THE HUNT FOR PERFECTION


Topography- and wavefront-guided approaches to refractive surgery each have strong points.

BY EDWARD E. MANCHE, MD; AND JOSHUA ROE, MD

On the hunt for perfection with keratorefractive procedures, refractive surgeons are increasingly performing wavefront- and topography-guided ablations. Continued evolution of laser technology has improved results and limited some of the vision-related changes encountered with previous ablation algorithms.[1-7]

Wavefront-guided ablation profiles are generated from preoperative aberrometry measurements of the patient's higher-order aberrations (HOAs). These profiles aim to treat preexisting HOAs and minimize the induction of new HOAs. Topography-guided ablation profiles are generated based on an elevation profile of the corneal surface; the corneal HOAs, as measured by corneal aberrometry; and the refraction. The actual corneal surface map is compared with the desired or ideal corneal surface, and the difference becomes the ablation profile.[8]

Is one approach better than the other? The answer is not a simple matter of A or B. This article addresses some of the nuances in making a choice between topography- or wavefront-guided modalities.

WAVEFRONT-GUIDED ABLATIONS

Recent publications on wavefront-guided ablation document improved results with a high-resolution aberrometer (iDesign Advanced WaveScan Studio System, Johnson & Johnson Vision). These publications report superior results with this latest platform in comparison with those of earlier wavefront-guided platforms, conventional and wavefront-optimized platforms, and small-incision lenticule extraction.[9-14] Early studies show better astigmatism control,[12,15,16] superior low-contrast vision,[17] improved distance UDVA, and better aberrometric outcomes with the high-resolution device.[10]

TOPOGRAPHY-GUIDED ABLATIONS

Topography-guided platforms have received more recent regulatory approvals in the United States, and less published data is available on them than wavefront-guided platforms. Much of the literature on topography-guided ablation focuses on treating highly aberrated and ectactic corneas, cases for which this technology has been shown to outperform other modalities. Topography-guided treatments can be successful in cases in which obtaining wavefront data is difficult if not impossible (eg, eyes with corneal scars, eyes with highly irregular corneas, and eyes that have undergone penetrating keratoplasty).[18-21] That said, recent articles on the primary treatment of normal eyes have shown excellent and, in some regard, superior results with this modality compared with others.[22,23] Notably, the FDA clinical trial data for the Contoura Vision system (Alcon) are impressive: At 12 months, 34% of eyes had 20/12.5 or better distance UCVA, and 65% of eyes had 20/16 or better distance UCVA.[23]

An area of growing interest is combining topography-guided ablations with CXL to prevent keratoconus progression or ectasia after refractive surgery and simultaneously improve vision. The evidence to date is promising but largely limited to case series.[24-26]

AT A GLANCE

- Topography-guided platforms, only relatively recently approved in the United States, show excellent results in early studies.
- The advent of a high-resolution aberrometer has notably improved outcomes of wavefront-guided ablations.
- Both wavefront- and topography-guided platforms can achieve safe, effective, and predictable outcomes.

COMPARISONS

Prospective comparisons. To date, few publications have documented direct comparisons of the outcomes of topography- and wavefront-guided ablations. Our review of the literature identified one prospective comparison of the two modalities by Toda et al.[27] These investigators compared wavefront-guided results obtained with the iDesign Advanced WaveScan Studio System and Star S4 IR Excimer Laser System (both from Johnson & Johnson Vision) to topography-guided results attained with the OPD-Scan III and EC-5000 CXII excimer laser system (both from Nidek). Both modalities achieved excellent results, but the researchers reported that subjective quality of vision might have been better in the wavefront-guided cohort.[27]

Retrospective comparisons. In a retrospective analysis, Moshirfar and colleagues compared the FDA clinical trial data for the three most recently FDA-approved platforms for LASIK: the iDesign Advanced WaveScan Studio System with the Star S4 IR Excimer Laser System, the topography-guided Contoura Vision system, and the topography-guided Customized Aspheric Treatment Zone software (CATz, Nidek). This is the largest comparison of wavefront- and topography-guided LASIK that we found in our review of the literature.[17]

These investigators reported that a significantly higher percentage of eyes treated with the Contoura achieved distance UCVA better than 20/20. Notably, the Contoura eyes also had significantly lower sphere, cylinder, and spherical equivalent than the eyes treated with the other laser platforms.

When results were stratified by spherical equivalent, the Contoura system achieved significantly better results with higher myopic treatments, as had been seen in earlier studies.[28] The investigators also found, however, that patients in the clinical trial data submitted for FDA approval of the iDesign had significantly greater average preoperative sphere, cylinder, and spherical equivalent when compared with those included in data for the other platforms.

The analysis confirmed previous reports that topography-guided ablations may outperform alternatives in highly aberrated corneas. Treatment with the iDesign produced the largest improvement in mesopic contrast sensitivity, and the Contoura produced the largest improvement in photopic contrast sensitivity.

CONCLUSION

Both wavefront- and topography-guided ablation profiles can achieve excellent results. Some differences in outcomes remain, and certain clinical scenarios may be better suited to one platform than another.

Future studies will define the role each has in laser vision correction. ■

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