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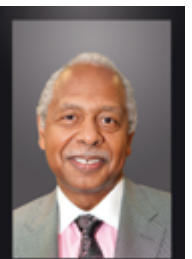
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## Find out why top surgeons choose Cassini for Total Corneal Astigmatism (TCA) diagnosis

### TCA is vital to calculating correct corneal refractive power for Toric IOL planning

Accurate measurement of total corneal astigmatism in cataract patients is crucial for achieving optimum postoperative uncorrected visual acuity and patient satisfaction, especially with the implantation of Toric intraocular lenses (IOLs). Traditionally, the corneal power and astigmatism values have been calculated by assuming a fixed posterior:anterior curvature ratio based on the measurement of the anterior surface curvature only. Unfortunately, a number of studies consistently suggest that current methodology is inadequate for achieving optimum astigmatic outcomes<sup>1-3</sup>.

Cassini Total Corneal Astigmatism (TCA) uses specular reflection technology to reconstruct the shape of both the anterior (1<sup>st</sup> Purkinje image) and the posterior (2<sup>nd</sup> Purkinje image) surface of the cornea. Ray tracing of point images from the camera back to its source allows for excellent accuracy and repeatability of corneal shape measurements. Reliable Purkinje imaging technology and precision ray tracing technology is used to determine corneal shape and optical aberrations.

In this Clinical Review you will find a detailed explanation of the importance of posterior cornea reading in current clinical practice. Preliminary data showing the accuracy of Cassini TCA measurements allow us to present this innovation's great potential to set a new standard for Toric IOL calculation.

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# Accurate posterior corneal data is critical

## In correcting astigmatism with Toric intraocular lenses

This study evaluated the impact of posterior corneal astigmatism on outcomes with Toric intraocular lenses (IOLs).

41 eyes of 41 patients, who underwent an uneventful Phaco+Toric IOL procedure without postoperative IOL decentration or tilt were enrolled. All eyes were measured by 5 different devices. 1. Partial coherence interferometry (PCI) device: IOL Master; 2. Optical low-coherence reflectometry (OLCR) device: Lenstar; 3. Placido disk-based corneal topographer: Atlas; 4. Manual Keratometry; 5. Placido-dual Scheimpflug analyzer: Galilei, both preoperatively and postoperatively.

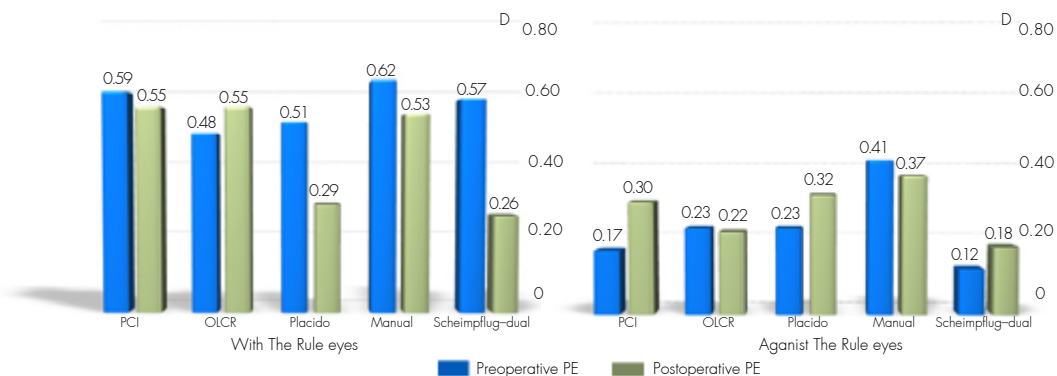


Figure 1 Preoperative and postoperative corneal astigmatism prediction errors (PE) in the WTR eyes (left figure) and ATR eyes (right figure) using different devices. (ATR: against the rule group with corneal steep meridian at 0-30 degrees or 150-180 degrees; WTR: with the rule group with corneal steep meridian at 60-120 degrees).

Actual corneal astigmatism = Postoperative manifest refraction (corrected to corneal plane) - effective toric power  
Prediction error = Corneal astigmatism measurement by each device - actual corneal astigmatism

The mean corneal astigmatism prediction errors were 0.5 to 0.6 D WTR in eyes with WTR corneal astigmatism and 0.2 to 0.3 D ATR in eyes with ATR corneal astigmatism for preoperative and postoperative corneal measurements in 4 anterior-only devices and 1 anterior-posterior device.

This study found that using the measurement based on devices currently available on the market (majority is anterior corneal measurements only) to calculate total corneal astigmatism, WTR astigmatism was overestimated and ATR astigmatism was underestimated. This study underscores the importance of accurate total corneal astigmatism measurement during Toric IOL calculation.

Data Courtesy of  
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Koch DD, Jenkins RB, Weikert MP, Yeu E, Wang L  
 J Cataract Refract Surg. 2013 Dec;39(12):1803-9



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# Posterior corneal data required with irregular corneas

## Correlation between anterior and posterior is lost in complicated scenarios

This study investigated preoperative and postoperative anterior and posterior keratometry and simulated corneal astigmatism in keratoconic eyes treated with collagen cross-linking combined with anterior surface normalization by partial topography-guided excimer ablation (the Athens Protocol).

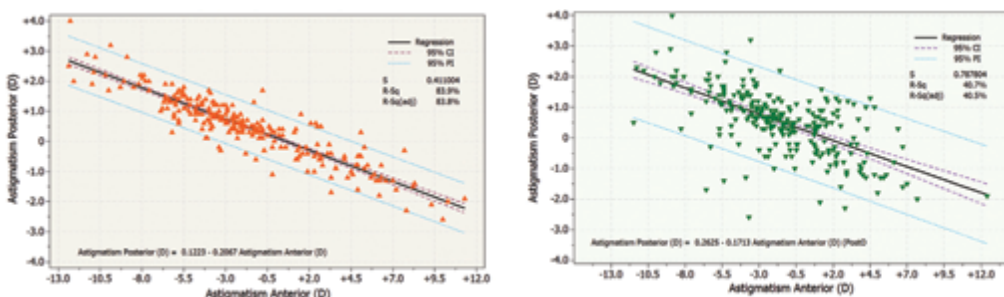


Figure 2 Scatter and fitted line plots of posterior astigmatism expressed in diopters (D) versus anterior astigmatism (also expressed in D) with 95% confidence intervals (CI) and 95% prediction intervals (PI) before (Left) and after (Right) treatment.

Before treatment the results were characterized by a pattern of linear correlation between anterior and posterior cornea astigmatism, as shown in the fitted line plot of left figure. This pattern does not seem to be consistent after treatment (right figure), due to the dramatic alteration of the anterior surface and cornea stromal changes. Thus in this group of complicated postoperative corneas, when patients undergo a future Toric IOL calculation, all the existing rules or equations will not be able to predict an accurate refractive astigmatism unless the cornea has been measured individually with a reliable total cornea evaluation device.

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Kanellopoulos AJ, Asimellis G.  
 J Refract Surg. 2014 May;30(5):342-6



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## Cassini measures Total Corneal Astigmatism Axis

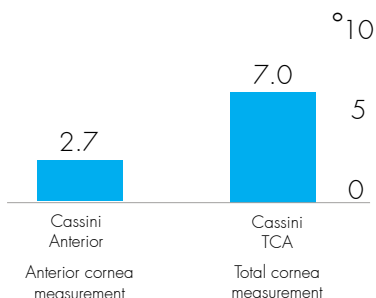


Figure 3 Good repeatability of determination of axis both in anterior and Total Corneal Astigmatism

## Cassini measures Total Corneal Astigmatism Magnitude

This study was designed to evaluate the accuracy of Cassini Total Corneal Astigmatism (TCA) and determine the contribution of posterior corneal astigmatism to total corneal astigmatism using Cassini TCA.

Consecutive pseudophakic eyes were measured by Cassini Anterior, Cassini TCA and auto refraction (Nidek ARK 530A). The vector difference between corneal astigmatism and the cylinder measurement obtained from auto refraction were analyzed and showed in Figure 4.

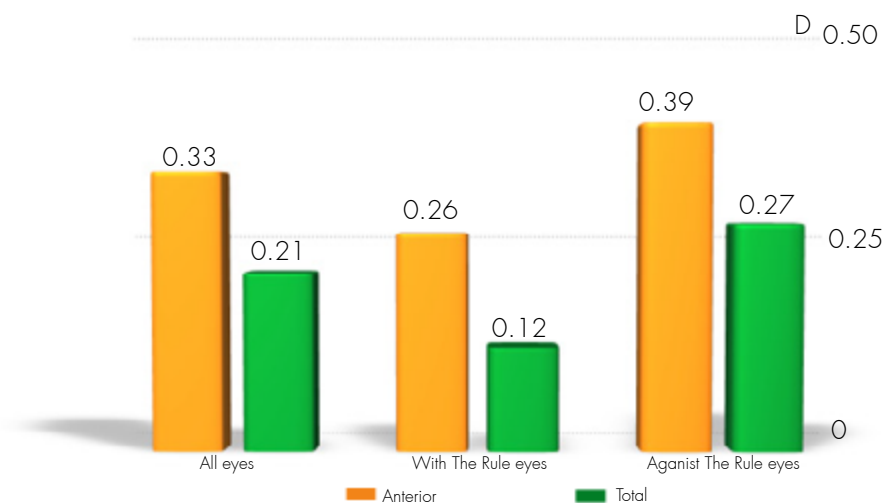


Figure 4 The magnitude difference of astigmatism of pseudophakic eyes (n=64) between Cassini anterior and Cassini TCA measurement

This study indicated that the Cassini TCA measurement is closer to the objective auto refraction measurement compared to using Cassini Anterior. Given the previously published outstanding performance of Cassini Anterior measurements<sup>1-4</sup>, the new Cassini TCA function further improves the control of astigmatism error range when evaluating corneas for treatment.

Data Courtesy of  
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Cassini Panel Event, ESCRS 2014

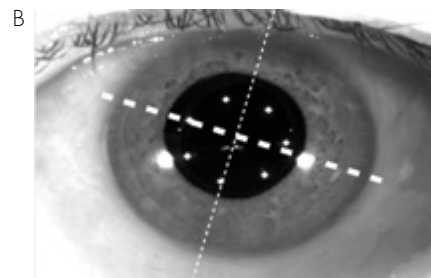
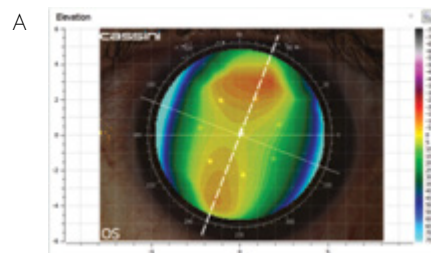
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# Cassini TCA Case Examples

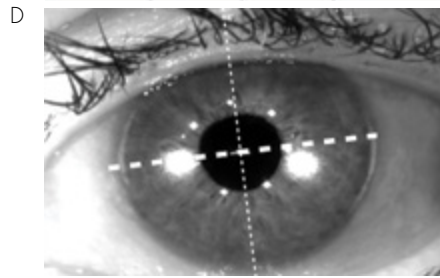
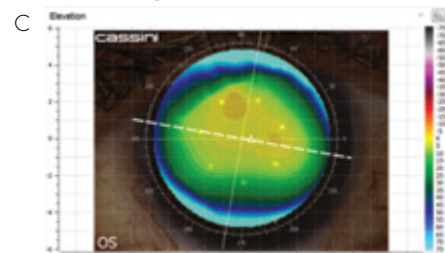
## With the Rule



Measurement	Astigmatism
Cornea, Anterior	1.94D @ 69°
Cornea, Posterior	0.47D @ 163°
Cornea, TCA	1.52 D @ 68°
Refractive Cylinder	1.30 D @ 68°

With the rule astigmatism measurement case shows a higher anterior cornea measurement **(A)** than total corneal astigmatism measurement **(B)** as well as the auto refraction. Ignoring posterior cornea measurement may lead to overcorrection in Toric IOL calculations.

## Against the Rule



Measurement	Astigmatism
Cornea, Anterior	0.50 D @ 38°
Cornea, Posterior	0.05 D @ 0°
Cornea, TCA	0.52 D @ 36°
Refractive Cylinder	0.71 D @ 33°

Against the rule astigmatism measurement case shows a lower anterior cornea measurement **(C)** than total corneal astigmatism measurement **(D)** as well as the auto refraction. Ignoring posterior cornea measurement may lead to undercorrection in Toric IOL calculations.

Data Courtesy of  
**Nic. J. Reus, MD**  
Amphia Ziekenhuis

Cassini Panel Event, ESCRS 2014



## Cassini Specifications

### True Axis

- Multicolor LED imaging technology combined with 2nd Purkinje imaging technology
- Axis repeatability within 3 degrees

### True Magnitude

- Diopter range 4.00D – 171.00D
- Display K-values per zone 3/5/7/9mm
- Keratometric indices display in D (diopters) or mm (millimeters)

### True Capture

- Auto Capture with joystick positioning
- Measurement Quality Factor parameter
- Auto pupil detection
- Topographic indices - E (shape factor), e (eccentricity), Q (asphericity), p (form factor)
- Keratoconus indices - SAI (Surface Asymmetry Index), SRI (Surface Regularity Index)

### True Accuracy

- Submicron accuracy due to color LED triangulation technology < 0.8µm

### True Technology

- External Ocular Photography
- Topographic maps - Axial, Refractive, Tangential, Elevation, Corneal Aberrations, Recorded color HD external ocular photography
- Multiple color spectrum options
- Incorporated patient management program
- USB, Direct print, PDF, JPG, 3rd party output connectivity
- Mesopic and photopic pupillometry



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