P S S N E W S

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Soft Toric Contact Lens Update

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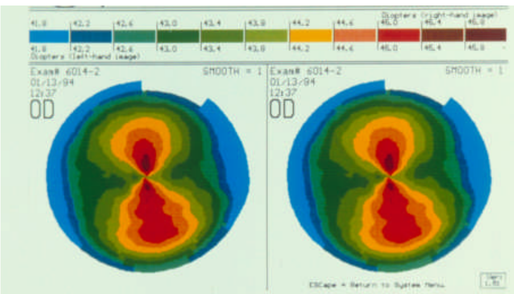
Learning Objectives:

1. *To know when soft toric lenses are indicated*
2. *To understand the different designs of soft toric contact lenses*
3. *To know the techniques for determining an accurate toric contact lens order*

Astigmatism (Figure 1) is an everyday part of our practices and our lives. Demographics indicate that over 81% of the population has astigmatism.[1] Astigmatism doesn't need to be intimidating- for patients or for contact lens practitioners.



The technology, design and materials of soft toric contact lenses have improved to such an extent that they can be manufactured more quickly, less expensively, and more accurately than ever. There is no longer any advantage to "masking" a patient's astigmatism with a spherical contact lens. Today, soft toric contact lens fitting is both easy and rewarding.

The availability of disposable trials in almost any power and axis allows for instant in-office evaluation. Disposable soft torics can provide protection from ultraviolet light, correct presbyopia, and cosmetically change eye color. The newest materials impart tremendous oxygen permeability and comfort, which can enable all-day lens wear.

For high astigmats, custom soft torics provide a tremendous range of options. Several lens designs offer corrections of up to -10.00 DC--one provides -20.00 DC--at any axis.[2] In short, today's soft toric lenses provide excellent correction, comfort, and health for almost any astigmatic patient.

The following article will present ideas to improve soft toric contact lens fitting and review the most popular toric lens options.

Patient Selection

Patients with regular cylindrical refractive errors (i.e. the two axes are 90 degrees apart) are good candidates for today's soft toric contact lenses. Optimal correction typically occurs for moderate-to-high spherical refractive error and low-to-moderate refractive astigmatism. Patients with cylinders equal to or greater than the spherical power are more likely to notice if there is not optimal correction of the cylinder. The more cylinder is present, the more critical it is for the axis to be specified correctly. This is achieved by the practitioner performing an accurate spectacle refraction and a perfect assessment of on-eye lens rotation as well as properly fitting the lens to ensure adequate (but not excessive) lens movement and consistent rotational stability.

Soft torics can be utilized for with-the-rule (WTR, minus cylinder axis is at or near 180 degrees), against-the-rule (ATR, minus cylinder axis is at or near 90 degrees), and oblique (the cylinder axis is at or near 45 or 135 degrees) astigmatism at any axis. Unlike gas permeable (GP) lenses for astigmatism, the refractive cylinder, not the residual astigmatism, is the primary concern. For example, patients with -2.00 DC (diopters cylinder) WTR in their glasses and -1.00 DC WTR on keratometry would have -2.00 DC uncorrected astigmatism with a spherical soft lens, -1.00 WTR residual astigmatism with a GP lens, and no residual cylinder with a -2.00 DC soft toric lens. As a result, soft torics would provide better vision for them. Also, patients who are intolerant or unsuccessful with GPs make good candidates for soft toric lenses. Soft torics often work better than GPs for patients with ATR astigmatism because it is easier to achieve good stability with the lens. They are also particularly beneficial for lenticular astigmatism (usually ATR). Standard soft toric lenses, however, are often of little value for patients with keratoconus or irregular astigmatism. There are, however, 11 different soft toric lens designs for keratoconus, most of which provide correction by virtue of their much-increased center thickness.[2]

Lens Design

Toric contact lenses can be manufactured with cylinder on the front or back surface of the lens. For most prescriptions, there is little difference in clinical performance between the two. For some corneas with high corneal astigmatism, a back surface toric enhances stabilization. However, if there is great disparity between the axes of the corneal and refractive cylinders, back surface torics may give unpredictable results.[3]

Methods of Stabilization

Prism Ballasting/Periballasting

Incorporating between 0.75 and 2.0 D of base down prism is an excellent way to stabilize the lens. The success of this modality, however, has little to do with gravity. Rather, it is thought that the "watermelon seed" effect (Figure 2) plays the predominant role in stabilization.[4]

The theory is best illustrated by the fact that, if a moist wedge is expelled, it moves in the direction away from the wedge apex. Thus, the upper eyelid forces the thick edge downward. Theoretically, it may seem that a vertical imbalance might ensue, especially for unilateral fits, but this rarely happens clinically.

Many of today's designs are actually periballasted, which means that the lens has no prism in the optical portion of the lens, but rather, only in its periphery. This allows for less lens edge-lid interaction; a thinner lens profile inferiorly; larger optical zones; and less prismatic effect.[5]

Lenses for ATR astigmatism require less prism than for WTR. For ATR lenses, the periphery is thickest in the horizontal meridian, allowing a thin zone effect to enhance stability.[6] This is one reason that soft torics are the lens of choice for ATR corneas. If the thickness of prism ballast impacts patient comfort or ocular health, a lens should be selected with a purely thin zone stabilization design.

Dynamic Stabilization and Thin Zones

This effect, also called double slab-off, is commonly achieved by thinning the upper and lower portions of the lens. No prism is necessary. It is technically a “double thin zone.” As a result, the thickest part of the lens is the center, which then positions appropriately between the eyelids. This design may be more comfortable, but less rotationally stable, than prism ballasting. However, unlike prism-ballasted designs, they are not affected by head position. They are also the design of choice in the rare event of a vertical imbalance created by a unilateral prism-ballasted soft toric lens fit.[5]

A popular subset of the thin zone design is accelerated stabilization, which utilizes four zones with a thicker profile placed at the midperiphery of the lens. The thinner portions lie under the open eyelids. It is known for its quick re-orientation speed.[5] This is particularly useful during our current COVID-19 pandemic, when “staggering patients” can be time consuming due to the importance of fully disinfecting each examination room in between patients, and minimizing patients’ exposures to others in the waiting room is of paramount importance.

While older lens designs sometimes incorporated truncation, newer designs may offer a combination of stabilization methods, including prism, periballasting, thin zones, and eccentric lenticulation. The latter involves removal of excess material on the front lens surface. It is most beneficial for front torics and oblique cylinder corrections.

Keep in mind that each individual soft toric lens design, due to differences in material, diameter, base curve, prescription, and stabilization method, will interact with the eye and eyelids in its own way. As a result, they will exhibit different amounts and directions of rotation on a given eye. Fortunately, most soft toric lenses rotate no more than 10 degrees from the zero position.[7]

Determining the Lens Order

First, perform a brand new refraction; then determine the theoretical contact lens prescription by adjusting for vertex distance in both meridians. Then, utilize one of the following methods.

- L.A.R.S. Apply a trial contact lens with parameters as close as possible to the sphere, cylinder, and axis of the vertexed refraction (+/- 20 degrees and +/- 1.00 D). In general, the priority is to get closest to the axis, followed by the cylinder, then the sphere. Some consider it more critical to be close to the refraction when using back surface toric lenses.[3]

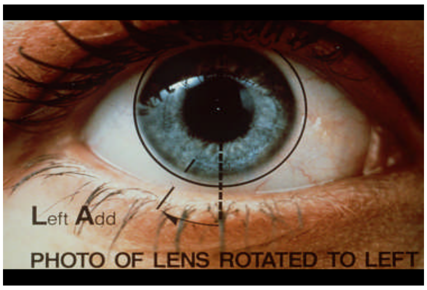
  According to Dr. Graeme Young, the following adjustments should be made to the spectacle prescription when selecting a trial soft toric contact lens:[7]

  - Correct for vertex distance
  - Round down to the nearest available cylinder power
  - Round to the nearest cylinder axis

  Utilize the manufacturer’s recommendation regarding minimum time to settle. Assess rotation. Almost all soft torics contain markings to aid in the determination. It can be assessed utilizing:

a trial frame with a low-powered cylindrical trial lens to mark the rotated axis; a slit lamp beam aligned with the marking- then read the rotation from the axis scale; a protractor reticle in one of the slit lamp oculars; and by a gross estimate. The latter is the most common, but least accurate. Most practitioners visualize rotation in clock hours, with 30 degrees equaling one clock hour. When doing this, it is important to avoid adding any amount of lateral decentration into the rotation assessment. One can make sure by passing the slit lamp beam through the toric lens marking and the optical center of the lens, rather than through the center of the pupil.

Next, compensate for lens rotation by amending the axis of the refraction (not the axis of the trial lens) for the contact lens order. If the lens rotates clockwise--i.e. to the left--add the amount of rotation to the axis value; if it rotates to the right, subtract (L.A.R.S.) (Figure 3)



During the diagnostic fitting, pay close attention to the overall fit of the lens. Tightly-fitting lenses can lock in at unpredictable and inaccurate orientations. They can also result in a compromised over-refraction and/or end point acuity.[8] Loosely-fitting lenses, meanwhile, can negate the stabilization methods, resulting in variable rotation.

Based on eyelid and anatomical factors, the trial and dispensed lenses (if identical in base curve, power, and brand) should rotate to the same point. If not, the L.A.R.S. compensation will be rendered obsolete. As a result, it is important to avoid utilizing trial lenses that are worn or deposited; they could rotate excessively or lock down into one position. Fortunately, most trial lens sets contain disposable lenses in a multitude of powers and axes.

- Sphero-cylindrical over-refraction. This method is used primarily for custom-designed planned replacement lenses. If there is rotation of the trial lens, then a cross-cylinder effect is induced and a sphero-cylindrical over-refraction (SCOR) will need to be performed. Because the axes of the trial lens and over-refraction will likely be different, the powers cannot simply be added together. There are three methods to obtain the resultant prescription: input the numbers into a pre-programmed calculator or computer program (most manufacturers have an online toric calculator and/or a phone app), call the manufacturer's consultant with your measurements (they will input them into their calculator), or place the powers of the trial contact lens and the OR into a trial frame and read the resultant with a lensometer. With four cells, there is just enough room in the trial frame for both sphero-cylindrical powers placed at their appropriate axes.

Some controversy exists over the role of trial lens rotation in determination of the resultant power. Some online calculators and apps do not require on-eye estimation of lens rotation. They consider the amount of rotation with their lenses to be "too minimal" to make a difference in the over-refraction. Although that's an estimate, the fact that lens flexure, draping, and tear layer effects are accounted for--unlike the empirical or L.A.R.S. methods—leads to good accuracy with these calculators for most prescriptions. Of course, as cylinder amounts increase, so do the resultants if there is rotation. If you utilize one of these calculators and want to be exact, input the lens power at its actual position. For example, a lens axis 180 rotated 10 degrees to the right is actually sitting at axis 010 (R.A.L.S.) Next, input the over-refraction and compute the resultant. Lastly, take the computed final axis and compensate for lens rotation (L.A.R.S.)[9] For this example, if the calculator computed the final axis to be 175, order axis 165. These steps can also be utilized with the trial frame method. Other calculators (e.g. www.eyedock.com) do take trial lens rotation into account.

For disposable trial lenses on low-to-moderate astigmatic patients, a spherical-only over-refraction should suffice because the trial lens sphere and cylinder power often match the refraction (after correcting for vertex distance). Of course, this holds if there is little to no rotation. Otherwise, a combination of a spherical over-refraction and the L.A.R.S. method should suffice--if the lens rotation is not excessive.

- Empirical. This method is primarily used for single or multiple-packaged lens designs which offer no fitting sets but excellent exchange warranties. Many companies allow the first lens to be ordered empirically, and then will send a subsequent lens or lenses at no charge until the best, final lens is determined. This is the simplest method of the three, but it also has the most potential for errors because it does not take into account tear layer power effects or rotation, draping, or flexure of the lens on the eye. It works best for lenses with minimal cylinder which do not rotate. Simply order the power of the vertex-adjusted spectacle refraction. Many custom toric manufacturers will also ask for the horizontal visible iris diameter (HVID) and keratometry readings and they will determine the base curve and lens diameter.

Note that all three of these methods are affected by errors in refraction. Refraction is the one variable that the practitioner can control. Keep in mind the American National Standards Institute (ANSI) standards for the labeling of soft toric contact lenses. For cylinders between 0.50 and 1.50 D, the axis tolerance is +/- 8 degrees. Above 1.50 D, the tolerance is 5 degrees. This, coupled with either ignoring (empirical method) or mis-estimating (L.A.R.S.) lens rotation can lead to an improper order. Therefore, it is important for the refraction to be performed to the nearest degree.

Multifocals

There are currently 24 soft toric multifocal lenses available today.[10.] They include aspheric center distance, aspheric center near, concentric center distance, and concentric center near designs. When fitting, one must consider the optical limitations of an astigmatic presbyopic eye and the contact lens needed to correct it; not all patients will succeed with this modality. To improve your patients' outcomes, correct their astigmatism at distance first. After proper determination of sphere, cylinder, and axis, then determine the appropriate addition power for both eyes. As always, follow each company's fitting guide for optimal success.

Toric Tips

- Don't hesitate to fit soft torics. Today's lenses are more reproducible and with better optics than in the past. There is no need to try to "mask" 0.75-1.00 D of cylinder anymore.
- The more cylinder present, the more critical the axis alignment and need for lens stability.
- Many soft torics still rotate slightly on the eye due to lid configuration, corneal shape, and blink mechanisms. The L.A.R.S. (Left Add, Right Subtract) method is the most efficient way to ensure optimal visual acuity. If the lens rotates clockwise (i.e. to the left) **add** the degrees of rotation to the

refractive cylinder axis when ordering the contact lens; if it rotates to the right, **subtract.** The scribe mark should orient in the same position as in the trial lens. (Figure 3)

- Despite the improvements in materials and design, soft toric lenses still require more time and effort to fit, order, and dispense than soft spheres. Make sure your professional fees reflect that.
- Soft torics are the correction of choice for corneal against-the-rule astigmatism due to the potential instability of rigid lenses on these eyes.
- For higher amounts of corneal cylinder, consider a back-surface soft toric design.
- Set the right expectations from the beginning. For example, "when handling your lens, it may feel thicker than your previous lens, but it may be easier to insert and remove." Or, "it may take a few minutes for the lens to settle and for your vision to clear right after you apply it."

Case Presentation #1:

A 26 year-old patient has the following manifest refraction: -5.00 -1.75 X 178.

Your daily disposable toric of choice comes in spherical powers of plano to -6.00 (.25 D steps); cylinder powers of -0.75, -1.25, -1.75 and -2.25; and axes every 10 degrees around the clock. What would be your initial trial lens selection?

Discussion of Case Presentation #1:

The refraction, corrected for vertex distance, is -4.75-1.50 X 178. So the initial trial lens selected should be: -4.75-1.25 X 180. It is always advisable, when between two cylinder powers, to select the lower one. For axis, select the one closest to the axis of the refraction; if directly in between two options, select the axis closest to 90 or 180 degrees.

Case Presentation #2:

Your patient's manifest refraction is -1.00 -1.75 X 172. A trial lens with parameters of -1.25-1.75 X 170 is placed on the eye. It centers and moves well with the blink, but rotates 3 degrees to the right. For an empirical order of a custom soft toric lens, what would you order?

Discussion of Case Presentation #2:

Using the L.A.R.S. method, order -1.00 -1.75 X 169. The lens is rotated to the right, so subtract 3 degrees from the spectacle Rx to obtain to final power.

CONTINUING EDUCATION QUIZ

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Quiz Questions

1. Your patient presents with a refractive error of -1.50 - 2.25 X 087. Keratometry readings are 43.25 @ 180/ 43.00 @ 090. Contact lens options for this patient include:
   a. Soft toric contact lenses
   b. GP prism-ballast front surface toric contact lenses
   c. GP bitoric contact lenses
   d. a and b

2. Which of the following is a true statement?
   a. The majority of patients with astigmatism are against-the-rule.
   b. The population as a whole becomes more with-the-rule with age.
   c. Over three quarters of the population has some degree of astigmatism.
   d. About one percent of the population has greater than or equal to 2 diopters of astigmatism.

3. Which of these classifications is correct for the following prescription: +2.50 - 3.75 X 169?
   a. With the rule astigmatism
   b. Against the rule astigmatism
   c. Oblique astigmatism
   d. Irregular astigmatism

4. Given for the right eye:
   K= 44.50 @ 175; 44.75 @ 085
   SR= -3.00 - 1.25 X 175

   The residual astigmatism present with a soft toric contact lens would be:
   a. -1.25 D X 175
   b. -0.25 D X 175
   c. 0 D
   d. -0.25 D X 085

5. Which of the following statements is true:
   a. Soft toric lenses are a poor choice for a patient with lenticular astigmatism.
   b. Soft torics are an excellent option for the correction of irregular astigmatism.
   c. Soft torics perform better than GP spheres for moderate ATR corneas.

d. GP spheres provide little benefit for low-to-moderate WTR corneas.

6. Which of the following refractive errors has the highest probability for successful correction with a soft toric contact lens?
   a. -5.00 -1.25 X180
   b. -5.00 -1.25 X090
   c. -0.25 -1.25 X180
   d. -0.25 -1.25 X090

7. Which of the following is *not* a common method to stabilize the rotation of a soft toric contact lens?
   a. Periballasting
   b. Prism ballasting
   c. Front-surface toricity
   d. Thin zones

8. Your patient's refraction and keratometry readings are as follows:
   SR= -6.75 - 2.00 X 173
   K= 46.25 @ 168/ 47.75 @ 078

   You wish to order a toric soft contact lens empirically. Your brand of choice offers axes every 5 degrees. Which of the following lenses would you order?
   a. -6.25 -1.75 X 175
   b. -6.75 -2.00 X 173
   c. -6.25 -1.50 X 175
   d. -6.50 -1.75 X 173

9. Which of the following is *NOT* an accepted method for the determination of soft toric contact lens rotation?
   a. Estimate (e.g. clock-hours)
   b. Keratometer
   c. Slit lamp reticle
   d. Cylindrical lens in trial frame

10. Which of the following are characteristics of a flatly fitting soft toric contact lens:
   a. Visual fluctuation
   b. Variable rotation
   c. Excessive movement with the blink
   d. All of the above

11. During trial lens fitting, the lens' scribe mark positions itself at 5:30. How much and in which direction is the axis rotation?
   a. 15 degrees to the right
   b. 30 degrees to the left
   c. 5 degrees to the right
   d. 15 degrees to the left

12. An empirically-ordered soft toric contact lens is rotated 35 degrees to the left. The rotation is stable and the lens moves less than .25 mm with the blink. To improve success with this patient, order:
   a. A flatter base curve
   b. The original contact lens axis + 35 degrees
   c. A larger diameter
   d. The original contact lens axis - 35 degrees

13. According to Young and Hickson-Curran, most soft toric lenses rotate no more than____ degrees:

a. 5
b. 10
c. 20
d. 25

14. Your patient presents for soft toric contact lenses and you obtain the following data for the right eye.

SR= -3.50 -1.00 X 150
Dx CL= -2.50 -1.00 X 180
O-R= -1.25 -0.25 X 141
Rotation= 10 degrees to the right

Which axis would you order for this patient?
a. 140
b. 150
c. 160
d. 170

15. Your patient presents for soft toric contact lenses and you obtain the following data for the left eye. What is your final contact lens order for this patient?

Spectacle Rx: -2.50 -1.00 X 088
Trial CL: -1.00 -1.00 X 093
O-R: -1.25 -0.25 X 092
Rotation: 5 degrees to the right
a. -2.25 -1.25 X 086
b. -2.50 -1.00 X 088
c. -2.25 -1.25 X 093
d. -2.25 -1.25 X 083

16. You have performed a sphero-cylindrical over-refraction through the phoropter. The axes of your trial soft toric contact lens and the over-refraction (OR) are 30 degrees apart. Which is *NOT* a good method of determining the exact resultant power so that you can order the correct sphere, cylinder, and axis for patient?
a. Input data into cross-cylinder calculator
b. Call company's consultation line
c. Add trial lens power and OR; add 15 degrees to trial lens axis
d. Place trial lens power and OR in trial frame and read resultant off lensometer

17. Which of the following is true regarding the ANSI standards for the labeling of soft toric contact lenses in the United States?
a. Every contact lens is labeled with its exact sphere, cylinder, and axis.
b. There are no industry guidelines for the labeling of soft toric contact lenses in the US.
c. For a soft lens with 1.50 D of cylinder, the listed axis can be 8 degrees different than the actual axis.
d. All contact lens designs provide True Specification Labeling on demand.

18. The amount of prism diopters in toric soft lenses is about:
a. 0.5
b. 1.5
c. 2.5
d. 3.5

19. Which of these classifications is correct for the following prescription: +1.50 + 2.75 X 175?
a. With the rule astigmatism

b. Against the rule astigmatism
c. Oblique astigmatism
d. Irregular astigmatism

20. Which of the following is TRUE concerning soft toric multifocals?
a. They haven't been invented yet
b. They are available only in center near optics
c. There are currently 24 different lenses on the market
d. There are very limited add powers