

# HIGH ASTIGMATISM WITH UNDERLYING ECTASIA

What are the options for reducing the patient's spectacle dependence?

BY PRIYA M. MATHEWS, MD, MPH; KANIKA AGARWAL, MD; AND FRANCIS W. PRICE JR, MD

## CASE PRESENTATION

A 58-year-old man is referred for a refractive surgery evaluation. The patient has no significant ocular history and has never undergone eye surgery. He began wearing glasses at a young age and desires spectacle independence.

On examination, the patient's uncorrected distance visual acuity is 20/100 OD and 20/80-1 OS. His BCVA is 20/20 OU with a manifest refraction of  $-3.00 +4.00 \times 010^\circ$  OD and  $-2.00 +3.50 \times 010^\circ$  OS. His current spectacle prescription is  $-2.50 +4.00 \times 010^\circ$  OD and  $-1.75 +3.50 \times 010^\circ$  OS. His Brightness Acuity Test is 20/30 OU.

The patient is happy with the quality of his BSCVA. He has never worn contact lenses. He reports no problems with driving at night or recent changes in his manifest refraction.

A slit-lamp examination finds mild corneal steepening and thinning just inferior to the corneal apex and a 1+ nuclear sclerotic cataract in each eye. The anterior segment of each eye is otherwise unremarkable. A fundus examination of both eyes is within normal limits, and the findings are confirmed with macular OCT imaging. Both eyes have a posterior vitreous detachment. Figures 1 and 2 present the biometry and corneal topography measurements, respectively.

How would you proceed?

—Case prepared by Priya M. Mathews, MD, MPH

| OD<br>right          |                   | IOL calculation      |                    | OS<br>left |                    |
|----------------------|-------------------|----------------------|--------------------|------------|--------------------|
| ☉                    |                   | ☉                    |                    | ☉          |                    |
| Eye status           |                   |                      |                    |            |                    |
| LS: Phakic           | VS: Vitreous body | LS: Phakic           | VS: Vitreous body  |            |                    |
| Ref: ---             | VA: ---           | Ref: ---             | VA: ---            |            |                    |
| LVC: Untreated       | LVC mode: -       | LVC: Untreated       | LVC mode: -        |            |                    |
| Target ref.: +0.00 D | SIA: +0.00 D @ 0° | Target ref.: +0.00 D | SIA: +0.00 D @ 0°  |            |                    |
| Biometric values     |                   |                      |                    |            |                    |
| AL: 24.85 mm         | SD: 6 μm          | AL: 24.77 mm         | SD: 5 μm           |            |                    |
| ACD: 3.81 mm         | SD: 4 μm          | ACD: 3.81 mm         | SD: 5 μm           |            |                    |
| LT: 4.36 mm          | SD: 38 μm         | LT: 4.37 mm          | SD: 9 μm           |            |                    |
| WTW: 12.0 mm         |                   | WTW: 12.1 mm         |                    |            |                    |
| SE: 45.01 D          | SD: 0.01 D        | K1: 42.94 D @ 94°    | SE: 45.34 D        | SD: 0.02 D | K1: 43.78 D @ 96°  |
| ΔK: -4.35 D @ 94°    |                   | K2: 47.29 D @ 4°     | ΔK: -3.23 D @ 96°  |            | K2: 47.01 D @ 6°   |
| TSE: 45.34 D         | SD: 0.03 D        | TK1: 43.21 D @ 94°   | TSE: 45.63 D       | SD: 0.03 D | TK1: 44.05 D @ 95° |
| ΔTK: -4.47 D @ 94°   |                   | TK2: 47.68 D @ 4°    | ΔTK: -3.28 D @ 95° |            | TK2: 47.33 D @ 5°  |

Figure 1. Biometry measurements of both eyes with the IOLMaster 700 (Carl Zeiss Meditec).



was implanted with a target refraction of -2.00 D. After the refraction stabilized, patients who achieved acceptable visual acuity with manifest refraction were given the option of undergoing RLE.

We found that a staged approach offered two advantages. First, if manifest refraction could not achieve acceptable visual acuity, then patients could be fit for a contact lens without the challenge of a toric IOL in situ. Second, both the sphere and cylinder could be fine-tuned based on the postoperative refraction. Patients' UCVA was 1 line better after the staged procedure compared to primary toric IOL placement.

Given that keratoconus increases higher-order aberrations, I would advise the patient against a multifocal or extended depth of focus IOL. One alternative would be a monovision or blended vision strategy with a standard monofocal IOL or monofocal plus lens such as the Tecnis Eyhance (Johnson & Johnson Vision) in one or both eyes. A second option would be to implant an IC-8 Aphera (Bausch + Lomb) in one eye.

The patient may be difficult to satisfy because his current BSCVA is 20/20 OU. In the right eye, the incision would be placed on the axis of astigmatism to decrease the cylinder. The same approach would be used in the left eye if implantation of an IC-8 lens is planned. A trial with lenses simulating a targeted monovision or blended vision result, while not perfect, would give him an idea of that form of visual correction and his level of comfort with it. A retina consultation would help with informed consent.



#### WHAT I DID: PRIYA M. MATHEWS, MD, MPH

The patient had underlying corneal ectasia, specifically keratoconus, in both eyes. He was aware of his high astigmatism but not his corneal disease. Based on my experience, subtle corneal irregularities and disease are underdiagnosed in patients whose visual acuity objectively corrects to 20/20. As this case illustrates, it is important to include corneal topography in the evaluation of any individual for refractive surgery, whether corneal or lens based.

The patient had experienced a mild myopic shift, but his glasses prescription remained stable. His BCVA was 20/20 OU, and he was happy with the quality of his BSCVA—something I inquire about when evaluating anyone who has irregular astigmatism for refractive surgery. Someone who must wear hard contact lenses to achieve an acceptable quality of vision is not a suitable candidate for an advanced technology IOL.

The patient desired the greatest degree of spectacle independence possible. Corneal irregularity ruled out laser vision correction. Early cataracts and posterior vitreous detachments, however, made him a candidate for bilateral RLE. We discussed the procedure and his IOL options at length. I explained that the irregularity of his corneas made a diffractive multifocal IOL a poor choice and discussed his other options:

- **Option No. 1: A toric monofocal IOL.** The amount and axis of astigmatism in each eye were similar on biometry and corneal topography. The probability of a residual refractive error after RLE was high, however, so the patient's ineligibility for a postoperative refractive enhancement was a concern.

- **Option No. 2: An LAL.** I explained to the patient that, although the implantation of an LAL allows for postoperative refractive adjustments, the Light Delivery Device might be unable to correct his residual refractive error fully, particularly in the right eye, which had greater than 4.00 D of corneal astigmatism.

The patient elected to receive an LAL in each eye with the understanding that he might need to wear glasses to see at all distances. As expected, his residual refractive errors after RLE were significant before the light adjustments; his manifest refraction was +1.75 -4.50 x 100° OD and +0.25 -3.25 x 102° OS.

Four light adjustments and two lock-in treatments were performed (a total of six treatments with the fourth adjustment off-label) to address the patient's refractive error. At the final visit, his UCVA was 20/20-2 and J2 OD and 20/20-1 and J2 OS. His BCVA was 20/15 OD with a manifest refraction of -0.25 -1.00 x 090° and 20/15 OS with a manifest refraction of -0.25 -1.00 x 065°. Thankfully in this case, the patient's subjective vision was the best it had ever been, and he achieved spectacle independence at all distances. In situations like this one, however, it is vital to set realistic expectations from the beginning. ■

1. Goebel GI, Price MD, Price FW Jr. Staged toric IOL exchange in keratoconus patients after cataract surgery. Paper presented at: World Cornea Congress; September 28, 2022; Chicago, IL.

#### GUEST SECTION EDITOR PRIYA M. MATHEWS, MD, MPH

- Cataract, refractive, and corneal surgeon, Center for Sight, Sarasota, Florida
- priya.m.mathews@gmail.com
- Financial disclosure: Consultant and speakers bureau (Alcon, Johnson & Johnson Vision, RxSight)

#### KANIKA AGARWAL, MD

- Massachusetts Eye and Ear Infirmary, Boston
- Instructor in Ophthalmology, Harvard Medical School, Boston
- kanika\_agarwal@meei.harvard.edu
- Financial disclosure: None

#### FRANCIS W. PRICE JR, MD

- Medical Director, Price Vision Group, Indianapolis, Indiana
- frankprice@pricevisiongroup.net
- Financial disclosure: Consultant (Bausch + Lomb)