

Topography-Guided Ablation Targeting the Anterior Corneal Astigmatism Yields Inferior Outcomes vs Targeting the Manifest Refractive Astigmatism

We read with interest the article by Zhang and Chen, “A Randomized Comparative Study of Topography-Guided Versus Wavefront-Optimized FS-LASIK for Correcting Myopia and Myopic Astigmatism” in the September issue.¹ The authors state that “Kanellopoulos and Wallerstein et al. found that topography-modified refraction offered superior refractive and visual outcomes to standard clinical refraction in myopic TCAT LASIK [topography-guided customized ablation treatment laser in situ keratomileusis] (p. 580).”¹ This statement is incorrect. Kanellopoulos does make that claim,² but our study³ reports the opposite. Superior outcomes were found treating the subjective clinical manifest refractive astigmatism (RA) compared to treating the topography-measured anterior corneal astigmatism (ACA) axis in 1,200 eyes.³ Topography-guided protocols that treat only the anterior corneal astigmatism, such as topography-measured refraction (TMR)² and LYRA,⁴ ignore the existence of other clinically significant sources of astigmatism such as posterior corneal astigmatism, lenticular astigmatism, and cortical perception,⁵⁻⁷ leading to outcome inaccuracies.

In Zhang and Chen’s study, “the topography-modified refraction (treating the ACA) was applied to the TCAT design of cylinder and axis,” but the subjective manifest refraction was used in eyes randomized to the WFO [wavefront-optimized] group.¹ The study design therefore did not investigate only one independent variable. Instead, the technologies being compared (TCAT vs WFO) had differing modalities of treatment (ACA vs RA). Because the TCAT (Contoura) group targeted plano ACA and the WFO group targeted plano subjective RA, using the same outcomes measure of RA in both groups would be expected to yield superior results in the RA-treated WFO group and inferior results in the ACA-treated TCAT group, related to the difference between RA and ACA. The study’s conclusion that TCAT was not as accurate in RA correction is related to the study design.

It is encouraging to see that Zhang and Chen’s results show that even WFO technology targeting RA produces better RA accuracy than topography-guided targeting the ACA.¹ It further confirms our findings that demonstrate that topography-guided outcomes based on treating the ACA (TMR or LYRA) are inferior to topography-guided treatment targeting the manifest RA.³

It is unfortunate to read in the abstract conclusion that “TCAT was not as accurate as WFO, especially in astigmatism correction” and that a “better compensation method for TCAT is warranted.” Such a generalization has the unintentional effect of leaving readers to wrongfully believe that topography-guided outcomes are inferior to WFO outcomes, when the real issue is not the topography-guided technology itself, but rather targeting the treatment on the ACA. This is especially troublesome because the article does not discuss the large amount of literature and exceptionally good results of topography-guided protocols that use the manifest RA for treatment. The title of the article, which simply states “Topography-Guided Versus Wavefront-Optimized” further incorrectly generalizes the topic, because the current study methodology is not set up to answer that question. Clearly, not all topography-guided treatments are equal.

We thank the authors for their contribution to this important topic.

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Reply

The comments of Wallerstein et al. are much appreciated. They have claimed that in our article,¹ we used two variables at the same time: one was the topography-measured refraction (TMR) versus clinical manifest refraction, and the second was topography-guided customized ablation treatment (TCAT) versus wavefront-optimized ablation (WFO), which would lead to study design errors. The design of our study was based on the hypothesis that TMR and clinical manifest refraction were the standard protocols for TCAT and WFO, respectively.

TCAT applying TMR used to be a whole treatment mode of correcting astigmatism with the data measured from the anterior cornea by a topographer rather than manifest refraction. TCAT in our article referred to TCAT using the TMR protocol. It would certainly have been more clear to emphasize this in the title. However, the limitation of words did not allow description in such detail. We have started TCAT surgeries on virgin eyes since 2016. At that time, clinical studies showed that TMR seemed to have more advantages,^{2,3} so we started to use the TMR method, which eventually led to the current findings. We have never concluded that TCAT was inferior to WFO. On the contrary, our results show that TCAT led to more regular anterior surface of the cornea, uncorrected and corrected distance visual acuity were similar to those of WFO at 6 months postoperatively, and only the accuracy of astigmatism correction was slightly inferior, which had an insignificant effect on visual acuity. To conclude, further improvement on TMR was required.

We agree and actually observed that TCAT could lead to a smoother anterior surface of the cornea and correct irregular astigmatism originating from the

anterior surface of the cornea. But those asymmetric ablations would bring about a change in refraction more or less. So TCAT using the subjective clinical manifest refractive astigmatism also has the problem of correction accuracy, especially in cases with obvious corneal irregularities, and the deviation may be more significant. There is currently no perfect method for TCAT treatment planning. Some researchers are mainly exploring how to compensate for this change, especially in astigmatism and its axis. TMR is one of the methods for those compensations despite its imperfections. Whether the manifest refraction should be applied directly to TCAT is also open to debate.

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