CASE REPORT

Managing Pigment Dispersion Glaucoma Postbilateral ICL Implantation in High Myopia: A Case Report on the Crucial Role of Gonioscopy in Correcting a Misdiagnosis

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Abstract

Secondary open-angle glaucoma (SOAG) is a rare yet consequential complication following implantable collamer lens (ICL), also known as a phakic intraocular lens insertion, particularly in high myopia patients. This case report emphasizes the importance of recognizing SOAG and details the diagnostic complexities, reevaluation procedures, and successful long-term management of a 24-year-old bilateral high myopia (−7.00 D) patient who initially received an erroneous diagnosis of secondary angle-closure glaucoma (SACG) after ICL insertion at an external medical facility. Persistent visual issues prompted the patient to seek a second opinion, leading to a comprehensive reevaluation that eventually unveiled pigment dispersion syndrome (PDS) as the underlying cause, subsequently resulting in SOAG. This case not only highlights the diagnostic challenges but also elucidates the re-evaluation process and effective 5-year management strategies employed to restore the patient's visual health and quality of life.

Keywords: Angle-closure glaucoma, Case report, Glaucoma, Implantable collamer lens, Misdiagnosis, Pigment dispersion syndrome, Secondary open-angle glaucoma.

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Introduction

Implantable collamer lens (ICL) implantation is a well-established refractive procedure for managing high myopia.[1,2] Despite its efficacy, it is imperative to recognize potential postoperative complications and their implications, notably in the context of glaucoma diagnosis.[3] The association between ICL and glaucoma misdiagnosis remains understudied. Glaucoma management relies on accurate diagnosis to ensure optimal outcomes. Identifying the etiology and distinguishing between open-angle glaucoma (OAG) and angle-closure glaucoma (ACG) in a post-ICL case is of utmost importance for tailored therapeutic interventions.[4,5] This case report highlights the complexity of glaucoma misdiagnosis after ICL implantation. Through a concise cease study, we emphasize the need for precise diagnosis, timely intervention, and comprehensive ophthalmological assessments following ICL implantation, emphasizing the importance of accuracy in patient evaluation and management in this unique clinical context.

Case Description

A 24-year-old male of Indian descent presented with a significant history of bilateral high myopia (−7.00 D) and previous barrage laser treatment for the right eye underwent uncomplicated bilateral ICL implantation for refractive correction at an external medical facility. On postoperative day (POD) 10, the patient presented with reduced vision, corneal edema, and elevated intraocular pressure (IOP) measuring 24 mm Hg in the left eye despite receiving maximum tolerated antiglaucoma medication (AGM) therapy, consisting of two carbonic anhydrase inhibitors [one topical dorzolamide 1% and one oral acetazolamide 250 mg/day once a day (OD)] and a topical alpha agonist brimonidine 0.2% twice daily (BD). A provisional diagnosis of ACG prompted the performance of surgical peripheral iridectomy (PI) to address possible pupillary

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block. Seeking a second opinion, the patient was recommended ICL explantation in the left eye at another medical facility. Subsequently, the patient sought evaluation and an opinion at our institution.

Upon examination, visual acuity was found to be 20/20 in the right eye and 20/40 in the left eye. A slit-lamp examination revealed normal eyelids and conjunctiva in both eyes, clear corneas, and appropriately sized anterior chambers (ACs). The right eye exhibited a normally patterned iris, a reactive 3 mm pupil, and an intact ICL with a central hole. In contrast, the left eye displayed a regular iris pattern with a surgical PI at 11 o'clock, along with a dilated 7 mm pupil and pigmentation over the ICL with a central hole (Fig. 1). Goldmann applanation tonometry registered IOP at 11 mm Hg for the right eye and 25 mm Hg for the left eye. A comprehensive evaluation, including fundus photography, optical coherence tomography (OCT), perimetry, and gonioscopy, was conducted. The ICLs' central holes eliminated the possibility of pupillary blockage as a contributing factor to the patient's condition, thus dispelling concerns about pupillary block glaucoma. In the anterior segment OCT (AS-OCT) analysis, it was observed that the ICL exhibited appropriate vaulting across all 12-hour clock positions (Fig. 2). The Anterion image also confirmed the adequacy of vaulting (Fig. 3). All

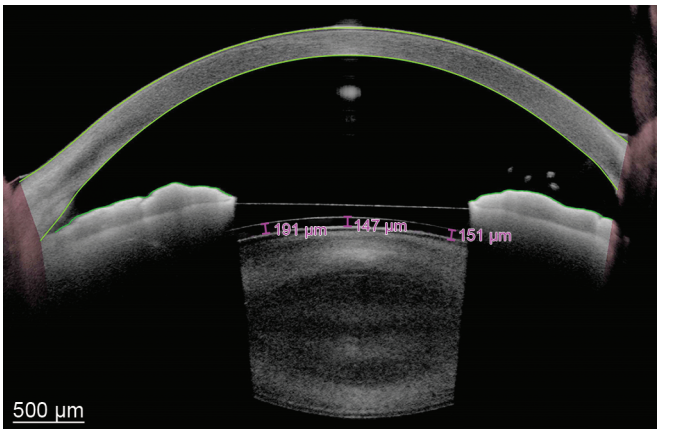
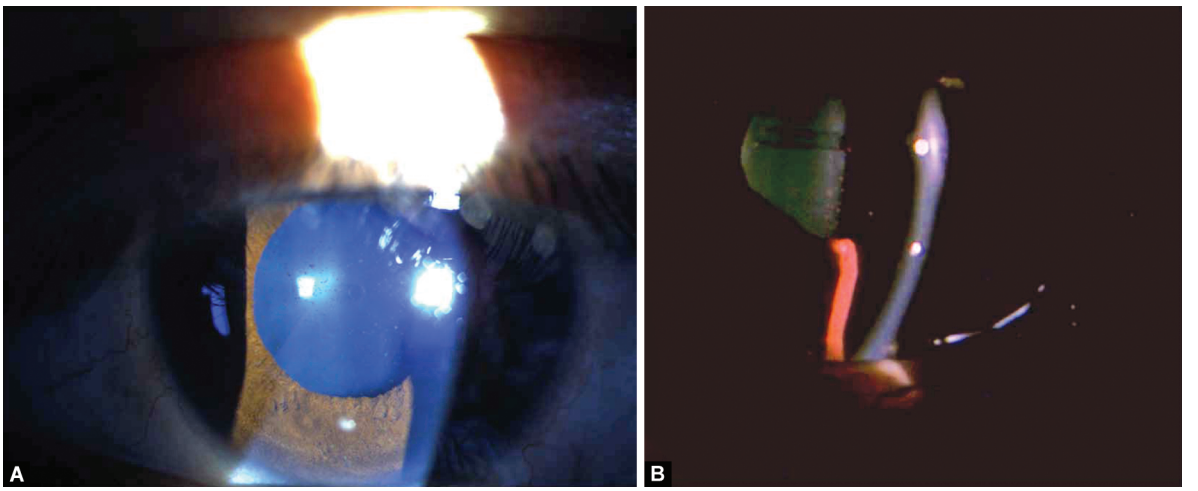


Fig. 3: Anterion image of the left eye showing adequate vaulting (191, 147, and 151 µm)



Figs 1A and B: (A) Slit-lamp image of the left eye depicting a dilated pupil and an ICL with a central hole and pigment dispersion over it; (B) Slit-lamp image of the left eye showing normal AC depth

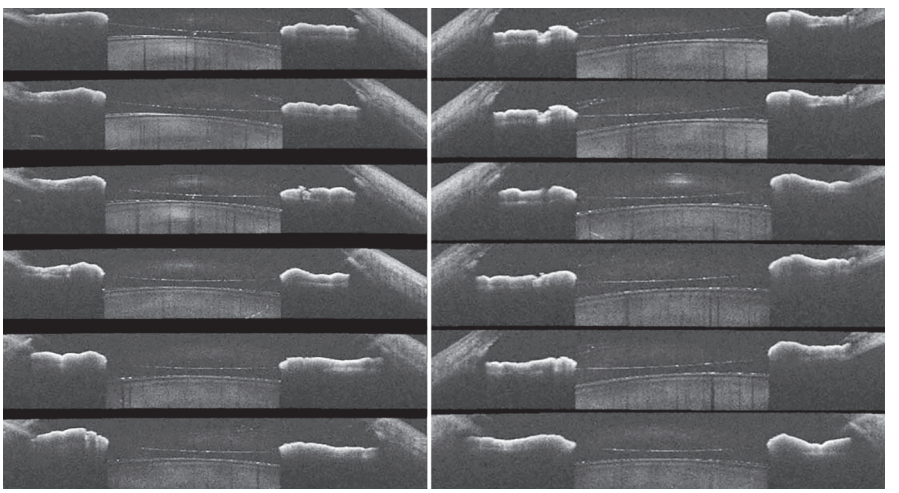


Fig. 2: Anterior segment OCT (AS-OCT) image of the left eye, illustrating proper vaulting of the ICL at all 12 o'clock hours

biometry readings were unremarkable for both eyes (Fig. 4). Gonioscopy, a technique allowing for direct visualization of the AC angle, played a pivotal role in elucidating the patient's condition. Contrary to the initial diagnosis, gonioscopy revealed a wide and open drainage angle, which is characteristic of OAG.[6] The absence of peripheral anterior synechiae and the clear visualization of the trabecular meshwork dispelled the notion of angle closure pathology.[7]

Notably, pigmentary depositions in the trabecular meshwork of the left eye were identified during gonioscopy, leading to the reclassification of the condition as secondary pigment dispersion syndrome (PDS)-related OAG (Fig. 5).[8–10] This underscores the crucial role of comprehensive examination techniques in arriving at an accurate diagnosis. PDS occurs when pigment granules from the iris disperse into the AC, potentially obstructing the trabecular meshwork and causing elevated IOP. In this case, the densely pigmented trabecular meshwork in the left eye resulted from PDS, contributing to the elevated IOP and glaucomatous changes. The identification of these pigmentary depositions during gonioscopy was pivotal in establishing the connection between PDS and the patient's condition, further emphasizing the significance of a comprehensive approach to diagnosis and management. Along with the pigment dispersion, the patient had developed Urrets–Zavalia syndrome, because of which the patient has a mid-dilated pupil.[11] The patient's management strategy was adjusted based on the redefined diagnosis. Given the patient's bilateral high myopia, the consideration of removing one of the ICLs introduces the potential for anisometropia, which could lead to visual discomfort. In addition, the removal of the ICL alone may not adequately address the underlying issue of a densely pigmented trabecular meshwork, potentially necessitating a trabeculectomy later on. Given this clinical scenario, a decision was made to prioritize trabeculectomy as a preliminary step to mitigate the need for subsequent procedures.[12] Furthermore, it is crucial to recognize and address the patient's significant cosmetic apprehensions related to the unilateral removal of the ICL. The patient underwent ICL implantation in both eyes, and a decision was made to eliminate the need to wear spectacles or contact lenses, which had been a significant motivation for pursuing the procedure in the first place. Consequently, the prospect of removing the ICL from one eye alone raises the concern that the patient will need to rely on corrective eyewear or contact lenses, effectively undoing the initial purpose of having both eyes treated. This cosmetic aspect further complicates the management of the case, as we must consider not only the clinical necessity but also the patient's desire for optimal visual outcomes and convenience. Therefore, to preserve the integrity of the ICL and prevent potential visual field deficits, the chosen course of action entails performing a trabeculectomy procedure with the incorporation of ologen, a biodegradable collagen matrix implant. This comprehensive approach aligns with our commitment to providing the patient with the most suitable and professional care.

		OD right eye		OS left eye	
			7		2
Measuring mode	Mode	Phakic		Phakic	
Axial length	AL	25.72 mm	±0.010 mm	25.42 mm	±0.011 mm
Cornea thickness	CCT	531 µm	±2.6 µm	515 µm	±1.2 µm
Aqueous depth	AD	3.08* mm	±0.002 mm	3.07 mm	±0.006 mm
Anterior chamber depth inc..	ACD	3.61 mm	±0.003 mm	3.58 mm	±0.006 mm
Lens thickness	LT	3.80* mm	±0.127 mm	3.68 mm	±0.089 mm
Retina thickness	RT	200** µm	±0.0 µm	200** µm	±0.0 µm
			1		3
Flat meridian	K1	44.89 D @ 2°	±0.031 D	44.87* D @ 167*°	±0.125 D
Steep meridian	K2	46.25 D @ 92°	±0.139 D	45.74* D @ 77*°	±0.169 D
Astigmatism	AST	1.36 D @ 92°	±2.5°	0.88* D @ 77*°	±2.9°
Keratometric index	n	1.3375		1.3375	
			1		1
White to White	WTW	11.79 mm	±0.098 mm	12.19 mm	±0.037 mm
Iris barycenter	ICX	-0.23 mm	±0.068 mm	0.32 mm	±0.042 mm
	ICY	0.34 mm	±0.104 mm	0.22 mm	±0.030 mm
			1		1
Pupil diameter	PD	5.91 mm	±0.649 mm	5.25 mm	±0.220 mm
Pupil barycenter	PCX	-0.39 mm	±0.045 mm	0.27 mm	±0.012 mm
	PCY	-0.19 mm	±0.052 mm	-0.45 mm	±0.015 mm

Fig. 4: Optical biometry report of both eyes with normal measurements

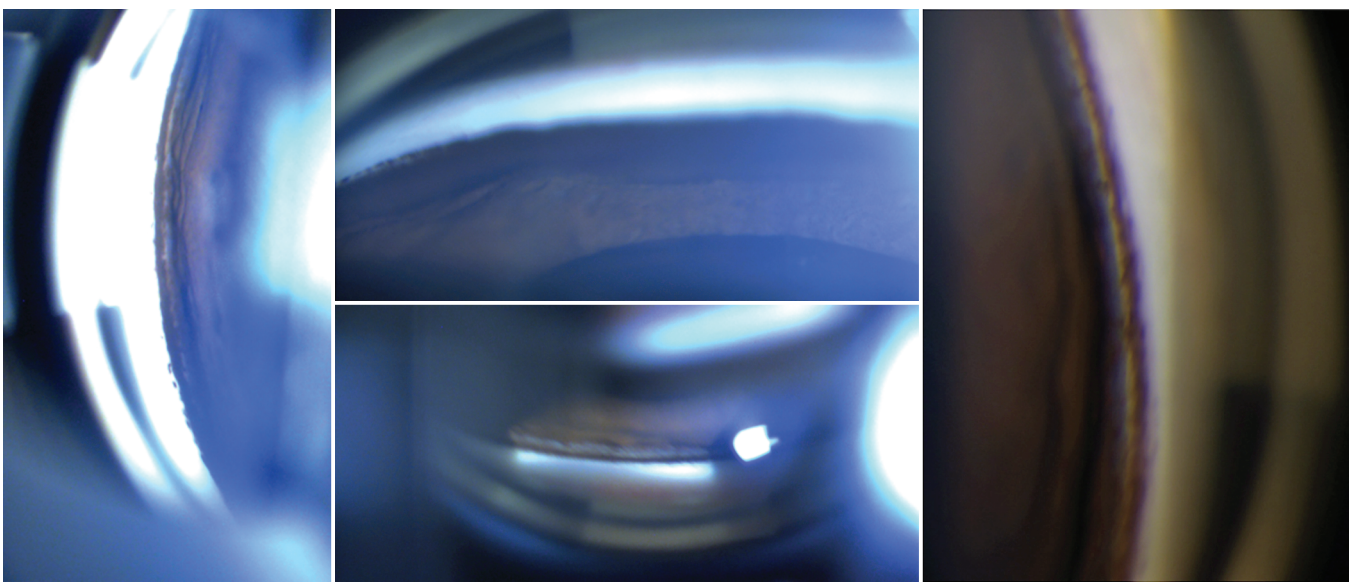
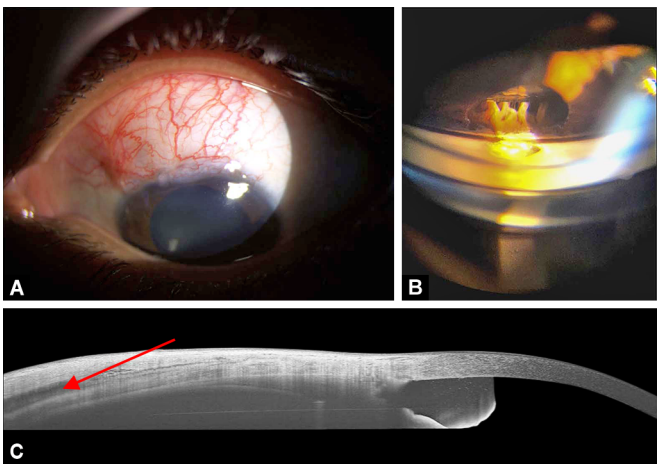


Fig. 5: Gonioscopy image of the left eye showing an open angle with heavy pigment dispersion

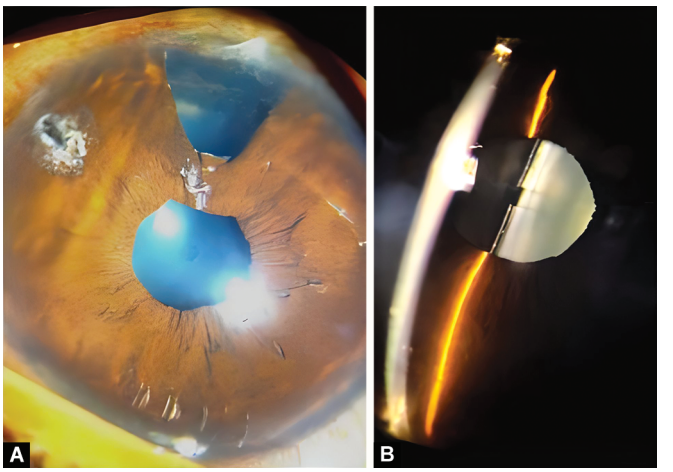
Following the trabeculectomy procedure, the patient consistently demonstrated a notable normalization of IOP. Precise assessments of IOP on specific POD yielded promising results; on POD 7, the IOP measured at 18 mm Hg, steadily declining and eventually stabilizing at a favorable 14 mm Hg on POD 120, all without the need for AGM administration. Over a meticulous 5-year monitoring duration, IOP levels consistently maintained within the optimal range. Simultaneously, visual acuity remained unimpaired at 20/20 for both eyes, while the surgically treated eye demonstrated the establishment of a well-functioning bleb, conclusively affirming the sustained effectiveness of the surgical intervention (Fig. 6).[13] Moreover, it is worth highlighting the patient's satisfaction with the treatment outcome. Nevertheless, it is important to acknowledge that Urrets-Zavalia syndrome has not fully regressed to its preoperative state in the patient's left eye. Comprehensive examinations, which included slit-lamp, fundus examination, OCT, and visual field analysis, consistently produced unremarkable findings (Figs 7 and 8). Specifically, OCT assessments indicated that both retinal thickness and ganglion cell layer (GCL) thickness remained within normal limits (Fig. 9). Furthermore, the visual field analysis demonstrated normal results for both eyes, implying the absence of significant abnormalities (Fig. 9). These findings firmly validate the successful outcome of trabeculectomy augmented with the ologen implant, emphasizing the pivotal role of gonioscopy-guided diagnosis in our approach.[14]

Discussion

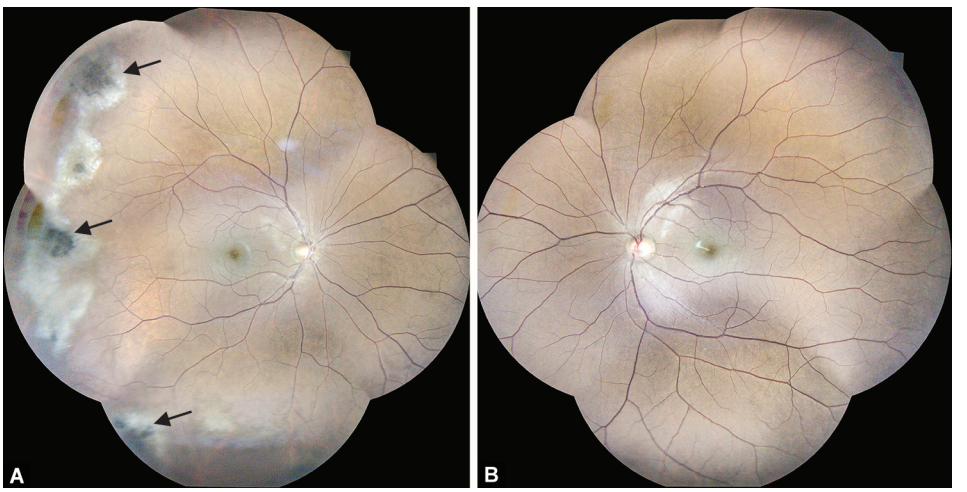
This case underscores the critical importance of thorough clinical evaluation, particularly in complex glaucoma cases involving factors like high myopia and previous surgical procedures. The diagnostic journey evolved from an initial misclassification to an accurate diagnosis of OAG, highlighting the pivotal role of gonioscopy. The reclassification of the condition was initiated upon the discovery of pigmentary deposits within the trabecular



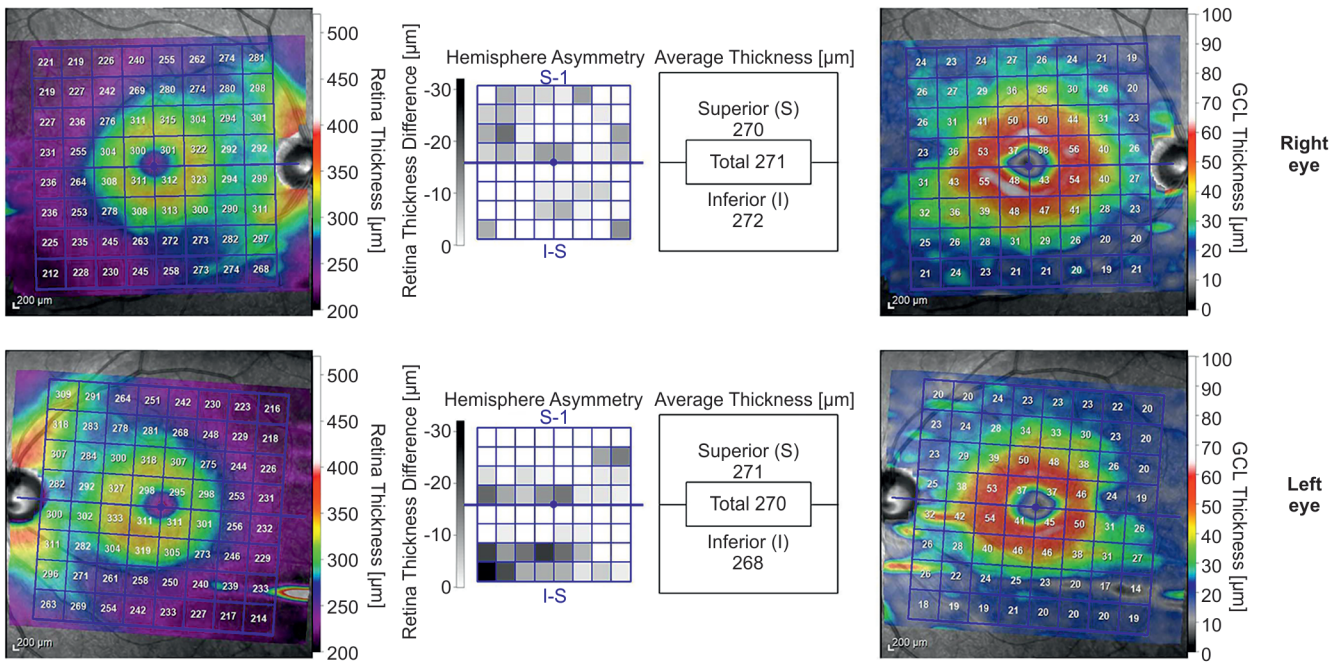
Figs 6A to C: (A) Slit-lamp image of the left eye displaying bleb formation following trabeculectomy; (B) Gonioscopy image revealing a patent ostium in the left eye; (C) AS-OCT image capturing the morphology of the bleb (red arrow) in the left eye

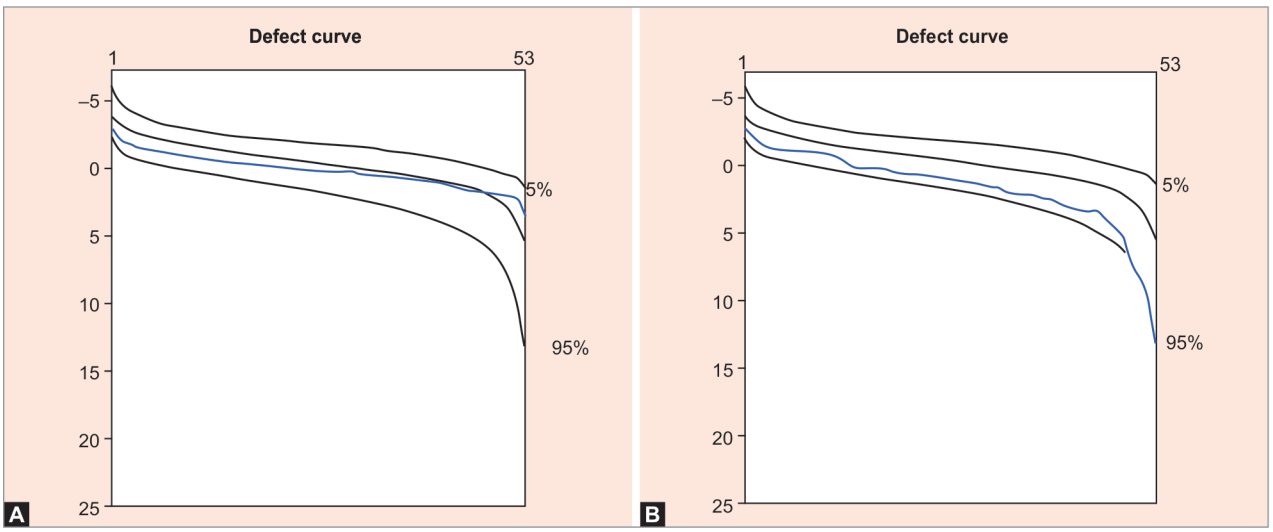


Figs 7A and B: (A) A 5th-year follow-up slit-lamp photo of the left eye showing the iridectomy without the pigment dispersion; (B) A 5th-year follow-up slit-lamp photo of the left eye showing normal AC depth



Figs 8A and B: A 5th-year follow-up mosaic fundus photographs of the right and left eye, respectively, with visible barrage laser marks (black arrows) in the right eye





Figs 9A and B: (A) A 5th-year follow-up OCT results for both eyes, showing retinal thickness and GCL thickness within normal limits; (B) A 5th-year follow-up visual field data represented by a Bebie curve for right and left eye, respectively

meshwork of the left eye, linking it to secondary open-angle glaucoma (SOAG) associated with PDS.

Two potential mechanisms have been postulated for the development of PDS in this case; one involves inherent pigment dispersion, and the other is iatrogenic, resulting in rubbing of the iris with ICL and causing PDS (Video 1). Advanced diagnostic modalities, including OCT, fundus examination, and perimetry reports, played a central role in untangling intricate cases. The decision to perform trabeculectomy with ologen while preserving the ICL exemplifies a customized approach aimed at preventing potential visual field deficits. The patient's treatment proceeded smoothly without encountering unforeseen issues, emphasizing the safety and success of the intervention. Long-term follow-up data provide invaluable insights. Identifying a misdiagnosis related to PDS-induced SOAG underscores the importance of not neglecting these critical steps. Furthermore, this case highlights how prior surgical interventions, such as ICL implantation, can influence the anatomical configuration of the iridocorneal angle.

Conclusion

This case narrates a patient's journey through misdiagnosis after bilateral ICL implantation, ultimately leading to an accurate diagnosis and effective treatment. The emphasis on precise diagnosis, comprehensive assessment, and personalized management strategies, even considering cosmetic concerns, is paramount.

Clinical Significance

Rectifying misdiagnoses through comprehensive evaluations ensures that patients receive the most appropriate treatment, potentially averting unnecessary interventions and complications.

Trabeculectomy was chosen due to the patient's bilateral high myopia (–7.00 D), aiming to prevent anisometropia from unilateral ICL removal and acknowledging that ICL alone might not restore the trabecular meshwork sufficiently. The sustained outcome from posttrabeculectomy with ologen implantation underscores the importance of tailored interventions and extended follow-up in glaucoma care. The comprehensive 5-year follow-up validates the sustained benefits of this approach.

Declaration of Patient's Consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Supplementary Material

The supplementary Video 1 is available online on the website of https://youtu.be/-iMQ1qgM9yM

Video 1: An animated video snippet showcasing the hypothesized possible mechanism for PDS

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