PRK and flap-discarded Epi-LASIK. We enrolled 124 eyes of 62 patients (35 males and 27 females, ranging from 22-35 years old). Preoperative myopia ranged from -2.00 to -5.75 D, with a mean spherical equivalent of -3.34 ± 1.14 D. 60 eyes were treated with PRK and 78 with Epi-LASIK. The two groups were similar in terms of age and refractive error.

An NSAID (Acular, Allergan) was given four times a day the day before surgery.

In the Epi-LASIK group, the Moria Epi-K™ was used to make a free epithelial flap of 8.0-8.5 mm in diameter. In the PRK group, an epithelial scraper was used to mechanically remove corneal epithelium over an approximately 8.0-mm-diameter area. All the patients were treated with the Wavelight Allegretto Wave 107 excimer laser.

Postoperative management was similar for both groups. The ablation area was rinsed with BSS and covered with an Acuvue Oasys bandage contact lens (8.4-mm base curve), which was removed after three days. Patients were given antibiotic/anti-inflammatory drops (TobraDex, Alcon) four times per day for one week. At one week postop, they were switched to fluorometholone, tapering from four times per day to once daily over 12 weeks. Artificial tears were also prescribed for the first week after surgery.

The results distinctly favored Epi-LASIK (Table 1). In the Epi-LASIK group, the edge of the epithelial defect was regular and clear, compared to the irregular edge common in the PRK group. The surface of Bowman's membrane was very clean, while in the PRK eyes there was residual epithelium. Re-epithelialization occurred quite quickly in the Epi-LASIK eyes, starting on Day 1; it was slower in the PRK group, which also had less regular epithelium with a little more edema.

Moreover, the Epi-LASIK eyes were noticeably less irritated. Redness and visible irritation, when it did occur, disappeared much more quickly in this group.

At one week postoperative, visual acuity was significantly better in the Epi-LASIK group. There was also a difference at one month, although it was not statistically significant.

Our study correlates with other reported results with Epi-LASIK. Although more data are needed, we believe that Epi-LASIK is superior to PRK for the management of mild to moderate myopia. Re-epithelialization and recovery of visual acuity are faster with Epi-LASIK, and patient comfort is better.

Epi-LASIK vs. PRK

	Epi-LASIK (flap discarded)	**Conventional PRK**
Quality of epithelial defect edge	Regular, clear	Irregular
Surface of Bowman's membrane	Clean	Residual epithelium
Re-epithelialization	Very regular No edema Fast recovery	Less regular Mild edema Slow recovery
Irritation	Mild or no irritation Cleared quickly	Noticeably more irritation

Keep or discard the flap?

The second question we hoped to answer is whether one should retain or discard the epithelial sheet in Epi-LASIK. Until recently, most of the literature supporting LASEK or Epi-LASIK emphasized the importance of a viable epithelial flap. Opposing studies pointed out that the epithelial flap might actually slow re-epithelialization, cause more severe and longer lasting irritation, and potentially cause plaque-like haze.

We studied 166 eyes of 85 Epi-LASIK patients, including 62 males and 23 females, 18-39 years old. Preoperative myopia ranged from a spherical equivalent of -1.75 to -10.25 D, with a mean of -4.52 ± 1.85 D.

In 88 eyes, a conventional Epi-LASIK procedure was performed, with the epithelial sheet remaining on the eye after ablation. In the other 78 eyes, the epithelial sheet created with the epikeratome was discarded. The two groups were very similar in terms of patient demographics and preoperative refraction.

In all eyes, an 8.0- to 8.5-mm epithelial flap was made using the Moria Epi-K™ device. Ablation was performed in both groups with the Wavelight Allegretto Wave 107 excimer laser.

In the flap-retained group, the laser treatment area was cleaned with a BSS-soaked cotton bud, the bed was dried before replacing the epithelial sheet, and then a hydrophilic bandage lens was placed on the eye. In the flap-discarded group, the treated area was washed with BSS and then bandaged with a hydrophilic contact lens. Both groups were given NSAIDs preoperatively and treated postoperatively with antibiotics and anti-inflammatory drops, as described above. The bandage lenses were removed three to five days after surgery.

In both groups, the epithelial flaps were of uniformly excellent quality, with regular, clear edges and consistent size and shape. There were no incomplete flaps. Bowman's layer was smooth in all eyes.

On the first day post-op, the flap-discarded group had regular epithelial re-growth, with no obvious edema. In some of the flap-retained eyes, there was edema in the stretched part of the epithelial flap overlying the epithelium underneath.

By Day 3, the group with the epithelium removed had completely re-epithelialized. In the eyes with flaps retained, 11 eyes had diffuse epithelial edema and 16 eyes had local epithelial edema. In seven of these eyes, recovery was delayed more than five days.

Comfort was different in the two groups, as well. On the first day post-op, the flap-retained group experienced milder symptoms than the group with no flaps. By Day 3, the situation was reversed. The eyes with the epithelium discarded were more comfortable. Only two eyes in this group had mild irritation symptoms, compared to 30% of the flap-retained group, which had varying degrees of irritation. In seven eyes, these symptoms lasted more than five days.

Visual acuity and refractive stability were better in the flap-discarded group at Day 1, 3, 7, and 30 post-op. By three months post-op, all of the mild to moderate myopic eyes in both groups had stable visual acuity and refraction.

Some of the high myopes in the flap-discarded group had varying degrees of disc-like haze in the central area, accompanied by some refractive regression. A few of the highly myopic eyes with the flap retained had Grade 1-2 disc-like haze and regression. Additionally, some of the eyes with delayed healing had plaque-like opacities. It is possible that mitomycin C (MMC), which was not used at all in our studies, could ameliorate these problems. Other surgeons who do use MMC, including Dr. Lindstrom, Dr. Verges, and others, have not reported such complications when using MMC.

Based on our study results (Table 2), we now discard the epithelial sheet for all cases under -5.0 D. Compared to Epi-LASIK with the flap retained, this technique results in faster recovery, less edema, and greater patient comfort. When patients do experience pain or edema, it resolves faster in the eyes with the epithelium removed. For higher myopes, I prefer to retain the flap for its potential benefits in preventing haze; I have also begun using MMC in these higher myopes.

Flap retained vs. flap removal in the early postoperative period

		Epithelium retained	Epithelium removed
Days 1-3	VA	Better	Worse
	Refraction	N/A	N/A
Days 7-30	VA	Good	Excellent
	Refraction	Most good	Ideal

In 2006, about 10%-15% of all our refractive surgery cases were surface ablation; last year this rose to 22%. With the benefits of Epi-LASIK, especially the reduced risk of flap complications, I expect the share of surface ablation procedures will continue to grow.

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