Topography guided LASIK improves vision in eyes with irregular corneas

Roibeard O’Héineachain
in Rome

TOPOGRAPHY-guided LASIK and PRK with the WaveLight Allegretto Wave are effective techniques for the management of highly irregular corneas resulting from trauma or previous refractive surgery, according to Mirko Jankov MD, Vardionyannion Institute of Crete, School of Medicine, University of Crete, Greece.

He reported a study of 16 eyes of 12 patients with highly irregular astigmatism who underwent topography-guided LASIK or PRK with the WaveLight laser. Patients’ mean uncorrected visual acuity improved from 0.16 to 0.61 and the mean best-corrected acuity improved from 0.59 to 0.88 at one year’s follow-up, Dr Jankov told the 9th ESCRS Winter Refractive Surgery Meeting.

In addition, the mean sphere decreased from -3.17 D to -1.88 D, while the mean cylinder decreased from -2.37 D to -1.29 D. The total asphericity in all patients assumed more negative values compared to the preoperative ones.

The study included four eyes with corneal scars, five eyes which had undergone previous hyperopic LASIK, four eyes which had decentrations and three eyes which had undergone penetrating keratoplasty. In all eyes, Dr Jankov used topography measurements obtained with the WaveLight Topolyzer and T-CAT software to generate the ablation algorithms.

Optimised ablation profile

To create the customised algorithms, the T-Cat software averages up to eight topographic maps per eye and uses a Zernike-based algorithm to create an ablation profile that corrects for corneal irregularities and which is optimised to achieve the ideal asphericity, aiming for a Q-value of -0.46.

Among the five PRK-treated eyes only one eye lost one line of BCVA, while two remained unchanged, one eye gained one line, one eye gained two lines, another gained four, and the rest remained unchanged. Among the 11 LASIK treated eyes none lost any lines, two gained one line and the rest remain unchanged.

The mean postoperative Q-value was -0.04 and the mean postoperative Q-value was -0.33.

“We did not achieve the ideal asphericity but these were very irregular corneas and we brought them much closer to that goal. The uncorrected visual acuity was also not that good, but in these highly irregular eyes what we were really aiming for was to achieve an improvement in BCVA and we achieved that in most eyes.”

Dr Jankov noted that the LASIK treated eyes achieved refractive stability, with little change between one and twelve months while PRK-treated eyes continued to change for up to one year after surgery.

“Topography-guided ablations with the T-CAT software and the WaveLight Allegretto laser is a safe and powerful tool. We expect to be able to achieve better predictability in terms of refraction and asphericity in the future. We also noticed that LASIK was more predictable than PRK using this technique.”

Functional optical zone

In a separate presentation, Dr Jankov used an objective mathematical method to evaluate the size of functional optical zone (FOZ) after LASIK and PRK with WaveLight Allegretto wave excimer laser.

The retrospective study included one hundred eyes of fifty-five patients that underwent LASIK or PRK between June 2003 and June 2004 to treat myopia. The mean spherical error was -3.41 D (range: -2.00 to -8.50 D) and asphericity was less than -0.75 D.

“We observed how much of that ideal curve was accompanied by the corneal contour and then we made a difference function error between the best-fit curve and the real contour,” Dr Jankov explained.

His study showed that while the optical zones were approximately as targeted for spherical treatments of up to -8.5 D, the FOZ decreased and the Q-value increased (changed into more positive values) with the amount of myopic excimer laser treatment. That is, in eyes with an ablation profile programmed for a 6.0 mm ablation profile the mean functional optical zone 6.32 mm (range: 5.4 mm-7.1 mm) in the PRK-treated eyes and 6.23 mm (range: 5.0 mm-7.3 mm). In eyes with 6.5 mm ablation profiles, the FOZ was 6.99 mm (range 6.5 mm-7.3 mm) for PRK and 6.5 mm (range: 6.1 mm-7.0 mm) for LASIK.

In eyes with the 7.0 mm ablations it was 6.91 (6.0-7.3) for PRK and 6.51 (6.1-7.0) for LASIK.

“In our sample the FOZ were close to the programmed values. In smaller zones (6.0, 6.5 mm) the outcome was even wider than the programmed. It appears that the ablation profiles were properly designed for the periphery to compensate for various factors entering the peripheral FOZ postoperatively.

Dr Jankov noted that the importance of having a functional optical zone wider than the pupil may vary between patients, due to the Stiles-Crawford effect, which minimises importance of rays entering the pupil’s periphery. However, he pointed out that a smooth and regular cornea is essential to good quality of vision. He added that the wavefront-optimised ablation profiles used in the study still change the asphericity of the cornea. He therefore plans further studies with the recently introduced Eye-Q ablation profiles for the WaveLight laser, which are specifically adjusted to result in corneas with a more ideal aspheric contour.

mirkojankov@hotmail.com

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