

Stable Astigmatism?

**BY CHRISTOPHER L. BLANTON, MD; MARGUERITE B. McDONALD, MD;
AND LOUIS E. PROBST, MD**

CASE PRESENTATION

A 31-year-old white woman presents for a LASIK consultation. She discontinued wearing her toric soft contact lenses 4 days earlier. Her slit-lamp examination, pachymetry, and ocular and general health are completely normal. Her questions concentrate on her astigmatism, specifically whether or not it is stable and how it would be treated with a laser.

The patient's manifest refractions from her referring doctor are -5.75 -2.25×175 OD and -5.75 -2.25×175 OS, both correcting to 20/20. The Topographic Modeling System TMS 4 (Tomey Corp.) shows simulated keratometry values of K1 44.82 @ 004 and K2 47.30 @ 094 in her right eye (Figure 1A) and K1 45.17 @ 176 and K2 47.53 @ 086 in her left eye (Figure 1B). Measurements with the WaveScan Wavefront System (Abbott Medical Optics Inc.) at a 4-mm prescription calculation are -5.32 -2.80×11 OD (Figure 2A) and -5.47 -2.78×176 OS (Figure 2B). A subsequent WaveScan-assisted manifest refraction yields the following results: -5.75 -2.50×180 OD and -5.50 -2.75×180 OS, both also

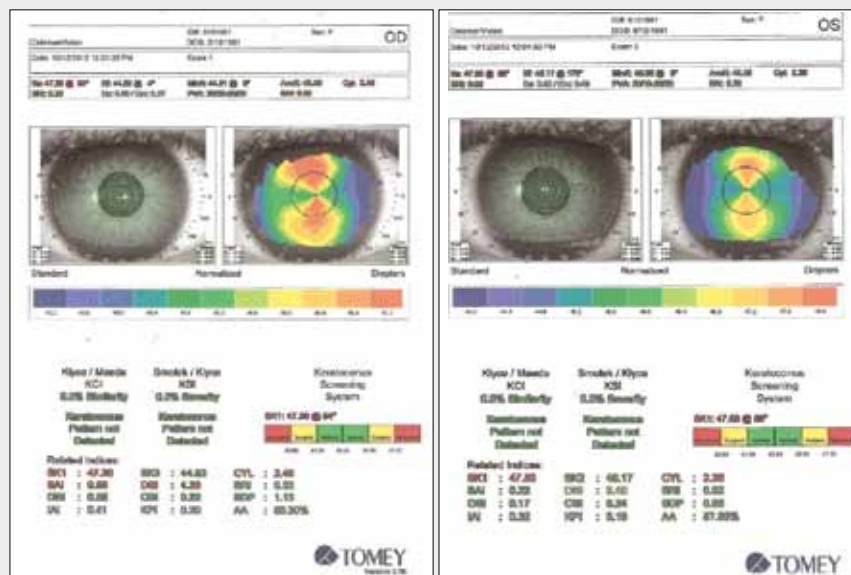


Figure 1. Scans of the patient's right (A) and left (B) eyes with the Topographic Modeling System TMS 4.

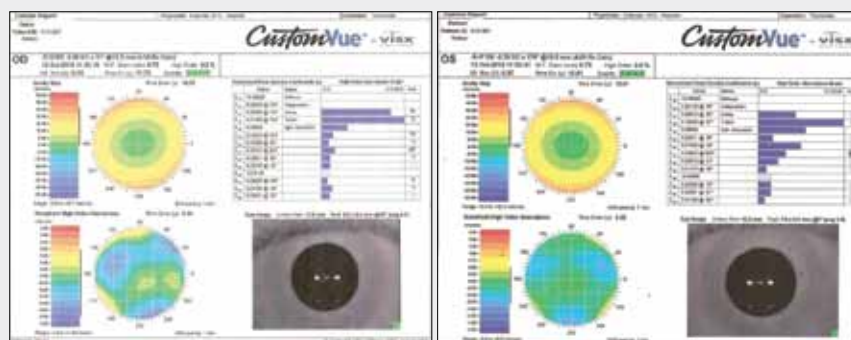


Figure 2. Measurements of the patient's right (A) and left (B) eyes taken with the WaveScan Wavefront System.

correcting to 20/20.

How would you answer this patient's initial questions?

—Case prepared by Stephen A. Coleman, MD.

CHRISTOPHER L. BLANTON, MD

This patient inquires about two issues regarding her astigmatism: stability and the actual mechanism of treatment with the laser. Stability implies *at least* two measurements separated by a reasonable amount of time. We have a refraction from her referring doctor and her recent discontinuation of soft toric contact lenses. The missing pieces of information are when the refraction was done and what her contact lens history was at the time of that refraction.

The most prudent course of action would be to have the patient remain out of her contact lenses and return in 1 week for more measurements. I would also measure her spectacles on a lensometer and request her previous chart notes to maximize the amount of information available. A perfect scenario would be to have three separate measurements in sequence in which the last two differ by no more than 0.50 D with regard to sphere and cylinder.

The second task is explaining laser treatment of astigmatism. I would show the patient her topography and explain the color-coding with regard to steeper and flatter areas. I would also use this visual aid to demonstrate the orthogonal nature of her astigmatism. I would explain that the laser will remove tissue to make her steep cornea flatter. Because certain regions are steeper than others, the laser will place more pulses in those areas, thereby turning her football-shaped cornea into one that more closely resembles a basketball (a time-honored analogy).

MARGUERITE B. McDONALD, MD

I think this patient has an excellent chance of achieving full correction of her refractive error, specifically her astigmatism. She should stay out of her toric soft lenses for at least 1 month, however, to allow for corneal unmolding. At that point, the manifest refraction, topography with keratoconus detection software, and wavefront analysis should be repeated. Some patients take longer than 1 month to unmold from toric soft lens wear; if the surgeon suspects this to be true here, the patient should be sent away for another month or until stability is documented.

The TMS topography maps were generated using the adjustable color scale instead of the fixed standard scale developed by Klyce. The standard Klyce scale has been adopted by the American National Standards Institute and the International Organization for Standardization, because it makes it easy to separate true pathology (such as keratoconus and pellucid marginal degeneration) from measurement noise. I would strongly recommend employing the raw data to generate a topography map that uses the fixed standard scale developed by Klyce.

A wavefront-based treatment is advisable. Although

the patient's higher-order aberrations represent only 4.2% of the total optical error in her right eye and 2.9% in her left, they are primarily coma, trefoil, and spherical aberration, which are visually disturbing.

LOUIS E. PROBST, MD

This is a fantastic educational case that illustrates many of the subtle variations that can occur during preoperative assessment and planning and have a significant impact on the outcome.

Although I will comment on the results as they are currently presented, this patient is not ready for a refractive assessment in my opinion. I believe that patients should be out of their soft toric contact lenses for 3 weeks prior to assessment to ensure the maximum potential of stability. The topographic maps of her right eye indicate a subtly but noticeably skewed pattern that I would like to see resolve before considering LASIK. Posterior corneal imaging with the Orbscan (Bausch + Lomb) or Pentacam Comprehensive Eye Scanner (Oculus Optikgeräte GmbH) as well as a cycloplegic refraction should be reviewed. Finally, the limbal ring on the WaveScan of the patient's right eye may not be appropriately aligned, which can be confirmed with the clearer image on the WaveScan itself.

Obviously, the most dramatic variation is the change in the axis of the astigmatism in the patient's right eye between the various measurement techniques and times. The refraction must be consistent to ensure a good refractive result. This amount of variation with a higher level of astigmatism could result in less than an ideal outcome. The first challenge is to discover the source of the variation in the patient's right eye. It could occur because of corneal and refractive instability but is more likely due to measurement error.

Because the results were different at the same examination time, varied between machines, and even varied for the left eye between the WaveScan and the wavefront-adjusted manifest refraction (WAMR), my first concern is measurement error due to a tilted head during the measurement process. It is not uncommon for patients to tilt their heads to one side as they lean onto the chinrest of the measurement device, and technicians are often so focused on the details of the machine itself that they may not notice. Different degrees of tilt on different machines will yield varying axial measurements. For this reason, it is necessary to ensure that the axis of the topography, Orbscan or Pentacam, WaveScan, wavefront, cycloplegic refraction, and WAMR match to within a few degrees. If they do not, the tests should be repeated with careful attention to head position. In my experience, the WaveScan

is extremely accurate at deriving the axis of astigmatism when the head is correctly positioned. This result should be confirmed with a WAMR, which should yield excellent visual results. Refractive surgery should not be considered until consistent measurements are achieved.

The answer to the patient's question is that we do not know if her astigmatism is stable at this time but that we do know that her axis measurements are inconsistent. I would suggest that she leave her contacts out for another 3 weeks and repeat testing with additional posterior corneal imaging, a cycloplegic refraction, and a WAMR with the technician's careful attention to the position of the patient's head. Refractive surgery can only be considered when the topography is normal and the refractive measurements are repeatable and consistent. ■

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