Astigmatism Treatment Bias in a Topography-Guided vs Wavefront-Optimized LASIK Meta-analysis

We read with interest the meta-analysis by Cheng et al, “Topography-Guided [TCAT] Versus Wavefront-Optimized [WFO] LASIK for Myopia With and Without Astigmatism: A Meta-analysis.” The authors included seven randomized controlled trials of TCAT-LASIK versus WFO-LASIK. However, they did not account for the differing astigmatism laser programming protocols between the TCAT and WFO groups. The astigmatism magnitude and axis inputs, which are programmed by the surgeon on the excimer laser planning software, varied among the seven studies.

The subjective clinical manifest refraction remains the gold standard treatment target for LASIK. The effectiveness and predictability of this long-standing approach using WFO and TCAT has been widely published. Some TCAT surgeons advocate modifying the Manifest protocol to target the anterior corneal astigmatism (ACA) magnitude and axis in eyes with primary LASIK, such as with Topography-Modified Refraction (TMR) or Layer Yolked Reduction of Astigmatism (LYRA). Those protocols ignore posterior corneal, ocular, and cortical astigmatism, leading to inferior astigmatism treatment accuracy in several studies.

The 2019 article by Zhang and Chen included in the meta-analysis by Cheng et al is a TCAT study using the TMR treatment protocol. This study design failed to investigate only one independent variable. The two software programs being compared had differing modularities of treatment, with the TCAT group targeting plano ACA, ignoring subjective refractive astigmatism (RA), and the WFO group targeting plano RA. Therefore, the superior astigmatism accuracy in the RA-treated WFO group and inferior accuracy in the ACA-treated TCAT group was anticipated. It further confirmed that TCAT outcomes based on treating the ACA are inferior to TCAT treatment targeting the manifest RA. The conclusion of Zhang and Chen that TCAT was not as accurate in astigmatism correction was invalid because of the study design. These scientific concerns were highlighted in a previous correspondence.

The study by Zhang and Chen contributed nearly half of all data in the meta-analysis of Cheng et al, disproportionally representing the analyzed groups. The final pooled relative risk calculations are therefore biased, and the scientific validity of this otherwise well-conducted meta-analysis comes into question. Because the calculated relative risk depends on both the software used and astigmatism treatment target, the meta-analysis cannot conclude on TCAT versus WFO because these two groups also had different astigmatism treatment modalities (ACA vs RA target treatment). Future comparative studies and meta-analyses should control for TCAT treatment protocols and nomogram accuracy. Network meta-analyses would also be appropriate in this area. We appreciate the authors’ work in bringing attention to this important topic.

REFERENCES


Avi Wallerstein, MD, FRCSC
Mathieu Gauvin, B. Eng., PhD
Montreal, Quebec, Canada

Disclosure: The authors have no financial or proprietary interest in the materials presented herein.

Drs. Wallerstein and Gauvin contributed equally to this work and should be considered as equal first authors.

doi:10.3928/1081597X-20220103-01
Reply

It is my pleasure to hear from Drs. Wallerstein and Gauvin regarding our article published in the October 2021 issue of the Journal of Refractive Surgery. They pointed out the 2019 article by Zhang and Chen used TCAT-LASIK with Topography-Modified Refraction (TMR, targeting the anterior corneal astigmatism [ACA] in the study), whereas the other six studies included in the meta-analysis used TCAT-LASIK targeting the subjective clinical manifest refraction.

We acknowledge this limitation of our meta-analysis, which has not been mentioned and discussed in our study. Nevertheless, we re-conducted the analysis of all endpoints in our study by excluding the 2019 article by Zhang and Chen and found that all of the conclusions remained unchanged (Table 1).

As suggested by Wallerstein and Gauvin, comparative studies or meta-analyses should control for TCAT treatment protocols and nomogram accuracy. This would be a valuable recommendation for future research in the field of refractive surgery. Many thanks to Drs. Wallerstein and Gauvin for their comments.

We noticed that much work has been done recently by Drs. Wallerstein and Gauvin to advocate TCAT-LASIK targeting the subjective clinical manifest refraction rather than targeting ACA magnitude and axis in eyes with small or large preoperative axis discrepancy between refractive astigmatism and topography-measured ACA. They have committed a lot of their time to providing high-quality clinical evidence in favor of TCAT-LASIK targeting subjective clinical manifest refraction rather than targeting ACA magnitude and axis for the sake of patients. Their contribution to this research field is acknowledged and deeply appreciated. We also appreciate the contribution of Alpins, who first described treatment of patients with combined topography and refraction parameters.

### REFERENCES

2. Zhang Y, Chen Y. A randomized comparative study of to

A-Yong Yu, MD, PhD
Wenzhou, China

Disclosure: The author has no financial or proprietary interest in the materials presented herein.

doi:10.3928/1081597X-20220103-02