Survey reveals practices in employing toric IOLs and managing astigmatism

Toric intraocular lenses (IOLs) are of major interest among today’s cataract surgeons. To gauge current practices pertaining to this technology, ASCRS included questions regarding astigmatism management and toric IOLs in the annual ASCRS Clinical Survey. This analysis, which focuses on the most compelling and controversial issues facing ASCRS members, identifies areas where there may be educational opportunities.

Designed to determine members’ clinical opinions and practice patterns, the 2014 ASCRS Clinical Survey produced 268 data points from 137 questions, with responses from more than 1,500 unique respondents.1

The 2014 survey revealed important information regarding ways surgeons are implementing toric IOLs and managing astigmatism in their patients.

Factors that guide management

When respondents were asked about the primary preop measurement driving their astigmatism axis decisions when implanting a toric IOL, overall, 11% use manual or autokeratometry when making their choices, whereas 45% use topography.

When they were asked how they align the preoperative axis assessed with their diagnostic tools with their intraoperative axis where they are placing the toric IOL during surgery, 37% used anatomic landmarks with no marking or used ink marking without instruments. We think this technique may be prone to increased error. However, I think clinicians are changing direction in this area as we increasingly understand how to optimize outcomes with toric IOLs.

Less than half of ASCRS members responding to the survey reported that they calculate...
Driving adoption and outcomes with toric IOLs: Pre-, intra-, and postoperative pearls for success

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“Nearly one-third of survey respondents stated that 10 degrees or more of rotational error is acceptable after toric IOL implantation.”

their surgically induced astigmatism based on their own recent surgical results. Clearly, we have come to understand that our surgical techniques affect outcomes and must be taken into consideration.

The survey showed that 25% of respondents overall ignore posterior corneal cylinder because they believe it is insignificant. However, we continue to learn that this may be an important factor that we should take into account.

Nearly one-third of survey respondents stated that 10 degrees or more of rotational error is acceptable after toric IOL implantation before visual quality and acuity are significantly affected. They will discuss the impact of rotational error, ways to improve treatment planning, techniques for intraoperative alignment, and how to manage postoperative error in toric IOL patients.

Toric IOL strategies for success

Responding to some of the educational gaps identified by this survey, this supplement shares the astigmatism management strategies and toric IOL optimization techniques of some of our most noted experts.

Reference


Dr. Vukich is a partner at the Davis Duehr Dean Center for Refractive Surgery in Madison, Wis. He can be contacted at javukich@facstaff.wisc.edu.

The 2014 ASCRS Clinical Survey asked, “How do you manage posterior corneal cylinder?”

Overall, 25% of respondents ignore posterior corneal cylinder because they believe it is insignificant.

Ignore it because it is typically insignificant
Estimate it based on published average values
Measure for each patient and include it in my calculations

U.S. Non-U.S. Overall

The 2014 ASCRS Clinical Survey asked, “After implanting a toric IOL, how many degrees of postoperative rotational error is acceptable before visual quality and visual acuity are significantly affected?”

30.2% of respondents believe 10 degrees or more is acceptable.

The 2014 ASCRS Clinical Survey asked, “What is your most common procedure to manage astigmatism in a cataract patient with the following levels of cylinder?”

<table>
<thead>
<tr>
<th>Cylinder Level</th>
<th>On axis incision</th>
<th>Manual LRI or AK</th>
<th>Femtosecond laser LRI or AK</th>
<th>Toric IOL</th>
<th>Postop laser vision correction</th>
<th>Glasses or contact lenses</th>
<th>No special correction needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75 D</td>
<td>42.1%</td>
<td>13.2%</td>
<td>7.9%</td>
<td>5.9%</td>
<td>0.9%</td>
<td>7.1%</td>
<td>22.9%</td>
</tr>
<tr>
<td>1.25 D</td>
<td>12.0%</td>
<td>17.1%</td>
<td>8.3%</td>
<td>53.9%</td>
<td>1.6%</td>
<td>5.3%</td>
<td>1.9%</td>
</tr>
<tr>
<td>2 D</td>
<td>0.9%</td>
<td>3.5%</td>
<td>1.6%</td>
<td>89.7%</td>
<td>2.7%</td>
<td>2.7%</td>
<td>0.1%</td>
</tr>
<tr>
<td>3 D</td>
<td>0.5%</td>
<td>1.1%</td>
<td>1.1%</td>
<td>91.6%</td>
<td>3.6%</td>
<td>3.6%</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

Only 54% of respondents reported they would implant a toric IOL in a patient with 1.25 D of astigmatism.

The 2014 ASCRS Clinical Survey asked, “What is your most common procedure to manage astigmatism in a cataract patient with the following levels of cylinder?”
Impact of rotational error on toric IOL outcomes

by John Berdahl, MD

Precise IOL alignment is essential for crisp, clear vision, but it is particularly critical with high-powered IOLs

When correcting astigmatism during cataract surgery, it is easy to reach the 5-yard line. However, it takes considerable effort to target sources of potential error and consistently reach the end zone.

Residual astigmatism

There are 3 causes of residual astigmatism after intraocular lens (IOL) implantation: positioning the IOL incorrectly, choosing the incorrect IOL, or implanting the IOL in an eye with severe ocular surface disease, anterior basement membrane dystrophy, or irregular astigmatism.

The IOL may be implanted in the wrong location or an incorrect IOL may be used if measurements or calculations were performed incorrectly or as a result of unexpected surgically induced astigmatism (SIA).

Posterior corneal astigmatism also plays a role. Roughly 80% of the time this is against-the-rule, but at least 15% of the time it is with-the-rule astigmatism. Therefore, estimating posterior corneal astigmatism rather than measuring it can result in suboptimal outcomes.

Furthermore, the IOL may rotate or it may have been positioned improperly. If the correct IOL is used but it is in the wrong position, I prefer to rotate the IOL. If the incorrect IOL was used, I may perform an IOL exchange or laser vision correction.

Tools for correction

To guide surgeons in correcting residual astigmatism, David Hardten, MD, and I created the Toric Results Analyzer (astigmatismfix.com).

In a large database, we found that in 76% of cases the intended axis will not neutralize the most astigmatism. Moreover, the IOL rotated 70% of the time. Therefore, in 52% of cases both of these problems contribute to residual astigmatism.

Figure 1 shows that at 0 degrees of misalignment, vision is crisp and clear with a T9 IOL. If this IOL is misaligned by 15 degrees, patients have much blurrier vision.

If the IOL is misaligned by 1 degree, the patient loses approximately 3.3% of the effective toric power. If it is off by 10 degrees, the patient loses approximately 35% of the toric power (Figure 2). Although this may be less significant with low-power lenses such as a T3—resulting in 0.36 D of astigmatism—with high-powered toric IOLs it is a major problem. A T9 corrects 4.11 D at the corneal plane. Therefore, the patient will have almost 1.5 D of residual astigmatism with a 10-degree misalignment.

One of our patients received a T9 IOL and had 3.5 D of astigmatism 1 week after surgery. When we plugged the information into the Toric Results Analyzer at astigmatismfix.com, it indicated that rotating the lens 28 degrees clockwise would reduce the astigmatism to less than 1.0 D.

During surgery, I looked at the preoperative and intraoperative aberrometry measurements, which confirmed that she had approximately 3.0 D astigmatism. After we rotated the IOL 28 degrees, we repeated intraoperative aberrometry measurements and found that the measured residual astigmatism was less than 0.5 D. One day after we rotated the IOL, she was plano 20/20 and very pleased.

Although surgeons may not achieve their target results every time when implanting toric IOLs, tools such as excimer lasers and understanding whether to perform an IOL exchange or rotate the IOL can be very helpful.

Conclusion

Precise IOL alignment is especially critical when implanting high-powered toric IOLs, but it will be more important with toric multifocal IOLs, which are even more sensitive to residual astigmatism.

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Driving adoption and outcomes with toric IOLs: Pre-, intra-, and postoperative pearls for success

Preoperative tools and diagnostics: Pathways to improved treatment planning with toric IOLs

by David R. Hardten, MD

Surgeons must manage astigmatism to achieve good uncorrected vision

More than 70% of cataract patients have 0.5 D of astigmatism or more before surgery. It is crucial to recognize this and successfully manage astigmatism to provide the uncorrected vision our patients seek.

We have a number of tools at our disposal to help us reach this goal. These include corneal relaxing incisions and laser vision correction, but toric intraocular lenses (IOLs) are gaining popularity and offer an excellent means to correct very significant levels of astigmatism.

Technologic necessities

It is remarkable how many patients are referred to us after implantation of a toric IOL because they are unhappy with their astigmatic results. Irregular astigmatism is one of the main reasons for residual astigmatism after implantation of a toric IOL. Irregular astigmatism may result from previous RK or LASIK, anterior basement membrane dystrophy, dry eye, previous scars, and other conditions.

Surgeons seeking good refractive outcomes in their patients with astigmatism must determine the true astigmatic power of the cornea before surgery and predict how it will change after surgery. They also must verify whether astigmatism is regular. Toric IOLs feature a flat axis and steep axis, but they cannot correct for asymmetric astigmatism. Topography is necessary to verify that the astigmatism is regular; K readings are not sufficient.

Regular astigmatism also may change if the incision is made in a slightly different location than intended. Furthermore, the internal incision or incision length can dramatically affect the amount of induced astigmatism. Surgeons should consider their average astigmatic result or customize their results.

Surgeons must also be able to position the IOL correctly intraoperatively and examine and verify it after surgery. IOL misplacement or postoperative IOL rotation can result in residual astigmatism.

We need to accurately measure the primary curvature and verify that measurement. Tomography can be used to examine the anterior and posterior curvatures and understand the asphericity. This also can be accomplished empirically by nomograms of average asphericity and ratios of anterior and posterior corneal astigmatism. In addition, we can use a system that measures front and back, such as the Pentacam (Oculus, Arlington, Wash.) or the Galilei analyzer (Ziemer Ophthalmic Systems, Port, Switzerland), which can measure total corneal curvature by subtracting the back curvature of the front of the eye.

An accurate calculator and reliable alignment method are essential. The Barrett toric IOL calculator on the ASCRS website (www.ascrs.org/barrett-toric-calculator), which can be used for any toric IOL, can help surgeons estimate asphericity based on population averages (Figure 1). This formula also takes into consideration posterior corneal curvature and the lens position.

Conclusion

A number of low-tech tools are available to guide toric IOL implantation.

We need to verify that the patient’s topography shows regular astigmatism and be very wary of considering toric IOLs in patients with irregular astigmatism. The irregularity creates an outcome that typically can’t meet expectations of most patients when using toric IOLs, which only correct the regular component of the astigmatism.

For optimal results, surgeons should use a high-quality calculator that incorporates asphericity. They also should consider measuring it directly with a tomography system.

Almost everyone has some degree of astigmatism that must be addressed. Our patients have high expectations. We need to make every effort to reduce astigmatism to less than 0.5 D.

Reference


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Intraoperative toric IOL alignment: Technologies and techniques for optimal outcomes

by Bonnie An Henderson, MD

Device manufacturers continue to strive for seamless integration of systems

Most cataract surgeons rely on manual marking techniques when implanting toric intraocular lenses (IOLs), but technologic advances are streamlining this process by linking automated systems. Learn more about the array of available options to determine the best ways to improve accuracy and your surgical outcomes.

**Manual marking**

With manual marking techniques, it is critical to avoid the effects of cyclorotation.

In a LASIK study, Swami et al. reported that the average torsional misalignment was approximately 4 degrees, but more than 8% rotated more than 10 degrees.1

To avoid the effects of cyclorotation, surgeons must make preoperative reference marks on the cornea while the patient is upright.

Subsequently, when the patient is supine, surgeons can use marking instruments that are held with one hand by dialing in the steep axis on a marker, then marking the cornea and aligning the preoperative reference marks to determine the incision location. Another approach is to use marking instruments with a bimanual approach and mark the steep axis with the other hand.

**High-tech systems**

Image-guided systems increasingly link devices seamlessly to reduce the risk of manual data entry errors, while eliminating the need for manual marking. Wirelessly or with a USB stick, these tools capture data in a clinical area and transfer it to the intraoperative area, potentially decreasing the risk of error.

The Verion Reference Unit (Alcon, Fort Worth, Texas) measures keratometry, pupillometry, and other parameters in the surgeon’s office and produces a high-resolution image of the eye (Figure 1). This information is imported into the planning

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Practice pearl: When using toric IOLs, it is important to take into consideration the effects of cyclorotation. Additionally, using marking instruments or a refractive reference unit is important to align the IOL properly.

It performs aphakic calculations that take into consideration the corneal incision and posterior corneal curvature. Pseudophakic calculations check the power and alignment of the toric IOL and assess the effects of limbal-relaxing incisions. If the IOL is misaligned during surgery, we can continue rotating the lens until we reach our target (Figure 5).

Conclusion
Many high-tech and low-tech tools are available to guide IOL alignment. Device manufacturers are linking systems with preoperative, intraoperative, and postoperative data collection to decrease human error and improve overall outcomes.

Reference

Dr. Henderson is clinical professor of ophthalmology at Tufts University School of Medicine, Boston, and a partner at Ophthalmic Consultants of Boston. She can be contacted at bahenderson@eyeboston.com.
Pearls for achieving surgical success with toric IOLs

Douglas D. Koch, MD

To ensure patient satisfaction, surgeons must be prepared to refine postoperative outcomes if necessary

Implantation of toric intraocular lenses (IOLs) is more than a procedure—it is a comprehensive process, said Douglas D. Koch, MD. Surgeons must take critical steps before, during, and after surgery to ensure precise visual outcomes and patient satisfaction.

Causes of error

Regardless of surgeons’ experience, surgical outcomes occasionally fall short, Dr. Koch said.

There are many causes. Preoperative measurements may be imperfect (Figure 1). Intraoperatively, misalignment can occur, Dr. Koch said. Marks may be blunt or imprecisely located, and there may be parallax as the surgeon examines the lens.

Furthermore, surgically induced astigmatism (SIA) may vary because of the wound construction and location, as well as the patient’s biologic features (Figure 2). The effects of relaxing incisions also may differ.

“Postoperatively, the IOL can rotate,” he said. In addition, a spherical error may occur.

Additional treatments

After surgery, patients with monofocal IOLs may require additional treatment if residual astigmatism is 0.75 D or greater, depending on their visual needs, Dr. Koch explained.1 “With a multifocal IOL … we have to be much tighter, reducing astigmatism to less than 0.5 D,” he said.

Hayashi et al. reported that patients had 20/20 vision at distance if astigmatism was 0 after implantation of an AcrySof ReSTOR IOL with a +3.0 D add (Alcon, Fort Worth, Texas), but if they had 0.5 D of astigmatism, their vision decreased to 20/30.2

When making postoperative adjustments, surgeons need to consider the alignment of the IOL, whether they have under- or overcorrected the astigmatism, the magnitude of the error, and the IOL power accuracy, Dr. Koch said.

If the IOL power is incorrect, he recommended an excimer laser ablation or IOL exchange, depending on the magnitude of the error. He suggested an IOL exchange for larger residual errors, especially on the hyperopic side.

If the spherical power is correct, the IOL is aligned, and astigmatism is within 1.25 D, he performs a peripheral corneal relaxing incision if it was not performed previously. He takes this approach regardless of whether astigmatism is under- or overcorrected. “If there are existing relaxing incisions, you can either reopen them, enlarge them, or even consider making another one,” he said. If astigmatism is 1.5 D or greater, he recommends considering excimer laser ablation or IOL exchange.

If the IOL is misaligned and astigmatism is 1.0 to 1.25 D, he again prefers relaxing incisions. If it exceeds 1.25 D, the Toric Results Analyzer developed by John Berdahl, MD, and David Hardten, MD, is a helpful tool (astigmatismfix.com).

Conclusion

“Astigmatism correction is a process with our patients,” Dr. Koch said. “There are critical steps before, during, and after surgery. It’s mandatory to be prepared to adjust your patients postoperatively in order to provide them with optimal outcomes. Fortunately, we have excellent options available to us, thanks to things like astigmatismfix.com and techniques as simple as relaxing incisions.”

References


Dr. Koch is a professor and the Allen, Mosbacher, and Law chair in ophthalmology, Cullen Eye Institute, Baylor College of Medicine, Houston. He can be contacted at dkoch@bcm.edu.

Figure 1. Dual Scheimpflug Placido map of a patient with a large amount of anterior and posterior corneal astigmatism; ignoring or misestimating the latter can result in suboptimal uncorrected acuity.

Figure 2. Dr. Koch’s SIA in a series of eyes
1. According to Dr. Berdahl, if a toric IOL is misaligned by 10 degrees, the patient loses approximately what percentage of the effective toric power?
   a. 15.3%
   b. 35%
   c. 25%
   d. 10.5%

2. Residual astigmatism after toric IOL implantation may result from irregular astigmatism, which can be caused by:
   a. Dry eye
   b. Previous LASIK
   c. Anterior basement membrane dystrophy
   d. All of the above

3. According to Dr. Koch, patients may require additional treatment after implantation of monofocal IOLs if:
   a. Residual astigmatism is 1.0 D or greater
   b. Residual astigmatism is 0.50 D or greater
   c. Residual astigmatism is 0.75 D or greater
   d. Residual astigmatism is 0.25 D or greater

4. According to Dr. Henderson, image-guided total refractive suites:
   a. Eliminate the need for manual marking
   b. Reduce the risk of human error
   c. Transfer data directly to the surgical area
   d. All of the above

5. Based on results in a large database, Dr. Berdahl reported that IOLs rotated:
   a. In 70% of cases
   b. In 60% of cases
   c. In 10% of cases
   d. In 30% of cases