

The Surgically Induced Astigmatism Calculator

A new tool to analyze how much the cataract incision influences the refractive outcome.

BY WARREN E. HILL, MD

Since the introduction of phacoemulsification, improvements in the safety and predictability of cataract surgery combined with an astonishing array of technical advances, have raised the expectations of both patients and surgeons alike. A focus on meeting the individual refractive goal for each patient has become the norm while the occasional refractive surprise of only a few years ago has become unacceptable.

As a result, cataract surgeons are now also refractive surgeons, and they must constantly work to achieve the best possible outcome for each patient. Eliminating, or at least reducing, corneal astigmatism is particularly important with patients receiving premium IOLs. To manage corneal astigmatism with the greatest degree of accuracy and predictability, surgeons must understand the impact of the cataract incision. The Surgically Induced Astigmatism Calculator was developed to give surgeons a useful tool to better understand and individually determine this important value.

NEED

The Surgically Induced Astigmatism Calculator uses vector analysis to calculate the change in corneal astigmatism resulting from the cataract procedure. The calculator allows surgeons to generate several different types of reports that summarize individual case information by the type, size, and location of the corneal

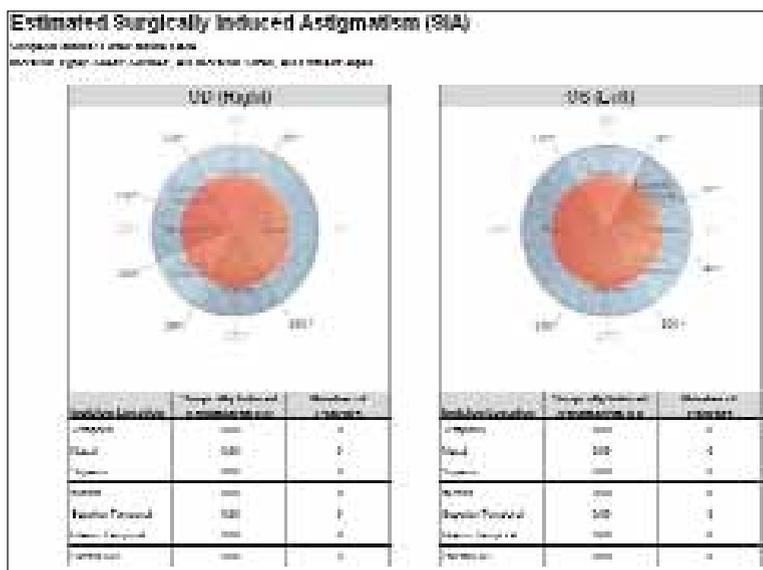


Figure 1. The Surgically Induced Astigmatism Calculator uses vector analysis to determine the amount of surgically induced astigmatism created during the cataract procedure. Surgeons can generate reports that sort their surgical data by the incision's type, size, and location.

incision. Like all of the tools on my Web site, the calculator made available to the ophthalmic community free of charge.

Although temporal clear corneal incisions induce less astigmatism than those of similar size placed elsewhere on the eye, no incision is truly astigmatically neutral. The cataract incision's vector (having both a magnitude and a direction) invariably changes the vector of the preoperative corneal astigmatism, depending on the

incision's location, size, and architecture. The two are added together to create a new vector, representing the postoperative corneal astigmatism. If this second influencing vector (the cataract incision) is not taken into account, the resulting change in both the axis and the magnitude of the postoperative astigmatism will typically result in an undercorrection of the corneal astigmatism by a toric IOL.

It is helpful to keep in mind that the astigmatism induced by the cataract incision can vary widely among surgeons based on factors such as the incision's location, size, and architecture; whether the ophthalmologist is right- or left-handed; and any stretching of the incision during the insertion of the IOL. The Surgically Induced Astigmatism Calculator accounts for these factors.

“After surgeons enter a minimum of 10 cases, they can obtain the magnitude of their surgically induced astigmatism.”

Once surgeons know a baseline amount of astigmatism normally induced by their incision, they can use it to manage their patients' postoperative corneal astigmatism more effectively. Surgeons can change the incision's size and location relative to the steep meridian in order to achieve different effects. They can also plan to use adjunctive astigmatic treatment when the amount of preoperative astigmatism is too great to be sufficiently reduced by the cataract incision alone.

HOW TO USE THE SURGICALLY INDUCED ASTIGMATISM CALCULATOR

Surgeons can download the Surgically Induced Astigmatism Calculator free of charge from the physician download area at my Web site at <http://www.doctor-hill.com> in a Microsoft Excel format (Microsoft Office 2000 [Microsoft Corp., Redmond, WA] or later for personal computers and Office 2001 [Microsoft Corp.] or in the future for Macs [Apple Computer, Inc., Cupertino, CA]) (Figure 1).

The user enters the following information for sequential cataract surgery cases:

- Date of the surgery;
- Chart or case number;
- Patient's date of birth;
- Operative eye (OD/OS);
- Whether or not the patient has had previous corneal surgery;

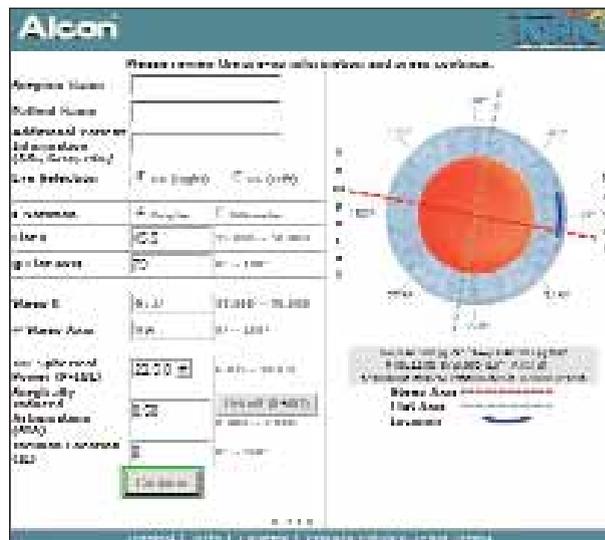


Figure 2. Surgeons implanting the AcrySof Toric IOL can use the Surgically Induced Astigmatism Calculator to generate a personalized value for surgically induced astigmatism. That value can replace the 0.50 D default value used with the AcrySof Toric IOL calculator. The latter calculator, pictured here, can then determine with more precision the most effective toric IOL power and axis of implantation.

- The incision's location, description, size, and type;
- Preoperative steep keratometry (K) reading, flat K, steep meridian, and flat meridian; and
- Postoperative steep K, flat K, steep meridian, and flat meridian.

A pull-down menu facilitates certain data entry. Based on the operative eye and the location of the incision, the calculator will determine if the incision was temporal, nasal, superior, or inferior, and this cell will be automatically filled.

After surgeons enters a minimum of 10 cases, they can click *create report* to obtain the magnitude (in diopters) of their surgically induced astigmatism. The results are sorted by the incision's type, size, and location. As desired by the operator, the data can be further sorted by the patient's age.

When preparing to use the calculator, surgeons should keep the following points in mind. Surgeons should make the location of the incision and its architecture as consistent as possible. They should obtain postoperative K values at the last postoperative visit or whenever they seem stable. Surgeons should use the same instrument for all preoperative and postoperative corneal power measurements. We as surgeon should take care not to mistakenly flip the pre- and postoperative meridians. Postoperatively, the axis for the steep preoperative principal meridian should shift by between 5° and 20°. A postoperative change in the power of the steep axis of the cornea should not be greater than

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DisCoVisc[®] Ophthalmic Viscosurgical Device (Sodium Chondroitin Sulfate - Sodium Hyaluronate)

Description: DisCoVisc[®] Ophthalmic Viscosurgical Device has an intermediate cohesive/dispersive index (CDI) and can best be described as the first viscous dispersive viscoelastic and is optimized for the entire surgical procedure.

Indications: DisCoVisc[®] Ophthalmic Viscosurgical Device is indicated for use during surgery in the anterior segment of the eye. It is designed to create and maintain space, to protect the corneal endothelium and other intraocular tissues and to manipulate tissues during surgery. It may also be used to coat intraocular lenses and instruments during cataract extraction and IOL insertion.

Warnings: Failure to follow assembly instructions or use of an alternate cannula may result in cannula detachment and potential patient injury.

Precautions: Precautions are limited to those normally associated with the surgical procedure being performed. Although sodium hyaluronate and sodium chondroitin sulfate are highly purified biological polymers, the physician should be aware of the potential allergic risks inherent in the use of any biological material.

Adverse Reactions: DisCoVisc[®] Ophthalmic Viscosurgical Device was very well tolerated in nonclinical and clinical studies. A transient rise in intraocular pressure in the early postoperative period may be expected due to the presence of sodium hyaluronate, which has been shown to affect such a rise. It is therefore recommended that DisCoVisc be removed from the anterior chamber by thorough irrigation and/or aspiration at the end of surgery to minimize postoperative IOP increases. Do not overfill anterior chamber.

ATTENTION: Reference the Physician Labeling/Directions for Use for a complete listing of indications, warnings and precautions.

CAUTION: FEDERAL (USA) LAW RESTRICTS THIS DEVICE TO THE SALE BY OR ON THE ORDER OF A PHYSICIAN.

U.S. Patent Nos. 5,273,053; 5,876,379 and 6,051,930.

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COVER STORY

SUBMIT YOUR DATA

I ask all surgeons who use the Surgically Induced Astigmatism Calculator to contribute their information to a HIPAA-compliant database for further analysis. The goal of this effort is to study the magnitude of surgically induced astigmatism as a function of the incision's location, type, architecture, and size. To date, little has been published in this area.

Surgeons may send their data to me once they enter a minimum of 20 cases into the Surgically Induced Astigmatism Calculator, but 50 to 100 cases are preferable. Instructions for submitting data are included with the download of the Surgically Induced Astigmatism Calculator.

1.00 D unless the cataract incision is very large. Double-check K values that are very steep or very flat. The axes of the steep and flat meridians should be 90° apart. If not, they should differ by no more than ±5° from a 90° separation. Values outside this range may indicate irregular astigmatism and should be evaluated by topography. Additional instructions and tips are included with the calculator.

Surgeons implanting the AcrySof Toric IOL (Alcon Laboratories, Inc., Fort Worth, TX) can enter their calculated, individualized value for surgically induced astigmatism generated by the Surgically Induced Astigmatism Calculator into the AcrySof Toric IOL calculator at <http://www.acrysoftoriccalculator.com> to determine the most effective toric IOL power and the final axis of implantation as calculated by vector analysis (Figure 2). The AcrySof Toric IOL calculator also determines the amount of anticipated residual refractive astigmatism so the surgeon can decide whether or not it would be useful to adjust the location of the cataract incision to optimize this correction.

CONCLUSION

By using the new Surgically Induced Astigmatism Calculator, cataract surgeons can now more precisely manage their patients' corneal astigmatism and improve their outcomes by knowing how much their cataract incision affects preexisting corneal astigmatism. A value for surgically induced astigmatism can be generated using as few as 10 cases, but this value will be more meaningful using data from 50 to 100 cases. ■

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