

Late Post-LASIK Enhancement

BY STEVEN J. DELL, MD; COLMAN R. KRAFF, MD; LOUIS E. PROBST, MD;
AND KARL G. STONECIPHER, MD

CASE PRESENTATION

A 22-year-old woman had a 10-year history of rigid gas permeable (RGP) contact lens wear. She had wanted to undergo LASIK since watching her mother's procedure 9 years earlier. The visual acuity of her right and left eyes corrected to 20/20 with a manifest refraction of -4.25 D sphere and -4.75 D sphere, respectively. Her preoperative topography was obtained 3 weeks after she discontinued wearing her contact lenses (Figure 1). Both the slit-lamp and dilated fundus examinations were entirely normal, as was her medical history. Preoperative pachymetry readings were 540 µm OU.

The patient underwent uneventful LASIK in both eyes. After creating 8.2-mm flaps using the IntraLase FS 60 laser (Abbott Medical Optics Inc., Santa Ana, CA) at a depth of 110 µm, the surgeon performed bilateral customized myopic ablations with a Visx Star S4 excimer laser system (Abbott Medical Optics Inc.). The patient had a visual acuity of 20/20 OU on postoperative day 1 and did well for 5 years after surgery.

Now, the patient presents with a UCVA of 20/40 OD that corrects to 20/20 with a refraction of -1.00 D sphere. The UCVA of her left eye is 20/20 and plano. She is interested in an enhancement procedure for her right eye to improve her distance vision. Figure 2 shows the map captured by the WaveScan Wavefront System (Abbott Medical Optics Inc.) for her right eye. At the 4.00 D Rx calculation with this device, as is typical, the manifest refraction reads -0.71 DS -0.22 DC X 155. The ablation depth with this refraction is 15 µm.

Would you relift the LASIK flap, create a new flap, or perform PRK? If you favor a new flap, what would your ideal approach be? If you would perform PRK, what would be your preferred method for epithelial removal and why? What adjustments, if any, would you make to the WaveScan treatment regarding sphere, cylinder, optical zone, ablation zone, and depth? Postoperatively, what eye drop regimen would you prescribe for this patient?

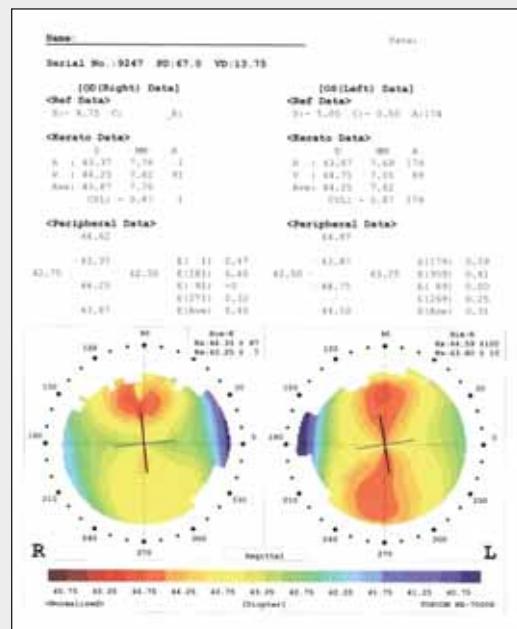


Figure 1. Preoperative topography of both of the patient's eyes with a Topcon KR 7000P (Topcon Medical Systems, Inc., Oakland, NJ).

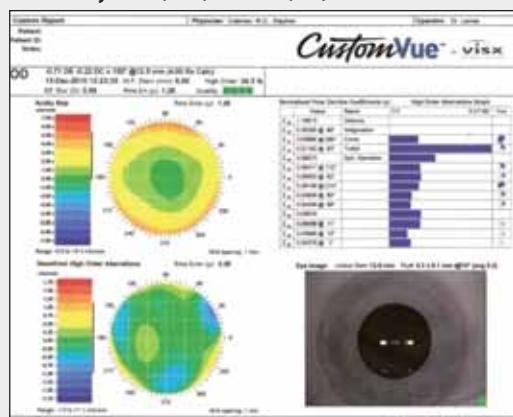


Figure 2. Postoperative wavefront analysis of the patient's right eye with the WaveScan Wavefront System.

STEVEN J. DELL, MD

This case represents an increasingly common phenomenon of patients seeking late enhancements after LASIK. Given this patient's current refractive error, the surgeon must be careful to avoid interventions that might swap the annoyance of mild myopia in one eye for a sight-threatening complication. Ocular dominance and her looming presbyopia would also influence my discussion with the patient.

The current topography is not supplied, but the original preoperative topography shows some irregularity in the patient's right eye that might indicate residual warpage from RGP contact lenses at the time of the original ablation. Three weeks of RGP abstinence often is not enough to obtain a stable cornea. As is typical with many wavefront-guided procedures, the higher-order terms other than trefoil are currently all reasonably low. This is generally associated with very good BCVA. It appears that there is probably sufficient tissue for a relift, but this approach is associated with a greater incidence of epithelial ingrowth.¹ Some surgeons have advocated using a new side cut for these enhancements, but this technique can have its own set of complications.

My preferred strategy would be to perform a surface ablation procedure using a wavefront-guided treatment followed by a 10-second application of 0.02% mitomycin C (MMC). In this case, the proposed ablation depth makes sense when compared to the manifest refraction, so minimal adjustments to the correction would be required. I would use a standard post-PRK regimen comprising a bandage soft contact lens and 2 days' treatment with a topical nonsteroidal anti-inflammatory drug, 5 days of a topical fluoroquinolone, and a 1-month tapering of a weak topical steroid.

COLMAN R. KRAFF, MD

This patient has two options for a low-diopter enhancement, as long as the topography and clinical data are stable. If the stromal bed is of adequate depth, the surgeon could lift the flap created by the iFS 60 and perform the enhancement. The problems that I have found when performing this sort of retreatment when the flap was created with a microkeratome (eg, epithelial ingrowth) seem to occur less frequently with an IntraLase-created flap. I think that the 70° to 90° angle of the side cut is somewhat protective against ingrowth. The steeper angle makes it more difficult for epithelial cells to migrate underneath.

The second option here would be a simple PRK enhancement, an approach I routinely use for all LASIK patients whose flaps were made with a metal-bladed microkeratome. My preference for removing the epithelium is an Amoils brush. Although I have heard anecdotal reports of the flap's being "spun off," I have never experienced this

complication. When the Amoils brush is used properly, it is very gentle on the underlying stroma.

I would aim for a slight overcorrection in this eye. Typically, I would add 0.10 to 0.20 D myopia to the wavefront correction. I would leave the optical zone and ablation zone alone during this treatment. I tend to have patients who undergo PRK over an old flap use steroids a bit longer than in typical cases (ie, tapering prednisolone over 3 months).

LOUIS E. PROBST, MD

Before proceeding with an enhancement, it would be important to verify the corneal integrity. In addition to obtaining surface topography from prior to the initial LASIK procedure, I would like to review the posterior surface with either the Orbscan (Bausch + Lomb, Rochester, NY) or the Pentacam Comprehensive Eye Scanner (Oculus, Inc., Lynnwood, WA). This information is particularly important in this case, because the pattern of superior steepening in the right eye, although magnified by the small scale on the topography, is atypical. Similarly, I would like to review the posterior corneal curvature with the Orbscan or Pentacam prior to performing an enhancement. Although this analysis is less accurate after LASIK, it can be reassuring when the posterior float changes are symmetrical. I would also ensure adequate corneal thickness prior to performing an enhancement, although it should be fine in this case, based on the preoperative pachymetry.

For enhancements after LASIK, I now perform surface ablation in 100% of cases, which is definitely not the most popular option for patients or comanaging doctors. Although it is definitely possible to lift laser flaps, I have found doing so to be more difficult when the flap was created with the inverted side cut of the iFS. Lifting LASIK flaps with difficulty often results in epithelial defects and puts the patient at risk for epithelial ingrowth, problems that can be avoided with a surface ablation enhancement. I have not created new flaps for years because of the risk of intersecting planes, and I have not performed side-cut enhancements with the IntraLase due to the risk of the flaps' edges intersecting.

My technique for a post-LASIK PRK enhancement involves epithelial removal with 70% ethanol (undiluted from the vial, as originally described by David Hardten, MD) placed on the cornea with a circular sponge for 10 seconds, after which I wipe off the epithelium with a Merocel sponge (Medtronic ENT, Jacksonville, FL). The Amoils brush works well for epithelial removal in primary PRK, but it can move the flap when used for LASIK enhancements. For customized enhancements, I am always very careful to use the surgeon adjustment to keep the ablation depth at 18 µm/D to

avoid overcorrections. In this case, the ablation depth is appropriate, so I would not make any changes. I do not make adjustments in the ablation zone's size unless I am reducing the zone to decrease the ablation's depth for high myopic corrections. I therefore would not make any changes in this case. I apply MMC 0.02% for 12 seconds after all surface ablations on corneas with previous surgery, followed by placement of a bandage contact lens (Oasis Medical, Inc., Glendora, CA). I instill one drop each of Pred Forte, Zymaxid, Acuvail, and Polytrim (all from Allergan, Inc.) at the conclusion of every refractive procedure.

Postoperatively, I prescribe Pred Forte, Zymaxid, and Acuvail (for comfort) q.i.d. and Optive Sensitive (Allergan, Inc.) q1h until the contact lens is removed. Thereafter, the patient continues using Pred Forte and Zymaxid q.i.d. and Optive Sensitive q1h for 1 week. He or she also starts Restasis (Allergan, Inc.) b.i.d. after the contact lens' removal. I prescribe Polytrim q.i.d. postoperatively if the patient has any increased risk of exposure to methicillin-resistant *Staphylococcus aureus*.

KARL G. STONECIPHER, MD

I would like to see a serial topography or some type of analysis to ensure that the superior asymmetry is not unstable. If keratoconus is going to become manifest, it tends to present in this age group. Assuming that this patient's posterior float and serial topography are normal, I think there are several key points to discuss.

First, two studies have shown that lifting a previous LASIK flap after 2 to 3 years is prone to producing epithelial ingrowth, with its associated complications.^{2,3} For this reason, I favor advanced surface ablation for patients with simple myopic or myopic astigmatic refractions 2 years after previous LASIK. Second, the rmsH or level of higher-order aberrations is less than 0.3, which is my cutoff for a customized treatment. At a level between 0.3 to 0.4 or higher, the appropriateness of a customized treatment is debatable.⁴ In this case, however, treating the refractive error alone should be sufficient, and a contact lens trial could prove that to the surgeon.

Finally, I have shown in recent presentations that patients such as this one do well with a transepithelial approach to an advanced surface ablation enhancement. Briefly, the cornea is dried, followed by a phototherapeutic keratectomy-mode removal of the epithelium at the 6.5-mm optical zone with a 0.5-mm transition zone. I then wait 1 minute to let the surface dry without touching the cornea before following up with an appropriate treatment of the manifest refraction, which has been nomogram adjusted. I apply 0.02% MMC for 12 seconds and irrigate the eye with 30 mL of chilled balanced salt solution. I place a bandage contact

lens on the cornea, followed by a fourth-generation fluoroquinolone and topical FML 0.1% (Allergan, Inc.). Postoperatively, patients are seen for removal of their bandage contact lens on day 4, and they discontinue the antibiotic 1 week after re-epithelialization. The FML is tapered over the course of 3 months.

My colleagues and I presented a series of cases at the ASCRS annual meeting. Among patients with myopia of up to -2.50 D and cylinder of up to -1.75 D, postoperative UCVA equaled preoperative BCVA in 94% of the cases. There were no postoperative reports of haze, intraoperative complications, or infections. Patients tolerated the procedure well, and their postoperative satisfaction has been high.⁴ ■

Customized enhancements are off label.

Section Editor Stephen Coleman, MD, is the director of Coleman Vision in Albuquerque, New Mexico. Parag A. Majmudar, MD, is an associate professor, Cornea Service, Rush University Medical Center, Chicago Cornea Consultants, Ltd. Dr. Coleman may be reached at (505) 821-8880; stephen@colemanvision.com.

Steven J. Dell, MD, is the director of refractive and corneal surgery for Texan Eye in Austin. He is a consultant to Abbott Medical Optics Inc. Dr. Dell may be reached at (512) 327-7000.



Colman R. Kraff, MD, is the director of refractive surgery at the Kraff Eye Institute in Chicago. He participates in clinical trials for Abbott Medical Optics Inc. and Alcon Laboratories, Inc. Dr. Kraff may be reached at (312) 444-1111; ckraff@kraffeye.com.



Louis E. Probst, MD, is the national medical director of TLC The Laser Eye Centers in Chicago; Madison, Wisconsin; and Greenville, South Carolina. He is a consultant to Abbott Medical Optics Inc. and TLC. Dr. Probst may be reached at (708) 562-2020.



Section Editor Karl G. Stonecipher, MD, is the director of refractive surgery at TLC in Greensboro, North Carolina. He is a consultant to, is a speaker for, and has received travel reimbursement from Abbott Medical Optics Inc.; Alcon Laboratories, Inc.; Allergan, Inc.; and Bausch + Lomb. He has received grant support from Alcon Laboratories, Inc., and Allergan, Inc. Dr. Stonecipher may be reached at (336) 288-8523; stonenc@aol.com.



1. Probst LE, Machat JJ. Epithelial ingrowth following LASIK. In: Machat JJ, Slade SG, Probst LE. *The Art of LASIK*. 2nd ed. Thorofare, NJ: Slack, Inc.; 1999:427-433.
2. Solomon KD, Fernández de Castro LE, Sandoval HP, et al; Joint LASIK Study Task Force. LASIK world literature review: quality of life and patient satisfaction. *Ophthalmology*. 2009;116(4):691-701.
3. Stonecipher KG, Kezirian GM. Wavefront-optimized versus wavefront-guided LASIK for myopic astigmatism with the Allegretto Wave: three-month results of a prospective FDA trial. *J Refract Surg*. 2008;24(4):S424-S430.
4. Stonecipher KG. Transepithelial PRK as an enhancement option for residual refractive error with the Visx laser. Paper presented at: ASCRS Symposium on Cataract, IOL and Refractive Surgery; April 6, 2008; Chicago, IL.