Nailing the Power Calculation for Multifocal IOLs

What you need to know.

BY WARREN E. HILL, MD

For many surgeons, multifocal IOLs represent a test of every aspect of clinical practice: the selection and education of patients, surgical skill, astigmatic correction, the management of expectations, and the accuracy of IOL power selection. It is over this last aspect that surgeons sometimes feel they have the least control.

It may surprise you to read that the actual ±0.50 D spherical equivalent accuracy for refractive outcomes of practices that faithfully track their outcomes is generally between 71% and 80%.[1-3] Only 6% of practices are at an 84% level or higher, and less than 1% of practices are at 92%.[4] What this means is that, lacking a well-reasoned approach to the process, for a majority of surgeons, more patients than anticipated will likely require some form of an enhancement to achieve emmetropia.

What separates the upper-tier, consistently successful practice from the rest? This article outlines what you need to know to maximize the possibility of achieving your refractive target for multifocal IOLs.

PREOPERATIVE MEASUREMENTS

In general, a measurement is only as good as your ability to know what it means. For IOL power calculations, the name of the game is consistency. Many biometers have validation criteria with which everyone involved in the process of preoperative measurements should become familiar. Validation criteria help to provide a "heads up" if a measurement or measurements are different than anticipated. These could be measurements for the operative eye or between both eyes.

41.55 D @ 158°	±0.153 D
42.66 D @ 68°	±0.169 D
1.11 D @ 68°	±2.3°

Figure 1. An example of K readings on the Lenstar that meet the accepted standard deviation validation criteria for a set of five preoperative measurements.

For example, a valid set of keratometry (K) readings on the Lenstar LS900 (Haag-Streit) requires that the standard deviation for the power in each of the principal meridians be 0.25 D or less and that the standard deviation for the steep meridian be 3.5° or less (Figure 1). Valid K readings with the IOLMaster (Carl Zeiss Meditec) require three measurements within 0.25 D in each of the principal meridians. As Jack Holladay, MD, explained years ago,[5] the difference in the axial length between eyes should be no more than 0.30 mm. An example of an aviation-style checklist of the validation criteria commonly used for the IOLMaster (Figure 2) can be downloaded at http://bit.ly/1r4MPuS.

Measurements that fall outside generally accepted validation criteria should be deleted and repeated. If there is some underlying problem that must be addressed first such as significant dry eye disease, the patient should be brought back to have the measurements repeated. Although it is tempting simply to soldier on and move to the next patient, such a strategy will invariably lead to unanticipated outcomes.

Axial Length

Correct setting (phakic, acrylic, silicone oil)	CONFIRM
Patient sees red fixation light	CONFIRM
Double peaks (identify ILM, RPE, other)	DELETED
Poorly formed primary maxima	DELETED
Outliers (> 0.05 mm from valid composite AL)	DELETED
At least 5 measurements within 0.05 mm	CONFIRM
Composite SNR > 10 (typically will be > 100)	CONFIRM
OD & OS AL within 0.33 mm	CONFIRM
AL consistent with oldest Rx	CONFIRM

Figure 2. The portion of the IOLMaster's validation criteria checklist that pertains to the measurement of axial length.

FORMULAS

Modern theoretical IOL power calculation formulas are essentially hybrids. The vergence part of the calculation is based on one of the basic theoretical formulas for emmetropia such as Fyodorov or Colenbrander. They then typically estimate the effective lens position by means of a regression-derived algorithm. Because between 30% and 40% of a formula's accuracy depends on the preoperative estimation of the effective lens position, the more sophisticated a formula is in this regard, the better job it will do.[6]

Third-generation, two-variable formulas such as SRK/T may be old and trusted friends, but for patients with high expectations who are paying significant amounts of money out of pocket, the predictive accuracy of formulas from more than 20 years ago may not justify their use.

Extensive testing has shown Holladay 2, Olsen, and Barrett Universal II to have the highest overall ±0.50 D outcomes accuracy.[7] For patients receiving a multifocal IOL, it may be best to consider using one of these three formulas. The Holladay 2 formula is part of the Holladay IOL Consultant software (Holladay Consulting). The Olsen formula is part of the PhacoOptics software (IOL Innovations) and is also available on the Lenstar. The Barrett Universal II formula in its present form can be accessed via the Internet on the website of the Asia Pacific Association of Cataract and Refractive Surgeons at http://bit.ly/1pkLKes and will soon be available on the Lenstar.

For each formula used, it is always best to optimize lens constants. For some, the software that contains these formulas is capable of doing so.

TRACKING OUTCOMES

As with any effort, tracking your outcomes will help you to fine-tune your future efforts and spot trends. This exercise is well worth the effort. The Holladay IOL Consultant has an excellent outcomes tracking feature that will also optimize lens constants.

COMPONENT PARTS

The best refractive outcomes for IOL-based surgery can only occur with the optimization of every component: preoperative measurements, the calculation method used to select the IOL power, surgery, and outcomes tracking with individual lens constant optimization. Each is important and has the potential to derail the final outcome. For those of you implanting multifocal IOLs, consistency and an attention to detail remain the best pathway to success. ■

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