# How Do You Approach Unexpected Results From PRK Over Prior LASIK?

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***Have you ever performed a -1.00 D spherical enhancement with PRK after prior myopic LASIK only to achieve a surgical outcome of -2.50 D sphere? Alternatively, have you ever treated a patient for a -1.00 D refraction with PRK over prior myopic LASIK only to obtain a postoperative refraction of 2.25 D? Why do these unusual results occur, and how do you resolve them?***

## STEPHEN COLEMAN, MD

Laser technology is very precise, but it is less exact on previously operated eyes. In general, truly unexpected results following a primary procedure are relatively uncommon, whereas little surprises after enhancements are much more likely. This motivates many surgeons to strive to maintain a low enhancement rate.

Myopic LASIK commonly induces a small amount of spherical aberration (less so today compared with years past). The postoperative shape of the cornea is typically more oblate, making retreatments more challenging, particularly considering the new relationship between the peripheral and central cornea after LASIK. One pearl that I have found helpful when performing PRK over previous LASIK is to use the preoperative central keratometric values. They initially dictate the peripheral shot pattern and compensate for the cosine effect—a significant factor that affects enhancement outcomes. Additionally, the role of the epithelium after LASIK is a significant variable, because it is responding to a new and different corneal shape. Optical coherence tomography technology will be very useful in furthering our understanding in this area.

> "The role of the epithelium after LASIK is a significant variable, because it is responding to a new and different corneal shape."
> *–Stephen Coleman, MD*

## STEVEN J. DELL, MD

Many corneal irregularities are minimized by the natural tendency of the epithelium to smooth over underlying problems. For example, in a keratoconic eye, the epithelium over the apex thins, which reduces the steepness in that area and may mask early forme fruste keratoconus. The epithelium is also an excellent apologist for iatrogenic insults to the cornea. An oblate cornea after myopic LASIK may have a very thick central epithelial cellular layer as a result of the epithelium's attempt to deal with the abnormal shape. After an enhancement in an eye that has undergone myopic LASIK or PRK, the epithelium may regrow with a similar, greater, or smaller number of cellular layers compared with its pre-enhancement state. This usually results in emmetropia, but occasionally, it results in under- or overcorrections. In my experience, this phenomenon is much more common after hyperopic LASIK corrections, where peripheral epithelial hypertrophy will cause hyperopic regression. Epithelial debridement is sometimes helpful in dealing with the hypertrophic epithelium.

## MARK A. KONTOS, MD

Although PRK over prior LASIK has advantages, it carries a degree of uncertainty regarding the surgical outcome. Multiple factors probably cause variable outcomes. Mitomycin C (MMC) may have a less predictable effect in this setting, and epithelial hyperplasia is also a significant factor in many of these cases. When I looked through my past cases, I noticed that the patients who had a hyperopic overcorrection tended also to have moderate-to-high myopia at the time of their primary LASIK. The patients who had little or no effect after PRK often had lower myopia at the time of their primary LASIK. I try to keep this in mind when planning treatments. Because of the unpredictable nature of this type of enhancement, a detailed discussion with the patient about all possible outcomes is critical. Sometimes, the best plan of action is to leave things as they are.

## ROBERT K. MALONEY, MD

Reoperations can produce strange refractive results, and it is often hard to determine why they occur. The surgeon should be aware of the possibility of map regions from basement membrane dystrophy. These areas of thickened epithelial cells affect refraction, and their removal during PRK can produce significant refractive shifts. These thickened areas of epithelial cells are best seen with fluorescein and by looking for areas of negative staining. Another problem occurs with PRK enhancements after PRK, particularly if corneal haze is present. Accidental or intentional debridement of the haze produces a large hyperopic shift, even before laser retreatment. Subepithelial tissue from prior surgery is more likely to be inadvertently removed if a rotating brush is used to remove the epithelium for the enhancement. For this reason, I use alcohol to remove the epithelium for PRK enhancements.

> "Surgeons need to carefully monitor the amount of higher-order aberrations and the depth of ablation for enhancements."
> –Louis E. Probst, MD

## LOUIS E. PROBST, MD

Although the results of lifting the flap for LASIK retreatments for myopic regression are potentially more precise and definitely more convenient than PRK enhancements, it is has been shown that there is an increasing risk of epithelial ingrowth associated with lifting the flap as the postoperative time increases.[1] Therefore, PRK is my preferred enhancement method, particularly in the eyes of older patients that may have looser epithelial attachments.

In my experience, a myopic outcome after an enhancement for myopic LASIK regression is rare. When this does occur, it is likely the result of epithelial hyperplasia. A reasonable additional treatment would be epithelial removal with no laser treatment and the application of MMC to prevent further epithelial hyperplasia. Surgeons should always be careful about chasing progressive myopia with additional procedures, as this may indicate other ocular pathology.

Iatrogenic hyperopia after a customized myopic enhancement for myopic LASIK regression is more common. This outcome is due to the combined effect of the treatment of the myopia and higher-order aberrations, which result in an excessive ablation depth. Surgeons need to carefully monitor the amount of higher-order aberrations and the depth of the ablation for enhancements. With customized treatments, 18 µm per spherical equivalent diopter would be the expected depth of the ablation (a -1.00 D enhancement should have an ablation depth of only 18 µm). If the treatment plan shows a proposed depth of 30 µm, this is because of the additional treatment of the higher-order aberrations, which are probably greater than 0.50 µm. The treatment sphere should be reduced with the surgeon's adjustments until the ablation depth is closer to 18 µm to avoid overcorrection. Obviously, these adjustments are critical for patients in the presbyopic age group. With these adjustments, customized myopic enhancements yield excellent results with an improvement in uncorrected vision and quality of vision.

## STEPHEN A. UPDEGRAFF, MD

I think that unusual results are directly related to wound healing after surface treatments. In the case of a myopic result, epithelial hyperplasia is the most likely culprit and typically would be associated with corneal haze but not always. I would wait a minimum of 6 months before considering the next step. If appropriate, corneal segments may be the safest and most reliable next enhancement. A hyperopic result is typically related to subclinical stromal melting from MMC, which creates a flatter-than-intended cornea. If you pan the slit beam obliquely, you may pick up an otherwise imperceptible divot. I have reduced the concentration of MMC that I use to 0.01%, and I do not exceed 30 seconds of application. I also rinse the eye with continuous irrigation (50 mL). Surface treatments are easy until you are faced with these outcomes. That is why it is best not to plan a LASIK case with surface retreatment as your sole fallback for fine-tuning. ■

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1. Caster AI, Friess DW, Schwendeman FJJ. Incidence of epithelial ingrowth in primary and retreatment laser in situ keratomileusis. *J Cataract Refract Surg*. 2010;36(1):97-101.