

Correcting Refractive Surprises After Toric IOL Implantation

An online calculator assists in planning for toric IOL implantation and analyzing unexpected results postoperatively.

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Selecting the most accurate measurement of corneal astigmatism as measured by one or several devices is the key to good toric IOL outcomes. This requires repeatable measurements of corneal astigmatism while factoring in the contribution of the posterior cornea to the total corneal astigmatism.

When planning toric IOL surgery, the surgeon should incorporate the axial length of the eye, his or her personalized IOL constant, and the effect of the phaco incision on the preoperative corneal astigmatism. Further, the calculations for the most appropriate toric IOL should take into account the spherical component of the IOL, as the toric power at the corneal plane will vary depending on the spherical power.

All of these factors have been considered in the recently released Alpíns Statistical System for Ophthalmic Refractive Surgery Techniques (ASSORT) Toric IOL calculator (available for free at www.assort.com). Figure 1 displays the user's ability to move the primary phaco incision around the eye and demonstrate the resulting effect on corneal astigmatism magnitude and meridian. The greater the surgically induced astigmatism from the incision, the greater the effect on the preexisting corneal astigmatism and the tendency

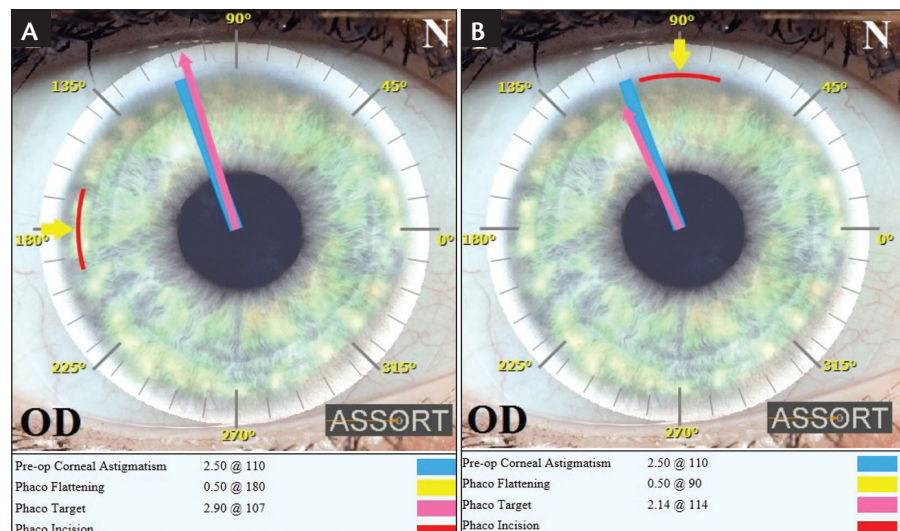


Figure 1. The ASSORT Toric IOL calculator incorporates active dynamics to demonstrate how the preoperative corneal astigmatism changes in magnitude and orientation depending on the position and flattening effect of the phaco incision. The phaco incision is displayed at 180° (A) and 90° (B), in each case changing the preoperative magnitude and orientation.

to rotate the astigmatic meridian away from the incision meridian.

The effective lens position is best calculated using the surgeon's personalized IOL constants. The ASSORT software includes the SRK/T A-constant, the Holladay surgeon factor, the Hoffer Q pseudophakic anterior chamber depth (ACD), and the Haigis formula, which uses ACD (Figure 2).

The ability to select any toric IOL currently manufactured worldwide is a unique feature of the ASSORT calculator. This offers the advantage of being able to compare different IOLs for each case without having to go to several

Implant Parameters (IOL plane)

IOL Type: **Alcon SN6AT5 Stock**

Details ...

Sph Equiv: **28.00** Cylinder: **3.00** Planned +ve Axis: **114**

IOL Power: **26.50** Sphere: **26.50**

☒ SRK/T A-constant ☐ Holladay 1 Surgeon Factor ☐ Hoffer Q pACD ☐ Haigis

Value: **118.2**

Recalc lens power

Figure 2. The effective lens position is accurately calculated using the surgeon's personalized IOL constants.

Alpins Method

SIA	3.26	Ax	35
TIA	2.28	Ax	20
Difference Vector	1.75	Ax	147
Correction Index	1.43		
Index of Success	0.77		
Magnitude of Error	0.98		
Angle of Error	15 (CCW)		

Figure 4. The Alpins Method of analysis determines the magnitude of error, indicating if the correct powered toricity of the IOL has been selected.

manufacturers' websites. The eight most suitable IOLs are displayed according to the preoperative parameters input, together with the expected postoperative spherocylindrical refraction in positive or negative cylinder format. The user has the ability to paste this content into an e-mail and order the IOL from his or her local representative.

ANALYZING REFRACTIVE SURPRISES

Another unique feature of the ASSORT calculator is the ability to solve for postoperative refractive surprises, which occur when the patient has some unexpected cylinder remaining in his or her refraction.

To do this, the user enters the postoperative axis of the IOL and the postoperative spherocylindrical refraction. The display (Figure 3) shows the amount and direction

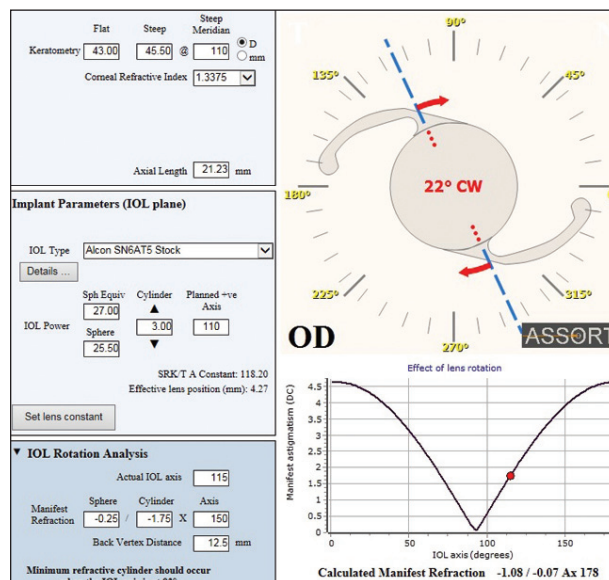


Figure 3. Calculation of the amount and direction of rotation of the toric IOL required to minimize refractive cylinder.

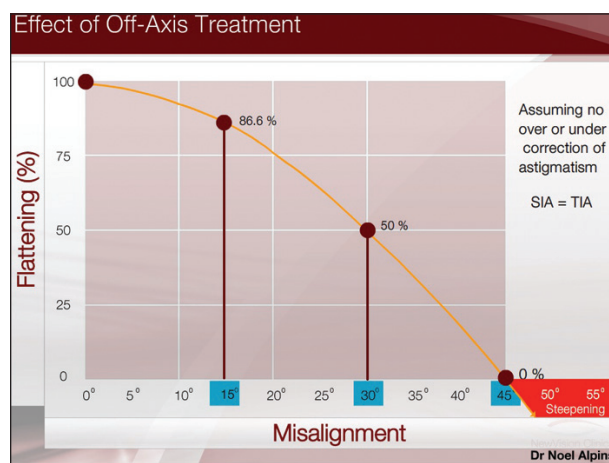


Figure 5. Misalignment of a toric IOL versus the reduction in astigmatic effect is represented by a sigmoidal curve, not a linear relationship, so that a 15° toric IOL misalignment will reduce the astigmatic effect by approximately 15%.

of IOL rotation required to minimize the refractive cylinder. In some cases, the amount of cylinder that can be reduced by rotation of the IOL is not significant, which is demonstrated to the user by display of a shallow sigmoidal curve. In that case, the Alpins method of astigmatic analysis, which is a feature included with the online calculator, advises the user as to whether IOL exchange or LASIK is a better option (Figure 4) to address the remaining error. If the magnitude of error is greater than 1.00 D, then IOL exchange or LASIK may be indicated.

It is important to note that loss of astigmatic effect due to toric IOL misalignment is often overstated. The

TAKE-HOME MESSAGE

- When planning toric IOL surgery, the surgeon should take into account the axial length of the eye, his or her personalized IOL constant, and the effect of the phaco incision on the preoperative corneal astigmatism.
- Calculations for the most appropriate toric IOL should take into account the spherical component of the IOL, as the toric power at the corneal plane will vary depending on the spherical power.
- With the ASSORT Toric IOL calculator, multiple toric implants from several manufacturers can be compared to see which is the best for a particular patient.
- A unique feature of ASSORT software is the ability to solve for postoperative refractive surprises, which occur when the patient has some unexpected cylinder remaining in his or her refraction.

relationship between misalignment of the IOL and reduction of the astigmatic effect is sigmoidal and trigonometric, not linear. Vectorial calculation of loss of effect shows that misalignment by 15° causes a 13.4% loss of effect (Figure 5), not the 45% that is commonly quoted due to a scalar comparison of astigmatism magnitudes postoperatively versus preoperatively.

The ASSORT Toric IOL calculator is divided into two modules so that the surgeon can go right into the postoperative refractive surprises module without having to enter preoperative data.

CONCLUSION

With the ASSORT Toric IOL calculator, we have tried to make planning and analyses of toric IOLs as transparent as possible to allow surgeons to improve their astigmatic outcomes with toric implants. As more manufacturers develop toric IOLs, their specifications will be added to the ASSORT calculator selection. ■

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