

Posterior Corneal Astigmatism and Efficacy in Refractive Correction

We read with interest the article by LaHood et al.¹ in the November 2017 issue regarding the effect of posterior corneal astigmatism on toric intraocular lens (IOL) calculation for the correction of 2.50 diopters (D) or greater astigmatism. The authors found that the adjustment of the anterior corneal cylinder based on the mean posterior corneal cylinder for toric IOL power calculation did not improve the results in a clinical way. This seems to contradict the advice of Koch et al.² of reducing the toric power of the IOL in with-the-rule astigmatism cases, and vice versa in against-the-rule astigmatism cases, to counteract the effect of the “mean” posterior corneal astigmatism.

LaHood et al. believe that it might well be that the effect of the posterior corneal cylinder is different in eyes with low astigmatism than in eyes with high astigmatism. We agree with them and have some comments to make.

Total corneal astigmatism is the sum of the anterior corneal astigmatism and the intraocular or ocular residual astigmatism, which seems to be induced mainly by the posterior corneal astigmatism. We have previously evaluated the effect of preoperative ocular residual astigmatism on the efficacy of LASIK in high myopic astigmatism.³ Our results had interesting similarities with LaHood et al.’s study that we would like to discuss.

In our study, the ocular residual astigmatism (0.82 ± 0.50 D; range: 0.09 to 2.29 D) was similar to the normal population value. This magnitude did not seem to affect the results obtained after LASIK performed in high myopic astigmatism. Others have suggested that the efficacy of LASIK to correct low astigmatism could be improved considering the magnitude of the ocular residual astigmatism.⁴ We suggest that this influence seems to be different in low versus high astigmatism.

Interestingly, the results reported by LaHood et al.¹ agree with our results. It is known that pseudophakic eyes do have significant ocular residual astigmatism, coming mainly from the posterior surface of the cornea, demonstrated previously by our group.⁵ In this the ocular residual astigmatism should be exactly the same as the posterior corneal astigmatism, given the absence of the lens. In other words, and similarly as we found in our study, the impact of the ocular residual astigmatism on the refractive correction, using either LASIK or a toric IOL, depends on the amount of the total corneal astigmatism that comes mainly from the anterior surface of the cornea in eyes with high astigmatism.

The study by LaHood et al.¹ indicates that the effect of the posterior corneal astigmatism on the total cor-

neal astigmatism is proportionally lower as the magnitude of the anterior corneal astigmatism increases. Again, this fact was also previously observed in our study.³ We suggested that rather than the magnitude of the ocular residual astigmatism, it is the ocular residual astigmatism/anterior corneal astigmatism ratio that seems to be relevant for the refractive outcome. This implies that the higher the anterior corneal astigmatism is, the less impact the ocular residual astigmatism (or posterior corneal astigmatism) has on the total corneal astigmatism. This could explain why including the posterior corneal astigmatism in the toric IOL calculation seems to have a negligible effect in eyes with anterior corneal cylinder of 2.50 D or greater.

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Reply

We thank Hernández-Verdejo et al. for their comments on our article.¹ We are aware of the publications of Dr. Hernández-Verdejo and his group on the subject of ocular residual astigmatism (ie, the vector difference between anterior keratometric and refractive astigmatism). It is of considerable interest that the ocular residual astigmatism values they describe² in phakic patients who had LASIK (mean: 0.82 diopters [D]) are similar to those more recently described by us in pseudophakic eyes (mean: 0.87 D) in an un-

published study presented at the European Society of Cataract and Refractive Surgeons (ESCRS) meeting in 2017. We are wary of direct comparison of these values between phakic and pseudophakic eyes because of the possible presence of crystalline lens lenticular astigmatism. Comparing their values from phakic eyes with ours from pseudophakic eyes, it would appear that the contribution of crystalline lens lenticular astigmatism in their phakic eyes is small. However, it probably still exists. Their article on pseudophakic eyes (obviously more comparable with ours) does not give a value of ocular residual astigmatism.³ It would be of interest to know what that value was, although the population described in their data had low astigmatism on average by comparison to the population described by us.¹

We would like to correct one minor error in their letter. Our data did not refer to eyes with “anterior corneal cylinder of 2.50 D or greater.” Our data referred to eyes where the use of toric IOL cylinder power of 2.50 D or greater was indicated for higher anterior corneal astigmatism values. The exact lower limit of corneal astigmatism that will require such a lens is variable and depends not only on the anterior corneal astigmatism, but also on the pseudophakic anterior chamber depth and the IOL sphere power. This latter value in

turn depends on the related variables of axial length and the required refractive target, which is not necessarily emmetropia.

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