

Cassini TCA Outperforms Nomogram and Calculation Based Estimates of Posterior Corneal Astigmatism

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PURPOSE: To compare toric IOL astigmatism correction based on Cassini Total Corneal Astigmatism (TCA) with calculations based on anterior corneal measurements and nomogram adjustments.

METHODS: Retrospective chart review of patients who received toric IOLs at the time of cataract surgery for astigmatism correction.

RESULTS: Cassini TCA achieved 94.0% accuracy within 0.50 D and 74.0% accuracy within 0.25 D postoperative manifest refractive cylinder, compared with 84.0% and 54.0%, respectively, for the Barrett toric calculator, and 79.4% and 50.0% for the Baylor nomogram.

CONCLUSION: Cassini TCA provided the most accurate prediction of residual refractive astigmatism, and permitted superior astigmatic correction, achieving 94% of eyes within 0.50 D and 74% accuracy within 0.25 D residual manifest refractive cylinder.

Refractive cataract surgery requires accurate surgical correction of corneal astigmatism. However, methods for the determination of true, total corneal astigmatism are still evolving. As Koch et al have pointed out, "Ignoring posterior corneal astigmatism may yield incorrect estimation of total corneal astigmatism. Selecting toric intraocular lenses based on anterior corneal measurements could lead to over correction in eyes that have with-the-rule astigmatism and under correction in eyes that have against-the-rule astigmatism."¹

While approximately 51% of corneas are aligned with-the-rule anteriorly, upwards of 87% of corneas are aligned with-the-rule posteriorly. Taking mean posterior corneal astigmatism into account has led to the development of the Baylor toric IOL nomogram² and the Barrett toric

calculator³, allowing surgeons to improve results while still using only standard anterior keratometry. However, direct measurement of the posterior cornea in each individual case should yield superior results to applying population means and blanket adjustments.

CASSINI TOTAL CORNEAL ASTIGMATISM (TCA)

Cassini uses patented multi-colored LED point-to-point ray tracing to provide a GPS-like analysis of the cornea along with high-resolution images utilized for surgical guidance (Figure 1). The unique measuring principle enables highly accurate and repeatable measurements of TCA. To evaluate the performance of Cassini TCA,

we undertook a comparative retrospective analysis of a series of 50 toric IOLs based on measurement with Cassini TCA, the Baylor toric IOL nomogram and the Barrett toric calculator.

METHODS

This retrospective chart review included consecutive cases beginning in September, 2015, performed by one surgeon (Elizabeth Yeu, MD, Virginia Eye Consultants). Preoperative measurements included Lenstar biometry and Cassini TCA. Eyes with clinically significant corneal dystrophy, a history of prior keratorefractive surgery,

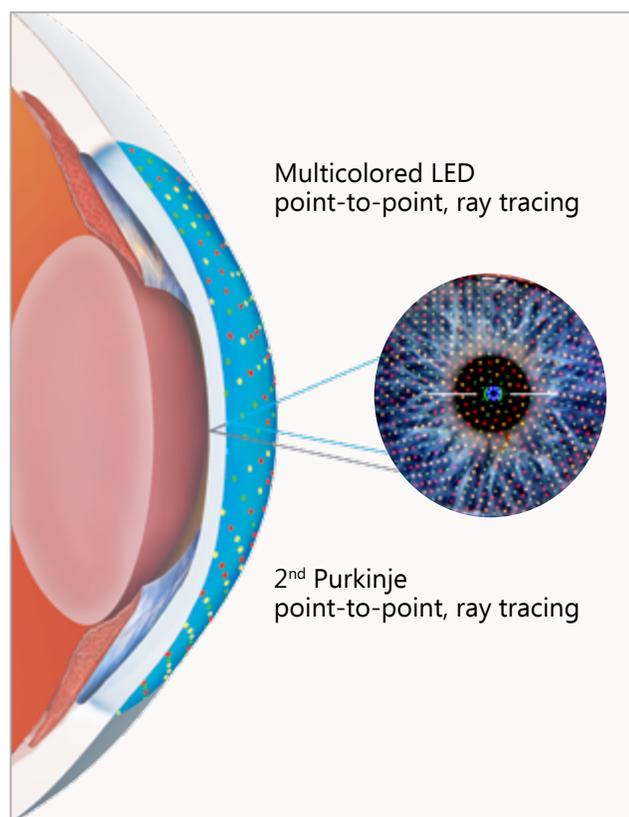


Figure 1 Cassini Total Corneal Asigmatism

uncontrolled ocular surface disease, short axial length (i.e., < 22.5mm), or that were missing postoperative information, were excluded. Postoperative manifest refraction and visual acuity were collected at one month. Barrett toric calculation and Baylor toric nomogram recommendations were obtained from the Lenstar anterior keratometric values.

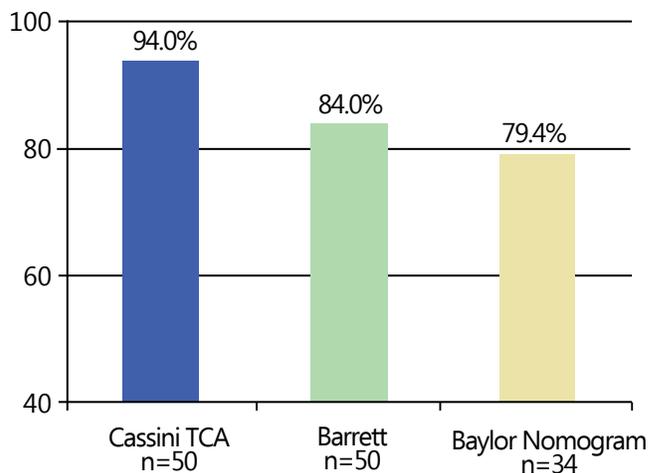


Figure 2. Prediction residual cylinder within 0.5D

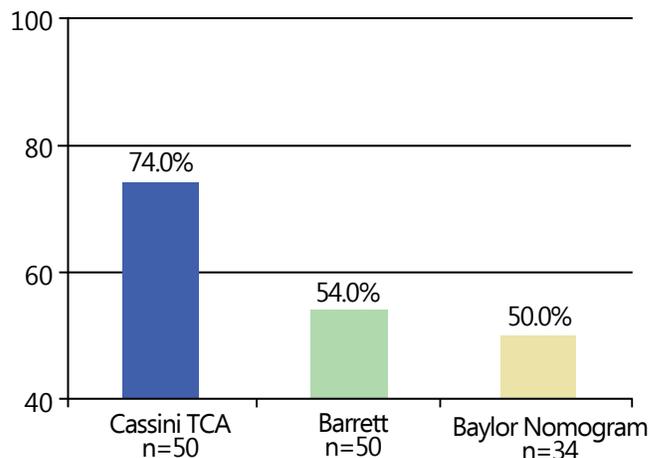


Figure 3. Prediction residual cylinder within 0.25D

RESULTS

A total of 50 cases were included, and 13 cases were excluded. Figures 2 and 3 provide the percentage of eyes with ≤ 0.50 D and ≤ 0.25 D residual manifest refractive astigmatism at one month postoperative. 70% (35/50) of eyes demonstrated posterior corneal astigmatism aligned with-the-rule, 18% (9/50) demonstrated posterior corneal astigmatism aligned against-the-rule, and 12% (6/50) demonstrated posterior corneal astigmatism aligned obliquely (Figure 4). All the cases of oblique posterior corneal astigmatism were found in eyes with

oblique anterior corneal astigmatism. The incidence of oblique anterior corneal astigmatism was 22% (11/50 eyes). Of note, the Baylor nomogram makes no specific recommendation for eyes with oblique anterior corneal astigmatism. In these oblique eyes, Total Corneal Astigmatism measured greater than anterior astigmatism in 45.5% (5/11), while Total Corneal Astigmatism measured less than anterior astigmatism in 54.5% (6/11).

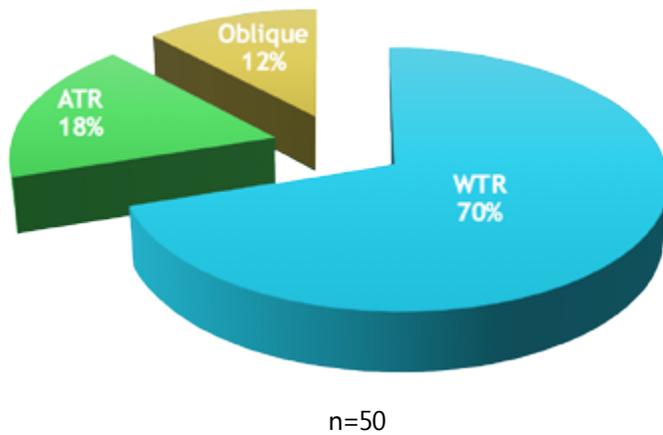


Figure 4. Steep Axis orientation of posterior corneal astigmatism

DISCUSSION

In terms of residual manifest refractive cylinder prediction error, Cassini TCA outperformed both the Baylor nomogram and the Barrett calculator. Cassini TCA achieved 94% accuracy within 0.50 D and 74% accuracy within 0.25 D postoperative manifest refractive cylinder. These results compare favorably with other methods of posterior corneal measurement, including intraoperative aberrometry, which has been reported to achieve 78% within 0.50 D and 38% within 0.25 D.⁴

Oblique anterior astigmatism was found in 22% of eyes. In approximately half of these cases, TCA was greater than anterior astigmatism. Therefore, no generalized

rule for the posterior behavior of oblique eyes could be determined, making these particularly challenging for nomogram based toric IOL calculation.

In conclusion, Cassini TCA provided the most accurate prediction of postoperative refractive astigmatism, and permitted superior astigmatic correction, achieving 94% of eyes within 0.50 D residual manifest refractive cylinder. The benefit to patients of reduced astigmatism means better vision without glasses, while surgeons enjoy enhanced outcomes and a reduction in the need for postoperative enhancement procedures.

REFERENCES

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