

# ICL SIZING



Refining techniques for this step of the planning process.

BY PATRICK J. PHAM, MD, AND ROBERT T. LIN, MD

*Extreme myopia significantly challenges those affected by the condition in their daily activities. Spectacle lenses, being heavy and causing significant image minification, may not be compatible with sports and other physical activities. Contact lenses pose a continuous expense and risk of infection, and over time, some individuals become intolerant of them. For these reasons, many patients have described their experience with phakic IOLs as life changing. In this Fundamentals in Five, Patrick J. Pham, MD, and Robert T. Lin, MD, discuss crucial considerations for the EVO ICL (STAAR Surgical), a phakic IOL that was approved by the FDA in 2022.*

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The EVO ICL is a posterior chamber phakic IOL indicated for the treatment of myopia. This removable implant is made from a biocompatible collagen polymer and does not cause the permanent corneal changes associated with typical laser refractive procedures.

The EVO ICL has demonstrated great efficacy and safety. In an FDA clinical trial of both spherical and toric implants, 90.5% of patients with a mean spherical equivalent of -7.62 D of myopia were within 0.50 D of target at 6 months and 87.6% achieved 20/20 UCVA or better.<sup>1</sup> Moshirfar et al compared FDA outcomes with the ICL, SMILE, and topography-guided LASIK. The researchers concluded that all three procedures produced comparable UCVA at the 6- and 12-month intervals with a high degree of safety.<sup>2</sup>

## FUNDAMENTAL 1 IDENTIFYING SUITABLE CANDIDATES

The EVO ICL is indicated for the correction or reduction of stable moderate to severe myopia (spherical equivalent of -3.00 to -20.00 D) and up to 4.00 D of myopic astigmatism at the spectacle plane with the toric model. The lens has been approved by the FDA for patients between 21 and 45 years of age with an anterior chamber depth (ACD) of at least 3 mm and a suitable

minimum endothelial cell count. The EVO also carries the European CE Mark for use in eyes with an ACD of at least 2.8 mm. Studies have demonstrated the implant's safety.<sup>3,4</sup>

In our clinic, we consider an ICL for patients whose refraction approximates a -7.00 D spherical equivalent or greater and whose biometric parameters are appropriate. We also offer an ICL to individuals with lower prescriptions who have thin or suspicious corneas and to those who have dry eye disease. We are most confident implanting an ICL in eyes with an ACD of at least 2.8 mm, although we have safely implanted the lens in eyes with an ACD as shallow as 2.6 mm with appropriate preoperative counseling and postoperative monitoring.

## FUNDAMENTAL 2 ACCURATE SIZING

The sizing of an ICL is crucial because it determines the vault—the distance between the posterior surface of the implant and the anterior surface of the crystalline lens—and influences the implant's rotational stability, which is paramount in the efficacy of astigmatic correction.

An ideal vault ranges from 250 to 750  $\mu$ m. A vault of less than 250  $\mu$ m increases the risk of anterior subcapsular cataract formation. Conversely, a vault greater than 750  $\mu$ m could lead to

pupillary block, angle crowding and pigment dispersion that might lead to glaucoma and endothelial cell loss.

In our clinic, we take a conservative approach to vault sizing and favor the smaller implant if the eye falls between ICL sizes. Because the central 360- $\mu$ m port of the EVO ICL preserves the physiologic circulation of aqueous humor, reports of visually significant anterior subcapsular cataracts following EVO ICL implantation are uncommon, suggesting an improved tolerance to lower vaults.<sup>5,6</sup> When it comes to toric ICLs and eyes with an ACD of less than 2.8 mm, however, optimal sizing becomes critical because of the reduction of the anterior chamber angle (16° on average but can vary significantly). The risk of rotation appears to be related more to specific measurements such as sulcus-to-sulcus (STS) and angle-to-angle (ATA) rather than to vault. In our hands, we have observed about a 2% rate of rotation (unpublished data). Fortunately, this can be corrected easily with LASIK, limbal relaxing incisions, re-rotation, or ICL exchange.

## FUNDAMENTAL 3 ICL SIZING TECHNIQUES

Traditionally, external white-to-white (WTW) measurements have been used to select the ICL size. The STAAR Online Calculation and Ordering System



Figure. Preoperative biometric image captured with an automated very high-frequency ultrasound device. Calipers may be used to obtain many internal measurements, including the anterior chamber angle, ATA distance, STS distance, and ciliary body inner diameter.

uses a nomogram derived from WTW measurements obtained with an Orbscan tomographer (Bausch + Lomb). Studies have indicated a weak correlation between the WTW measurement and the actual STS diameter, however, which is the presumed location for lens placement.<sup>7</sup> This discrepancy could lead to incorrect sizing and the related complications previously noted.

It stands to reason that a more precise measurement of the posterior chamber could enhance the accuracy of lens selection. Several research groups have sought to optimize ICL sizing by developing nomograms that draw upon measurements of the STS diameter.<sup>8,9</sup> Recently, the inner diameter of the ciliary body and scotopic pupil size were also identified as significant predictors of postoperative vault and have been integrated into the process of ICL sizing.<sup>10</sup>

**FUNDAMENTAL 4 INCORPORATING PREOPERATIVE DIAGNOSTIC TESTING**

Direct measurements of the anterior and posterior chambers play a pivotal role in identifying the optimal size for an ICL. Although ultrasound biomicroscopy can obtain these measurements, the handheld operation of the device often depends on user proficiency, which can lead to variability in results.

We favor an automated very high-frequency ophthalmic ultrasound device (Insight 100, ArcScan) for obtaining detailed biometric information with a repeatability of 0.12 mm when measuring behind the iris. In our experience, technicians can capture high-resolution images, yielding highly consistent results and thereby boosting our confidence in the measurements (Figure). These images enable us to discern critical parameters

such as the STS distance, ciliary body inner diameter, and STS lens rise.

The parameters are fed into the [iclsizing.com](http://iclsizing.com) calculator developed by Dan Z. Reinstein, MD, MA(Cantab), FRCS(C), DABO, FRCOphth, FEBO, and colleagues at the London Vision Clinic. The free tool not only suggests lens sizes based on the Kojima, Dougherty, and Nakamura nomograms, but it also predicts vaults for each potential implant size to guide surgical decision-making (Table).

**FUNDAMENTAL 5 POSTOPERATIVE CONSIDERATIONS**

In addition to an evaluation of refractive outcomes, patients are routinely monitored for signs and symptoms that may suggest improper lens sizing. Systematic assessments of the anterior segment, including IOP measurements, lens vault, and a gonioscopic examination of the angle, are performed over time. A practical method by which to estimate vault at the slit lamp involves comparing the distance between the ICL and crystalline lens to the corneal thickness as

TABLE. OUTPUTS FROM THE ICLSIZING.COM CALCULATOR INDICATING SUGGESTED ICL SIZE OPTIONS AND PREDICTED VAULTS			
Recommended Lens Size Formulas		OD	OS
Kojima		12.5	12.5
Dougherty		12.6	12.6
Nakamura		12.7	12.7
Predicted Vault Formulas		OD	OS
LoVC	12.1	284	282
	12.6	509	508
	13.2	780	778
	13.7	1005	1003
Nakamura	12.1	-143	-143
	12.6	407	407
	13.2	1067	1067
	13.7	1617	1617

Abbreviation: LoVC, London Vision Clinic

viewed through a narrow slit beam. If an inappropriate vault is suspected, OCT or ultrasound imaging may be performed to measure it directly.

It is crucial to educate patients that, despite a successful refractive outcome, they remain at risk for ocular complications associated with their initial prescription. Individuals who had high myopia continue to be at increased risk of retinal detachment and early cataract development. Annual follow-up visits are therefore strongly recommended for these patients. ■

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