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COVER
FEATURE

Refractive Custom LASIK

by Jena Passut EyeWorld Staff Writer

Wavefronts are all the rage, so where will topography-guided systems fit in?

For refractive surgeons, custom LASIK platforms are producing amazing results for patients with traditional spherical refractive error.

So where will extremely customizable topography-guided platforms, which aren't yet available in the U.S., fit in?

Topography-guided platforms are used to treat patients with irregular corneas.

"That's really where you need the fingerprint identification of the cornea and to be able to treat every cornea for those specific defects," said David Goldman, M.D., assistant professor of clinical

ophthalmology, cornea and external disease department, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine.

A recent report in the Journal of Cataract & Refractive Surgery reported that topography-guided LASIK results were excellent in patients who had a decentered ablation.

"It's a great technology that's going to apply, I think, to a small percentage of patients, and those are the people who have some irregularity of the cornea where it's so critical to measure the corneal topography and treat it specifically," Dr. Goldman said.

Wavefront-guided

Wavefront-guided systems create a customized ablation profile by using three-dimensional measurements of the patient's cornea. The wavefront map is then used to guide the laser to reshape the corneal surface and correct any abnormalities.

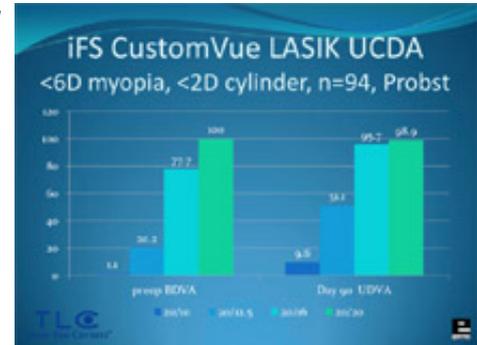
Currently, there are two types of wavefront platforms. A wave of light is used in wavefront-guided platforms to measure the cornea's optical abnormalities, while the laser corrects those aberrations and the treatment prevents the onset of further ones.

Abbott Medical Optics (AMO, Santa Ana, Calif.) offers the iLASIK and VISX CustomVue platforms, while Alcon (Fort Worth, Texas) owns the Wavelight Allegretto Wave, and Bausch + Lomb (Rochester, N.Y.) offers the Zyoptix. For Louis E. Probst, M.D., national medical director, TLC Laser Eye Centers, who uses the CustomVue and VISX systems, the results of custom LASIK have been nothing short of "mind blowing."

"It's no question, for the standard patient, wavefront-guided is extraordinarily effective, particularly used in conjunction with IntraLase [AMO]," he said, adding that he gets "ridiculously incredible" results, such as 98% of patients seeing 20/16 or better uncorrected post-op, 78 are 20/12, and 50% are 20/10.

Those are patients who went into the procedure with healthy corneas, however.

"For problem patients, particularly those with keratoconus or ectasia, topography-guided treatment makes more sense," Dr. Probst said.



This graphic shows the drop in enhancements once Dr. Probst started using the CustomVue. It went from around 6% to 2 or 1.5% Source: Louis E. Probst, M.D.

The technology, however excellent, is not without risks.

"Custom-guided ablations do tend to take a little more tissue than your regular ablation profiles, so if you are doing a really high treatment or have a patient with a cornea on the thin side, you have to be a little more cognizant of that," Dr. Goldman said. "You need to be aware of how much tissue you are taking or leaving the patient with for the residual stromal thickness."

One of the issues with the measurement is that it is static, while wavefronts generally are dynamic, said A. John Kanellopoulos, M.D., associate clinical professor of ophthalmology, New York University, New York, and director of laser vision, GR Institute, Athens, Greece.

"It is very difficult to make a conclusion that this measurement is the optimal wavefront of this patient and if I mimic the changes that the wavefront imaging determines, then I will have an optimal wavefront environment for the patient," he said.

Topography-guided

Topography, on the other hand, is highly reproducible and can give a surgeon correction at the level he or she desires.

"One of the differences when you treat irregularities, where you need a customized treatment, however, is that topography-guided does not have the brain cells, so to speak, to correct refraction," he said. "The topography-guided system will give you a much better optical media as far as regularity and the IHD index of height decentration and IHA index of height asymmetry."

Dr. Kanellopoulos said clinicians in Europe also see the value in using topography-guided LASIK as a hyperopic treatment up to +0.6 D.

"By definition topography-guided treats on the visual axis, not on the geometric center," he explained. "In my mind, hyperopic LASIK should only be topography-guided LASIK because it treats on the visual axis versus the center of the cornea. If you treat a hyperopic eye as the opposite of myopia, you're invariably misplacing the ablation temporally."

Surgeons in Greece also have incorporated corneal collagen crosslinking into this hyperopic treatment, which may change the thinking that hyperopia "is something that regresses," Dr. Kanellopoulos said.

Just comparing imaging alone in irregular corneas, Dr. Kanellopoulos said topography systems are superior because "it's extremely rare that you are not able to obtain reproducible maps with topography, whereas wavefront imaging of these corneas is very challenging."

Limitations

Still, each system has its limits. "Topography-guided is limited as being able to have a good picture of what the spherical equivalent of that eye would be after the procedure," Dr. Kanellopoulos said.

As with any surgical procedure, there are risks. "When you increase the index of irregularity and incorporate it into treatment, you're becoming extremely demanding of the centration and reproducibility of that treatment," Dr. Kanellopoulos said. "You increase the gains, but you quadruple the risks. Say I envision an irregularity that is a map of Greece, for instance, and I ablate that irregularity of Italy, then I exacerbate that irregularity by three times."

The difficulty is exacerbated because most images of patients' eyes are taken while a patient is sitting, but the patient is ultimately treated while lying on the operating table.

"Therefore we have issues of cyclorotation, different pupillary dilation status, and a potential shift of the visual axis," Dr. Kanellopoulos said. "The [issue] in my mind going into anything customized is that you're increasing the risks of creating a bigger problem than the problem you are trying to treat."

The next step

Investigators now are trying to marry the advantages of both the wavefront- and topography-guided systems.

"It's called ray tracing, where they include topographic data, wavefront data, and axial length data, and anticipated tissue

response to the treatment into an extremely calculated formula," Dr. Kanellopoulos said. "This is not yet commercially available, but I think it will be toward the end of 2012 as a one-box machine that will be able to give you all these measurements

together and give you more elegant topography and wavefront."

In Europe, surgeons are using the fourth generation of the Wavelight platform called Vario, which incorporates different pupil sizes on the topography and transfers that data for the laser to use.

Iris recognition and limbal anatomy also are used as landmarks to perform the treatment, as well as correct for cyclorotation.

"We're seeing very good results with this, but I have to mention that it's extremely rare that cyclorotation is a big issue," Dr. Kanellopoulos cautioned.

For improvements, Dr. Probst said the tracking on the excimer lasers could be better.

"They are designed to work on the reflecting surface of the cornea, but not on the bed of a LASIK flap," he said, adding that he would also like to see a higher tracking speed and a better way to use the LASIK interface.

Dr. Goldman said wavefront-guided and wavefront-optimized platforms are top-notch today.

"We've already raised the bar so high with what we can do, which is a great thing, but we're always looking for more improvement. The ways of us improving are faster lasers, faster capture rates, and smoother ablations."

Editors' note: Dr. Goldman has no financial interests related to this article. Dr. Kanellopoulos has financial interests with Alcon. Dr. Probst has financial interests with AMO.

Contact information

Goldman: 561-515-1543, dgoldman@med.miami.edu

Probst: 708-562-2020

Kanellopoulos: +30-210-74-7277, ajk@laservision.gr



AT A GLANCE

- Wavefront-guided and topography-guided, both used to reshape the cornea, are two very different LASIK platforms
- Topography-guided LASIK, which is not yet available in the U.S., is used to treat patients with highly irregular corneas
- Wavefront-guided LASIK has been shown in several studies to be highly effective for regular corneas