Finally, we do not see in the reference quoted that topographic measurement is more likely to achieve optimal refractive outcome when there is a disagreement between optical biometry and automated keratometry in eyes with oblique astigmatism.[6]

The conclusion of that publication is, by contrast that, in reference to the 6 methods of keratometry examined that included autokeratometry and the IOLMaster, "Therefore, to maximize subsequent satisfaction of patients having toric IOL implantation in clinical practice, the use of any of these methods is necessary and sufficient for the comprehensive analysis of astigmatism."—*Shira Sheen Ophir, MD, Ben LaHood, FRANZCO, MBChB, Michael Goggin, FRCSI(Ophth), FRCOphth, FRANZCO, MS*

REFERENCES

1. Sheen Ophir S, LaHood B, Goggin M. Refractive outcome of toric intraocular lens calculation in cases of oblique anterior corneal astigmatism. J Cataract Refract Surg 2020;46:688–693
2. Goggin M, Zamora-Alejo K, Esterman A, van Zyl L. Adjustment of anterior corneal astigmatism values to incorporate the likely effect of posterior corneal curvature for toric intraocular lens calculation. J Refract Surg 2015;31:98–102
3. Goggin M, van Zyl L, Caputo S, Esterman A. Outcome of adjustment for posterior corneal curvature in toric intraocular lens calculation and selection. J Cataract Refract Surg 2016;42:1441–1448
4. LaHood BR, Goggin M, Esterman A. Assessing the likely effect of posterior corneal curvature on toric IOL calculation for IOLs of 2.50 D or greater cylinder power. J Refract Surg 2017;33:730–734
5. Goggin M, Patel I, Billing K, Esterman A. Variation in surgically induced astigmatism estimation due to test-to-test variations in keratometry. J Cataract Refract Surg 2010;36:1792–1793
6. Lee H, Chung JL, Kim EK, Sgrignoli B, Kim TI. Univariate and bivariate polar value analysis of corneal astigmatism measurements obtained with 6 instruments. J Cataract Refract Surg 2012;38:1608–1615

Is Phorcides more likely to give better vision than treating the manifest refraction?

We read with interest the article by Lobanoff et al., "Clinical outcomes after topography-guided LASIK: comparing results based on a new topography analysis algorithm with those based on manifest refraction."[1]

We noted that, in the manifest group, there was a trend to better postoperative spherical equivalent refraction (SEQ) accuracy within ±0.25 diopter (D) (84.9% in manifest group vs 81.4% in Phorcides Analytic Engine group [Phorcides LLC]), even if not statistically significant. Although postoperative mean refractive astigmatism accuracy was similar overall (0.15 D ± 0.33 manifest vs. 0.16 D ± 0.32 Phorcides), it was statistically inferior in the eyes in the Phorcides group matched to the U.S. Food and Drug Administration topography-guided customized ablation treatment study criteria (0.15 D ± 0.22 manifest vs. 0.20 D ± 0.23 Phorcides; P = 0.01).

Surprisingly, the less postoperative SEQ and refractive astigmatism accuracy results with Phorcides were accompanied with significantly better postoperative 20/16 uncorrected distance visual acuity (UDVA) (41.3% manifest vs. 62.5% Phorcides group) yet identical 20/20 UDVA. In all of
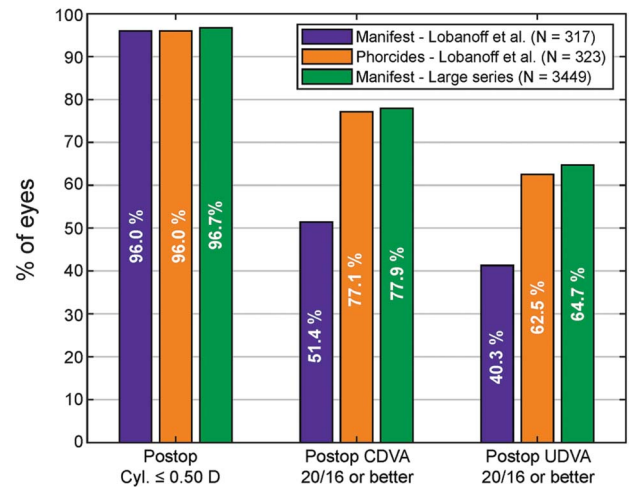

Figure 1. Percentage of eyes with postoperative cylinder ≤0.50 D, percentage of eyes achieving a postoperative CDVA of 20/16 or better, and percentage of eyes achieving a postoperative UDVA of 20/16 or better in the manifest and Phorcides groups of the study by Lobanoff et al., and in a large consecutive standardized series of 3449 eyes matched to the inclusion/exclusion criteria of the Lobanoff et al. study and treated on the manifest refraction using advanced big data nomograms, and a mean of up to 3 manifest refractions prior to nomogram calculations (CDVA = corrected distance visual acuity; UDVA = uncorrected distance visual acuity).

our published outcomes studies, visual efficacy corresponded with refractive accuracy.[2–4]

The authors stated that the lower 20/16 rate in the manifest group "may be due to changes in the preoperative to postoperative cylinder axis," but they did not conduct an astigmatism vector analysis or include the JCRS/*Journal of Refractive Surgery* standard target-induced astigmatism vs surgically induced astigmatism graph for verification. They comment that "the retrospective data here do not lend themselves to such detailed analysis."[1] An astigmatism vector analysis only requires refractive astigmatism data,[5] which were available in that study. It would reveal whether the postoperative astigmatism was overcorrected at a new axis. Although this might explain inferior 20/16 outcomes in the manifest group, it would also highlight that eyes in the manifest group were subjected to an imprecise nomogram that could be improved.

The methods state "nomogram adjustments were permitted in both groups."[1] There is no detail whether these nomograms were discretionary, used by all surgeons, applied with the same rules, or identical for each group. A lack of nomogram standardization would directly impact the outcomes.

Considerably more patients were comanaged in the manifest vs the Phorcides groups (54% vs 35%; P < .01). This study design, where not all data were collected in a similar way, introduced inherent observer and confirmation biases due to lack of rigorous controls and standards on vision measurements between surgeons and

numerous comanagers and a greater number of nonblinded surgeons collecting vision data in the Phorcides group. These shortcomings might explain the worse 20/16 vision outcomes in the manifest group.

We matched 3449 eyes to this study's inclusion/exclusion criteria and found that 65% of manifest-treated eyes achieved a postoperative UDVA of 20/16 or better (Figure 1). With well-calibrated nomograms, multiple accurate refractions, and standardized vision measurements, treating on the manifest refraction leads to visual outcomes that are better than those of the Phorcides group in this study.

In summary, the conclusion "Phorcides increased the likelihood of 20/16 UDVA relative to using manifest" is questionable considering: the undefined criteria in choosing between manifest and Phorcides treatment, the clinical inconsistencies between visual acuity and refractive accuracy, the omission of vector analyses, the observation bias introduced from nonblinded surgeons assessing vision, and the confirmation bias of unmatched study groups with a larger number of comanaged patients in the manifest group with variability in vision measurement standards.

Avi Wallerstein, MD, FRCSC
Mathieu Gauvin, BEng, PhD
Montreal, Quebec, Canada

REFERENCES

1. Lobanoff M, Stonecipher K, Tooma T, Wexler S, Potvin R. Clinical outcomes after topography-guided LASIK: comparing results based on a new topography analysis algorithm to those based on the manifest refraction. J Cataract Refract Surg 2020;46:814–819
2. Wallerstein A, Gauvin M, Cohen M. Effect of anterior corneal higher-order aberration ablation depth on primary topography-guided LASIK outcomes. J Refract Surg 2019;35:754–762
3. Wallerstein A, Gauvin M, Qi SR, Bashour M, Cohen M. Primary topography-guided LASIK: treating manifest refractive astigmatism versus topography-measured anterior corneal astigmatism. J Refract Surg 2019;35:15–23
4. Wallerstein A, Gauvin M, Qi SR, Cohen M. Effect of the vectorial difference between manifest refractive astigmatism and anterior corneal astigmatism on topography-guided LASIK outcomes. J Refract Surg 2020;36:449–458
5. Alpins N. Practical Astigmatism Planning and Analysis. Thorofare, NJ: SLACK Incorporated; 2017

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Reply: We thank Wallerstein and Gauvin for their insightful comments related to our recent publication.[1] We also appreciate their important work in this field.

Suggesting a trend to better postoperative SEQ, as they do, is one of the means by which readers can become confused. Having set a criterion for statistical significance, the study results determine whether differences can be stated as such. Our reported *P* value of .25 does not approach the .05 cutoff we established for a statistically significant difference and would not suggest a trend to most statisticians. Furthermore, we have indicated in the article that refractions were not always consistent with visual acuity findings. This is a recognized limitation of retrospective data collection.

As was also noted, the astigmatic analysis suggested was not conducted. This was not because of lack of astigmatism data but because of the recognized variability in those data. We did not feel the results would be meaningful based on the variability in refractions that we noted in our results.

Wallerstein and Gauvin also noted that the differences in nomograms would impact outcomes. However, site-specific nomograms are not unusual. As outlined in the Methods section of our study, nomogram adjustments were permitted in both groups of data, so the outcomes from both manifest and Phorcides planning would be affected. There is no reason to suspect a specific nomogram bias in the manifest group.

One of the strengths of our study (which was considered a weakness by Wallerstein and Gauvin in their commentary) was that comparative data were collected from 4 different sites, using different nomograms, and included both manifest and Phorcides data. Refractions were slightly more variable, and visual acuity data were collected less stringently than might be the case for a prospective trial. However, there is no reason to believe that there would be a difference between the data collection based on whether the eye was treated on the manifest refraction or based on Phorcides data. This is particularly the case with comanaged data. What is perhaps most important in our analysis is that, despite these limitations, significant *relative* differences in the results were evident.

The comparison provided related to the results for 3449 eyes matched to the inclusion/exclusion criteria of the current study does not provide any indication that the eyes were matched in any other way. Refractive error, topography, and differences between corneal and refractive astigmatism are all likely to be different in these datasets. The comparisons, thus, cannot be presumed to be based on matched data, and as such, they are not particularly meaningful. Furthermore, results reported for these 3449 eyes seem significantly better than anything previously published by the authors of this letter.[2,3]

We must note that the degree of precision adopted by Wallerstein et al. in their clinic is to be admired. We know of few sites that will average up to 3 manifest refractions (although the way in which these are averaged is unspecified) per eye and analyze between 4 and 8 corneal topographies to determine the best treatment parameters.[2] The results they achieve are correspondingly good. We can only imagine what results such an approach, augmented by the Phorcides Analytical Engine, might produce. We would encourage them to perform such a comparative trial.

Finally, as noted in our comments regarding the limitations of the current study, a prospective trial of the Phorcides Analytical Engine would be helpful in corroborating the findings here. We have initiated such a trial and hope to report the results in future.

—*Mark Lobanoff, MD, Karl Stonecipher, MD, Richard Potvin, OD.*