Enhanced corneal smoothness may result in shorter recovery time of visual acuity

Technology also yields higher levels of postoperative visual quality, shorter re-epithelialization time

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Take-home message: Proprietary technology enhances corneal smoothness that resulted in a shorter recovery time of the visual acuity, higher levels of postoperative visual quality, and shorter time to re-epithelialization.

Reviewed by David T.C. Lin, MD, FRCSC

Vancouver, British Columbia—Extended periods of healing—and therefore, delayed visual recovery—after surface ablations may be a thing of the past with the advent of technology that was seen to enhance corneal smoothness in a multicenter evaluation.

Investigators reported shorter recovery time of visual acuity, higher levels of postoperative visual quality, and shorter time to re-epithelialization using SmartPulse Technology (SPT) (SCHWIND AMARIS).

SPT was evaluated retrospectively in eight clinical centers worldwide.

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"The starting point of this innovation was the recognition that a smoother cornea has a positive effect on vision, particularly during the first few days after treatment," according to David T.C. Lin, MD, FRCSC, lead author of the multicenter evaluation.

The developers of SPT redefined the ablation profile in geometric structure and pulse definition and distribution, explained Dr. Lin, clinical associate professor of ophthalmology, University of British Columbia, Vancouver, and medical director, Pacific Laser Eye Centre, Vancouver.

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SPT uses a geometric model of the cornea that is based on a three-dimensional fullerene structure that realistically portrays the corneal curvature (Figure 1), which allows the pulses to be positioned more closely than previously, especially in the corneal periphery.

Pulse definition changed from second-order super-gaussian to truncated quasi-gaussian, whereas the pulse distribution changed from random to a global optimization strategy.

All of this results in a very smooth corneal surface, as shown in Figure 2.

How it works

How it works

This treatment can be used for both stromal and surface procedures, but the effect is more marked in surface procedures.

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SPT is used for all ablations (and cannot be enabled/disabled per procedure) irrespective of the technique (LASIK, PRK, or transPRK), type (PTK, refractive treatments, presbyopic treatments, therapeutic treatments) or level of customization (aspheric, corneal, or ocular wavefront-guided).

SPT positively/synergistically combines with other features of the AMARIS, such as dual fluence (using a high fluence level for some 80% of the treatment to speed up ablation, and a low fluence level to smooth out), or small spot size of just 0.54 mm (enabling fine structures to be effectively ablated, while keeping pulse energy low even for the high fluence level).

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The low fluence level is not an additional polishing procedure but the final step of the ablation using a lower energy/fluence to fill up the remaining (not completely ablated) gaps. Using SPT, the two levels of fluence move from coarse/fine to fine/finer.

Retrospective study

Retrospective study

A total of 1,159 eyes were treated underwent TransPRK. This procedure was chosen for evaluation because of the increased roughness of the corneal surface compared with other surface procedures. The retrospective chart review made among the eight centers on healthy eyes and initial treatments revealed preoperative manifest refractions ranging from –12.25 to +3.25 D, with astigmatism up to 8 D.

Sixty-six percent (765 eyes) of eyes were evaluated immediately after surgery (day 0), 60% (695 eyes) on day 1 postoperatively, 59% (679 eyes) on week 1, 41% (471 eyes) on week 2, and 46% (538 eyes) on month 1.

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Investigators reported that the mean visual acuity was 20/40 immediately after surgery, continued to improve over the first postoperative days, and stabilized 2 weeks postoperatively. By 1 week postoperatively, the uncorrected distance visual acuity (UDVA) reached 20/27 (range among centers, 20/25-20/36).

“These results confirm excellent visual performance in the early postoperative stage compared with the reported visual recovery after surface treatments,” Dr. Lin said. “We are at the front edge of a paradigm shift in refractive surgery. Most patients comment that shortly after surgery, they are seeing almost as well as previously with their glasses. SPT has brought the ‘wow’ effect to transPRK.”

By month 1 postoperatively, UDVA was comparable to preoperative corrected distance visual acuity (CDVA).

Importantly, SPT exhibited a high safety profile. At the 1-month evaluation 75% of eyes had not lost any lines of Snellen CDVA; and 27% of eyes had gained one or more lines of Snellen CDVA, according to Dr. Lin.

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In addition to the safety profile, the predictability of the target refraction was also very good. At the 1-month time point, the mean spherical equivalent was +0.13 ± 0.42 D. The great majority of eyes (81%) were within ±0.5 D of the target refraction.

The study investigators concluded: “SPT provides excellent results, particularly in the early postoperative stage after surgery. The contributing surgeons reported shorter recovery time of visual acuity, higher levels of postoperative visual quality, and shorter re-epithelialization time using SPT. Most patients commented that immediately after surgery they were seeing almost as well as previously with their glasses.”

The early outcomes are especially noteworthy because they were obtained with transPRK, a surface treatment, which is characterized by longer visual recovery compared with LASIK in the early postoperative stage, according to investigators.

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Dr. Lin is a consultant for Schwind. The company released SPT in April 2015.