ZEISS IOLMaster 700

Total Keratometry

Why create a new keratometry measurement?

"Total Keratometry has the potential to reduce refractive surprises to a minimum."

Graham Barrett, M.D.

Classic keratometry is based on anterior corneal surface measurements. While posterior surface effects are not neglected in keratometry, they are considered via eye model assumptions only. The famous Gullstrand eye model, for example, utilizes a fixed anterior posterior corneal curvature ratio (APR) of 0.883. Keratometry respects this fixed APR by modifying the corneal refractive index to the so-called keratometric index (e.g., 1.3315, Olsen 1986).

In recent years, however, several studies have confirmed that posterior corneal astigmatism magnitude and axis orientation cannot be adequately predicted by measuring the anterior corneal curvature alone (Tonn et al. 2014; Koch et al. 2012; LaHood et al. 2017).

Based on such insights, several researchers have created regressions, nomograms and eye models in order to predict the posterior surface astigmatism and optimize toric IOL power calculation (Koch et al. 2013; Abulafia et al. 2016; Canovas et al. 2018). One of the most prominent and precise examples is the Barrett Toric Calculator (Abulafia, A., et al., 2015). Yet, these methods are based on mathematical predictions of posterior corneal astigmatism and, therefore, cannot fully account for outliers and irregularities.

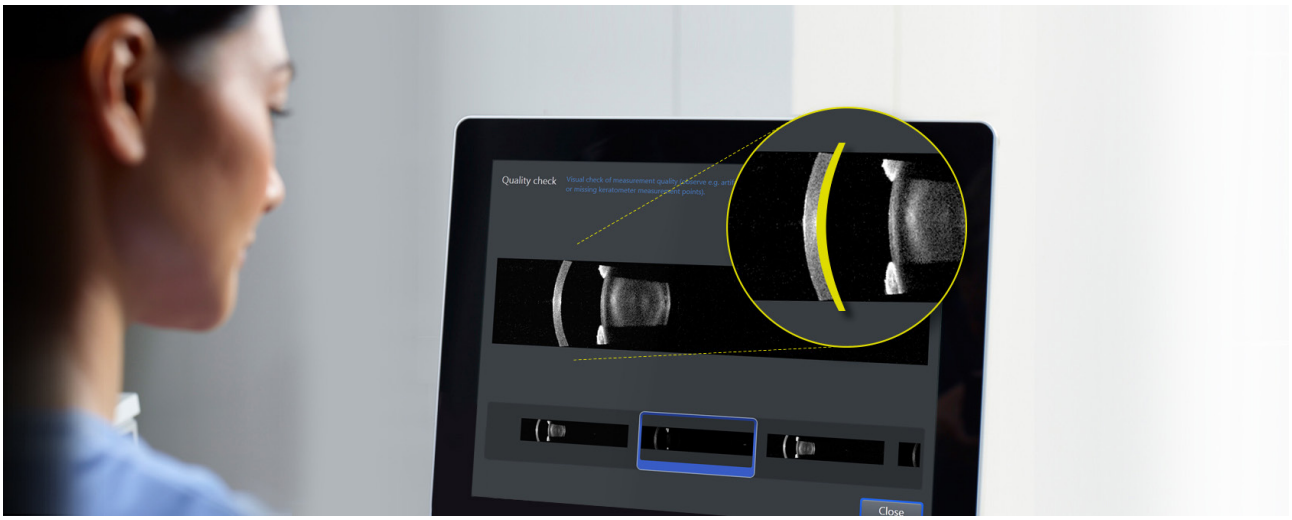
The imprecision of these previous estimations led to the development of technology able to measure, not estimate, the posterior curvature. This is Total Keratometry.

The Keratometry Transformation

Posterior corneal curvature cannot adequately be predicted by anterior corneal curvature alone.
A more effective method is necessary to produce better results and eliminate outliers.

ABSTRACT

How is Total Keratometry different?



Total Keratometry differs from most established methods for total corneal power assessment. It considers corneal thickness and posterior corneal curvature in addition to the anterior corneal curvature measurements. It combines the proven and trusted telecentric 3-Zone Keratometry of the IOLMaster® 700 from ZEISS with its patented SWEPT Source OCT Cornea-to-Retina Scan (Akman A., Asena L., Güngör SG. 2016; Srivannaboon S. et al. 2015; Kunert KS. et al. 2016). This way, each eye's posterior curvature is considered individually rather than based on general model eye assumptions. Because of this, outliers in IOL calculation can be minimized.

Total Keratometry has been designed by ZEISS optical engineers to match the Gullstrand ratio in a normal population. However, it still is capable of detecting the impact of posterior astigmatisms in individual eyes, such as eyes with post corneal laser vision correction or physiologically unusual eyes. This is how Total Keratometry values differ from the many total cornea values provided by other instruments.

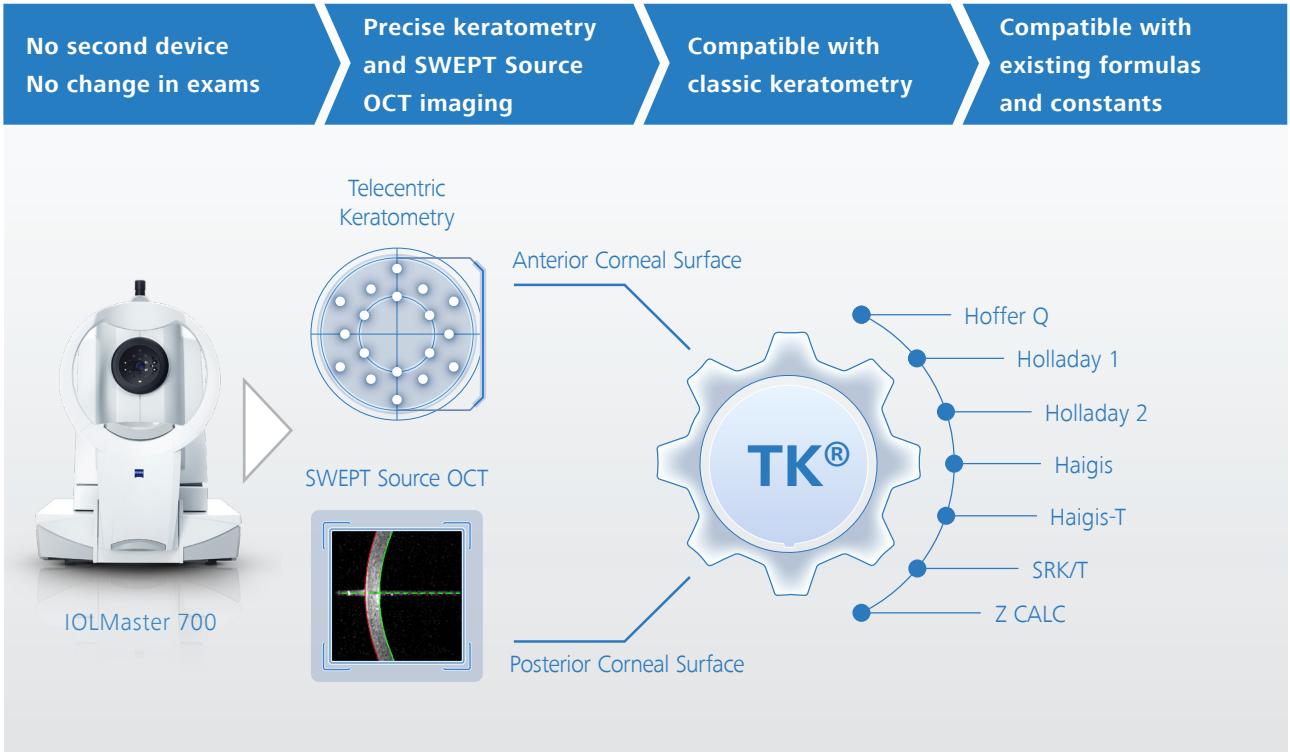
An additional significant advantage of Total Keratometry is that it can be directly incorporated in classic IOL power calculation formulas, while existing optimized IOL constants, such as ULIB constants, can still be used (Haigis W. et al. 2014).

The Total Keratometry Difference
Total Keratometry combines corneal pachymetry with anterior and posterior corneal surface measurement to assess each eye's individual corneal characteristics.

ABSTRACT

How do I benefit from Total Keratometry?

With Total Keratometry, there is no need for a second device (LaHodd et al. 2018), third-party software or an online calculator to utilize posterior corneal curvature for IOL power calculation. Therefore, clinics and practices do not have to change their measurements or calculation workflows. The IOLMaster 700 will automatically calculate Total Keratometry and incorporate it into current IOL calculations, if desired.



Total Keratometry overview

Ultimate Versatility

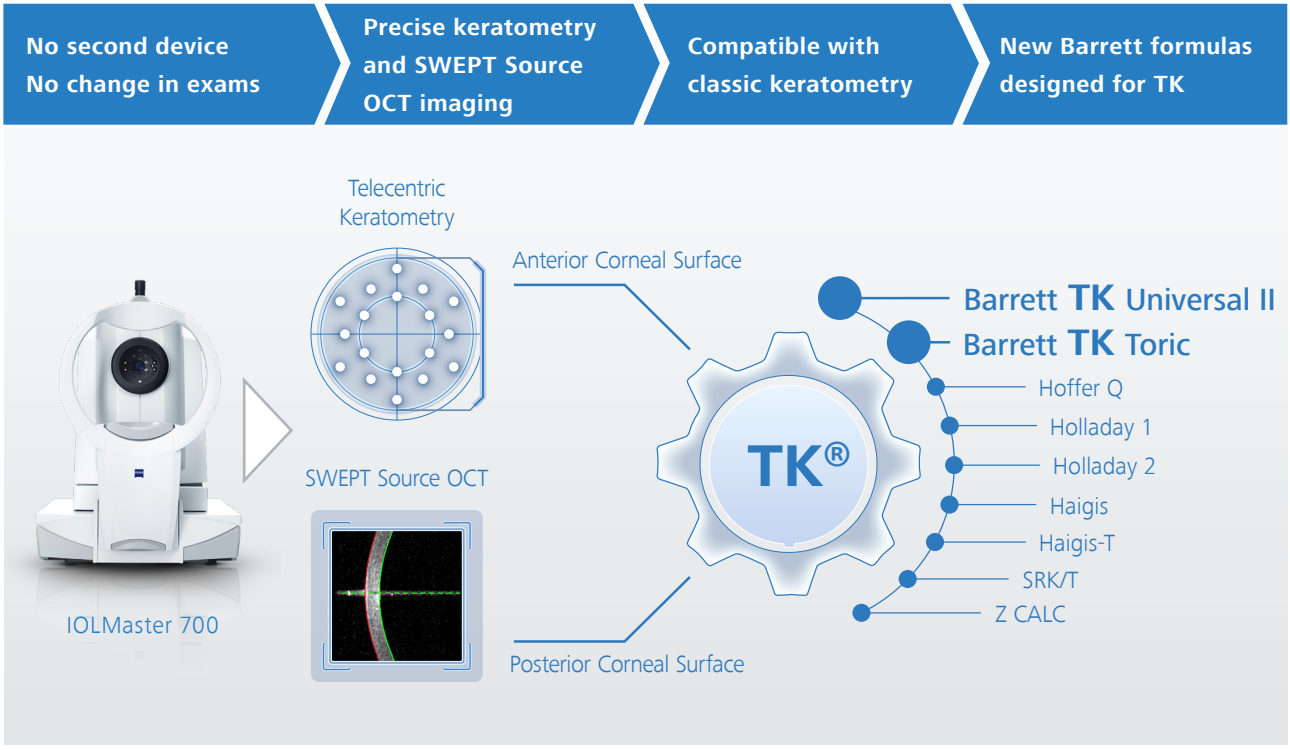
Total Keratometry offers clinics great flexibility. It can be used with classic IOL power calculation formulas and existing optimized IOL constants. Plus, there is absolutely no need for a second device, third-party software or an online calculator.

ABSTRACT

Barrett TK Formulas

The current Barrett Toric Calculator uses a unique eye model to predict the posterior corneal surface. Using Total Keratometry with the Barrett Toric Calculator will lead to overcompensation of posterior corneal astigmatism.

Because of this, Graham Barrett has developed two new IOL power calculation formulas: the Barrett TK Universal II for non-toric IOLs and the Barrett TK Toric for toric IOLs. Both new formulas use posterior corneal surface measurements instead of the eye model used by the Barrett Toric Calculator.



Barrett TK Formulas overview

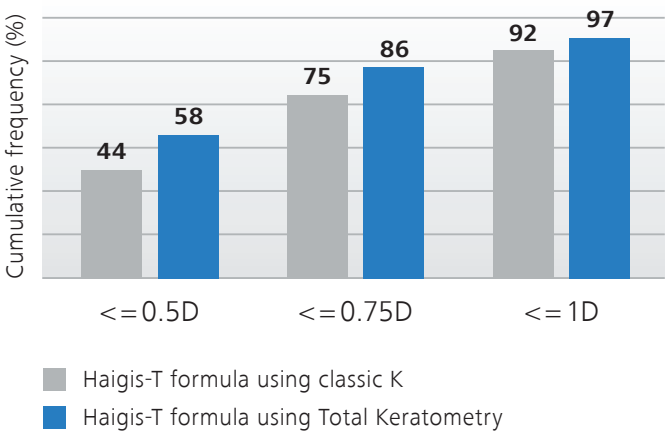
New Barrett Formulas

To further improve his classic formulas, Graham Barrett has developed two new ones for use with Total Keratometry. They use posterior corneal surface measurements instead of the eye model used by the previous formulas.

ABSTRACT

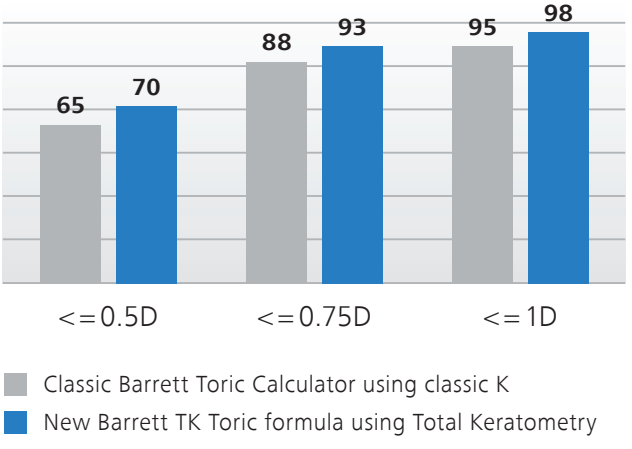
The figures below suggest that toric IOL power calculation will improve for the Haigis-T and Barrett Toric Calculator formulas when Total Keratometry is used instead of keratometry.

Haigis CYL APE



Outcomes of toric IOL calculations with the Haigis-T formula. CYL APE: Absolute prediction error for cylinder; frequency of eyes in respective CYL APE diopter ranges; N=145 eyes.*

Barrett CYL APE



Outcomes of toric IOL calculations with classic Barrett Toric Calculator and the new Barrett TK Toric formula; CYL APE: Absolute prediction error for cylinder; frequency of eyes in respective CYL APE diopter ranges; N=145 eyes.*

Improving Toric IOL Power Calculation

Initial clinical data indicate that Total Keratometry will improve the outcomes of toric IOL power calculation when compared to classic keratometry. These preliminary results are a good indication of the future success of Total Keratometry.

ABSTRACT

**Retrospective post-hoc analysis of 145 normal cataract eyes implanted with aspheric IOL, 6 weeks post-op.*

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