

How to Perform Presby-LASIK Today

Recently, surgeons and patients have expressed great interest in treating presbyopia.

BY ERIC D. DONNENFELD, MD

Presbyopia remains one of the great challenges for both patients and ophthalmologists. The loss of accommodative amplitude over time causes a loss of near visual acuity in patients with good distance visual acuity, forcing presbyopic patients to reach for their glasses on a regular basis. Presbyopia becomes functionally important for most patients in their early 40s, and by their early 50s, they have usually completely lost useful accommodation. Over the years, a variety of different surgical techniques have been attempted to treat presbyopia. These techniques include procedures such as scleral expansion bands, corneal inlays like the AcuFocus (AcuFocus, Irvine, CA), and intraocular procedures such as multifocal and accommodating IOLs. A corneal procedure that could safely improve patients' reading ability and correct their ametropia would be of significant benefit.

INTRASTROMAL ABLATIONS

Recently, surgeons have become interested in intrastromal ablations using the femtosecond laser to create ring patterns for the correction of presbyopia and hyperopia and to make radial patterns for the correction of myopia. These intrastromal ablations have been found to improve reading add, but this technology is not available in the United States and has not been fully evaluated. Traditional excimer laser photoablation to treat presbyopia has been attempted, and the International Multifocal Presbyopia Trial with the Visx platform (Abbott Medical Optics Inc., Santa Clara, CA) performed in Canada showed significantly improved reading ability.¹ There was a loss of best-corrected distance visual acuity in some patients, however. In the Visx clinical trial, patients achieved a significant improvement in reading vision in their nondominant eye. The hyperprolate ablation created greater depth of field. Because of the loss of BCVA with this hyperprolate ablation, however, the trial has not progressed in the United States.

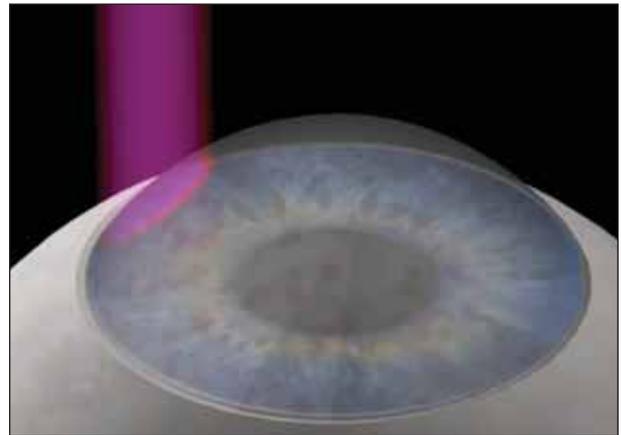


Figure 1. Ovalization of a peripheral ablation.

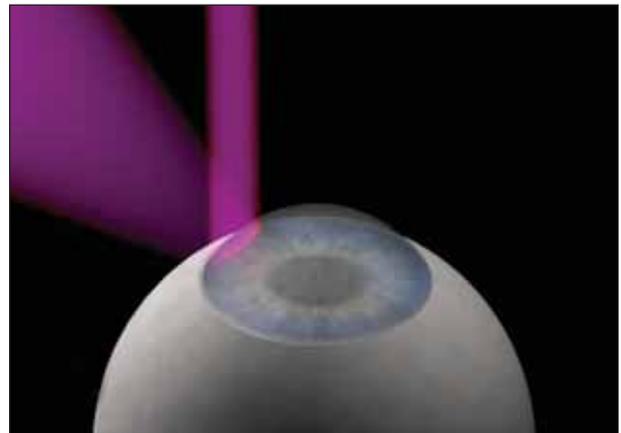


Figure 2. Reflection of a peripheral ablation.

MODIFIED TECHNIQUE

Recently, I have used a modified technique to improve patients' near vision. This technique, using current technology, increases the prolate peripheral ablation associated with customized laser ablation on the Visx Star S4 laser with Iris Registration (Abbott Medical Optics Inc.). It is well known

that positive spherical aberrations create halos and a loss of contrast sensitivity. For this reason, prolate peripheral ablations were added, with the advent of customized ablations to increase the asphericity of the cornea and improve quality of vision.

Peripheral ablations of the cornea have a cosine effect in which the peripheral cornea, which is steeper than the central cornea, causes ovalization of the peripheral excimer laser ablation (Figure 1) as well as reflection (Figure 2) due to the lack of perpendicular energy being delivered to the cornea. The Visx laser compensated for this effect by increasing the peripheral ablation of the steep corneas and reducing the peripheral ablation in flat corneas. When a customized ablation is performed with the Visx Star S4 Iris Registration laser, it starts with a WaveScan. After the WaveScan is performed, the patient's keratometry is recorded on the surgical planning sheet (Figure 3). The final central ablation is determined by the wavefront aberrometry and physician adjustment, but the peripheral ablation is modified by the keratometry. Steeper corneas are given more pulses in the periphery, and flatter corneas are given fewer laser pulses in the periphery to reduce the induction of positive spherical aberration. With this knowledge, my colleagues and I have performed a trial, which we will present at the upcoming ASCRS meeting, to increase the Q factor or prolate nature of the cornea by programming the laser to provide additional pulses in the periphery, which induces negative spherical aberration and increases the depth of focus.

REDUCED OPTICAL ZONE

In our trial, we reduced the optical zone of the ablation from 6.0 to 5.5 mm and the ablation zone from 8.0 to 7.5 mm so that the blend zone in the periphery could provide greater reading. We found that the hyperprolate ablation was more effective in eyes with pupils greater than 6.5 mm compared with smaller pupils, where the peripheral ablation does not enter the optical zone. In our trial, we increased the programmed keratometry by 15.00 D so that, when a patient comes in with a central keratometry of 43.50 D, he or she receives an ablation with a keratometry reading of 58.50 D. Manually overriding the keratometry significantly increased the peripheral ablations, to create a more prolate contour and greater depth of field.

In our trial, we have only treated the nondominant eye. Near vision generally increased by 1.00 to 1.25 D in individuals who received this hyperprolate ablation profile. Patients

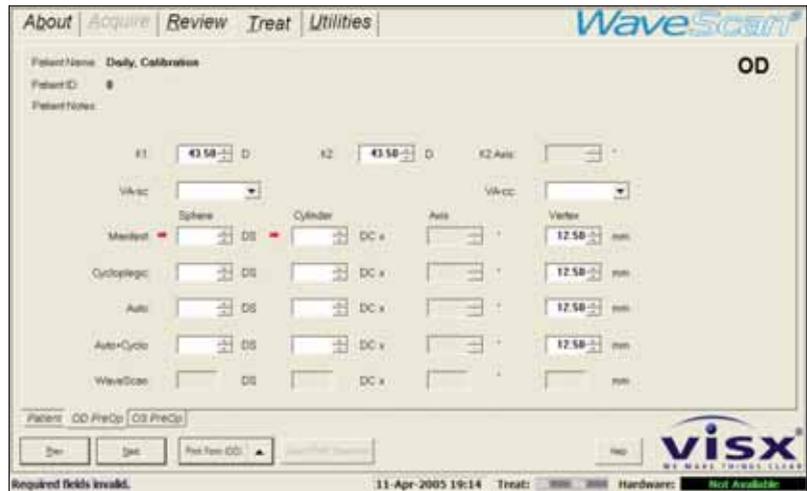


Figure 3. Keratometry is entered into the preoperative information.

noted an increased reading ability in their nondominant eye. Depending upon their age, they may have noticed increased midrange vision but may have required a reading add for close work.

ADVANTAGE OF PARADIGM

One advantage to this treatment paradigm is that it is done with one treatment, so there is no risk of decentering the ablation with two ablations or a loss of BCVA. Moreover, the procedure uses an iris registration system, so the ablation is well centered and there is no need for double-carding. In addition, because the central ablation is unchanged, the mean visual acuity for distance in these patients is better than 20/20, and we have heard only minimal complaints of glare and halos from the occasional patient. Most patients have not noticed a significant difference in distance vision between their eyes.

We can perform hyperprolate ablations on the cornea using the Visx Star S4 Iris Registration system by increasing the Q factor and the peripheral pulses. This technique provides a greater depth of field and added near vision. We look forward to future generations of excimer lasers with which we are able to customize the ablation to meet the needs of patients by altering their higher-order aberrations. ■

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1. Jackson, WB. Long-term results from the International Multifocal Presbyopia Trial. Paper presented at: The 2005 Meeting of the European Society of Cataract and Refractive Surgery; September 11, 2005; Lisbon, Portugal.