Ophthalmology Times EUROPE

Allegretto Wave

Looking at topography–guided custom retreatments

Sep 1, 2006
By:
Ilya Petrou, MD
Ophthalmology Times Europe

Ophthalmologists who perform refractive procedures today, often to the dismay of patients as well as the treating physicians, achieve less than optimal satisfactory results postoperatively in 5% to 25% of their patients. Residual refractive errors, overcorrection, as well as pre-existing irregular astigmatisms induced by small optical zones and/or decentred ablations are difficult to correct with standard treatments because of their irregular nature.

According to A. John Kanellopoulos, MD, these "problem" patients would clearly benefit more from a custom ablation. Dr Kanellopoulos is Clinical Associate Professor of the Department of Ophthalmology at New York University Medical School and Director of the LaserVision Institute in Athens, Greece. He presented the results of his study on such problem patients employing a topography-guided wavefront optimized Allegretto system (WaveLight Laser Technologie AG), and spoke of the very positive results attained when using this fine-tuned custom re-treatment system.

"Although the term customized treatment is usually used for wavefront-guided treatments, topography-guided ablation is also a form of customized ablation. However, instead of conforming treatment to the wavefront map, it uses the patient's topography height map as the basis for the treatment," he said.

The Allegretto Wave excimer laser is a flying spot laser system, working with a 0.95 mm Gaussian spot and fires at a rate of 200 Hz. The laser works in conjunction with a 250 Hz video-based infrared tracking system to compensate for any eye movement, making it even more precise in performing tissue ablation.

Putting it to the test

In his prospective, non-comparative study, 27 eyes of 22 patients with a history of LASIK for myopia underwent topography-guided enhancement treatment with the Allegretto Wave excimer laser system. All patients included in the study had previous myopic or hyperopic laser surgery and were dissatisfied with their quality of vision because they still had residual myopia, hyperopia, or mixed astigmatism. Indications included small original optical zone, decentred ablation, irregular astigmatism, as well as night vision problems. Pre- and postoperative evaluations of the study patients were recorded including refraction, uncorrected visual acuity (UCVA), best spectacle-corrected visual acuity (BSCVA), corneal asphericity (Q value), low contrast sensitivity, scotopic pupil size, topography with the Orbscan II (Bausch & Lomb) and with the Wavelight Topolyzer (yielding the topography height maps), ultrasound corneal pachymetry with the NIDEK US-1800, as well as the patient's subjective assessment of improvement. Patients were evaluated one hour, one day, one week, one month, three months and six months post-procedure.

Results showed that, at the six-month follow-up exams, the mean UCVA improved from 20/49±0.22 to 20/25±0.21 and the mean BSCVA improved from 20/32±0.15 to 20/21±0.14 in patients. The refractive error also improved from sphere of -0.84±1.37 D to -0.61±0.81 D, and cylinder of -0.55±0.78 D to -0.53±0.58 D. Corneal asphericity, as measured by the Q value, improved on average from +1.46±0.79 to +1.07±0.89. Dr Kanellopoulos noticed that the mean contrast sensitivity scores at 12 cycles/degree improved by 70% from a mean of 3.56±0.66 to 6.05±0.59. In the majority of cases, study patients reported an improvement of their symptoms postoperatively.

Why do we need it?

According to Dr Kanellopoulos, eyes with decentred and/or small optical zone ablations may suffer from irregularities in the corneal surface, which can dramatically affect the quality of vision in patients. Here, the cornea acts like a multifocal lens and causes uneven distributions of light. Subsequently, the eye loses BSCVA, contrast sensitivity, and experiences halos and starbursts around objects. These symptoms can be especially bothersome during scotopic and/or mesopic conditions when the pupil dilates and exposes more of the irregular cornea. Eye surgeons, therefore, opt to perform "customized" forms of ablations, including this technique of topography-guided treatments, as well as wavefront-guided ablations.

The wavefront guided VISX CustomVue (AMO) is another system on the market claiming superiority in customizing the cornea. Dr Kanellopoulos said that not all treatment modalities are equally effective, and explains why.

"The mechanism of topography-guided ablation is the fitting of an ideal corneal shape, usually a sphere, under the present topography map with the ablation of tissue in between. The clear advantages of this treatment over other treatment modalities are that it can be used in highly irregular corneas, which are beyond the limits of wavefront measuring devices, and it can be used in cases that have media opacity such as in eyes with corneal scars, as its measurements are based strictly on the surface. Because it is based on the corneal surface, it is theoretically possible to factor in the asphericity or Q value, and maintain the natural aspheric shape of the cornea," Kanellopoulos affirmed.

Dr Kanellopoulos cited recent studies demonstrating that there is a shift in the pupillary centre that occurs between a normal (photopic) and a dark-adapted (mesopic/scotopic) state. He claims that because of this shift, topography-guided treatments might hold greater accuracy on delivery to the cornea as the ablation maps are captured with the photopic pupil, which is the same as in treatment.

Perfection is unrealistic

He did, however, admit that the major disadvantage of topography-guided ablation is that it ignores the rest of the refracting media because it centres its focus mainly on the contour of the cornea, producing refractive "surprises" postoperatively — as he experienced in the treatment of previously myopic patients when attempting to widen the optical zone. The aim is for the laser to flatten a broader area of the cornea and therefore ablate tissue peripherally. This ablation pattern resembled a hyperopic treatment and thus caused some amount of myopic shift, and sometimes necessitated an enhancement procedure with a "standard" treatment to correct the remaining spherical refractive error. Dr Kanellopoulos hence, made adjustments to the refractive targets to compensate for this shift in refraction, with very positive results.

He stated that, "From the results of this study, we saw that topography-guided treatments were successful in correcting most irregularities caused by previous refractive surgery. Although we encountered some refractive changes in terms of refractive sphere that may require further standard enhancement, overall, this technique was shown to be a valuable method that may benefit from confirmation with further studies of larger patient groups and a longer follow-up."

A. John Kanellopoulos, MD is Clinical Associate Professor of Ophthalmology at the Department of Ophthalmology, NYU Medical School, New York, USA and Director of the LaserVision.gr Institute, Athens, Greece. He may be contacted by E-Mail: ajk@laservision.gr
; Tel: +1 917 770 0586 (USA), +30 210 747 2777 (Greece).

Dr Kanellopoulos' study investigating topography-guided custom retreatments in 27 symptomatic eyes was published in the *Journal of Refractive Surgery* Sept/Oct 2005; 21:S513-S518.

A. John Kanellopoulos