Intraoperative Aberrometry and Intraocular Lens Power Calculation

We read with interest the article on intraoperative aberrometry by Hatch et al. in the April 2015 issue.1 Several studies have shown that influence of posterior corneal astigmatism may be significant when implanting toric intraocular lenses (IOLs), but despite the availability of technologies for measuring the total corneal astigmatism (such as Scheimpflug cameras), their accuracy is still not adequate to ensure that they are consistently superior to the calculations based on the standard keratometry.2,3 On the other hand, automated intraoperative refraction/aberrometry emerges as a useful tool to determine total corneal astigmatism without the necessity of measuring the radii of anterior and posterior curvature of the cornea.

When reporting residual refractive astigmatism (RRA) in the two groups of eyes, the authors included the standard deviation in addition to the arithmetic mean, and they also mentioned the RRA results by quartile (Table C). However, we think the range should have been included. We wonder why in two eyes (5%) of the group in which intraoperative aberrometry was used residual astigmatism was as high as 1.50 and 2.00 diopters (Figure 1). These amounts of cylinder are undoubtedly unsatisfactory results in these patients. It would be important to determine what factors might influence these results (eg, high intraocular pressure and effect of the eyelid speculum during measurement or pseudophakic anterior chamber depth). The authors indicated that intraocular pressure was in the range of 15 to 21 mm Hg according to a Barraquer tonometer and that no distortion from the eyelid speculum was present. However, Stringham et al. highlighted the potential influence of the design of the eyelid speculum, so it would be useful to clarify exactly what kind of eyelid speculum was used on those cases with unexpected results.4 It would also be interesting to analyze the results of postoperative spherical equivalent, comparing the absolute prediction error of biometric formulas in one group and the prediction error of intraoperative aberrometry in the other group of eyes.

We are convinced that this technology will improve refractive results in procedures involving toric IOL implantation, which are becoming more common. This tool will also be useful in cases that pose a challenge, such as patients with previous refractive corneal surgery. In the future automated intraoperative aberrometry will most likely include additional features such as the capability of intraoperative measurement of aphakic anterior chamber depth, which will improve its precision.5 However, it is possible that even with the current technology, entering in the software information about preoperative anterior chamber depth and lens thickness (readily available from an optical or ultrasonic biometer) could increase the accuracy of calculating the power of the IOL (spherical equivalent and toricity, both influenced by the pseudophakic anterior chamber depth).

Surely, in the future, the system will become so consistent and user-friendly that it will also be used in the routine cases. However, currently it seems that refinements are necessary to make these instruments more precise.

REFERENCES

Virgilio Galvis, MD
Alejandro Tello, MD
Jose I. Sacoto, MD
Floridablanca, Colombia

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Reply

We would like to thank Galvis et al. for their comments and questions regarding our article.1 Intraoperative aberrometry can have a positive impact on astigmatism management in the patient with a toric intraocular lens (IOL), but we appreciate that the technology has limitations, especially if it is not used accurately or guidance is not followed. Variables that can affect accuracy, correctly described by Galvis et al., include intraocular pressure, eyelid speculum, patient fixation, and irregular tear film.

The two outlier outcomes (patients who had 1.50 and 1.75 diopters (D) of residual refractive astigmatism [RRA]) may be a result of surgeon learning curve with the system or due to fluctuations in accuracy more commonly seen with earlier versions of the technology. Both of these cases appear to be due more to learning curve because the surgeon made the decision...
to implant IOLs less powerful than recommended by aberrometry and more in line with preoperative keratometry measurements.

In the first instance (1.50 D RRA), the surgeon implanted an Alcon SNAT3 IOL when an SNAT4 IOL was recommended by ORA (Alcon Laboratories, Inc., Fort Worth, TX). For the second (1.75 D RRA), the surgeon implanted an SNAT3 IOL when an SNAT5 IOL was recommended by ORA. Additionally, in the case with 1.50 of RRA, there was a discrepancy in axis rotation between what the system recommended (counterclockwise rotation due to an RRA reading of 0.88 D) and what the surgeon did (nothing).

These cases occurred early in our surgical experience with aberrometry, and as later iterations emerged and our experience broadened we found ourselves following ORA’s recommendations more closely. As such, it is possible that if a subanalysis of eyes treated after we had more experience with the system were done a trend toward more precise outcomes would be evident. However, given the size of the case series we analyzed and published, it seemed unlikely that important additional conclusions about the data set would emerge from such an exercise and hence we did not perform further statistical computations in this regard.

Currently, the proprietary formula used by ORA with VerifEye and VerifEye+ takes into account axial length, keratometry values, and corneal diameter to calculate effective lens position. The additional technology enhancements mentioned by Galvis et al. are being considered as future additions to the system.

REFERENCE

Kathryn M. Hatch, MD
Emily Woodcock, FAOI
Jonathan H. Talamo, MD
Waltham, Massachusetts

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