

A PERFECT FIT

Elliptical LASIK flaps allow for manual centration over the pupil to adjust for a nasally decentered pupil.

BY ASIM R. PIRACHA, MD



Technology affords ophthalmologists the opportunity to examine accepted surgical paradigms, fine-tune settings and techniques, and collaborate with colleagues to achieve better visual results and improve patients' overall surgical experience. My change from round to elliptical or oval LASIK flaps simplified my technique and improved my LASIK patients' outcomes.

IMPERFECTIONS

I encountered several problems with round corneal flaps. First, I found that the pupil was often more superonasal with respect to the cornea. Consequently, if I manually centered a round flap over the pupil, the exposed stromal bed did not fully incorporate the excimer laser's ablation profile. This leads to the excimer ablation being applied beyond the edge of the flap nasally and superiorly and potentially creating additional higher-order aberrations (HOAs).

With-the-rule myopic astigmatism is the most prevalent refractive error in all age groups.¹ In WTR, the long axis of the treatment is performed horizontally, and the short axis of treatment is vertical. With round flaps, the excimer ablation often extends beyond the flap's margin horizontally, unless a flap with a large diameter (greater than 9 mm) is created. For flaps smaller in diameter, the excimer ablation will not fit fully in the exposed stromal bed and may increase the risks of epithelial ingrowth, residual refractive error, irregular astigmatism, and greater HOAs.² Larger corneal flaps will incorporate the full excimer ablation, but this can also increase the incidence of dry eye.³

MY TECHNIQUE FOR OVAL FLAPS

An elliptical flap allows me to manually center the flap over the pupil to adjust for a nasally decentered pupil, and the full laser ablation is still performed on the exposed stromal bed. To further improve the centration of the exposed stromal bed over the ablation area, I also turn off the pocket superiorly. In my experience, doing so allows for larger flap diameters and better centration over the pupil. With the pocket turned on, there is less vertical space with which to work that can limit the flap's size. To compensate for the absence of the pocket, I dock the unit more lightly

and leave a meniscus at the superior edge of the flap's margin. This technique reduces the chance of opaque bubble layer formation, bleeding from the limbal vessels and pannus, and anterior chamber air bubbles, which allows for better eye tracking during the excimer laser ablation and reduces the incidence of diffuse lamellar keratitis. With this approach, I have not found lifting the flap to be more difficult, and the treatment times with the femtosecond laser are shorter.

SETTINGS

I use a fifth-generation iFS Advanced Femtosecond Laser (Abbott Medical Optics) to make a 110° reverse side-angle cut and an elliptical 8.7-mm flap. I use the reverse side cut to produce a more secure flap with better adherence and to improve the biomechanical and neuronal properties of the flap (Figure).^{4,5} I custom cut an elliptical flap for better visual outcomes and a better fit.⁶ I use the meniscus as my pocket superiorly, since it is not necessary to create a pocket with elliptical flaps. (For a video demonstrating this technique, go to eyetube.net.)

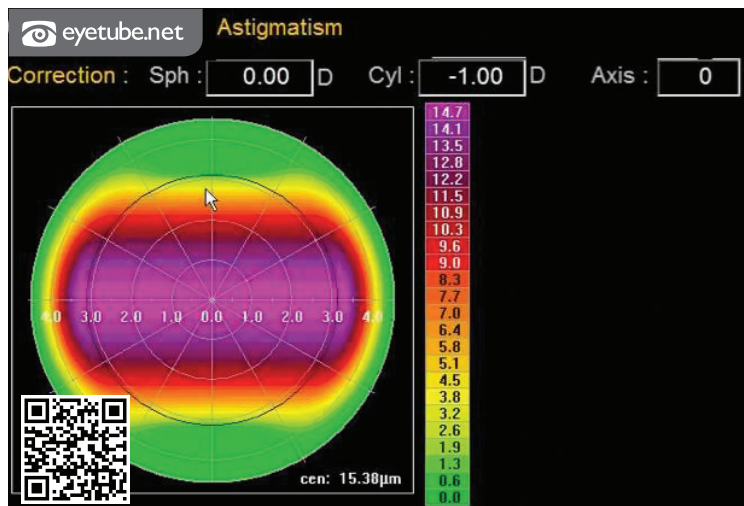


Figure. An image of a pure astigmatic treatment profile. Note the long axis of treatment is on the flat axis, which is horizontal in WTR. By creating an oval flap that is of greater diameter horizontally than vertically, the flap is custom made to fit the ablation pattern.

BENEFITS OF ELLIPTICAL FLAPS

- Better UCVA, less changes in cornea asphericity and biomechanics of the cornea, as well as less induced HOAs can be achieved with elliptical flaps versus conventional circular flaps.
- These improvements are presumably from better matching of the available stromal bed with characteristics of the excimer laser ablation profile for compound myopic astigmatism.
- The flap can be manually decentered over the pupil without shrinking the diameter of the flap, allowing a smaller-diameter flap while still incorporating the entire laser ablation within the exposed stromal bed can reduce the incidence of postoperative dry eyes.⁷
- Elliptical flaps allow for a more precise alignment of the flap because they can only fit back in place in one way due to its shape, whereas a circular flap can rotate when being repositioned. Poor repositioning of the flap increases the risk of flap striae.
- Using the meniscus technique instead of a pocket with elliptical flaps that are longer horizontally and shorter vertically, allows for better centration of the flap over the pupil. This approach also reduces the formation of an opaque bubble layer, anterior chamber bubble formation, and bleeding from the superior limbal vessels, which reduces the incidence of diffuse lamellar keratitis from the heme and may also reduce enhancement and decentration rates due to better and more accurate pupil tracking.

OUTCOMES

Since changing the angle cut and the shape of the flap, I have noted an improvement in my outcomes. Of my last 700 cases, 96% and 99% of eyes with oval flaps and 93% and 97% of eyes with round flaps have achieved 20/20 and 20/25 visual acuity, respectively. These results are for myopic astigmatism only, with at least 3 months of postoperative data. The preoperative average spherical equivalent was -3.80 ± 1.93 D, and the preoperative cylinder was 0.91 ± 0.88 D. Postoperatively, the mean spherical equivalent was $+0.02 \pm 0.26$ D, cylinder was 0.20 ± 0.26 D, and 96.9% achieved 20/20 or better. Elliptical flaps have also been shown to minimize the changes in the corneal biomechanics, corneal asphericity, and induce less postoperative higher order aberrations versus conventional circular flaps.⁸ Elliptical flaps have also been shown to significantly improve uncorrected visual acuity for compound myopic astigmatism than a circular flap.⁹

SURGICAL TOOLS

In addition to changing my surgical approach, I have switched to single-use disposable surgical instruments. These changes have reduced my incidence of inflammation and diffuse lamellar keratitis, leading to quicker visual recovery and greater comfort for my patients. Not having to prepare and switch out instrumentation between procedures has increased efficiency in the OR, and my staff is no longer burdened with instrument management, including acquisition, repair, replacement, cleaning, decontamination, and sterilization, ultimately saving time and expense.

CONCLUSION

By turning off the pocket and using elliptical flaps, I can manually center the flap over the pupil and still maintain the full diameter of the flap that was programmed. The flap is perfectly centered on the pupil, and the full laser ablation profile is performed on the exposed stromal bed. ■

1. Wen G, Tarczy-Hornoch K, McKean-Cowdin R, et al. Prevalence of myopia, hyperopia and astigmatism in non-hispanic white and Asian children: Multi-Ethnic pediatric eye disease study. *Ophthalmology*. 120(10):2109-2116.
2. Henry CR, et al. Epithelial ingrowth after LASIK: clinical characteristics, risk factors, and visual outcomes in patients requiring flap lift. *J Refract Surg*. 2012;28(7):488-492.
3. Donnenfeld ED, Ehrenhaus M, Solomon R, et al. Effect of hinge width on corneal sensation and dry eye after laser in situ keratomileusis. *J Cataract Refract Surg*. 2004;30:790-797.
4. Stahl JE, Durrie DS, Schwendeman FJ, et al. Anterior segment OCT analysis of thin IntraLase femto-second flaps. *J Refract Surg*. 2007;23:555-558.
5. Jaycock PD, Lobo L, Ibrahim J, et al. Interferometric technique to measure biomechanical changes in the cornea induced by refractive surgery. *J Cataract Refract Surg*. 2005;31:175-184.
6. Chayet A, Bains HS. Prospective, randomized, double-blind, contralateral eye comparison of myopic LASIK with optimized aspheric or prolate ablations. *J Refract Surg*. 2012;28(2):112-119.
7. Donnenfeld ED, Ehrenhaus M, Solomon R, et al. Effect of hinge width on corneal sensation and dry eye after laser in situ keratomileusis. *J Cataract Refract Surg*. 2004;30:790-797.
8. Gupta A. Elliptical versus conventional circular flaps in LASIK surgery. Poster presented at: the XXXII Congress of the ESCRS; September 2014; London, UK.
9. Gatineau D. Customized hinge elliptical versus circular flaps using Femto-LASIK for correction of compound myopic astigmatism. Presented at: the ASCRS-ASOA, April 27, 2014; Boston, MA.

Asim R. Piracha, MD

- medical director of John-Kenyon American Eye Institute in Louisville, Kentucky
- apiracha@johnkenyon.com
- financial disclosure: consultant to Abbott Medical Optics