

consultation section

refractive surgical problem

edited by Thomas Kohnen, MD

A 37-year-old woman had simultaneous bilateral laser in situ keratomileusis (LASIK) to correct myopia and astigmatism of $-4.00 -1.00 \times 65$ in the right eye and $-4.50 -2.50 \times 120$ in the left eye. Surgery was performed with a Schwind Automated Corneal Shaper and a Chiron Technolas Keracor 117 excimer laser using a scanning mode. The surgeon intended to create in both eyes a small hinge for the flap to perform the astigmatic correction. Unfortunately, in the right eye a free cap was produced by the microkeratome cut; this was repositioned without sutures after the planned intrastromal ablation. The procedure in the left eye was uneventful.

Twenty-four hours postoperatively, uncorrected visual acuity (UCVA) was 20/100 in the right eye. This was attributed to a small central epithelial defect (refraction was not performed at that time). Acuity was 20/25 in the left eye. In both eyes, the flaps were attached. The patient left town and came back 10 weeks later for re-evaluation. Slitlamp examination revealed perfectly clear corneas in both eyes; UCVA was 20/100 in the right eye and 20/25 in the left eye. Best spectacle-corrected visual acuity (BSCVA) was 20/25 with $+2.75 -5.50 \times 25$ in the right eye and 20/20 with -0.50 in the left eye.

Figures 1 and 2 show the preoperative and postoperative corneal topographies and the difference maps of the right and left eye, respectively.

What are the surgical and nonsurgical treatment options in this case, and what would you recommend to the patient?

■ At 10 weeks postoperatively, I do not believe any nonsurgical option would prove beneficial for this patient. At this point, the initial complicating factors of corneal and epithelial edema have largely subsided, and although mild changes may occur from this point forward, 5.50 diopters (D) of astigmatism is a significant refractive error.

To understand this case, one must give some thought to the origin of the problem. Although small deviations in axis and cylinder may occur with eye torsion, it is unlikely that the 1.00 D of requested astigmatic correction caused the significant astigmatism seen in this patient. A second common and significant cause of astigmatism is decentration; however, a cursory

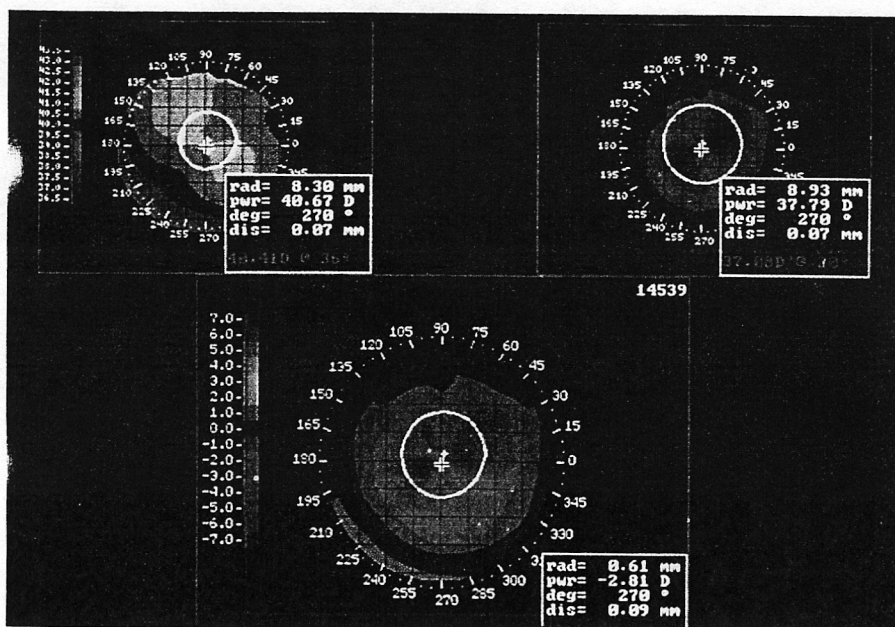


Figure 1. (Kohnen) Corneal topography of the right eye (EyeSys Corneal Analysis System): preoperative (upper left), postoperative (upper right), and difference maps (below).

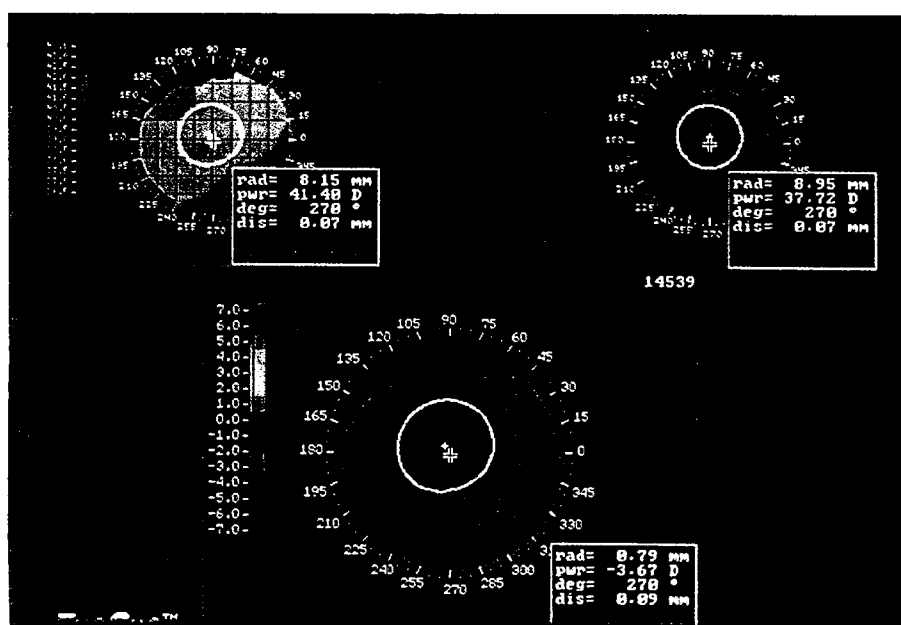


Figure 2. (Kohnen) Corneal topography of the left eye (EyeSys Corneal Analysis System): preoperative (upper left), postoperative (upper right), and difference maps (below).

examination of the topography reveals a relatively well-centered ablation. Another cause of induced and irregular astigmatism is inadvertent hydration of the corneal bed, which results in uneven laser ablation that often leads to irregular astigmatism.

Finally, with a free flap it is extremely important to precisely reapposition the corneal cap; I believe this is the cause of the current problem. In this case, I would not be surprised if the cap were rotated or improperly reapplied to the corneal bed. Although not mentioned, I would look carefully for evidence of folds/microstriae in the cap.

There are three treatment options for this patient. The first is LASIK reablation, which would require hyperopic LASIK to induce approximately 2.50 D of myopia followed by a 5.50 D astigmatic correction because this laser corrects primarily minus-cylinder astigmatism. I would not recommend this approach for two reasons. First, it requires cutting a significant amount of additional cornea, and the act of lifting and reapposing the flap may change the correction.

The second option is to lift the flap, clean the bed, and under more controlled circumstances, lay the flap back down and allow it to heal. Although I have had limited success doing this in my own cases as I place an inordinate amount of attention on precise reappositioning the flap, I have performed the procedure (straight-

ening and smoothing the flap) in consultation cases with significant refractive changes. Richard Raskin, MD, has named this the flip/flop procedure. Because it is minimally invasive, it is a reasonable first approach in this patient. If flap reapposition is a problem and it is corrected in any manner, it may be unstable; thus, this should be performed as a first procedure.

Finally, if astigmatism remains a problem in the approximate amount cited in the question, I would perform relaxing incisions as the natural and most noninvasive approach. The spherical equivalent is approximately zero, and the relaxing incisions will correct the astigmatism and result in a nearly plano spherical equivalent.

KURT A. BUZARD, MD
Las Vegas, Nevada, USA

■ In this case, the left eye can be left out of consideration. It has a perfect result within the limits of laser refractive surgery.

In the right eye, the problem is high mixed astigmatism. The overall refractive result, judged by the spherical equivalent, is close to perfect. Therefore, the most probable reason for the high astigmatic ametropia is the free flap. The case description contains no clues on whether there is an irregular cut of the flap or a

possible misalignment. The most probable cause is unequal shrinkage of the flap resulting from its free nature.

To correct the situation, one would first evaluate whether the flap is misaligned. If there is no suggestion of that, I would wait for about 4 to 6 months. If the refractive result is stabilized by that time, as expected, I would re-elevate the flap, now with a controlled hinge, then correct the topographic astigmatism with the scanning spot mode. Because the ablation pattern is different with this particular laser, whether the plus- or minus-cylinder notation is entered, I would compare both and choose that pattern that would provide the most symmetrical and least central ablative approach.

Alternatively, as this is a mixed cylinder with a spherical equivalent of zero, one could consider astigmatic curved keratotomies. However, because the patient's history suggests that the main astigmatism resides in the cap, predictability from regular nomograms cannot be as expected.

The nonsurgical treatment of rigid contact lenses must also be discussed. However, a basic indication for refractive surgery is contact lens intolerance. Thus, this is probably not a good option for a patient who has opted for refractive surgery. She could have tried this simpler solution without having the surgery in the first place.

In the "real world", my recommendation to this patient would be as follows:

1. Wait for at least 6 months, while using a rigid contact lens if at all tolerable. This would provide good vision and may have an "ironing" effect on the flap.
2. After 6 months, I would lift the flap and do astigmatic correction as outlined above with the laser.
3. If the patient were reluctant to try that option, I would propose paired curved antiastigmatic keratotomies.

THOMAS NEUHANN, MD
München, Germany

■ The astigmatism in the preoperative refraction and the preoperative topography do not agree. The refraction found -1.00×65 and the topography is -0.69×36 . This 30 degree disparity indicates that there is a significant lenticular component to the astigmatism. Crossed-cylinder calculation demonstrates

that the lenticular astigmatism must be -0.86×86 . Postoperatively, the topography shows an astigmatism of -2.20×30 while the refraction demonstrated an astigmatism of -5.50×25 , almost a 3.00 D disparity, with the axes being much closer together.

The increase in corneal astigmatism after LASIK in this case can be from at least three causes: (1) The free cap was rotated when replaced to an axis nearer the lenticular astigmatism. (2) The axis of astigmatism was set to the wrong axis for the laser treatment. (3) The free cap was not smoothed ("squeegeed") uniformly, inducing regular and irregular astigmatism. It is possible all three occurred simultaneously.

I would recommend surgical treatment at this time. I would first mark the rim of the cap, lift the cap and rotate it 90 degrees, squeegee it centrifugally using the Caro central corneal compressor, and measure the central corneal astigmatism with a surgical keratometer. I would repeat this procedure until the minimum corneal astigmatism was observed under the microscope using a surgical keratometer. I would then follow the patient for 2 months or longer until the remaining refractive and corneal astigmatism were stable.

If the stabilized astigmatism were less than 1.00 D, I would recommend no further treatment. If it were greater than 1.00 D, I would consider re-treatment with the laser. As the patient's current postoperative spheroequivalent refraction is near zero, a further laser procedure could only be performed using a combination of myopic and hyperopic treatments. I do not believe that combining these is very predictable with the current algorithms, so I would send the last topography and refraction to Chiron and have them generate a custom ablation profile for this patient's mixed astigmatism. I would recut a LASIK flap, with a 180 or 200 μm setting, so that I was at least 20 μm deeper than the original free cap when performing the second LASIK. I would tell the patient that it may take more than 6 months for her vision to stabilize after re-treatment.

JACK T. HOLLADAY, MD
Houston, Texas, USA

■ We recommend LASIK for surgical correction of myopic errors ranging from 6.00 to 15.00 D. For low myopia (2.00 to 6.00 D) in combination with low astigmatism, as in this case, we prefer photorefractive keratectomy (PRK) or photoastigmatic refractive kera-