

The Literature

BY JEFFREY LIU, MD, AND MARJAN FARID, MD

COMPARISON OF IOL POWER CALCULATION METHODS AND INTRAOPERATIVE WAVEFRONT ABERROMETER IN EYES AFTER REFRACTIVE SURGERY

Canto AP, Chhadva P, Cabot F, et al¹

ABSTRACT SUMMARY

Canto et al compared the predictive accuracy of the ORange intraoperative wavefront aberrometer (WaveTec Vision) to the SRK-T formula with IOLMaster keratometry (Carl Zeiss Meditec), SRK-T formula with corneal topography central keratometry, and the American Society of Cataract and Refractive Surgery (ASCRS) online calculator for eyes that previously underwent refractive surgery. This was a retrospective study of 46 eyes that had undergone myopic PRK, myopic LASIK, hyperopic LASIK, and radial keratotomy. For each method, the investigators evaluated the difference between predicted and actual lens power for emmetropia.

The researchers found the ORange to be within 0.50 and 1.00 D of emmetropia more frequently than the other methods. The device predicted IOL power to within 0.50 D for 37% of cases, whereas IOLMaster keratometry was 30%, topographic keratometry was 26%, and the ASCRS calculator was 17%. When subdivided for previous myopic treatment, a prediction within 0.50 D was 39%, 27%, 24%, and 18%, respectively. For eyes that had undergone radial keratotomy, however, the ORange was less accurate than IOLMaster keratometry (14% vs 43% within 0.50 D).

DISCUSSION

Cataract surgery is increasingly becoming a refractive procedure, and patients' expectations are already high. Those with a history of refractive surgery typically come to the office with even higher expectations. They assume that cataract surgery offers the same precision and results as their laser refractive surgery did. Whereas LASIK has an accuracy of 91% within 0.50 D and 100% within 1.00 D,² cataract surgery on eyes with a history of myopic refractive surgery offers a level of precision up to 58% within 0.50 D and 90% within 1.00 D.³ The last are extremely low numbers and are far from ideal. Intraoperative wavefront aberrometry can increase the predictive accuracy by capturing and measuring the entire optical system. It accounts for the anterior and

posterior corneal curvatures as well as the axial length and cataract incision. Intraoperative wavefront aberrometry is performed while the eye is aphakic without any potential artifact from the cataract.

Canto et al are the first group to publish results specifically on the ORange with postrefractive surgery patients. The device improved postoperative outcomes by making the IOL power calculation more accurate. Although the investigators noted the superior accuracy of the ORange, no single method achieved a prediction within 0.50 D of emmetropia more than 50% of the time.

When the ORange prediction was not at emmetropia, it tended to leave the patient with more postoperative hyperopia, whereas the ASCRS calculator tended to leave the patient with more postoperative myopia. By having these two calculations available simultaneously when selecting an IOL, surgeons can elect to take a "middle of the road" approach for an overall balance toward emmetropia.

This study is limited due to its retrospective design and the small number of eyes in each postrefractive surgery group. It is also unclear if there was a single surgeon or multiple surgeons; surgical technique can influence the effective lens position, and the technique of performing the ORange measurement can also be affected by wound hydration and placement of the speculum.⁴ The ORange has since been upgraded to the ORA with VerifEye (WaveTec Vision), which includes a sharper light source, aspheric optics, and current algorithms that may further improve the predictive accuracy for eyes that have undergone refractive surgery.

INTRAOPERATIVE REFRACTIVE BIOMETRY FOR PREDICTING INTRAOCULAR LENS POWER CALCULATION AFTER PRIOR MYOPIC REFRACTIVE SURGERY

Ianchulev T, Hoffer KJ, Yoo SH, et al⁵

ABSTRACT SUMMARY

Ianchulev et al performed a retrospective study of 215 consecutive patients at the time of cataract surgery who had previously undergone myopic laser refractive surgery. The purpose of the study was to compare the ORA intraoperative aberrometer with the surgeon's best preoperative choice (determined by the surgeon with all available data), Haigis L method, and Shammas method.

“[An intraoperative aberrometer] significantly improved outcomes but still is not a perfect tool; the algorithms are constantly being refined as more data are obtained.”

The median absolute error of prediction within 0.50 and 1.00 D of refractive prediction error was analyzed for each method.

The ORA provided the highest predicted accuracy of the compared methods after myopic refractive surgery. Of the 246 eyes included in the study, 67% of the device's predicted errors were within 0.50 D, and 94% were within 1.00 D. The median error was 0.35 D for the ORA, which was significantly lower than that of the other methods ($P < .0001$): 0.60 D for the surgeon's best choice, 0.53 D for the Haigis L method, and 0.51 D for the Shammas method. The ORA calculation was chosen or influenced the lens power selection in 68% of cases. The lens power originally selected agreed with the ORA's selection in only 13% of cases.

DISCUSSION

Ianchulev et al published the largest series assessing the predictive accuracy of the ORA intraoperative aberrometer and one of the largest studies examining power calculations after prior myopic refractive surgery. The results provide additional evidence of the benefit of and improvement in accuracy provided by this device in eyes that have undergone myopic refractive surgery. The ORA was more accurate than the surgeon's best choice (this method was not well described or characterized) and the ASCRS calculator for the Haigis L and Shammas methods.

The study yielded a higher level of accuracy than the previously discussed study. These results are even comparable to those of cataract surgery on eyes that have not undergone refractive surgery.⁶

One limitation of the study is its large number of investigators (> 60) without a unified protocol (some physicians used the IOLMaster, whereas others used the Lenstar [Haag-Streit] for preoperative measurements). These loose criteria, however, also produced results that are more applicable to average ophthalmologic practices that may be considering using an ORA.

The unit significantly improved outcomes but still is not a perfect tool; the algorithms are constantly being

refined as more data are obtained. The better outcomes likely result from the device's ability to capture a perfect aphakic refraction. The limitation lies in the ORA's ability to predict the effective lens position based upon its measurements and the preoperative measurements provided. One could expect the device's results to continue to improve over time. ■

Section Editor Edward Manche, MD, is the director of cornea and refractive surgery at the Stanford Eye Laser Center and a professor of ophthalmology at the Stanford University School of Medicine in Stanford, California. Dr. Manche may be reached at edward.manche@stanford.edu.

Jeffrey Liu, MD, is a fellow in cornea, external disease, and refractive surgery at the Gavin Herbert Eye Institute at the University of California, Irvine. He acknowledged no financial interest in the products or companies mentioned herein. Dr. Liu may be reached at (949) 824-2020; jeffrey.liu@uci.edu.



Marjan Farid, MD, is the director of cornea, refractive, and cataract surgery; vice-chair of ophthalmic faculty; codirector of the Cornea Fellowship Program; and an associate professor of ophthalmology at the Gavin Herbert Eye Institute at the University of California, Irvine. She acknowledged no financial interest in the products or companies mentioned herein. Dr. Farid may be reached at (949) 824-2020; mfarid@uci.edu.



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