

# EXCESSIVE VAULTING OF A PHAKIC IOL

Surgeons discuss how to proceed in the early postoperative period.

BY SUPHI TANERI, MD, PHD, FEBOS-CR; MARTIN BECHMANN, MD; GERMÁN ROBERTO BIANCHI, MD; AND KRISTINA MIKEK, MD, MSC

## CASE PRESENTATION

A 32-year-old woman presents for a refractive surgery consultation. The patient's manifest refraction is  $-9.00 -2.75 \times 132^\circ = 0.63$  OD and  $-8.75 -3.00 \times 42^\circ = 0.8$  OS. She has a history of rheumatism but no known uveitis.

An examination of the anterior segment of each eye reveals clear corneas. Both crystalline lenses are clear. The optic nerves and retinas are healthy except for small chorioretinal atrophic areas in each eye. The patient reports no history of ocular surgery or disease.

Imaging with the Pentacam AXL (Oculus Optikgeräte) shows a thin cornea in each eye,

with pachymetry readings of 490  $\mu$ m OD and 482  $\mu$ m OS and a horizontal white-to-white (WTW) distance of 12.3 mm OU. Anterior segment OCT (ACE, Bausch + Lomb) finds WTW distances of 12.48 mm OD and 12.42 mm OS. The anterior chamber depth is 3.00 mm OD and 2.96 mm OS.

Given the patient's high ametropia and thin corneas, bilateral phakic IOLs are recommended, with the procedures to be separated by several days. An IPCL V2.0 Toric (Care Group) is selected. This lens features a central hole similar in design to the EVO ICL (STAAR Surgical).

Surgery on the first eye using the physician's standard technique is unremarkable ( $-10.75 +3.00 \times 130^\circ$ , 13.75-mm diameter). During a routine examination 2 hours postoperatively, however, an asymmetric vault of 1.83 mm and a shallow chamber are observed (Figures 1 and 2). The orientation of the IOL is the intended  $7^\circ$ , but slight inferior decentration is evident. The IOP is 15 mm Hg. A check of the preoperative sizing calculations reveals no errors.

How would you proceed?

—Case prepared by Suphi Taneri, MD, PhD, FEBOS-CR

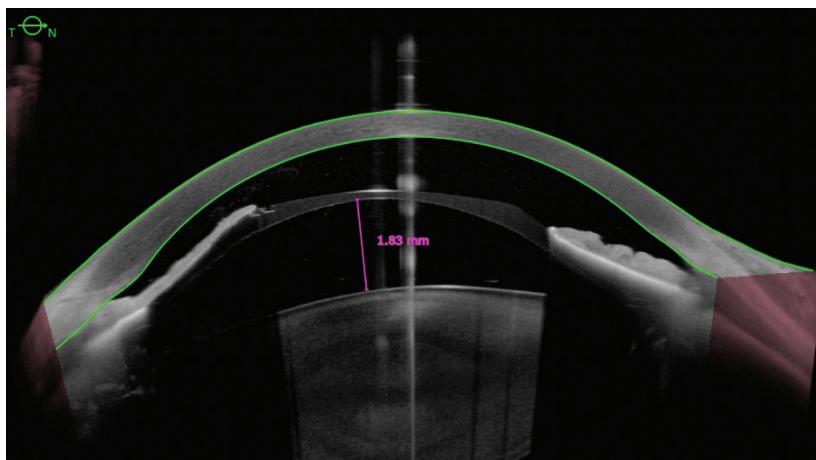


Figure 1. Anterior segment OCT shows a high vault and a shallow chamber angle 2 hours after uneventful phakic IOL implantation.

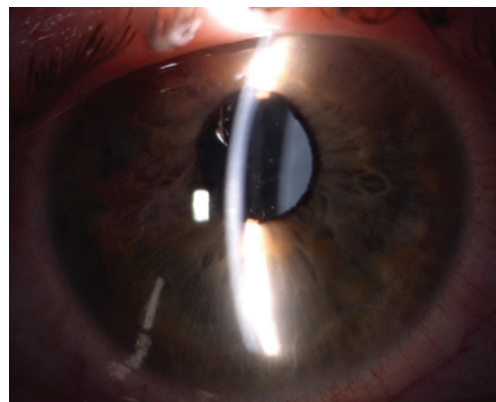


Figure 2. A slit-lamp examination performed 2 hours after the uneventful implantation of an IPCL shows a very shallow anterior chamber and a slightly decentered pupil. The position of the central hole indicates slight decentration of the IPCL.



MARTIN BECHMANN, MD

With a sufficient anterior chamber depth and a normal WTW distance,

this highly myopic patient was an excellent candidate for a phakic IOL. Unfortunately, a significant hypervault and slight inferior decentration of the IOL are observed approximately 2 hours after surgery on the first eye. The IOP is within normal limits, and the chamber angle in the horizontal meridian is narrow but open.

I lack experience with the IPCL but will assume for this article that it behaves similarly to the EVO ICL, in which case the most likely causes of the hypervault are retained OVD material behind the lens or, more plausibly, a sizing error. Given the concomitant decentration, an iridociliary cyst could also be a factor.

I would be interested to know whether hypervaulting and decentration were apparent immediately after lens implantation because the approximate final position of a phakic IOL typically can be assessed intraoperatively. In some instances, gentle pressure on the optic can reduce the vault significantly.

I would educate the patient on the signs and symptoms of acute glaucoma, provide acetazolamide tablets for emergency use, and ask her to return the next day for observation. If the hypervault persists without changes in the IOP or chamber angle, the lens would be exchanged for a smaller IPCL model, and the sizing calculation for the fellow eye would be adjusted accordingly. If available, ultrasound biomicroscopy (UBM) would be performed to exclude the presence of an iridociliary cyst.



**GERMÁN ROBERTO BIANCHI, MD**

A 1.83-mm vault observed 2 hours postoperatively despite correct lens orientation and centration strongly suggests oversizing. In eyes with high myopia and a narrow anterior segment, basing the lens size only on the WTW distance and anterior chamber depth can be misleading.<sup>1</sup>

I believe high-resolution UBM should be routinely performed preoperatively—not only to provide a better estimate of the sulcus-to-sulcus diameter but also to rule out ciliary body cysts and other anatomic irregularities that might distort lens vaulting behavior.<sup>2</sup> In situations like this one, I would also order UBM postoperatively to evaluate the current sulcus anatomy and lens position.

If the IPCL is not a toric model, one could consider rotating it 90°.

Oftentimes, horizontal sizing can produce higher vaulting than vertical placement owing to anatomic asymmetry between the horizontal and vertical sulcus diameters. This maneuver might reduce the vault and buy time before a decision must be made regarding an IOL exchange.

If the vault remains greater than 1.5 mm 24 to 48 hours postoperatively and there are signs of angle narrowing, pigment dispersion, or patient discomfort, the IPCL would be exchanged for a shorter model.



**KRISTINA MIKEK, MD, MSC**

A shallow anterior chamber following EVO ICL surgery can be caused by retained OVD material behind the lens, a posterior iris cyst, or excessive lens diameter relative to the WTW distance, leading to anterior lens displacement and high vaulting.

Given the early postoperative timing of a shallow anterior chamber and the absence of IOP elevation, the patient would be monitored without immediate intervention until the next follow-up appointment.

With nontoric ICLs, rotating the lens from a horizontal to vertical orientation can sometimes reduce vault height.<sup>3,4</sup> With toric models, however, rotation compromises refractive alignment and is therefore contraindicated.

The slit-lamp examination suggests inferior subluxation of the lens. Should the high vault persist or worsen, it may be necessary to explant and reimplant the lens. If UBM identifies a posterior iris cyst as the underlying cause, surgical management, including lens removal, may be warranted.

A similar experience in my practice involved an inadvertently inverted ICL. The patient presented with a shallow anterior chamber on postoperative day 1. Reimplantation of the same lens in the correct orientation led to a successful outcome.



**WHAT I DID: SUPHI TANERI, MD, PHD, FEBOS-CR**

After long consideration, I educated the patient on the symptoms of acute angle-closure glaucoma and provided her with acetazolamide tablets. I hoped the phakic IOL would return to its normal position overnight, but the vault was even higher the next morning, presenting a risk of endothelial injury. Immediate surgical revision was therefore planned.

After the IPCL had been repositioned, the vault was still too high. Hourly treatment with topical pilocarpine was initiated to induce miosis and push back the IPCL with the understanding that the lens might have to be removed the following day. When the patient returned, the vault was 1.28 mm, the anterior chamber angle was open, and the IOP was 11 mm Hg.

The following options were subsequently discussed with the patient:

- No. 1: Removal of the IPCL and a return to wearing glasses or contact lenses;
- No. 2: An IOL exchange for a smaller toric phakic lens implant to reduce the vault; or
- No. 3: An IOL exchange for a spherical monofocal IOL followed by laser vision correction to address astigmatism.

The patient was highly motivated to achieve spectacle independence and

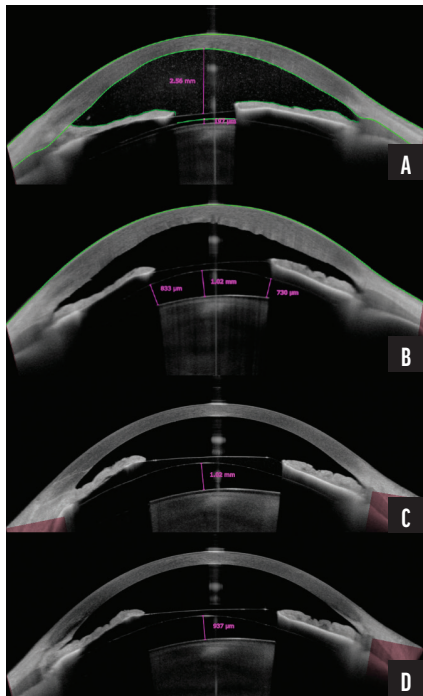


Figure 3. Horizontal OCT scan of the right eye 2 hours (A), 1 day (B), 1 year (C), and 2.5 years (D) after ICL implantation. All images show depigmentation of the temporal iris.

avoid additional laser vision correction. She therefore chose option No. 2.

An EVO Toric ICL (STAAR Surgical) was selected because it had the shortest delivery time. Until the IOL exchange could be performed, the patient administered pilocarpine eye drops three to four times per day to reduce vaulting.

Three weeks later, the IPCL was uneventfully exchanged for an EVO Toric ICL (model VTICM5 13.2; -12.00 +2.00 × 34°). Two hours after surgery, the cornea was edematous and swollen, the vault was only 197 µm on a horizontal OCT scan, and the IOP was 8 mm Hg (Figure 3A). On the following day, the vault was surprisingly high again—1.02 mm on a horizontal OCT scan (Figure 3B). No significant change was observed during the next several days with and without pilocarpine therapy. UBM revealed no iris cyst or anatomic deformation in either eye,

but depigmentation of the temporal iris was observed in the operated eye.

The patient was presented with the following options on how to proceed:

- No. 1: Removal of the ICL and a return to wearing glasses or contact lenses;
- No. 2: A delay of surgery on the second eye, which would wear a contact lens while the first eye was monitored closely; or
- No. 3: EVO Toric ICL implantation in the second eye and close follow-up of both eyes.

The patient was advised that the same high-vault situation might occur in the second eye because the cause of hypervaulting was unknown.

After 2 months of close follow-up, the patient chose to undergo surgery on the second eye. A matching EVO Toric ICL (-11.50 -2.50 × 130°) was implanted uneventfully. A vault of 1.44 mm (still mydriatic) was observed 2 hours after surgery.

The vault in both eyes remained stable, and the IOP was 13 mm Hg OU. Because the patient's UCVA was better than ever before in her life (1.0 OD and 0.8 OS), she did not want the phakic IOLs removed. Close observation was therefore maintained for a year and then tapered. The patient was repeatedly advised to be alert for signs of high IOP, which she never reported.

At the time of this writing, 2.5 years after the original IPCL implantation, the vault in each eye remains approximately 1 mm without medication. The patient's UCVA is 1.0 OU, the endothelial cell count is stable, and her IOP is 12 mm Hg OU.

In essence, this is a case of bilateral dislocation of the temporal haptic of a phakic IOL in the early postoperative period in the absence of iris anomalies that led to asymmetric hypervaulting despite normal vaulting at the end of surgery. Clearly, the temporal haptics are no

longer in the intended position, as has frequently been reported in other studies. No measurement technique and no IOL sizing formula can prevent such surprises. Luckily, the high vault was well tolerated and is now borderline. ■

*Editor's note: Dr. Bechmann acknowledged using ChatGPT to assist with the editing of his originally submitted portion of the article.*

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