

Frequently Asked Questions (FAQ) - HOYA Toric Calculator (HTC 4.0)

1. Which web browser should be used?

The HOYA Toric Calculator (HTC) can be found at www.HOYAtoric.com
HTC is compatible for use with internet web browsers including:

Internet Explorer	Ver. 11 or newer
Google Chrome	Ver. 54 or newer
FireFox	Ver. 43 or newer
Safari	Ver. 9.1 or newer
MS Edge	Ver. 38.14393 or newer

2. What has changed with the new HTC versus the old?

Abulafia - Koch Regression

This 4.0 revision of the HTC provides an option that accounts for induced astigmatism from the posterior surface of the cornea. The calculator allows the User to apply the Abulafia - Koch Regression formula¹. This regression, which is based on clinical results, uses standard keratometry measurements of the anterior surface of the cornea and estimates the added astigmatic effect of the posterior cornea to produce an overall net astigmatism of the cornea. The Abulafia - Koch Regression, applied to a clinical patient cohort, has been shown to improve predictability of TIOL refractive outcomes. The regression was developed using eyes considered to be inside normal range of eye biometry with no prior corneal refractive surgery. The results of the regression may not be applicable to individual eyes with corneal abnormality (e.g. Keratoconus, post Penetrating Keratoplasty, post refractive surgery). Only anterior corneal curvatures values are appropriate for use of the Abulafia - Koch Regression.

Users of the calculator also have the option to enter keratometry values that represent the total corneal power. Many anterior segment imaging and biometry diagnostic tools, such as Scheimpflug and optical coherence tomography (OCT) imagers, can measure curvature values for both the anterior and posterior surfaces of the cornea. These instruments produce keratometry values representative of the total cornea. These total corneal power values can be entered as keratometry input and the calculator will provide astigmatism results representative of the total cornea. If the User enters total corneal power values the Abulafia - Koch Regression should be turned OFF.

Keratometer Index

The calculator assumes a default index for standard keratometry input of 1.3375 (as previously used). The User may change that index if their keratometer uses a different index value from the following options:

- 1.332
- 1.336
- 1.3375
- 1.338

Any setting change will be recalled in the browser's cookies.

Cylinder Notation

The calculator will default to displaying results using positive cylinder notation. The User may change the displayed results to negative cylinder notation if desired. Any setting change will be recalled in the browser's cookies.

Flat K

Increased range for the patient’s anterior corneal curvature value on the flat axis as measured by standard keratometry in either mm radius or diopters. The entered value must be within a range of 6.14 to 11.25 mm or 30.00 to 55.00 diopters (previously 6.75 to 9.75 mm / 35.00 to 50.00 diopters).

Steep K

Increased range for the patient’s anterior corneal curvature value on the steep axis as measured by standard keratometry in either mm radius or diopters. The entered value must be within a range of 6.14 to 11.25 mm or 30.00 to 55.00 diopters (previously 6.75 to 9.75 mm / 35.00 to 50.00 diopters).

Adjust ELP and Cylinder Power on Corneal Plane [Optional]

A measured value of Axial Length is used to estimate the Effective Lens Position (ELP) of the IOL and will adjust the TIOL cylinder power on the corneal plane. The value should be in a range from 18.0 to 30.0 mm. If Axial Length is not entered the calculator will use a fixed cylinder value power on the corneal plane that is based on average pseudophakic human eye geometry with the values shown in the Table of question 3.

Print to PDF

With the desired TIOL option selected, the User can produce a two-page formatted PDF document output. The first page is the same surgical plan information described for the print out. The new additional second page shows the results for the three TIOL options determined by the calculator. Selecting this option will cause the browser to download a PDF file which the User may store electronically or use for printed output. The User must use appropriate PDF reader software on their computer to open the file.

Export to Excel

With the desired TIOL option selected, the User can produce an Excel file which captures patient identification, data input, calculation results and TIOL options for that patient. Selecting this option will cause the browser to download an Excel file which the User may store electronically or copy and paste the information where needed to archive their patient’s results. The User must use appropriate Excel software on their computer to open the file. The Excel output will display the calculation results computed for the User’s input preferences and selected IOL.

3. What can the HTC be used to calculate?

The HTC will calculate three different cylinder power options for each patient, as well as the orientation in which the toric IOL (TIOL) should be placed and the predicted postoperative residual astigmatism to obtain optimum results. In addition, HTC provides an option that accounts for induced astigmatism from the posterior surface of the cornea by using the Abulafia - Koch Regression formula¹.

4. Why is it important to account for posterior corneal astigmatism?

Several studies reported that methods of calculation that account for posterior corneal astigmatism might be more appropriate for toric IOL calculations, because standard toric IOL calculations tend to result in undercorrection of eyes with against-the-rule astigmatism (ATR) and overcorrection of eyes with with-the-rule astigmatism (WTR). The HTC provides such an option that accounts for induced astigmatism from the posterior surface of the cornea. The calculator allows the User to apply the Abulafia - Koch Regression formula¹.

5. What are the details of the Abulafia – Koch Regression algorithm?

The Abulafia – Koch Regression, which is based on clinical results, uses standard keratometry measurements of the anterior surface of the cornea and estimates the added astigmatic effect of the posterior cornea to produce an overall net astigmatism of the cornea. This regression, applied to a clinical patient cohort, has been shown to improve predictability of TIOL refractive outcomes. It was developed using eyes considered to be inside normal range of eye biometry with no prior corneal refractive surgery.

6. How does the Abulafia – Koch Regression adjust for posterior corneal astigmatism?

Vector analysis is used in all calculations. A linear regression is derived between the estimated net corneal astigmatism and the measured astigmatism, separate for the x component and y component. To calculate the predicted total corneal astigmatism from the anterior corneal measurements, the measured corneal astigmatism was first separated into its x and y components; then, the new regression formulas were applied for each component to derive new x0 and y0 values. A new vector (the estimated net corneal astigmatism) was then reconstructed using the x0 and y0 values. For more details, please read the publication from Abulafia A et al, "New regression formula for toric intraocular lens calculations," J Cataract Refract Surg 2016; 42(5):663-671

7. Is the Abulafia – Koch Regression defaulted ON or OFF?

The default setting for use of the regression is OFF. The User must move the slide to ON if use of the regression is appropriate for TIOL calculations of the patient's eye. The final print out will indicate whether the regression was applied to the calculator results.

8. What formula does the calculator use for the cylinder calculations?

The HTC also provides optional input of axial length (AL) in a range from 18.0 to 30.0 mm that together with keratometry values and the Holladay 1 formulaⁱⁱ will estimate position of the effective lens position (ELP) of the TIOL and adjust the TIOL cylinder power on corneal plane.ⁱⁱⁱ The use of the Holladay 1 formula, includes Wong-Koch AL adjustments for eyes with AL > 25.0 mm.^{iv}

If AL is not entered the calculator will use the following fixed cylinder value power at the corneal plane that is based on average pseudophakic human eye geometry:

Lens Type	Model	IOL Cylinder Power	Cylinder Power at the Corneal Plane*	
			HOYA iSert Toric 351 or 355	HOYA Vivinex Toric XY1A
Non-toric IOL	---	0.00 D	0.00 D **	0.00 D ***
Toric IOL	T2	1.00 D	---	0.69 D
Toric IOL	T3	1.50 D	1.03 D	1.04 D
Toric IOL	T4	2.25 D	1.55 D	1.56 D
Toric IOL	T5	3.00 D	2.06 D	2.08 D
Toric IOL	T6	3.75 D	2.58 D	2.60 D
Toric IOL	T7	4.50 D	3.09 D	3.12 D
Toric IOL	T8	5.25 D	3.61 D	3.64 D
Toric IOL	T9	6.00 D	4.12 D	4.17 D

* Based on an average pseudophakic human eye.

** Equivalent models with no cylinder power (non-toric IOL) of HOYA iSert Toric 351 and 355 are HOYA iSert 251 and 255 respectively.

*** Equivalent models with no cylinder power (non-toric IOL) of HOYA Vivinex Toric XY1A is HOYA Vivinex XY1.

9. What are the advantages of doing a complete calculation including axial length (AL) input against using a fixed ratio for toric IOL power at corneal plane?

The larger differences between a complete calculation and the use of a fixed ratio for the cylinder power at corneal plane occur in eyes with an effective lens position (ELP) or spherical equivalent IOL power differing from the average pseudophakic eye. Using exact calculations, large under corrections of the astigmatism in lower powered IOLs and overcorrections in higher powered IOLs may be avoided.

10. Which ratio between IOL toricity and corneal astigmatism is used in the HTC?

By using axial length data input, IOL toricity and residual astigmatism are calculated for each particular eye in a customized fashion, using the Holladay 1 formula instead of using a fixed cylinder value power based on average pseudophakic eye.

11. Which formula should be used to calculate the spherical equivalent IOL power to introduce in the HTC?

The User could select from the pull-down tab the appropriate value of the spherical power of the lens which is determined by the User's method of choice and preferred formula for the particular eye.

12. How to calculate lens powers for multiple patients?

Each eye is considered a separate calculation. If the User wishes to start a TIOL selection for a new patient, "New Calculation" will clear all fields including patient identification and allow a new entry.

13. Are calculations of previous patients saved by the HTC?

No, the calculator does not save any portion of the calculation. It is recommended to use one of three options "Print Surgical Plan", "Print to PDF" or "Export to Excel" to archive or export the patient's calculation results.

[References]

- i. Abulafia A et al, "New regression formula for toric intraocular lens calculations," J Cataract Refract Surg 2016; 42(5):663-671
- ii. Holladay JT et al, "A three-part system for refining intraocular lens power calculations," J Cataract Refract Surg 1988; 14(1):17-24
- iii. Fam HB and Lim KL, "Meridional analysis for calculating the expected spherocylindrical refraction in eyes with toric intraocular lenses," J Cataract Refract Surg 2007; 33(12):2072-2076
- iv. Wang L et al, "Optimizing intraocular lens power calculations in eyes with axial lengths above 25.0 mm," J Cataract Refract Surg 2011; 37(11):2018-2027