Enhancement After LASIK

In this patient with recurrent hyperopia and partial amblyopia, refractive lens exchange was the only reasonable solution for postoperative adjustment.

BY ANTONIO LECCISOTTI, MD, PhD

The most challenging cases requiring enhancement after LASIK are those for which you cannot simply repeat the procedure to fine-tune refractive results. When the patient additionally has no preoperative data, partial amblyopia, and recurrent hyperopia at presbyopic age, the picture can be especially bleak. Below I recount one of my most difficult patients, who presented with these conditions and required further surgical intervention after LASIK.

PRESENTATION

A 49-year-old woman who had undergone bilateral hyperopic LASIK at another clinic 9 years earlier presented with complaints of poor distance and near vision. All pre- and postoperative records had been lost; however, the patient vaguely remembered using spectacles with a prescription of 3.00 D OU. In addition to the patient's chief complaint of needing glasses for distance and near tasks, she also had difficulty with night driving due to halos and starbursts. Her job at a post office included talking with clients but also working at a computer a couple of hours a day. Several attempts with contact lenses had been unsuccessful due to her inability to insert and remove them.

On examination, the cycloplegic refraction in her right eye was +5.00 +1.00 X 75°, with a BCVA of 20/25; in the left eye, the cycloplegic refraction was +6.25 +0.75 X 90° and refraction was 20/40, not improving with pinhole. Dominance tests indicated, as expected, a strong preference for the right eye and good tolerance of monovision as tested with trial frames. The LASIK flap edges were visible, and the cornea was perfectly transparent in both eyes.

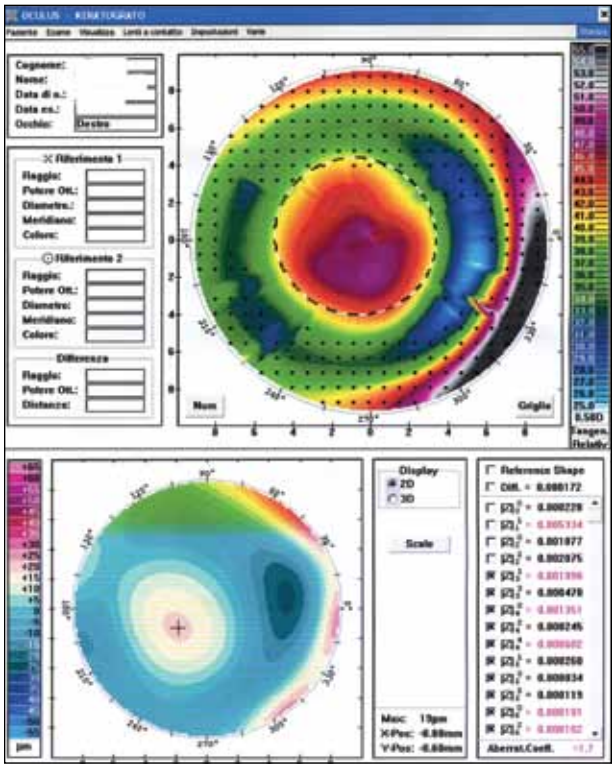

Figure 1. (Top) Tangential topography of the right eye. (Bottom) Aberrometry showing a centered hyperopic ablation that induced significant negative spherical aberration, among other aberrations.

Corneal topography showed a bilateral hyperopic ablation centered on the visual axis, which induced a significant negative spherical aberration, as shown by aberrometry

(Figure 1). Central ultrasound pachymetry was 525 µm in the right eye and 508 µm in the left. Endothelial specular microscopy was normal, with 2,485 cell/mm² and 2,352 cell/mm² in the right and left eyes, respectively.

OPTIONS FOR ENHANCEMENT

The only reasonable solution to this high recurrent hyperopia was refractive lens exchange (RLE) with a procedure I term *reverse bioptics*, in which an intraocular procedure is used as an enhancement of a corneal procedure, rather than the other way around.[1] Enhancement with excimer laser—surface ablation or LASIK—was contraindicated for two main reasons:

- Because the cornea was previously deformed by LASIK, subsequent excimer treatment would induce further spherical aberration; and
- High hyperopic ablations are prone to regression and irregularity and have only limited predictability.

Additionally, implantation of a phakic IOL in a highly hyperopic eye is not the best option in a presbyopic patient because of these factors:

- Preserving accommodation is the main reason for preferring a phakic to a pseudophakic IOL; and
- The anterior chamber shallows with age.

The cons of RLE in this case were the following:

- IOL power calculation can be inaccurate after hyperopic ablations; and
- Vitreoretinal complications are rare in hyperopic eyes but still possible.

All these considerations were discussed with the patient, who agreed with the choice of RLE. Previous hyperopic ablation, partial amblyopia, and limited precision of IOL power calculation were the reasons we chose a monofocal IOL for both eyes. Requirements for a multifocal IOL were not met in this case: There was no chance of excellent biometry, and a normal, prolate cornea and good binocular function were not present. Additionally, standard monofocal IOLs have positive spherical aberration and can therefore partially compensate for the negative spherical aberration induced by the previous hyperopic ablation.

PROCEDURAL OVERVIEW

IOL power calculation was performed with IOLMaster (Carl Zeiss Meditec) biometry and the Hoffer-Q formula, which is advised for short eyes. According to the Aramberri double-K method for eyes that have previously undergone hyperopic ablation,[2,3] for an axial length of 22 mm and an estimated hyperopic ablation of approximately 3.00 D, the IOL power obtained with actual K readings must be reduced by 0.50 D. Adjusted biometry gave a result of 29.00 D in the right eye and 30.00 D in the left.

TAKE-HOME MESSAGE

- In cases of high recurrent hyperopia after LASIK, a reverse bioptics approach with refractive lens exchange is the best option for enhancement.
- High hyperopic ablations are prone to regression and irregularity and have only limited predictability.
- Intraoperative autorefraction is useful when IOL power calculation is approximate and there is no chance of subsequent postoperative laser enhancement.

The left (nondominant) eye underwent phacoemulsification first. A 2.75-mm limbal tunnel was created using minimal ultrasound energy because of the soft nucleus, and a 31.00 D AcrySof IOL (Alcon Laboratories, Inc.) was implanted in the capsular bag to achieve micro-monovision by slight over-correction. Monovision is often well tolerated by patients with strong dominance, such as those with partial amblyopia, because they easily achieve interocular blur suppression.

At the end of surgery and before removing the eyelid speculum, refraction was verified with a handheld autorefractor (Retinomax 2; Righton) to prevent refractive surprise and, in case of significant error, to allow prompt exchange of the IOL.

Intraoperative autorefraction is particularly useful when IOL power calculation is approximate and the chance of postoperative laser enhancement is nil,[1,4] such as in the present case. Verification of the refraction on the operating table prevents the surgical and psychological trauma of another surgery for IOL exchange. In this case, the pseudophakic intraoperative autorefraction reading was satisfactory (-1.50 D). Three days later, with a refraction of -1.25 -0.50 X 180°, the BCVA in the left eye was 20/40. One week later, RLE was carried out in the right eye; a 29.00 D AcrySof IOL was implanted, and the patient achieved a BCVA of 20/25 in this eye, with a refraction of 0.00 +0.75 X 80°. The postoperative course was uneventful. Binocular UCVA was 20/25 and J2.

PATIENT COUNSELING, NEURAL ADAPTATION

The patient was asked to adapt to her new situation of monovision without using spectacles for reading or distance vision tasks. She reported that initially the monovision felt unnatural but that the feeling disappeared in a couple of months. She progressively realized that she was independent from glasses, except for driving, for which she felt safer using glasses with -1.25 D

of sphere correction in her left eye. She also found that her nighttime vision partially improved and starbursts were less disturbing.

RLE in hyperopes poses several challenges, especially predictability, due to the difficulty of determining postoperative IOL position. Neither third-generation biometric formulas nor the advent of partial coherence biometry devices has overcome this problem. It is therefore strongly advised to first operate on the nondominant eye in these cases, aiming for slight overcorrection; moderate myopia can be useful for monovision or subsequently corrected by excimer laser if needed (more accurately than under-correcting during the initial procedure). Additionally, the procedure in the dominant eye can then be planned by considering results in the first eye and adjusting the chosen IOL power accordingly.

Further laser enhancement was not needed in this case, but the preferred method to refine postoperative RLE refraction would have been PRK with mitomycin C on top of previous LASIK. This is currently our favored technique because it avoids epithelial ingrowth (which is especially common after hyperopic LASIK due to the peculiar adhesion of the peripheral flap), smoothes previous folds (when using a transepithelial approach), and does not affect stromal bed thickness.[5] Despite the use of mitomycin C, an adequate topical steroid course is warranted in such cases. ■

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