



**Off-Label Implantation of EVO Implantable Collamer Lens (ICL) in Eyes
with Low Anterior Chamber Depth: A Two-Case Report**

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Abstract

Background: *The EVO Implantable Collamer Lens (ICL) has become a well-established option for correcting moderate-to-high myopia in patients unsuitable for corneal refractive procedures. According to STAAR Surgical recommendations, the minimum anterior chamber depth (ACD) required for EVO ICL implantation is 2.8 mm (internal ACD) for myopic correction and 3.0 mm for hyperopic correction. However, some patients with high refractive errors and contraindications to corneal laser procedures may still seek refractive surgical alternatives despite having borderline or reduced ACD values.*

Case Presentation: *We report two cases of off-label EVO ICL implantation in patients with anterior chamber depths below the recommended safety threshold. The first patient was a 39-year-old male with high myopic astigmatism and internal ACD measurements ranging from 2.65–2.71 mm. The second patient was a 31-year-old female with high myopia and internal ACD measurements ranging from 2.54–2.69 mm. Both patients were unsuitable candidates for corneal laser refractive surgery. EVO ICL implantation was performed successfully in both eyes of each patient using 12.1 mm lenses. Postoperative follow-up demonstrated satisfactory vault measurements, stable visual outcomes, and absence of significant complications during the first postoperative month.*

Conclusion: *Carefully selected patients with low ACD may achieve favorable short-term outcomes following off-label EVO ICL implantation when detailed preoperative biometric evaluation and close postoperative monitoring are performed. Further long-term studies are required to evaluate safety and predictability in such borderline anatomical situations.*

Keywords: *EVO ICL, low anterior chamber depth, off-label implantation, high myopia, refractive surgery, vault, implantable collamer lens.*

Introduction

Correction of moderate-to-high myopia remains a significant challenge in refractive surgery, particularly in patients unsuitable for corneal refractive procedures such as LASIK or PRK. Implantable Collamer Lens (ICL) implantation has emerged as an effective alternative because of its reversibility, excellent optical quality, and preservation of corneal tissue.

The EVO ICL developed by STAAR Surgical has demonstrated excellent refractive outcomes and safety profiles in properly selected patients. Appropriate patient selection is essential to minimize complications such as cataract formation, angle crowding, pigment dispersion, and glaucoma. One of the critical anatomical parameters for EVO ICL candidacy is anterior chamber depth (ACD). Current manufacturer recommendations suggest a minimum ACD of 2.8 mm (internal) for myopic correction.

Patients with low ACD are generally excluded from ICL implantation due to concerns regarding insufficient postoperative vault and potential contact between the crystalline lens and the implanted lens. Nevertheless, some patients with severe refractive errors and contraindications to corneal laser correction may still benefit from carefully planned off-label implantation.

In this report, we present two patients with ACD measurements below the recommended threshold who underwent successful bilateral EVO ICL implantation with favorable short-term postoperative outcomes.

Recent advances in posterior chamber phakic intraocular lens technology, particularly the introduction of the central port design in EVO ICL, have improved aqueous humor circulation and reduced the incidence of complications such as anterior subcapsular cataract formation. Despite these improvements, anterior chamber depth remains a critical parameter in patient selection because inadequate space between the implanted lens and crystalline lens may increase the risk of long-term complications. Consequently, implantation in eyes with shallow anterior chambers continues to be considered relatively contraindicated, and evidence regarding outcomes in such borderline anatomical cases remains limited.

Case Presentation

Two patients with high myopia who were unsuitable candidates for corneal refractive surgery underwent off-label bilateral EVO Implantable Collamer Lens (ICL) implantation despite having anterior chamber depth (ACD) measurements below the minimum recommended threshold proposed by STAAR Surgical. The first patient was a 39-year-old male with high myopic astigmatism, while the second patient was a 31-year-old

female with severe bilateral myopia. Both patients presented with significant dependence on spectacles and sought refractive surgical correction to improve visual quality and achieve spectacle independence. Comprehensive ophthalmic assessment including manifest refraction, corneal tomography, pachymetry, anterior segment imaging, ultrasound biomicroscopy (UBM), Pentacam analysis, and IOLMaster measurements was performed in all eyes. External ACD values measured by IOLMaster is 3 mm, internal ACD values measured by Pentacam and UBM ranged between 2.54 mm and 2.71 mm, which are below the recommended safety threshold for standard EVO ICL implantation. Because corneal laser refractive procedures were considered unsuitable due to the degree of refractive error and anatomical limitations, posterior chamber phakic IOL implantation was considered after extensive counseling regarding the off-label nature of the procedure and its potential risks, including insufficient vault, anterior subcapsular cataract formation, angle crowding, pigment dispersion, and elevated intraocular pressure. Bilateral EVO ICL implantation was successfully performed in both patients using 12.1 mm lenses with individualized refractive power selection. Postoperative follow-up included serial anterior segment optical coherence tomography (AS-OCT) evaluation to assess lens position and vault measurements. In all implanted eyes, postoperative vault remained within clinically acceptable ranges during day 1, day 7, and day 30 follow-up examinations, with measurements ranging from 210 μm to 399 μm . Both patients demonstrated satisfactory visual rehabilitation, stable lens positioning, clear crystalline lenses, and absence of significant postoperative complications such as cataract formation, abnormal vaulting, angle closure, or elevated intraocular pressure during the early postoperative period. These cases demonstrate that carefully selected patients with borderline low ACD may achieve favorable short-term outcomes following off-label EVO ICL implantation when detailed biometric evaluation and close postoperative monitoring are performed.

All procedures were performed under sterile operating room conditions by an experienced refractive surgeon. Standard EVO ICL implantation technique was used. After creation of a temporal clear corneal incision, viscoelastic material was injected into the anterior chamber followed by insertion of the foldable EVO ICL into the posterior chamber. The haptics were carefully positioned behind the iris, and complete viscoelastic removal was performed at the conclusion of surgery. Postoperative treatment included topical antibiotics and corticosteroids.

Case 1

A 39-year-old male presented to the refractive surgery clinic with progressive difficulty in distance vision affecting both occupational and daily visual activities. The patient had a long-standing history of high myopia with significant astigmatism and was dependent on spectacles for visual function. He expressed dissatisfaction with the quality of vision obtained with spectacles because of image minification and distortion associated with high refractive correction. The patient was interested in refractive surgical correction to achieve spectacle independence.

Comprehensive ophthalmic evaluation was performed. Manifest refraction demonstrated high bilateral myopic astigmatism. Best corrected visual acuity (BCVA) was 0.8 in the right eye and 0.9 in the left eye.

Preoperative Refraction

| Eye | Sphere (D) | Cylinder (D) | Axis | BCVA |
|-----|------------|--------------|------|------|
| OD | -8.75 | -3.50 | 180° | 0.8 |
| OS | -7.50 | -3.50 | 10° | 0.9 |

Slit-lamp examination showed clear corneas, deep peripheral chambers clinically, and transparent crystalline lenses bilaterally. Intraocular pressure was within normal limits in both eyes. Fundus examination revealed myopic retinal changes without retinal tears or degenerative lesions requiring treatment.

Corneal laser refractive surgery was considered unsuitable because of the degree of refractive error and anatomical considerations. Therefore, phakic intraocular lens implantation was evaluated as an alternative refractive solution.

Detailed anterior segment biometric analysis was performed using multiple imaging modalities including IOLMaster 700, Pentacam, and ultrasound biomicroscopy (UBM). Although external ACD measurements obtained by IOLMaster were above 3 mm, internal ACD measurements obtained through Pentacam and UBM demonstrated values below the manufacturer-recommended safety threshold for EVO ICL implantation. External ACD from measurement from IOL master 700 must be reduced by central corneal thickness (CCT) to obtain internal ACD. In this case $3.21\text{mm} - 530\text{ micrometer} = 2.68\text{mm}$ right eye and $3.19\text{mm} - 531\text{ micrometer} = 2.65\text{mm}$ for left eye.

Anterior Segment Measurements

| Parameter | OD | OS |
|-------------------|---------|---------|
| CCT | 530 μm | 531 μm |
| WTW IOLMaster 700 | 11.9 mm | 11.8 mm |
| WTW Pentacam | 12.0 mm | 11.4 mm |
| WTW Caliper | 11.1 mm | 11.1 mm |
| ACD IOLMaster | 3.21 mm | 3.19 mm |
| ACD Pentacam | 2.68 mm | 2.65 mm |
| ACD UBM | 2.71 mm | 2.66 mm |

The patient was extensively counseled regarding the off-label nature of the procedure, possible anatomical risks associated with reduced anterior chamber depth, and the importance of close postoperative follow-up. After detailed informed consent, bilateral EVO ICL implantation was planned.

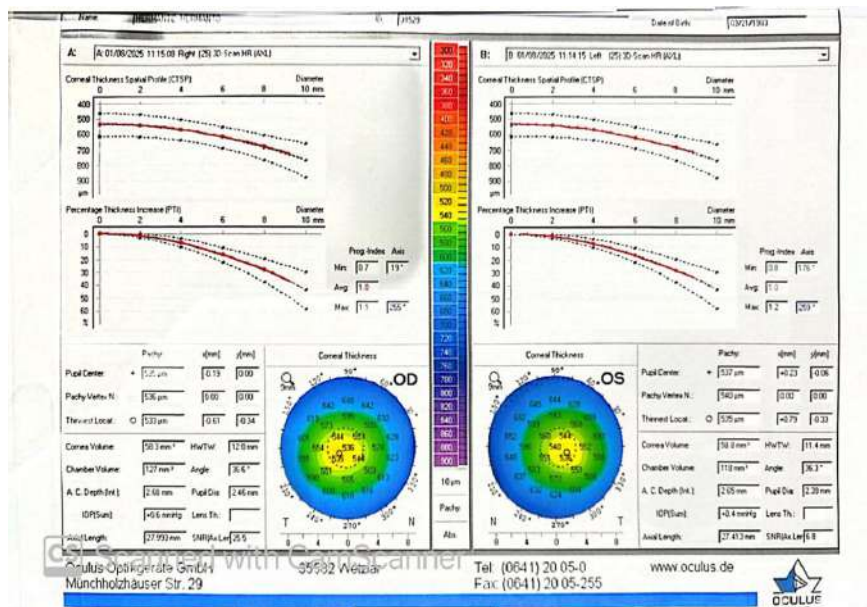


Figure 1: Preoperative anterior segment measurement of Case 1 using Pentacam demonstrating anterior chamber configuration to EVO ICL implantation

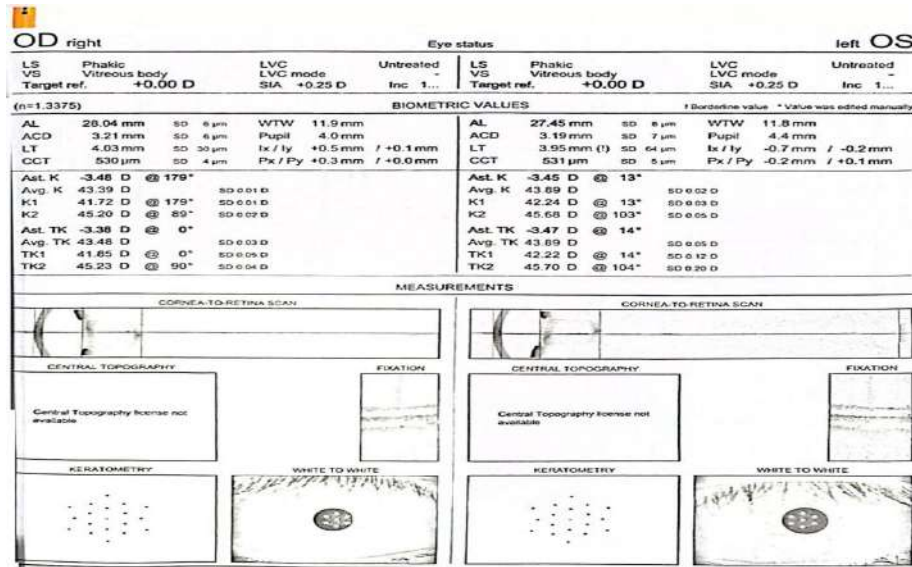


Figure 2: Preoperative anterior segment measurement of Case 1 using IOL master 700 prior to surgery

Implanted ICL Details

| Eye | ICL Power | Size |
|-----|------------------|---------|
| OD | -12.5 +3.00 × 90 | 12.1 mm |
| OS | -11.5 +3.00 × 91 | 12.1 mm |

The surgeries were completed uneventfully in both eyes. Intraoperatively, the lenses were well centered with satisfactory positioning in the posterior chamber. Immediate postoperative examination showed clear corneas, stable anterior chambers, and appropriate lens orientation.

Postoperative anterior segment optical coherence tomography (AS-OCT) was performed on day 1 and day 30 to evaluate vault and lens position. The vault remained stable and within acceptable clinical range throughout follow-up.

Postoperative Vault Measurements

| Eye | Day 1 | Day 7 | Day 30 |
|-----|--------|--------|--------|
| OD | 342 µm | 379 µm | 399 µm |
| OS | 360 µm | 360 µm | 347 µm |

At one-month follow-up, the patient achieved stable refractive correction with satisfactory visual quality. No early postoperative complications such as elevated intraocular pressure, pigment dispersion, cataract formation, lens rotation, or endothelial compromise were observed. AS-OCT imaging confirmed appropriate central vaulting without crystalline lens touch.



Figure 3: Pre operative EVO ICL size calculation using UBM with ICL Guru software of Case 1 right eye



Figure 4: Pre operative EVO ICL size calculation using UBM with ICL Guru software of Case 1 right eye

OCT day 1 Post OP OD

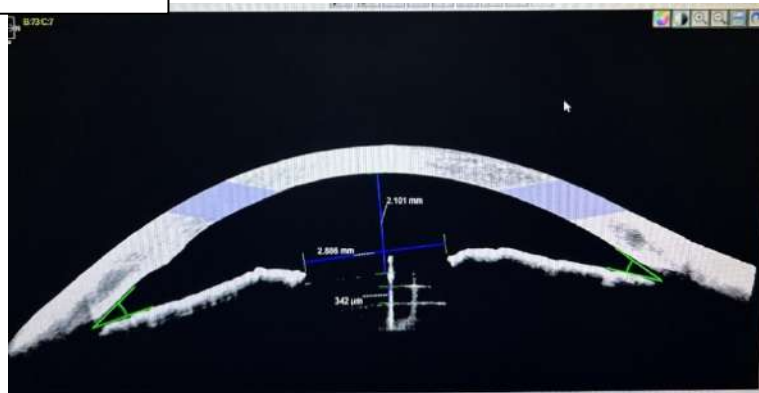


Figure 5: Postoperative day 1 AS-OCT image of Case 1 right eye demonstrating the EVO ICL position, vault and irido-corneal angle

OCT day 1 Post OP OS

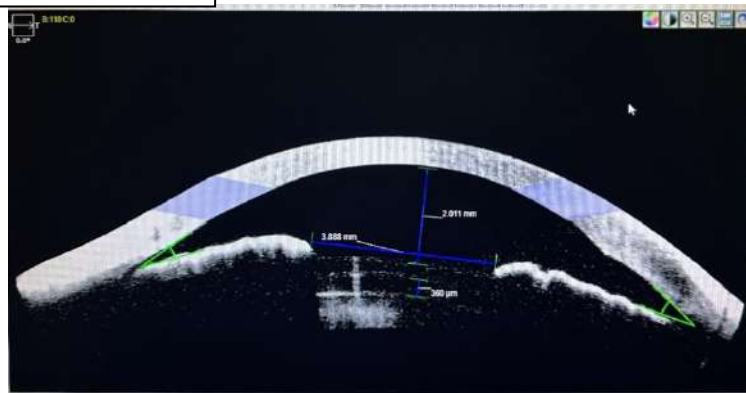


Figure 6: Postoperative day 1 AS-OCT image of Case 1 left eye demonstrating the EVO ICL position, vault and irido-corneal angle

OCT day 30 Post OP OS

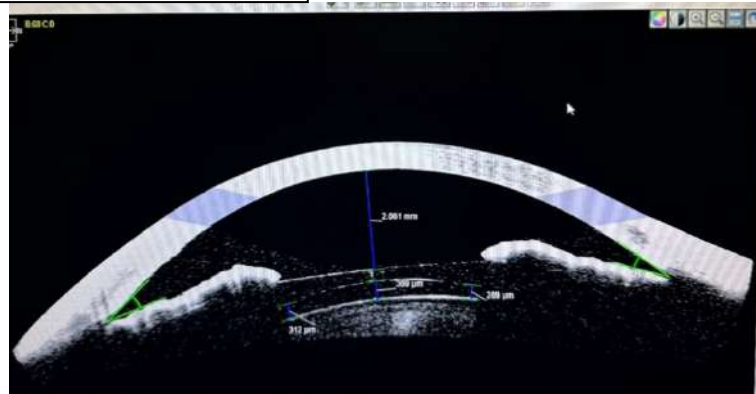


Figure 7: Postoperative day 30 AS-OCT image of Case 1 right eye demonstrating the EVO ICL position, vault and irido-corneal angle

OCT day 30 Post op OS

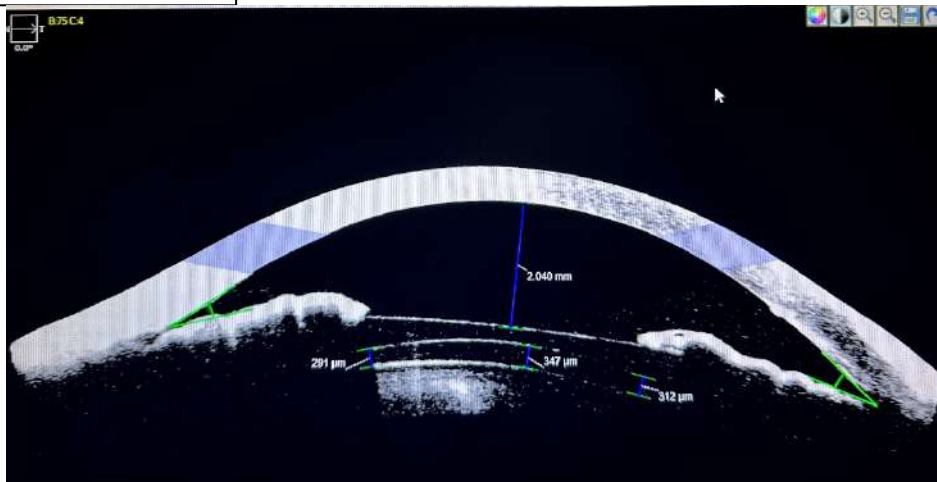


Figure 8: Postoperative day 30 AS-OCT image of Case 1 left eye demonstrating the EVO ICL position, vault and irido-corneal angle

Case 2

A 31-year-old female presented with complaints of severe blurred distance vision secondary to high bilateral myopia. The patient reported longstanding dependence on thick corrective spectacles and difficulty performing routine activities without visual aids. She sought refractive surgery primarily to improve visual quality and reduce dependence on spectacles.

Ophthalmological evaluation revealed high myopia in both eyes with mild astigmatism in the right eye. Best corrected visual acuity was 1.0 bilaterally.

Preoperative Refraction

| Eye | Sphere (D) | Cylinder (D) | Axis | BCVA |
|-----|------------|--------------|------|------|
| OD | -10.00 | -0.75 | 110° | 1.0 |
| OS | -9.50 | 0 | 0° | 1.0 |

Anterior segment examination demonstrated healthy ocular structures with transparent crystalline lenses and no evidence of cataract or glaucoma. Corneal topography was evaluated, and the patient was determined to be a poor candidate for corneal laser refractive procedures because of refractive and anatomical limitations.

Comprehensive biometric evaluation was conducted using several diagnostic devices. External ACD measurements obtained by IOLMaster were greater than 3 mm; however, internal anterior chamber depth measured by Pentacam and UBM revealed values significantly below the recommended threshold for standard EVO ICL implantation. External ACD from measurement from IOL master 700 must be reduces by central corneal thickness (CCT) to obtain internal ACD. In this case 3.04mm-486 micrometer = 2.55mm right eye and 3.03mm-494 micrometer=2.53mm for left eye.

Anterior Segment Measurements

| Parameter | OD | OS |
|-------------------|---------|---------|
| CCT | 486 μm | 494 μm |
| WTW IOLMaster 700 | 11.8 mm | 11.7 mm |
| WTW Pentacam | 11.6 mm | 11.4 mm |
| WTW Caliper | 11.1 mm | 11.0 mm |
| ACD IOLMaster | 3.06 mm | 3.03 mm |
| ACD Pentacam | 2.61 mm | 2.54 mm |
| ACD UBM | 2.69 mm | 2.60 mm |

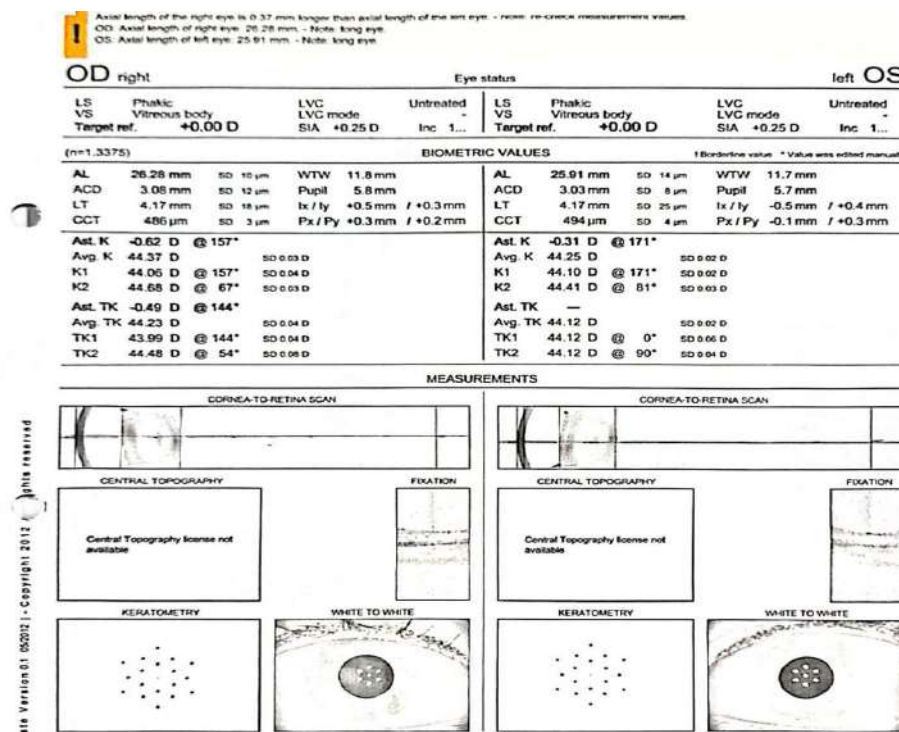


Figure 9: Preoperative anterior segment measurement of Case 2 using IOL master 700 prior to surgery

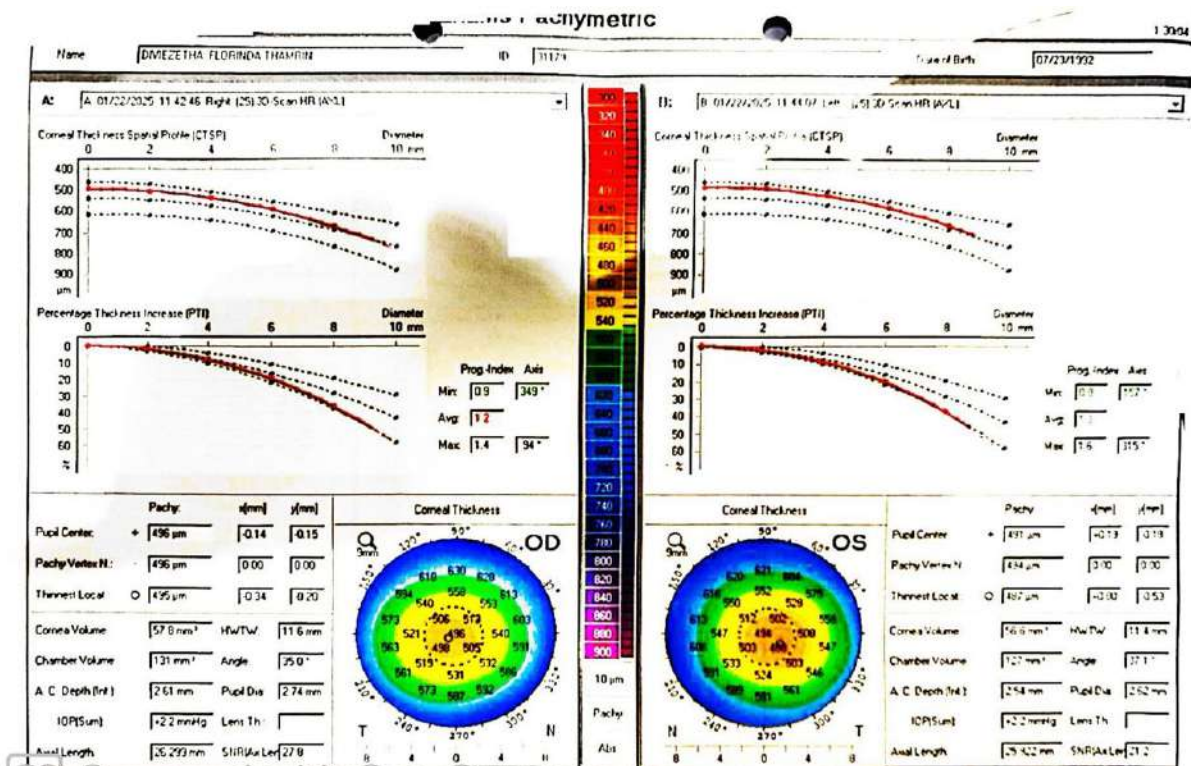


Figure 10: Preoperative anterior segment measurement of Case 2 using Pentacam demonstrating anterior chamber configuration to EVO ICL implantation

The patient was informed that the procedure would be considered off-label due to the reduced internal ACD measurements. Potential risks including insufficient vault, cataract formation, and angle-related complications were discussed in detail. Following extensive counseling and informed consent, bilateral EVO ICL implantation was performed.

Implanted ICL Details

| Eye | ICL Power | Size |
|-----|-----------|---------|
| OD | -11.0 | 12.1 mm |
| OS | -10.50 | 12.1 mm |

Surgery was completed successfully without intraoperative complications. Postoperative examinations demonstrated clear corneas, centered lenses, and quiet anterior chambers.

Serial postoperative AS-OCT imaging was used to evaluate vault stability and lens position. The vault measurements remained lower compared with Case 1 but continued to stay within clinically acceptable ranges without crystalline lens contact.

Postoperative Vault Measurements

| Eye | Day 1 | Day 7 | Day 30 |
|-----|-------------|-------------|-------------|
| OD | 298 μ m | 247 μ m | 247 μ m |
| OS | 231 μ m | 261 μ m | 210 μ m |

During the one-month postoperative follow-up period, the patient remained clinically stable with satisfactory visual rehabilitation. No postoperative complications including elevated intraocular pressure, anterior subcapsular lens changes, excessive vaulting, or angle narrowing were observed. OCT imaging confirmed stable lens positioning and maintained central vault throughout follow-up.



Figure 11: Pre operative EVO ICL size calculation using UBM with ICL Guru software of Case 2 right eye



Figure 12: Pre operative EVO ICL size calculation using UBM with ICL Guru software of Case 2 left eye

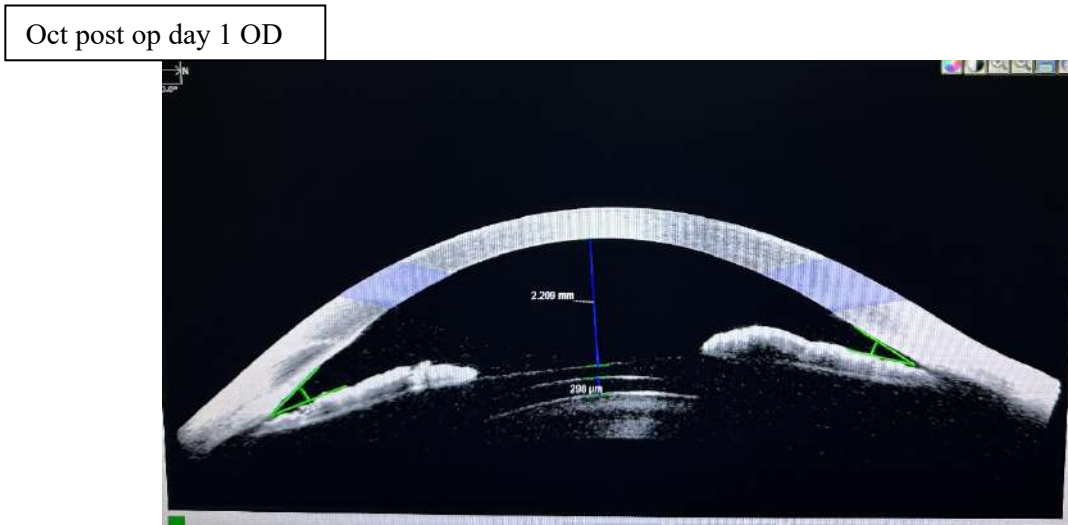


Figure 13: Postoperative day 1 AS-OCT image of Case 2 right eye demonstrating adequate vault despite low preoperative anterior chamber depth

Oct post op day 1 OS

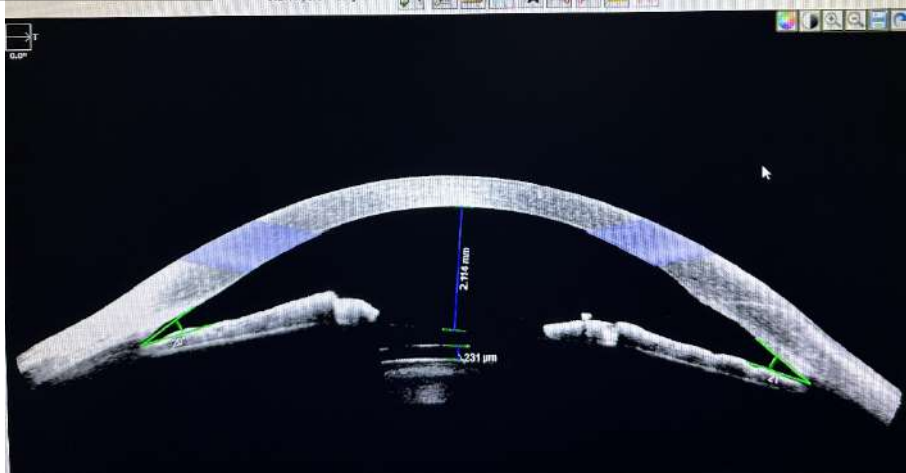


Figure 14: Postoperative day 1 AS-OCT image of Case 2 left eye showing maintained separation between the implanted lens and crystalline lens with good vault

Oct post op 30 day OD

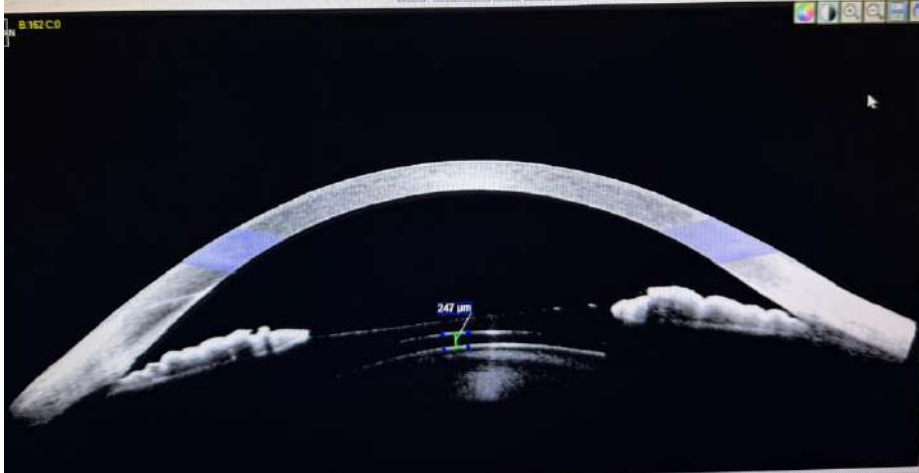


Figure 15: Postoperative day 30 AS-OCT image of Case 2 right eye demonstrating stable vault measurements and satisfactory anatomical outcome.

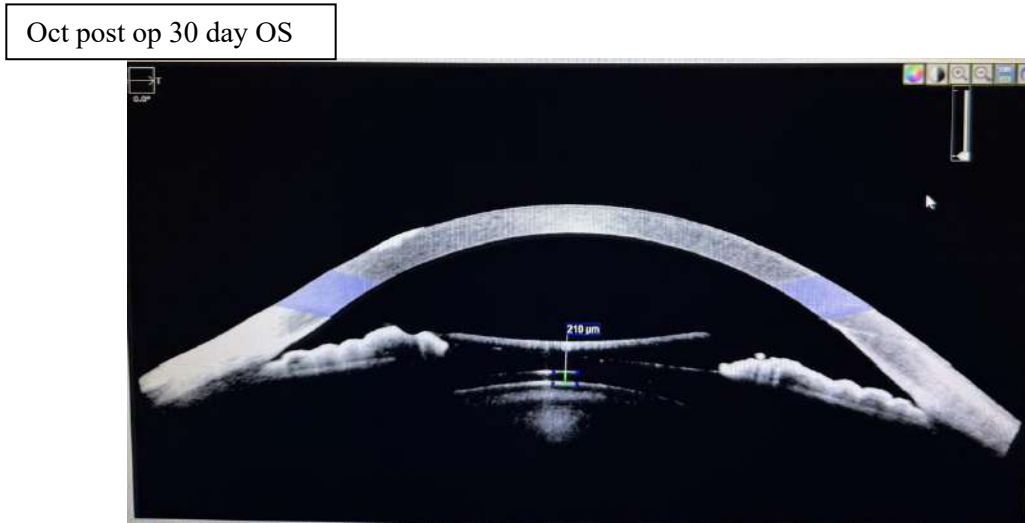


Figure 16: Postoperative day 30 AS-OCT image of Case 2 left eye showing maintained vault and stable EVO ICL position during follow-up

Discussion

EVO ICL implantation is increasingly utilized in patients with moderate-to-severe refractive errors, particularly in individuals unsuitable for corneal laser refractive surgery. Adequate anterior chamber depth remains one of the most important selection criteria because insufficient space may increase the risk of postoperative complications.

The present report demonstrates that carefully selected patients with low ACD may still achieve favorable anatomical and visual outcomes following off-label EVO ICL implantation. Both patients had internal ACD values below the recommended threshold but maintained satisfactory postoperative vault ranges.

An ideal postoperative vault generally ranges between 250 and 750 μm . Excessively low vault may predispose patients to anterior subcapsular cataract formation due to crystalline lens contact, whereas excessively high vault may contribute to angle closure and elevated intraocular pressure. In the current cases, postoperative vault measurements remained within clinically acceptable ranges throughout the first postoperative month.

The discrepancy observed between external ACD measurements obtained from IOLMaster and internal ACD measurements from Pentacam and UBM highlights the importance of multimodal anterior segment evaluation. Internal chamber measurements may provide more clinically relevant information when evaluating borderline candidates.

Careful case selection, precise sizing, and close postoperative monitoring are critical when considering off-label implantation in low-ACD eyes. Although the results in these patients were favorable, long-term follow-up remains necessary to evaluate cataract development, and angle anatomy over time.

Conclusion

Off-label EVO ICL implantation in selected patients with anterior chamber depths below 2.8 mm may provide satisfactory refractive and anatomical outcomes when comprehensive preoperative assessment and careful postoperative monitoring are performed. These findings suggest that borderline low-ACD eyes should not automatically be excluded from consideration; however, individualized risk assessment and long-term observation are essential.

Limitations

Limitations of this report include the small sample size and short postoperative follow-up period. Long-term evaluation is necessary to assess endothelial cell density, cataract formation risk, vault stability, and angle anatomy changes over time. Larger studies are required to determine the long-term safety profile of EVO ICL implantation in eyes with borderline low anterior chamber depth.

Patient Consent

Written informed consent was obtained from the patients for the procedure and publication of anonymized clinical data and images.

Conflict of Interest

The authors declare no conflict of interest.

Funding

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