ABOUT THE AUTHOR

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Cataract Surgery in the Myope: What You Should Know

Joshua Teichman, MD, MPH, FRCSC

Background
Improvements in technology have led to an increased safety profile in cataract surgery. Accordingly, in recent decades there has been an increasing clinical focus on providing improved refractive outcomes.

Initially using manual keratometers and ultrasound biometry, advances in intraocular lens (IOL) formulae lead to increased precision and accuracy of IOL calculations. This manifested in the form of decreased requirement for spectacle correction, usually at a distance target.

Later, optical biometry supplanted ultrasound as a more accurate method for the measurement of axial length and anterior chamber depth; it may also be useful in the measurement of lens thickness and white-to-white limbal distance. Newer biometers have built-in topographers with accurate keratometry.

It is beneficial to have an experienced ultrasonographer to perform testing in myopes, but it should be noted that posterior staphyloma can cause issues for the most experienced technicians. Some of the newer optical biometers capture a small OCT image at the time of testing to be used to test for foveal alignment, which is especially important in staphylomatous eyes.

More accurate testing, combined with newer-generation IOL formulae, has resulted in further improvement in the accuracy and precision of IOL calculation and increased spectacle independence for patients, commonly at distance. Moreover, newer intraocular lenses including multifocal and trifocal IOLs have increased the probability of spectacle independence at both distance and near. Furthermore, extended range of vision IOLs can provide distance and intermediate vision, with less dysphotopsia than current multifocal lenses.

Despite these advances, there are patient populations in which special attention is required to achieve improved refractive outcomes. Patients with increased axial length (myopes) have suffered from systematic errors in IOL calculation. Initially, modifications to previously developed IOL formulae were developed to compensate for this. The Wang-Koch correction (including its newer-generation correction) to various formulae would be an example of this.[1]

Currently, the newest generation of IOL formulae perform better, without correction, than the previous generation of formulae, with or without correction.[2]

Axial length is important
All formulae perform relatively well for the average length

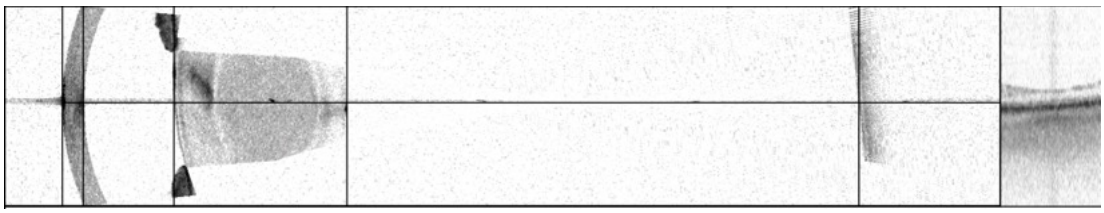

Figure 1. Image from optical biometer centered on the fovea; courtesy of Joshua Teichman, MD

eye, however as eyes become shorter or longer, IOL formulae become less reliable when plotting mean absolute error vs axial length. Most studies suggest that the Barrett Universal II Formula is the most accurate IOL formula for calculating the intraocular lens in patients with a long axial length[2],which aligns with the author's current recommendation in this patient population. Given the increased variability of IOL calculations, it is important to consider using multiple formulae and comparing the results between them; however, care should be taken not to use formulae that are known to perform poorly in longer axial lengths as this may skew the surgeon towards less accurate results. Clinicians should be aware that these formulae continue to evolve and that newer generations are constantly being released. For instance, the Hill-RBF Version 3.0 accepts eyes that would previously have been "out of bounds" in previous versions of the formula.

In many provinces in Canada the provincial health plan will cover ultrasound biometry but not optical biometry. Thus, for patients that choose not to pay for optional, non-medically necessary, although advanced testing, it is important that the surgeon be aware of modifications that may still improve results in these patients. The Wang-Koch axial length modification may be performed on ultrasound biometry derived measurements to improve the accuracy of IOL calculations. While the Barrett formula is meant for optical biometry, if the surgeon does not select an IOL and the ultrasound A-constant is manually inserted, the formula can be used, albeit not as accurately. As a final point, the Wang-Koch modification is for virgin eyes only and should not be used in those patients who have undergone prior refractive surgery.

Prior refractive surgery

This category of myopic patients—those that have undergone prior refractive surgery--- must be considered carefully. In the setting of prior surgery for myopia, there are multiple intraocular lens formulae and calculations that may be used. With or without the availability of historical data, measurements can be entered into an online calculator such as the one available at the ASCRS website and multiple formulae may be calculated simultaneously.

Personal experience suggests that the Barrett True K is the most accurate formula and is also available for toric IOLs, as well as with total keratometry (TK), which uses posterior corneal measurements as opposed to predicted values. Clinicians should not use TK values in non-TK formulae, nor vice versa, as this will induce error in IOL calculations.

While these techniques are vast improvements on the previous methods of calculating IOLs in patients with previous refractive surgery, they are less accurate than IOL calculations on virgin eyes and the proportion of patients within half a diopter of plano is expected to be lower in patients with previous refractive surgery than in patients with virgin eyes .

IOL target

Another important consideration in myopic patients undergoing cataract surgery is the IOL target. While most patients undergoing cataract surgery opt for distance vision correction and expect to wear glasses for reading if they chose a monofocal lens, this is not a scenario that the average myope anticipates as they are accustomed to wearing glasses for distance tasks and removing them to read. It is important that these patients are counseled about the fact that they may lose their ability to read without glasses if they are aiming for a plano outcome. Clinicians should also be aware that multifocal IOLs require a close-to-plano outcome to minimize issues and maximize their efficacy and both myopes and those with previous refractive surgery are less likely to achieve this outcome without careful planning.

An additional option for these patients is monovision; however, a contact lens trial is recommended prior to considering the surgical approach.

The presence of a unilateral cataract in a myope is not uncommon. The discussion of the IOL target in the eye with the cataractous lens is more challenging as compared with a patient having a -6D or -9D refraction in an eye with a clear lens. These patients have the option of aiming the eye for plano and it would be practical to aim each eye for the ideal life-long target (distance or near), as opposed to

compromising in the interim and leaving the patient with a sub-optimal long-term refractive outcome. However, even if targeted at near, a patient with a refraction of -9D in the contralateral eye is very unlikely to be able to function and extremely likely to experience symptoms of anisometropia. When the difference is not as extreme, the patient may be able to tolerate a near target. If symptoms of anisometropia occur, attempting a contact lens trial is the next step. If the patient is unable to tolerate a contact lens, then an earlier lens extraction can be considered. While the scope of this article is not meant to cover surgical complications in myopes, it is important to note that these surgeries carry higher risks than in those patients with normal axial lengths (e.g. retinal detachment), so patients are accepting additional risk, especially in an eye that can be corrected to a standard of acceptable vision. In a younger patient, one may consider an implantable collamer lens (ICL) with its own set of inherent risks, however these may be lower than those associated with cataract surgery. Moreover, these lenses can be removed if a cataract develops, and cataract surgery can then be performed at that time. This may be preferable to laser vision correction in high ametropia; however the individual procedural risk-benefit considerations must be carefully weighed, and the patient's preferences included as part of an approach centered on shared decision-making.

Conclusion

With optical biometry fixated at the fovea, the continued evolution of newer IOL formulae and newer IOLs, information regarding patients preferred visual outcomes, and informed discussion, clinicians can be confident that even very highly myopic patients may obtain excellent visual outcomes.

References

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