

Wavefront is showing signs of success, but can it do it alone?

Wavefront technology is the new kid on the block and is showing signs of success, but is it the best option for LASIK surgery?

by Michael J. Walsh
Staff Writer

BOSTON – With the dawn of wavefront, the first results of custom cornea ablations are coming in, as well.

Among the results presented at the American Society of Cataract and Refractive Surgery meeting were studies using the Summit Autonomous (Waltham, Mass.) CustomCornea wavefront device as part of the LADARvision system (Summit Autonomous) clinical trials. The studies treated 20 bilateral patients with laser in situ keratomileusis (LASIK) and also allow for the treatment of 20 bilateral patients with photorefractive keratectomy (PRK), 13 of which have been treated as of this writing. Marguerite B. McDonald, MD, presented the results of the Food and Drug Administration feasibility study.

Dr. McDonald presented only the 10 myopic LASIK patients in the interest of time. The long-term results for the PRK studies were not yet available, as they had been treated more recently. The preoperative uncorrected visual acuity results ranged from 20/12.5 to 20/25 and were stable at one month.

The LASIK surgical parameters were the creation of an optical zone of 6.5 mm with a blend zone of 1.25 mm. The patients were broken into two groups, with five patients in group 1 and five patients group 2. Dr. McDonald remarked that the nomogram for the surgery was improved for group 2, after the initial group 1 results were tabulated.

At 3 months, all eyes were 20/40 or better and 85% were 20/25 or better. The CustomCornea eyes were better than the normal LASIK surgery in four out of five eyes.

A step toward supervision

In most commercial LASIK cases, the Root Mean Square (RMS) value for higher order aberrations at least doubles after surgery. In one patient, the RMS value actually dropped from 0.22 to 0.15 in her CustomCornea LASIK eye. "A tiny step toward 'super vision,' the goal of improving on Mother Nature," Dr. McDonald said.

Most patients were pleased with their CustomCornea eyes, according to Dr. McDonald, although two patients were overcorrected and were waiting for re-treatment.

Of the 10 patients, seven said they prefer their CustomCornea eye or that both eyes were the same. Three patients preferred their conventional eye, one person stating that he preferred it was because it was his dominant eye.

Since the group 1 CustomCornea eyes appeared to be consistently overcorrected, the algorithm was changed for group 2 to account for this. Those

first eyes are the patients awaiting re-treatment.

Best corrected visual acuity was maintained in all eyes.

In the study of higher-order aberrations, all 10 myopes and 10 hyperopes can be analyzed. Smaller higher-order errors appeared in 12 of the 20 CustomCornea eyes when compared to the patients' contralateral conventional eyes, "which is a big improvement over doubling," Dr. McDonald said. She mentioned her most happy patients were the ones with the lowest RMS values postoperatively.

"Wavefront-guided CustomCornea surgery is a promising technology for addressing the aberrations of the visual system. Additional work is needed to realize the full potential of this approach," Dr. McDonald said.

Wavefront alone?

"Are you as confused as I am where in the past 3 to 4 years topographically-driven lasers were so effective, and now we're told wavefront refraction-driven lasers are the way to go?" Noel A. Alpines, MD, commented.

It is Dr. Alpines' contention that wavefront analysis is really just a part of a larger scheme to true custom ablations. He believes that vector planning, the integration of the most important measurements of wavefront technology and topography, is the best way to create a CustomCornea.

"Well, vector planning is the best way to integrate the best numbers we get from both these technologies. The two fundamental ways to map astigmatism is for the cornea by topography and for the refraction by wavefront values," Dr. Alpines said.

Dr. Alpines believes that even treating by corneal topography alone, surgeons already are creating CustomCorneas in a sense. The measurements are individualized for each patient. But he felt the larger problem is still the fact that topographer-driven treatments already get inconsistent and unpredictable refractive results, because these are not currently addressed in the planning process. Also, each topographer uses a different set of algorithms to gauge astigmatism irregularity.

Wavefront refraction, on the other hand, is intended to correct all the aberrations occurring within the eye on the corneal surface. The net effect can be to increase corneal irregularity, which could be working against the goal of super vision. "In addition, when we correct these aberrations in this way, there can be overlapping adjacent regions that can cause conflicting treatment priorities directing both ablation and addition of tissue at the same site, which is prob-

lematical," Dr. Alpines said.

He also explained that wavefront refraction does not give the perceptual view of astigmatism. Just like the autorefractor, it excludes the non-optical components of astigmatism interpreted in the visual cortex. Furthermore, it does not address the underlying topography values that are going to change. "So because of these differences between wavefront and topographic astigmatism values that do not match, we leave avoidable astigmatism remaining on the cornea," Dr. Alpines said. "Wavefront refraction has considerable obstacles to overcome before it can be the sole refractive treatment device."

Vector planning has the capabilities to bring together both modalities into the planning process. Vector planning more accurately integrates both modalities, the corneal curvature and the refractive power, so it can treat all aspects of possible astigmatism and address corneal irregularities systematically, Dr. Alpines said.

Vector planning provides the ability to incorporate both topographic and refractive data into the treatment paradigm where topographic linkage and wavefront technology principally address only one or the other dimension of the treatment.

There is a potential for unexpected or adverse outcomes where there are differences between preoperative corneal and refractive astigmatism values in the treatment of regular or irregular corneas. This potential conflict exists further where multiple data points utilized in both topographic mapping and ray tracing analysis make an integrated planning process of refractive and corneal values more complex but just as essential.

However, Dr. Alpines quickly pointed out that no technology supercedes the input of the most important aspect to refractive surgery – the doctor. "It will be a surgical decision based on his or her judgment and surgical skill how these two technologies should be apportioned emphasis in determining any given treatment," Dr. Alpines said. **CSN**

For Your Information:

Marguerite B. McDonald, MD, can be reached at Southern Vision Institute, 2626 Napoleon Ave., New Orleans, LA 70155; (504) 896-1250; fax: (504) 896-1251; e-mail: mmb2626@aol.com. Dr. McDonald has no direct financial interest in any of the products mentioned in this article. She is a paid consultant for Summit Autonomous. Noel A. Alpines, MD, can be reached at New Vision Clinics, 7 Chesterville Road, Cheltenham 3192, Australia; (61) 3-9585-0995; fax: (61) 3-9584-6122; e-mail: alpines@newvisionclinics.com.au.

Summit Autonomous can be reached at 21 Hickory Drive, Waltham, MA 02154; (781) 890-1234; fax: (781) 890-0313.