

Upside Down Multifocal IOL

**BY FRANK A. BUCCI JR, MD; MARK KONTOS, MD; TOBIAS H. NEUHANN, MD;
NIRAJ PATEL, MD; RICHARD TIPPERMAN, MD; AND TAL RAVIV, MD**

We at Cataract & Refractive Surgery Today would like to thank Bonnie Henderson, MD, for her work as one of the section editors of the "Cataract Surgery Complex Case Management" column. We would also like to take this opportunity to thank Thomas Oetting, MS, MD, and Tal Raviv, MD, for their continued efforts on this column and to welcome Audrey Talley Rostov, MD, as a new section editor in 2013.

—Gillian McDermott, MA, editor-in-chief

CASE PRESENTATION

A 74-year-old woman is referred to you by her primary ophthalmologist for an evaluation of a reversed IOL optic. Seven months prior to this visit, she underwent cataract surgery on her right eye with the insertion of a Tecnis Multifocal 1-Piece IOL (Abbott Medical Optics Inc.) that was inadvertently placed upside down (Figure). The unexpected postoperative refraction of -2.00 D was welcomed by the patient, a former hyperope who had used monovision contact lenses but could now read without correction. One month later, the surgeon implanted an AcrySof Single-Piece IOL (SA60AT; Alcon Laboratories, Inc.) in the patient's left eye with a plano result.

Over the ensuing months, her myopia regressed toward plano, and the corrected vision decreased in her right eye. The disappointed patient could no longer read unaided and wanted to see up close again.

On examination, the visual acuity in her right eye is a weak 20/50 with a refraction of approximately +0.25 D. Her left eye has a plano 20/20 refraction. An examination shows a well-centered, reversed multifocal IOL in the bag in the patient's right eye. The anterior capsule is fibrotic and whitened, about 4.5 to 5 mm in diameter with 360° of anterior capsular overlap. There is 3+ diffuse, pearly, posterior capsular opacification (PCO). Her left eye has a well-placed monofocal IOL with no PCO. A repeat IOL calculation predicts the same IOL power for the multifocal lens placed in the patient's right eye.

How would you proceed, and what are your thoughts on the refractive consequences of inverted multifocal IOLs?

—Case prepared by Tal Raviv, MD.

FRANK A. BUCCI JR, MD

When discussing the refractive and anatomic consequences of inverted IOLs, it is important first to distinguish between three- and single-piece designs. In general, the former have posterior angulation of the optic-haptic plane, whereas single-piece IOLs are planar. An inverted three-piece IOL can induce pupillary block or unintended myopia. This case involves a single-piece multifocal IOL, however, which may allow the surgeon more flexibility.

Although the Tecnis Multifocal 1-Piece IOL is not angulated, it does have an offset haptic design, which may cause the lens to take a more anterior position in the capsular bag if the IOL is placed upside down.

That is the likely explanation for the myopic shift in the early postoperative period. This effect diminished over time because of a strong fibrotic capsular reaction with 360° of anterior capsular overlap.

Under these circumstances, some surgeons might consider performing a YAG capsulotomy on the patient's left eye if they believed the following:

- The patient's 20/50 visual acuity was solely the result of the PCO (healthy macula confirmed by examination and optical coherence tomography).
- The capsule and position of the optic will remain stable after the YAG capsulotomy.
- The patient will be satisfied with the near vision provided by a multifocal lens in one eye (the

inverted Tecnis Multifocal 1-Piece IOL would result in a slightly shorter focal distance, and the amount of correction for spherical aberration would also be reduced by only a small amount).

- The patient will tolerate the IOL's explantation with vitrectomy if she is not satisfied after the YAG capsulotomy.

This patient adapted to and is happy with monovision. The multifocal IOL could be explanted and exchanged for a sulcus-fixated monofocal IOL targeted for myopia with a subsequent YAG laser capsulotomy. (During the past 6 years, numerous patients have been referred to me with single-piece multifocal IOLs that have been relatively easy to explant after extended postoperative periods.)

After implanting more than 1,200 Tecnis Multifocal 1-Piece IOLs right-side up, I do have a negative visceral reaction to leaving one of these lenses inverted in an eye. The risk of explantation, however, must be weighed against the potentially practical positive results of performing the YAG capsulotomy. I would assess the patient's personality and mental status during the consultation, because this evaluation would contribute significantly to my final decision.

MARK KONTOS, MD

Before the days of aspheric multifocal IOLs and the pressure for plano postoperative refractions, an inverted lens implant after surgery was not much of a problem. The patient had a slightly different refraction than anticipated, but his or her vision was generally unaffected. As this case demonstrates, things are different now; the lens' orientation is a less flexible issue. Generally, the improper orientation of premium lenses will cause problems, and it should be recognized and corrected at the time of the initial surgery. Usually, the process of repositioning the lens with the generous use of viscoelastics is relatively straightforward. For whatever reason, that did not happen in this case, and now, the management has become more complex.

It would be tempting to assume that the change in vision and refraction is solely due to PCO and to open the capsule. Once that step is taken, however, exchanging the lens implant, if necessary, becomes a much more difficult task. I would therefore discuss with the patient the need to return to the OR. The question then becomes what to do. I assume that the original plan was to use a multifocal lens in both eyes but that, after the first surgery, the surgeon decided to change to a monovision outcome. Because the patient was happy with this result initially, replacing the multifocal

IOL with a monofocal lens set at -2.00 D is a reasonable option and would be my first choice. The patient could have a YAG laser capsulotomy a few weeks later if need be. If she wished to have the benefit of a multifocal lens in her right eye, that option should be possible if the anterior chamber is deep enough to permit careful repositioning of the current lens without damage to the cornea or capsule. Otherwise, a lens exchange could be performed. In any case, the situation will not truly be resolved until the lens' current orientation is corrected.

TOBIAS H. NEUHANN, MD

The major problem is currently the visual acuity of the patient's right eye, which has regressed from an inadvertent -2.00 D of monovision with good near vision to weak 20/50- distance vision and no unaided near vision. Several approaches are possible to solve this problem.

If the patient today agreed to receive a plano multifocal implant in one eye and a monofocal implant in her second eye, I would recommend the following approach. The 360° capsular overlap plus the pearly secondary cataract could be helpful to carefully reopen the capsular bag with the aid of a highly polished spatula and a cohesive viscoelastic such as Healon GV (Abbot Medical Optics Inc.). After opening the bag and rotating the IOL, I would implant a capsular tension ring through a paracentesis. Because of the hydrophobic material properties of the Tecnis IOL—glass-transforming temperature at 14.5° C—the implant can be rotated out of the capsular bag and easily flipped over in the anterior chamber for correct implantation of the lens. I would also try to clean the posterior capsule underneath the implant by forced infusion of balanced salt solution. If this did not work, a YAG capsulotomy could be performed after the surgery.

If the patient desired her prior monovision, I would perform a YAG capsulotomy and see what the result was. If she again had a -2.00 D refraction, we would both be happy with this simple and easy treatment. If the current +0.25 D remained, I would wait to see if the reversed multifocal design of the lens would work. If not, she could undergo corneal laser refractive surgery to reach -2.00 D for the previous monovision.

Outside the United States, additional choices for achieving the patient's former monovision are possible. I could implant a piggyback IOL. Another option would be to implant a low-powered Visian ICL (STAAR Surgical Company) to reach the previous refraction. An advantage of this refractive lens surgery

would be its reversibility if the patient's refraction changed again.

NIRAJ PATEL, MD

If the surgeon finds the IOL to be inverted at the time of cataract surgery, it is usually recommended that he or she flip the lens into its correct orientation. This maneuver can be performed in the capsular bag or anterior chamber if there is adequate space or by removing the IOL and reinserting it correctly.

When a patient such as this one presents to my office for the first time, I like to get a detailed history to make sure I am addressing the patient's concerns from his or her perspective. In this case, the patient reports two problems, a reduction in her overall visual acuity and a loss of near vision in her right eye. She was initially pleased with her result despite the inverted multifocal lens and myopic surprise. Given her current BCVA of 20/50, I would undertake a detailed, dilated examination to rule out any corneal, macular, and/or optic nerve disease before focusing on the likely diagnosis of anterior and posterior capsular opacification.

In this case, the patient presented with a dense, fibrotic anterior capsule as well as diffuse, pearly PCO. The fibrotic anterior capsular contraction has likely eliminated her myopia by posteriorly displacing the IOL. Thus, the capsular opacity has changed the effective lens position. To address the patient's complaint of blurry vision, I would recommend a posterior YAG capsulotomy as the initial approach to her problem. This intervention would treat her diminished central visual acuity. I would perform the procedure in a 360° pattern, which would maintain a circular posterior capsule to allow for optic capture in case the patient needs the IOL exchanged in the future.

Next, I would perform a postoperative evaluation with a refraction to assess whether the visual acuity

of her right eye were once again working well for her at both distance and near, given that she might enjoy the new plano refraction in her right eye. If the patient felt that her near vision was still poor and she desired more myopia, an anterior YAG capsulotomy could be performed to break the fibrotic bands, thus helping to eliminate the posterior displacement of the IOL. I typically create four to six equally placed radial laser incisions through the dense fibrotic bands.

Staging of the laser procedures will give her more options versus performing a combined posterior and anterior YAG capsulotomy at the same time. If the patient desires myopia but does not achieve it with the anterior capsulotomy, further intervention such as a piggyback IOL or laser vision correction could be considered at future visits to help her obtain this endpoint.

RICHARD TIPPERMAN, MD

The refractive consequences of inverting a Tecnis Multifocal 1-Piece IOL are minimal.¹ It is more likely that the myopic surprise in this case is due to a more anterior effective lens position than predicted, which can occur in hyperopes.

Although the patient's "true" refractive state cannot be determined, because her BSCVA has decreased to 20/50, a significant issue to be addressed is why her refraction has drifted toward plano. One possibility is that the 360° fibrosis of the anterior capsule has shifted the IOL posteriorly.¹ Another is that the capsular fibrosis has affected the refraction, which is why the performance of a YAG capsulotomy is recommended prior to laser vision correction in pseudophakic eyes with fibrotic capsules.

The simplest approach to management would be a laser capsulotomy, which would improve the patient's BSCVA and likely restore her previous myopic status. She would need to understand that this procedure will

increase the risk of any future intraocular manipulation if she does not achieve her desired target refraction. If, after the capsulotomy, the patient were not happy with her refractive status, methods to increase her myopia would include laser vision correction or a piggyback IOL, although given her history of hyperopia, piggybacking might not be an option. A more aggressive approach would be to surgically polish the capsule, which would preserve its integ-

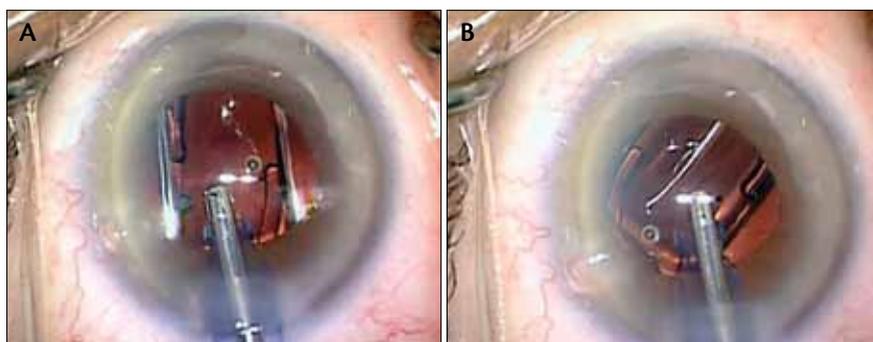


Figure. During the viscoelastic's removal, a Tecnis Multifocal 1-Piece IOL flips upside down, almost unnoticeably. With its haptics still unfolded, the surgeon cannot rely on the rules of S and Z configuration: correct positioning of the IOL (A) versus upside down positioning, where the haptics will have an incorrect S configuration upon opening (B).

rity if a future IOL exchange or piggyback IOL were required. Laser vision correction would remain a possibility with this approach.

If this 74-year-old were a patient of mine, I would encourage her to proceed with a laser capsulotomy.

WHAT I DID: TAL RAVIV, MD

I initially considered unroofing; I would unroof the fibrotic anterior capsule and either invert or exchange the current IOL. I would still have needed to perform a YAG capsulotomy to evaluate the refractive result, however, and the chance of an unexpected refractive outcome would have remained. I therefore decided to perform a YAG capsulotomy in hopes that it alone would solve the patient's problem while knowing that I could still perform an IOL exchange/vitreotomy if necessary.

Not being an optical scientist, I figured that the intended negative asphericity of the Tecnis IOL would likely be slightly positive if left inverted, but I knew this would be well tolerated, because all preaspheric IOLs and early multifocal lenses had positive asphericity without causing problems. The diffractive add, I had heard, would work inverted but would make the reading distance closer, because the add would be on the anterior surface. I also figured that the initial -2.00 D refractive result was likely due to the geometry of the IOL.

The haptics of the Tecnis Multifocal 1-Piece IOL are anteriorly offset to push the optic posteriorly, allowing for stable three-point fixation. A reversed lens would cause anterior displacement of the optic and myopia. As the well-centered, overlapping, anterior capsule stiffened, it overcame the lens material's flexibility and "compressed" the optic to the more physiologic posterior position. In addition, likely because of the initially vaulted optic, lens epithelial cells were able to migrate behind the IOL unencumbered, causing the grossly asymmetrical PCO seen in this eye.

I sent the patient back to the referring doctor for a YAG capsulotomy. She experienced an immediate relief of symptoms and achieved an uncorrected distance visual acuity of 20/30 and J1 plus at near. The residual refraction was -0.25 -0.25 × 100, and the patient was happy.

An IOL can become inverted in two ways. The more common reason is improper loading or delivery from the injector. The other is inadvertent inversion during I/A. In the accompanying video, I caught the inversion of an IOL that occurred during I/A of the residual viscoelastic, shortly after the lens' proper insertion (Figure). Before full unrolling of the IOL and prior to

complete unfolding of the haptics, there is enough room in the capsule to allow inversion to take place. The key is for the surgeon to recognize the problem and promptly correct it to restore the IOL to its proper orientation. In the video, I demonstrate both a two-handed and one-handed technique for accomplishing this reorientation. One other lesson I learned from this experience is to give the IOL a few seconds to unfold before clearing the viscoelastic. ■



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