Having been in practice for just over 10 years, I have seen technology advance relatively quickly in regard to premium IOL planning. When I first came into practice, we used one IOL formula and more or less used only one IOL. At that time, the main goal of cataract surgery was simply to remove the media opacity, and any refractive component was a potential added bonus to the patient but not necessarily an expectation.

With the advent of premium lenses providing astigmatism and presbyopia correction, the demand for accurate IOL planning has increased dramatically. At the same time, as the popularity of corneal refractive surgery has set new vision standards, patient expectations for lens surgery are also rising—as fast as or faster than technology can advance to meet them.

Tools such as the IOLMaster (Carl Zeiss Meditec) and Lenstar (Haag-Streit), which put multiple formulas and lens options at our fingertips, have helped improve precision in preoperative planning. However, they require understanding and proper decision-making to ensure that the correct formula is used for the correct anatomic and biometric situation. These variables can result in time-consuming and yet inaccurate preoperative planning.

**INTRAOPERATIVE PARADIGM SHIFT**

One technology our practice has incorporated that has helped to simplify preoperative planning and to close the gap between expectations and achievements is intraoperative aberrometry. For starters, astigmatism correction has become easier and more efficient with intraoperative aberrometry. Traditionally, astigmatism power and axis must be determined prior to entering the OR, a process that may require multiple preoperative diagnostic tests including topography, tomography, and keratometry. Often, different devices yield differing values, and estimating or guessing may be required to choose the correct power or axis of astigmatism. This is further complicated when surgically induced astigmatism is taken into account, as this value may vary from surgeon to surgeon and from patient to patient. Another consideration in planning astigmatism correction is the role of posterior corneal astigmatism, which may account for differing values when compared with anterior keratometry values alone.

Now, instead of worrying over multiple formulas depending on lens type or eye anatomy, I use a more simplified approach and more basic formula to get an approximation of lens choice. Then, with the knowledge that intraoperative aberrometry will help me focus the refractive picture, I proceed to the OR with multiple lens options available. For example, if a patient has significant astigmatism, it is not unusual for me to take up to 12 lenses with ranges of both sphere and cylinder power into the OR. I then use intraoperative aberrometry to help make the lens choice decision.

**AT A GLANCE**

- Intraoperative aberrometry can simplify preoperative planning for toric IOL implantation and arcuate incision creation and can provide an advantage over predicting effective lens position.
- Intraoperative measurements allow surgeons to once again need less preoperative planning, with the ultimate lens choice being delayed to the actual time of surgery.
- Managing expectations and offering premium upgrades to patients allows surgeons to use the appropriate time, technique, and technology resources only when patients have expressed interest in achieving a high level of precision in their refractive outcome.
Intraoperative aberrometry allows measurement of true corneal power and astigmatic axis after the incision has induced its effect. Furthermore, after the lens is placed, the alignment of a toric IOL may be further adjusted to ensure that proper astigmatism correction has been achieved.

The use of intraoperative aberrometry has helped to streamline the planning process and to increase our accuracy in hitting the target refraction. Intraoperative choice, placement, and adjustment has allowed surgeons to achieve more accurate results for astigmatism correction with toric IOLs.

**ARCUATE INCISIONS**

My approach to planning arcuate incisions for astigmatism has also changed with the availability of intraoperative aberrometry. Traditionally, with arcuate incisions as with toric IOLs, preoperative diagnostic results, incisional effect, and posterior corneal astigmatism had to be taken into account. This information would be programmed into one or more available nomograms that aim to predict the effect of the incision or incisions based on patient age, axis of placement, optical zone, and length and depth of incision.

Despite these measures, numerous variables can affect the planning and execution of arcuate incisions with traditional techniques. Now, with the availability of intraoperative aberrometry, all of this preoperative planning has been more or less eliminated. For arcuate incisions, I rely on intraoperative aberrometry to provide information on the axis and power of astigmatism. I then place an arcuate incision the designated axis and watch for the immediate effect of the incision in real-time streaming data supplied by aberrometry. Based on the observed effect, I can then titrate the initial incision by lengthening it or supplementing with an additional incision 180° away.

By observing the actual effect of the incision and making subsequent adjustments in real time, surgeons have reported increased accuracy and efficacy with this approach.

**ESTIMATED LENS POSITION**

One variable that has been hard to plan for with traditional methods is estimated lens position (ELP). Traditional formulas attempt to account for ELP based on regression analyses and measured ocular anatomy. However, the ELP variable has been difficult to predict.

Intraoperative aberrometry provides an advantage over predicting ELP. It has the ability to measure the effect of the actual lens position based on the pseudophakic refraction. The pseudophakic refraction allows one to determine whether there has been an IOL power surprise or if the lens position itself is resulting in a refractive surprise. If the predicted refraction is not observed in the pseudophakic refraction, an IOL exchange can be considered to make the proper adjustment and potentially avoid a second trip to the operating room.

In a retrospective analysis, a colleague and I have shown that, with careful control of surgical variables, it is possible to gain useful information from the intraoperative pseudophakic measurement and that its predictive value.
is similar to the predictive value of aphakic measurement.⁴

With the confidence provided by measuring the actual affect of lens position, we have been able to rely less on preoperative diagnostics. However, one must be prepared to act on the information intraoperatively and be comfortable with performing IOL exchange if necessary.

**EXPECTATION MANAGEMENT**

Our practice offers IOL technology to patients based on three packages: (1) basic cataract surgery, requiring glasses for distance and near vision; (2) premium distance cataract surgery for best distance correction, still requiring reading glasses for near vision; and (3) premium presbyopia correction, yielding distance and near vision that eliminates the need for glasses at most distances.

Focusing on target-based packages for patient decisions has decreased the complexity of preoperative planning for basic surgery. Because patients who opt for basic surgery expect to wear glasses postoperatively and understand that they are foregoing premium IOL technology that might deliver more accurate and desired outcomes, our need for extensive preoperative planning for these patients is lessened.

**FULL CIRCLE**

We have gone full circle with IOL planning. From rudimentary plans years ago with modest refractive technology and expectations, we proceeded to more complex techniques and planning with complicated sphere and astigmatism formulas requiring extensive time and techniques to achieve accurate targets. Now, intraoperative measurements allow us to once again need less preoperative planning. The ultimate lens choice is delayed to the actual time of surgery.

Furthermore, managing expectations and offering premium upgrades to patients has allowed us to use the appropriate time, technique, and technology resources only when patients have expressed interest in achieving a high level of precision in their refractive outcome.


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