Graefe's Archive for Clinical and Experimental Ophthalmology (2023) 261:891–892
https://doi.org/10.1007/s00417-022-05859-4

LETTER TO THE EDITOR

Comment on: Clinical results of topography-guided laser-assisted in situ keratomileusis using the anterior corneal astigmatism axis and manifest refractive astigmatism axis

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Received: 25 August 2022 / Revised: 25 August 2022 / Accepted: 3 October 2022 / Published online: 10 October 2022

We read the article by Liu et al., "Clinical results of topography-guided laser-assisted in situ keratomileusis using the anterior corneal astigmatism axis and manifest refractive astigmatism axis."[1] We commend the authors for reproducing our study [2] using the Pentacam anterior corneal astigmatism (ACA) axis as opposed to the Contoura-measured ACA axis (Topolyzer). Using a different anterior corneal topographer, identical conclusions were reached: Targeting the ACA axis leads to inferior visual and refractive astigmatism (RA) accuracy outcomes compared to targeting the manifest RA axis.

Liu et al. found that 16% of eyes treated on the ACA axis had residual astigmatism ≥ 0.75 D postoperatively vs 0% when treated on the manifest RA axis. These results confirm our findings that topography-guided LASIK eyes treated on the topography-measured ACA axis (e.g., TMR or LYRA protocols) result in statistically inferior outcomes and more postoperative refractive surprises compared to treating on the manifest RA [2]. If Liu et al. would have used an axis discrepancy threshold of 20° vs 5°, even poorer outcomes would have been seen in the ACA-treated eyes.

The authors state, "corneal higher-order aberrations can present as manifest refractive errors." [3] This statement implies that in healthy virgin corneas, anterior HOAs may impact refraction in a clinically meaningful manner. Virgin corneas differ from traumatically, surgically, or biomechanically induced irregular corneas where newly created HOAs may affect refraction. In these corneas, the central 4 mm has minimal irregularity which cannot induce a meaningful refractive effect that can be predicted. This explains why no relationship was found between coma and the amount of astigmatism axis discrepancy between RA and ACA in a study of 37,000 preoperative virgin eyes. [4] A large study similarly found identical amounts of preoperative coma in eyes with small versus large RA to ACA discrepancies. [5] If HOA were "presenting as manifest refractive errors," greater HOAs would be found in large axis discrepancy eyes. Posterior corneal astigmatism is the leading cause of the discrepancy and why ACA treatment protocols lead to inferior outcomes.

Their conclusion states that "a more precise algorithm for primary topography-guided excimer ablation is still needed for best clinical results." Such a generalization unintentionally leaves readers to wrongfully believe that topography-guided LASIK is a problematic technology that needs to be improved. The real issue is not the topography-guided technology itself, but not targeting the manifest RA with an accurate nomogram. In Liu et al.'s study, 94% of eyes treated on the manifest RA achieved a UDVA of 20/16. Those manifest-treated visual outcomes are superior to those reported in all previous TMR, LYRA, and Phorcides studies. Given those excellent outcomes, it is unclear why the authors emphasize the need to improve topography-guided algorithms.

In summary, Liu and colleagues reproduced our study and bring further evidence that ACA-treatment protocols are inferior to treating the manifest RA. Those inferior protocols remain wrongfully promoted in the peer-reviewed literature, at meetings, and the ophthalmic press. Primary healthy virgin topography-guided eyes should be treated on the manifest refraction. No advanced algorithms considering the HOAs or PCA are needed for highly successful outcomes as the manifest refraction already encompasses all

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This comment refers to the article available online at https://doi.org/10.1007/s00417-022-05775-7.

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sources of astigmatism and is not meaningfully influenced by naturally occurring anterior corneal HOAs. A calibrated and continually improved nomogram is what is paramount to obtaining good results with any laser vision correction technology.

Declarations

Conflict of interest The authors declare no competing interests.

References

1. Liu C, Luo T, Fang X et al (2022) Clinical results of topography-guided laser-assisted in situ keratomileusis using the anterior corneal astigmatism axis and manifest refractive astigmatism axis. Graefes Arch Clin Exp Ophthalmol. https://doi.org/10.1007/s00417-022-05775-7
2. Wallerstein A, Gauvin M, Qi SR, Bashour M, Cohen M (2019) Primary topography-guided lasik: treating manifest refractive astigmatism versus topography-measured anterior corneal astigmatism. J Refract Surg 35:15–23
3. Stulting RD, Lobanoff M, Mann PMI, Wexler S, Stonecipher K, Potvin R (2022) Clinical and refractive outcomes after topography-guided refractive surgery planned using phorcides surgery planning software. J Cataract Refract Surg 48:1010–1015
4. Wallerstein A, Gauvin M, McCammon K, Cohen M (2019) Topography-guided excimer treatment planning: Contribution of anterior corneal coma to ocular residual astigmatism. J Cataract Refract Surg 45:878–880
5. Wallerstein A, Gauvin M, Qi SR, Cohen M (2020) Effect of the vectorial difference between manifest refractive astigmatism and anterior corneal astigmatism on topography-guided LASIK outcomes. J Refract Surg 36:449–458