Surgically Induced Astigmatism

To the Editor:

We read with interest the article by Ofir et al. In 70 eyes, the authors used three devices to evaluate surgically induced astigmatism (SIA) in eyes undergoing cataract surgery with temporal 2.4-mm clear corneal incisions. Vector analysis was used appropriately to calculate the SIA in each eye. However, when reporting the median and mean of the SIA in the whole group, the authors calculated the median and mean of the magnitudes of the individual SIA vectors, independent of the vector angles (Figure 2, Table 2). Ofir et al. reported mean SIA magnitude values of 0.50 diopters (D) with the Lenstar LS900 (Haag-Streit, Koeniz, Switzerland), 0.53 D with the IOL-Master 500 (Carl Zeiss Meditec, Dublin, CA), and 0.56 D with the Atlas topographer (Carl Zeiss Meditec).

Because SIA is a vector, it has both magnitude and angular direction, and both vector components must be included when calculating the median or mean SIA in a group of cases. To illustrate this, if in 2 patients the SIA is 0.5 D at 90° in both eyes, the mean SIA is 0.5 D. However, if the SIA is 0.5 D at 90° in one eye and 0.5 D at 180° in the other, the mean SIA is 0, not 0.5 D.

We recommend using double angle plots with aggregate analysis of astigmatism, as first described by Holladay et al. Such a plot would clearly show both the mean SIA and the scatter of the individual measurements. We believe that, using aggregate analysis, Ofir et al. would find much lower values for mean SIA. We recently performed this analysis in our practice of Lenstar data of 25 eyes that also received 2.4-mm clear corneal incisions. The mean SIA was 0.13 D @ 95° (Figure 1), whereas the mean SIA magnitude was 0.39 D, close to the values reported by Ofir et al.

REFERENCES

Douglas D. Koch, MD
Li Wang, MD, PhD
Houston, Texas

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

Reply:

We thank Drs. Koch and Wang for their interest in our article “Surgically Induced Astigmatism Assessment: Comparison Between Three Corneal Measuring Devices.” They expressed some concern regarding the method of calculation of the mean and median magnitudes of the individual surgically induced astigmatism (SIA) vectors, independent of the vector angles. We agree that assessment of the centroid value is the correct method for calculating the best predicted SIA value for a single surgeon who is using a fixed incision location. Barrett and Abulafia showed that using the calculated centroid value (0.1 diopters [D]) rather than the traditional mean/median of the vectors magnitude (0.38 D) significantly reduced the error of the predicted residual astigmatism following toric intraocular lens (IOL) implantation when a fixed temporal main incision location was used by a single surgeon. Indeed, it is currently our routine practice to use the centroid value rather than the mean/median of the individual SIA vectors when a fixed incision location is used for all eyes.

Our study included individual SIA vectors by multiple surgeons who made 2.4-mm (two- or three-plane) clear corneal incisions (axis: 83° to 139°) when they performed toric IOL implantations. As we noted, the median SIA value by itself would therefore be clinically insignificant and the centroid value would be meaningless. Our aim in this study was to compare individual SIA vectors as calculated by three different devices for the same group of eyes. Our results showed that there were no significant differences
between the magnitudes of the individual SIA vectors derived by each device. A subsequent analysis comparing the x and y components of the individual SIA vectors also showed no differences between the three devices \( P = .529 \) [x-axis] and \( P = .496 \) [y-axis]). Further studies for comparing the centroid value derived by different devices in toric IOL implantations by a single surgeon using a fixed location for the main incision are warranted.

We appreciate Drs. Koch and Wang’s comments, which serve to highlight the importance of the use of a centroid value in SIA calculations and the use of double-angle plots with aggregate analyses of astigmatism.

**REFERENCES**


Adi Abulafia, MD
Shay Ofir, MD
Ehud I. Assia, MD
Tel-Aviv, Israel

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