

Overcorrection After Undercorrection of a High Myope

BY CHRISTOPHER BLANTON, MD; SUMITRA S. KHANDELWAL, MD;
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CASE PRESENTATION

A 52-year-old newspaper publisher presents to you for refractive surgery. The patient had previously been scheduled for LASIK in a different state, but he delayed the procedure until now due to relocation. On examination, his right eye corrects to 20/20 with a refraction of $-9.50 -0.25 \times 89$, and his left eye corrects to 20/20 with a refraction of $-8.25 -1.25 \times 150$. These measurements are consistent with his current spectacle correction. The patient stopped wearing contact lenses years ago. Both the slit-lamp and dilated fundus examinations are entirely normal. Pachymetry readings are $644 \mu\text{m}$ OD and $643 \mu\text{m}$ OS (Figure 1.)

Measurements of the patient's right eye with the WaveScan Wavefront System (Abbott Medical Optics Inc.) calculate a root mean square (RMS) error of $11.53 \mu\text{m}$ and a 6-mm wavefront refraction consistent with his manifest refraction (Figure 2A).

Measurements of his left eye with this system show an RMS error of $13.21 \mu\text{m}$ and a 6-mm wavefront refraction that is also consistent with his manifest refraction (Figure 2B).

The patient undergoes completely uneventful wavefront-guided Visx CustomVue LASIK with a $120\text{-}\mu\text{m}$, 8.2-mm -diameter flap created with an iFS laser (both products from Abbott Medical Optics Inc.). Eight months postoperatively, he presents with a UCVA of 20/20 OD and is happy with this result. The UCVA in his left eye is 20/25, however, correcting to 20/20 with a refraction of plano -1.00×171 . His primary complaint about this eye is bothersome ghosting. The results of topography on this eye are shown in Figure 3, and a WaveScan refraction measures $-0.07 -0.78 \times 165$ (Figure 4), which is consistent with his manifest refraction. The patient undergoes a

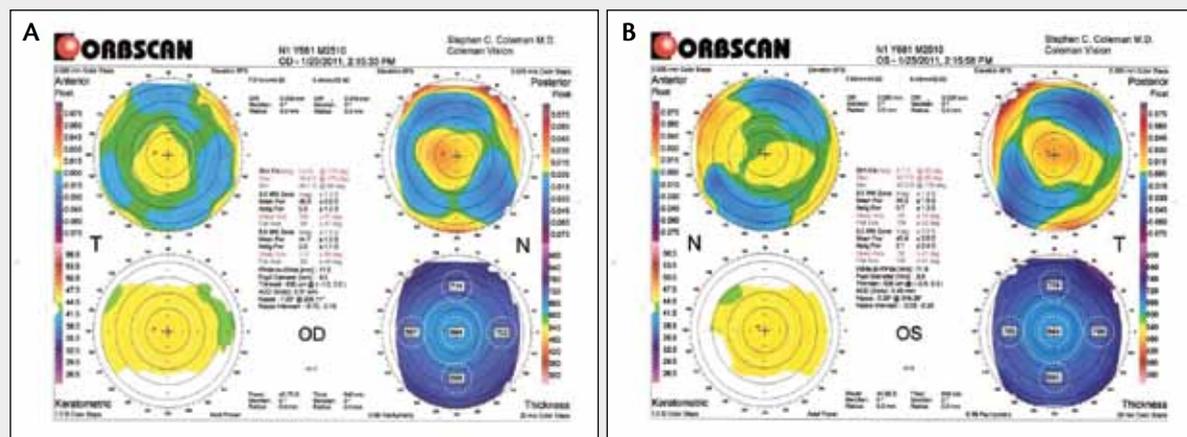


Figure 1. Preoperative topography of the patient's right (A) and left (B) eyes.

CASE PRESENTATION (CONTINUED)

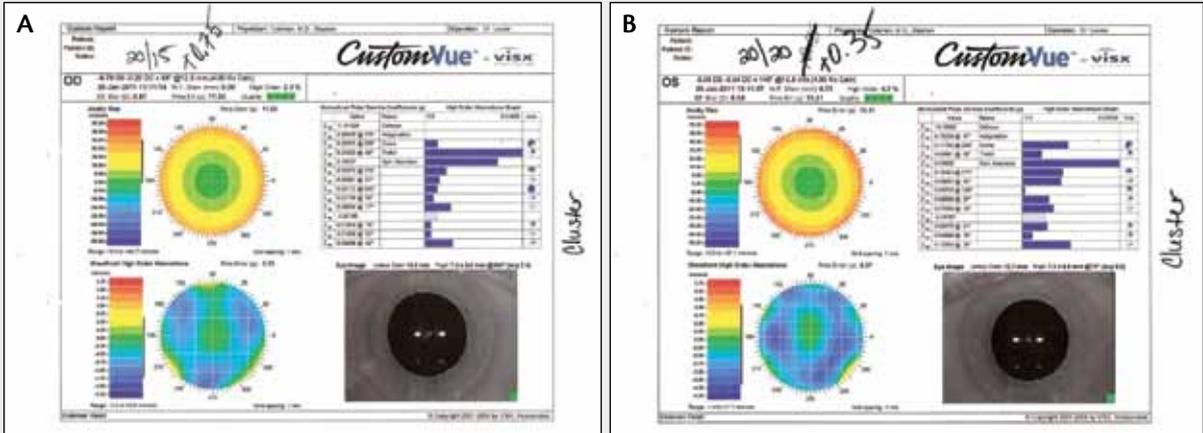


Figure 2. Preoperative measurements of the patient's right (A) and left (B) eyes with the WaveScan Wavefront System.

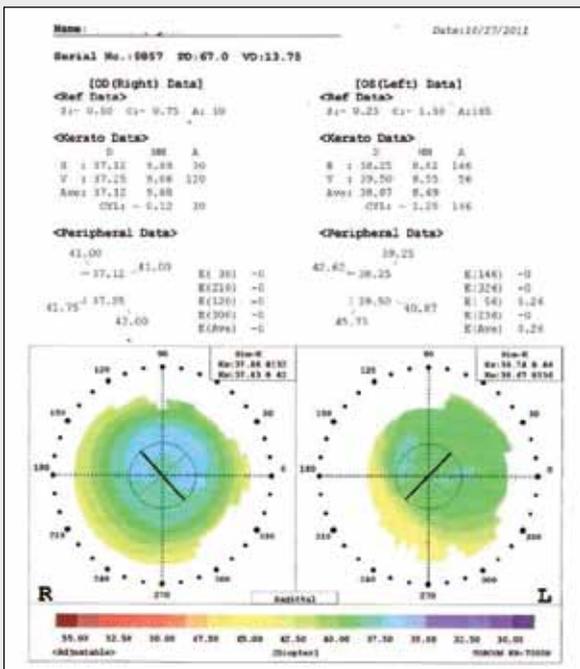


Figure 3. Topography of the patient's eyes 8 months postoperatively.

flap-lift enhancement without complication.

Fifteen months after his initial LASIK procedure and 7 months after his enhancement, the patient presents with a UCVA of 20/40 OS, correcting to 20/25 with a refraction of +0.75 -0.75 × 45. He still reports poor image quality and halos in this eye. A WaveScan refraction of this eye is +1.41 -0.89 × 32 (Figure 5).

At this point, how would you counsel this patient regarding his left eye?

—Case prepared by Stephen Coleman, MD.

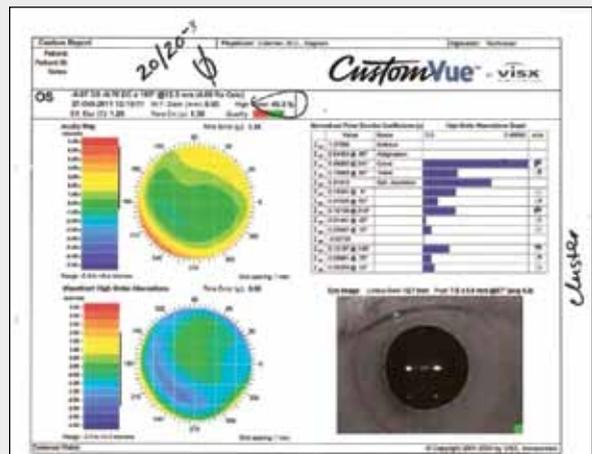


Figure 4. WaveScan measurement of the patient's left eye 8 months postoperatively.

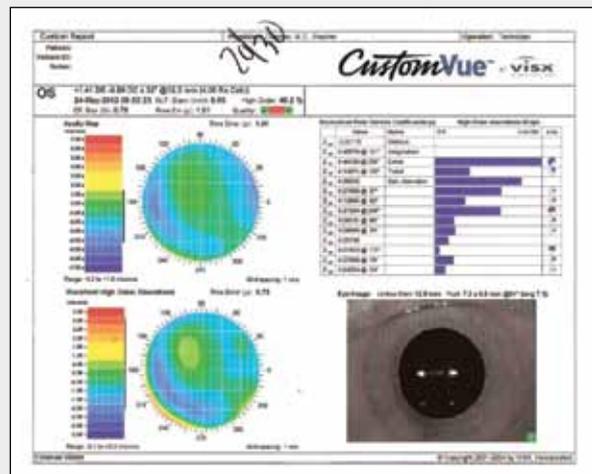


Figure 5. WaveScan measurement of the patient's left eye 7 months after a flap-lift enhancement.

CHRISTOPHER BLANTON, MD

Important considerations in this case include the initial undercorrection of the preexisting cylinder in the patient's left eye, the subsequent overcorrection, and his future options. I will focus my discussion on the left eye.

The case presentation raises several questions. What, if any, nomogram or physician adjustments were made for the original treatment of the patient's left eye? Was the iris registration feature used? If not, was the eye marked to compensate for cyclotorsion? The answers to these questions might offer insight into why the initial surgery did not fully correct the patient's astigmatism. Additionally, during the enhancement, how many microns of corneal tissue were removed? After treatment for high myopia, it is not unheard of to see the induction of higher-order aberrations (HOAs). When these wavefront-guided maps are then used to drive an excimer laser correction, the amount of tissue removal required to correct those aberrations can be significant and lead to an overcorrection. I would also note the relatively thick corneas and fairly high amounts of RMS error preoperatively. The clinical significance of these factors is not clear, but they may have had an effect.

What to do? If the patient wants further surgery, I would suggest a PreVue Lens (Abbott Medical Optics Inc.). This product allows a patient to "test drive" the potential outcome of an excimer laser procedure by looking through the lens in a trial frame. If he noted dramatic improvement, I would offer one more excimer laser procedure, but I would pay careful attention to the amount of tissue removed and specifically avoid "ping-ponging" back into a myopic refractive error.

**SUMITRA S. KHANDELWAL, MD, AND
DAVID R. HARDTEN, MD**

It is more difficult to obtain excellent results with corneal refractive surgery in patients with high refractive errors because of the large changes in shape required. Based on this patient's age, an initial lens procedure could also have been considered.

After his primary LASIK procedure, the patient's complaint was ghosting. He had residual astigmatism and HOAs. From the topography, it appears that the effective zone available for treatment under the flap is slightly decentered superotemporally, which might account for some of the asymmetry of the flat areas postoperatively.

The slightly hyperopic outcome after the flap lift is not surprising; this problem can occur after any enhancement but especially if the stromal bed available for treatment was smaller than anticipated. The over-

correction should not be the cause of the poor image quality and halos, however, so the focus of the examination should be on the flap's position and appearance to rule out decentration, striae, or epithelial ingrowth. In addition, one should look again for other causes of halos such as early cataract formation or ocular surface disease.

If the examination showed no other unusual findings, we would discuss with the patient the option of PRK with customized treatment over the flap, especially because the primary flap may be decentered. We would apply mitomycin C 0.1 to 0.2 mg/mL for 1 to 2 minutes, because his risk of haze will be higher than after a primary PRK. Patients requiring hyperopic ablations who have had prior myopic laser ablation tend to require less treatment, because there is less epithelial hyperplasia when the peripheral elevated ring is flattened than when peripheral tissue is removed to steepen the central cornea. Because of this effect, we would reduce the treatment compared to the wavefront readings for the PRK. We would also double-check that the wavefront appeared to accurately describe the curvature by looking for a pattern match with the topography. We would counsel the patient regarding slower recovery, the risk of postoperative haze, and the refractive goals.

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The topography of the patient's left eye demonstrates an asymmetric ablation pattern, which could be due to irregular healing, poor fixation by the patient during the procedure, or misalignment of the preoperative WaveScan or the intraoperative iris registration capture limbal rings. Although this healing pattern is not uncommon after large myopic corrections, in this case, it has become symptomatic, causing ghosting. This development correlates with the high degree of coma, total HOAs, and astigmatism measured on the WaveScan 8 months postoperatively. In most cases, a customized enhancement would reduce the level of coma, total HOAs, astigmatism, and visual symptoms. Unfortunately in this case, after the enhancement, the coma remained the same, the total HOAs actually increased, and the patient became slightly hyperopic. Because he is also presbyopic, he is less happy than before the enhancement.

The surgical solution to this situation is relatively simple compared with the compromised doctor-patient relationship. Presbyopic patients become very frustrated when they experience iatrogenic hyperopia, particularly after an enhancement procedure that they tend to perceive as relatively innocuous. The most important step in the management of this case is to recognize the dis-

satisfaction and concern that the patient is feeling and to commit completely to the resolution of the problem. This could involve regular follow-up visits, financial compensation for any spectacles he may require, and an ongoing recognition that this is a real problem from the patient's perspective.

The surgical course is more straightforward. It is imperative to achieve refractive stability, which can be confirmed with follow-up refractions and WaveScans. The enhancement should be performed as PRK with mitomycin C to avoid the risk of epithelial ingrowth associated with multiple flap lifts in a patient of this age as well as to maximize the accuracy of the customized correction. Limbal alignment of the WaveScan and the iris registration captures should be confirmed. The patient should be counseled that additional procedures may be required and that whatever is necessary will be done to improve his vision. I have found that this approach is universally successful in these rare but challenging situations. ■

Editor's note: this article discusses the off-label use of approved medical devices.

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