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# Topography-guided LASIK enhancement advantageous

## Quality of vision enhanced in eyes with small eccentric ablations, irregular astigmatism

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**Athens, Greece**—Topography-guided LASIK enhancement using the Allegretto Wave system (WaveLight Laser Technologie AG, Erlangen, Germany) appears to be safe and effective for improving poor quality of vision associated with small, eccentric ablations and irregular astigmatism after previous refractive surgery, said A. John Kanellopoulos, MD.

Dr. Kanellopoulos presented the results from his early experience using that technique to treat 17 consecutive eyes at his refractive surgery center in Athens, Greece. Based on data collected during a mean follow-up period of 6.5 months, he concluded the topography-guided enhancement resulted in improved topography accompanied by a reduction in the mean asphericity (Q) value toward a more desirable level. There was good cylinder correction and reasonable spherical adjustment, albeit with some refractive surprises.

Consequently, uncorrected visual acuity (UCVA) improvement was somewhat limited, but very significant gains in best spectacle-corrected visual acuity (BSCVA) were more impressive and 15 of 17 patients benefited with symptom improvement. He reported his results at the XXII Congress of the European Society of Cataract and Refractive Surgeons in Paris.

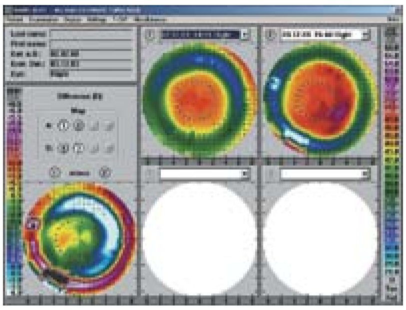


Figure 1. Enlargement of a small optical zone hyperopic ablation. Map 1 shows post-LASIK for a patient with +4.5 D of hyperopia who has +1.00 D astigmatism with night vision problems. Map 2 shows post-topography-guided enhancement with an increase in optical zone. This was accompanied by an improvement in contrast sensitivity score from 3 to 7 at 12 cycles/second.

"The topography-guided treatments corrected most irregularities, and we look forward to confirming these encouraging results with larger patient populations and longer follow-up," said Dr. Kanellopoulos, director, Laservision.gr Institute, Athens, Greece, and clinical associate professor of ophthalmology, New York University Medical School, New York.

"However, surgeons should be aware that this treatment may change refractive sphere unpredictably, and so it may be necessary to approach these enhancements as a two-step procedure. Because of the irregular ablations, these procedures should not be undertaken with high expectations for refractive accuracy," he added.

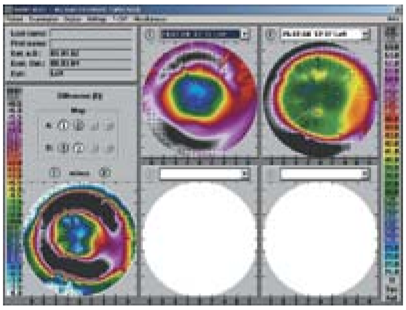


Figure 2. Enlargement of an optical zone in a post-RK patient. Map 1 shows a 10-year post-RK eye with a refraction of +2.50 D sph with -1.50 D cyl. The patient had debilitating night vision problems. In this patient, we anticipated a 4- to 5-D myopic shift based on the planned tissue removal in the mid-periphery resembling a +5 hyperopic correction. We therefore added a -2 D correction to our topography-guided treatment with good spherical approximation postoperatively. Map 2 shows post-topography-guided enhancement with obvious widening of the optical zone. Refraction improved to -0.50 D sph with -0.5 D cyl. This was accompanied by marked improvement in night vision quality.

Patients eligible for the procedure had to present with a small optical zone, decentered ablation, irregular astigmatism, or night vision problems and have a residual SE ±1.50 D. In addition, they were required to have estimated post-enhancement thicknesses of 280 µm in the stromal bed and 400 µm for the total cornea.

As an additional criterion, patients needed to have highly reproducible topography maps. Topography was performed using the WaveLight Topolyzer (WaveLight), and the average data from eight individual high-quality maps were fed into the T-CAT software for each eye. Only topographies with ≥75% of the corneal surface mapped were included.

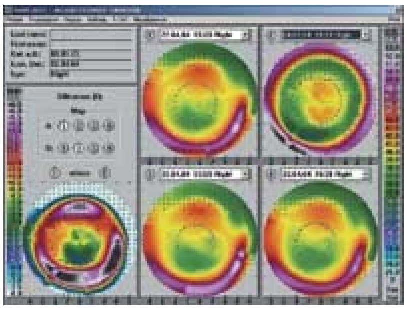
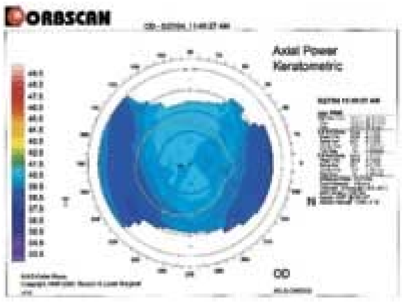


Figure 3. Treatment of a decentered ablation. Map 1 shows post-PRK eye with an inferiorly decentered ablation. The patient complained of starbursts, haloes, and significant night vision problems. Map 2 shows eye at 2 weeks post-enhancement with a good, centered optical zone with some irregularities, probably secondary to tissue remodeling (PRK) (left). Orbscan axial map 6 weeks post-enhancement, showing a very smooth and regular optical zone (right).

"Topography is as much an art as it is a science, and careful attention must be paid to obtaining high-quality maps," Dr. Kanellopoulos said.

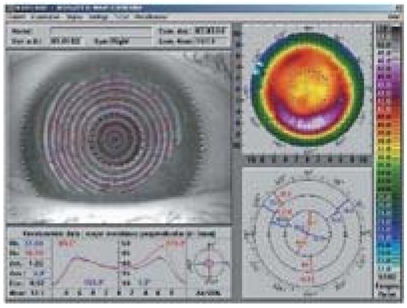



Orbscan axial map 6 weeks post-enhancement, showing a very smooth and regular optical zone

The Q value was calculated based on the central 7-mm optical zone (20° field) with a goal of between -0.3 and -0.46.

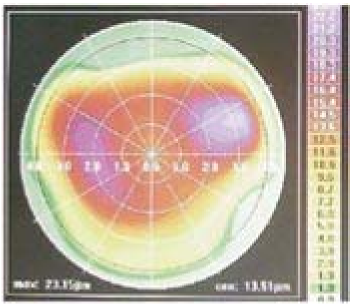
Re-treatment was performed with flap lifting, not cutting, and ultrasonic pachymetry measurements were obtained preoperatively and after flap lifting to verify that patients fulfilled the criteria for residual stromal and corneal thickness.

Preoperatively, mean refractive sphere for the group was -0.50 D (range, -1.50 to +1.25 D), and it improved to -0.14 D (range, -1.50 to +0.59). Mean cylinder preoperatively was -1.15 D (range, 0 to -2.00) and the postoperative value was -0.56 D (range, 0 to -1.00).



A. Pre-enhancement topography map

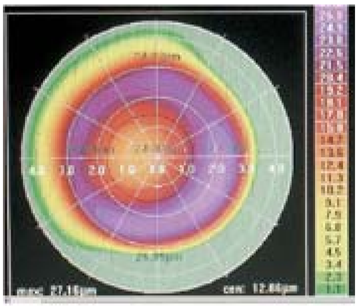
Mean preoperative UCVA was 20/31, and it improved to 20/24. Mean BSCVA improved from 20/25 to 20/18, with a single patient losing 2 lines. The Q value was reduced from +0.7 to +0.1, and low contrast sensitivity scores improved by 70%.



B. Wavefront-guided ablation plan

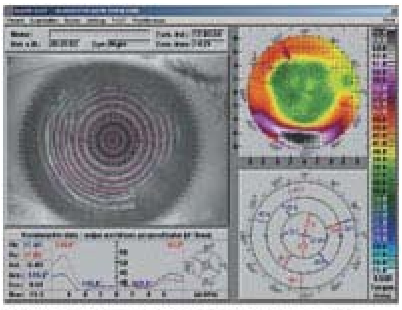
Results from patient self-rating showed a marked improvement in visual symptoms along with a relatively high patient satisfaction score (mean, 2.61 on a scale of -1 to +3).

Dr. Kanellopoulos noted that he has previously reported success using a wavefront-guided approach for performing these challenging enhancements. Currently, he works patients up for both wavefront-guided and topography-guided re-treatment and decides which technique might work better by correlating the point spread function with the patient's symptoms. The topography-guided option is applicable in more such cases due to better capture and the need of an impressive one-third of central tissue in comparison to wavefront-guided.



C. Topography-guided ablation plan

He indicated the topography-guided approach has several advantages in that it appears to use less tissue, can capture reliable images in eyes where wavefront cannot, and can be used in cases with media opacities since the measurements are based only on the surface. Recent studies have demonstrated that there is a shift in the pupillary center between normal (photopic) and darkness (mesopic, scotopic state). Therefore topography-guided treatments would hold greater accuracy on delivery to the cornea because they are captured with the photopic pupil, the same as in the treatment. In addition, because the treatment is based on the corneal surface, the topography-guided approach also always factors in the Q value and thereby can help achieve a more desirable aspheric corneal shape.



D. Post-enhancement topography map

Figure 4 Patient evaluation. For unhappy post-LASIK/PRK patients, we perform both wavefront-guided and topography-guided assessments. This gives the surgeon a choice of which treatment to proceed with based on the treatment ablation pattern generated by the software. (A) Topography map of a patient who had troublesome night vision post-LASIK. (B) A-CAT wavefront-guided ablation plan. (C) T-CAT topography-guided ablation plan. (D) Postoperative topography map. In this case a wavefront-guided ablation was performed. (Figures courtesy of A. John Kanellopoulos, MD)

"Furthermore, most clinicians are more familiar with reading topography maps and may be more comfortable making clinical judgments based on that information," Dr. Kanellopoulos said.