Wavefront mixed with topography offers 'ideal laser treatment'

A study showed a reduction in residual astigmatism and improved mesopic and photopic vision after LASIK with the combination.

by Jared Schultz
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Combining wavefront and topography in surgical planning for myopic and astigmatic LASIK reduces the residual astigmatism that can result from conventional treatment methods, according to one ophthalmologist.

OSN Refractive Surgery Section Member **Noel A. Alpins, FRANZCO, FRCOphth, FACS,** described the method of vector planning that combines the two modalities during the European Society of Cataract and Refractive Surgeons meeting in London.


Noel A. Alpins

He analyzed the results of 21 patients who were treated based on either wavefront and vector planning combined or wavefront-alone in a prospective, randomized, double-masked pilot study.

Combining wavefront and topography measurements using vector planning with his ASSORT (Alpins Statistical System for Ophthalmic Refractive surgery Techniques) program, Dr. Alpins sought to demonstrate the limitations of using only wavefront measurements.

"Vector planning for customized treatment ... actually links the wavefront and the corneal shape for what I would see as being the ideal laser treatment," he said. "When you treat conventionally, you are giving 100% emphasis to the refractive treatment, and you are totally disregarding the topographical astigmatism values that usually differ."

Inclusion criteria for the study were more than 1 D of cylinder, ocular residual astigmatism of 0.75 D or greater and best corrected visual acuity of 20/30 or better, Dr. Alpins said. Patients were excluded from the study if they had mixed astigmatism, hyperopic astigmatism or forme fruste keratoconus, he said.

"When you look at the treatment limitations of wavefront refraction alone, as against combining with topography, it doesn't address the underlying topography that's actually going to change," he said. "We are leaving an excess amount of astigmatism remaining on the cornea. The advantage of vector planning and bringing the topography into the plan is demonstrated in that it improves the corneal astigmatism and visual outcome as a consequence."

Eleven patients were treated based on wavefront analysis alone, and 10 patients were treated based on the wavefront and vector planning combined. All patients were treated with the VISX Star S4.

Decreased residual astigmatism

Patients in the wavefront-only group had preoperative wavefront refraction values of –1.71 D of cylinder, and patients in the combination group had preop wavefront values of –1.69 D of cylinder. The wavefront cylindrical results at 3 months postop were slightly better in the wavefront group at –0.57 D of cylinder compared with the combined group at –0.70 D of cylinder, Dr. Alpins said.

It was in the keratometric and topographic results that the effectiveness of combining topography and wavefront was demonstrated.

According to Dr. Alpins, the combined group started with a higher amount of preop corneal astigmatism than the wavefront group. The topographic values were 1.07 D in the wavefront group and 1.50 D in the combined group. Keratometric values for the two groups were 1.13 D in the wavefront group and 1.49 D in the combined group, he said.

"That's a significant additional hurdle for the combined group to jump," he said.

At the 3-month follow-up, the topography outcomes showed a parallel reduction of 31% (0.33 D) in the wavefront group and 51% (0.76 D) in the combined group, and the keratometry results showed that astigmatism was reduced by 30% (0.79 D) in the wavefront group and by 50% (0.75 D) in the combined group, he said. The topography results were the same, with astigmatism reduced in both groups to 0.74 D from the different preoperative amounts. At 6 months, astigmatism was reduced 34% (0.38 D) in the wavefront group and 44% (0.65 D) in the combined group by keratometry, 37% (0.40 D) and 45% (0.67 D) respectively by topography.

"When you look at the total astigmatism, by looking at the amount of astigmatism by refraction and keratometry together, we had a much greater decrease in the combined group than in the wavefront-alone group," Dr. Alpins said.

Mesopic and photopic advantage

Photopic and mesopic results showed a greater improvement of BCVA (log MAR) in the combined group compared with the wavefront-alone group, according to Dr. Alpins.

In low-contrast photopic conditions, the preop measurement was 0.14 for both groups, but at 3 months postop, the wavefront group was at 0.17, and the combined group was at 0.13. At 6-month follow-up, the wavefront group was at 0.12, and the combination group was at 0.12.

Under mesopic condition the combination group had a gain of 0.05 for low contrast visual acuity and 0.03 for high contrast visual acuity over the wavefront-alone group

The 3-month results also showed more favorable outcomes for total and higher-order aberration root-mean-square values, astigmatism, coma and trefoil, and at 6 months, higher-order aberration root-mean-square, astigmatism, horizontal coma and trefoil were better for the combined group, he said.

Statistical significance was not anticipated in such a small cohort. Two parameters, topography and horizontal coma, showed significant superiority of the combined technique (<0.05). Using t-test analyses, fewer than 300 eyes would be required to establish significance in many of the key outcomes measured.

The study was conducted to establish if there were any trends favoring one group over the other, and the outcomes show the wavefront and vector planning combined group achieving a trend for better outcomes in the parameters discussed above, Dr. Alpins said. This would suggest that outcomes are achievable above the current level of wavefront treatments being performed.

Applying the 'sweet spot'

The combined treatment program allows the surgeon to choose by percentage how much weight to give to topography and wavefront in the treatment planning, according to Dr. Alpins. He said in this study the percentages were 60% wavefront and 40% topography.

"This is really close to what we call the 'sweet spot,'" he said.

Dr. Alpins said by being able to choose the amount of topography and wavefront mix used in the treatment, surgeons can minimize remaining overall astigmatism. OSN

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