

# The Role of Aberrometry in LASIK

The quantifiable benefits of measuring and correcting higher-order aberrations.

BY ROBERT K. MALONEY, MD

I consider customized wavefront-guided laser vision correction a critical component of today's refractive surgical practice, because it delivers better outcomes than conventional treatments. Since I began performing customized corrections using the iLASIK suite (Abbott Medical Optics Inc., Santa Ana, CA) along with other technological improvements, my LASIK enhancement rate has decreased significantly (Figure 1). I now feel so strongly about customized wavefront-guided ablations that I would tell colleagues that, if they are not using this technology, it is time to switch.

## THE BENEFITS OF CUSTOMIZATION

The results achieved with wavefront-guided laser vision treatments are superior to those of conventional LASIK for three main reasons. First, wavefront-guided ablations reduce preoperative aberrations in some eyes. Scott MacRae, MD, has shown that eyes with higher preoperative aberrations have a greater reduction in higher-order aberrations after customized treatment (e-mail communication, March 2010). Second, customized procedures induce fewer aberrations than conventional ones. Third, I achieve better refractive accuracy with the iLASIK suite than I did with a conventional

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laser system. This improved accuracy may be related to the customized ablation's more monofocal shape. In short, this technology delivers cleaner refractions and better refractive accuracy postoperatively.

## WAVEFRONT CAPTURE

My staff and I capture at least three wavefront measurements on every patient and then choose the best one. We prefer to obtain a wavefront measurement when the eye is not accommodating so that the wavefront has less myopia and more hyperopia than the eye's manifest refraction. Our goal is for the amount of astigmatism on the wavefront to correspond with that on the manifest refraction. We want to ensure we have a fair measurement of the eye's image quality. The

WaveScan (Abbott Medical Optics Inc.) grades image quality by a number of checks that indicate how well the aberrometer processed the wavefront images.

My staff and I use a few strategies to capture a clean wavefront image. First, the operator ensures that the WaveScan is properly focused and centered on the eye. We verify the focus of the image spots and then confirm that the WaveScan's calculated refraction is consistent with our findings on manifest refraction. Some practitioners prefer to use the manifest refraction to calculate

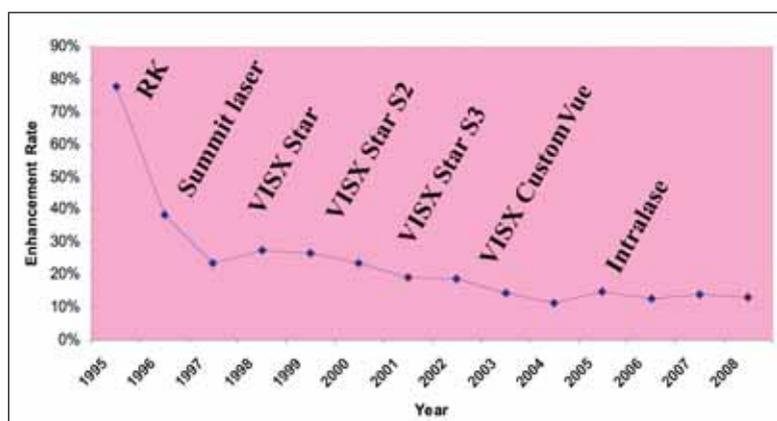


Figure 1. Enhancement rates over time.

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the ablation, but I suspect the wavefront refraction is more accurate. If the two measurements disagree, my staff and I may perform a cycloplegic refraction to check for errors in our manifest refraction. If the cycloplegic and manifest refractions are consistent, then we will repeat the WaveScan.

The biggest challenge in performing wavefront measurements is that patients' eyes occasionally accommodate during the process. If a wavefront reading is more myopic than the manifest refraction, especially in a young patient, then it is likely the eye was accommodating.

Wavefront analysis adds some time to the preoperative testing, but it ultimately saves us the time, trouble, and expense of having to re-treat patients postoperatively. Some doctors take wavefront measurements of all surgical candidates, but in my practice, we do not perform this test until someone has scheduled surgery.

## IRIS REGISTRATION

Iris registration compensates for the small cyclotorsional movements of the eye that reduce the accuracy of astigmatic correction. In addition, iris registration compensates for the shift from dark to light in the center of the pupil. An optimal laser treatment should be centered on the dark-adapted scotopic pupil, because nighttime is when patients most notice residual aberrations. Without iris registration, the treatment is centered on the pupil as it is under the operating microscope, which is a well-lit photopic environment. The difference is real, particularly in high myopes. In the iLASIK's FDA trial, my coinvestigators and I found that individuals with high myopia who were treated without iris registration had more coma postoperatively than those treated with iris registration. This is probably because of small decentrations of the ablation caused by not taking into account the center shift of the pupil between light and dark.

## SUMMARY

I have seen firsthand the advantages of measuring and treating higher-order aberrations during laser vision correction. Although performing wavefront aberrometry may slightly prolong the patient's workup, the measurable benefits of improved outcomes and lower enhancement rates are worthwhile. ■

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