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CLINICAL CASE REPORT

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Long-Term Observation of Coexistence of Posterior Polymorphous Corneal Dystrophy, Resultant High Myopia and Nonkeratoconic Developing Corneal Astigmatism

A Case Report of 7-Year Tracking in a Chinese Boy

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Abstract: Posterior polymorphous corneal dystrophy (PPCD) is an extremely rare, bilateral, and inherited disorder, which affects the corneal endothelium and Descemet's membrane. Few PPCD cases in Chinese patients have been published so far. As far as we know, there are few studies which focused on the associations between PPCD and high myopia either. Here we report a rare case of coexistence of posterior polymorphous corneal dystrophy, resultant high myopia and with-the-rule developing corneal astigmatism in a young Chinese boy.

A 6-year-old boy was first referred to our department 7 years ago, complaining of bilateral poor vision. Examinations of both eyes including ophthalmologic examination, cycloplegic refraction examination, confocal microscopy findings, and corneal topography were performed. Bilateral small aggregates of vesicular lesions and patchy hyperreflectivity were observed at the level of the Descemet's membrane on confocal microscopy, which is consistent with typical PPCD. Optometry and corneal topography examinations showed a resultant high myopia.

Ocular examinations were performed annually to follow up with the patient in the past 7 years. The corneal lesions remained stable whereas an axial elongation and a sharp increase in both spherical and cylindrical equivalent power were observed.

Close follow-ups including thorough scrutiny of the endothelium and systematic ocular ancillary examinations are essential for patients with PPCD. The pathological coexistence of PPCD and high myopia in our case is possibly due to a shared etiological pathway or genetic background. Advanced genetic analysis on similar cases is expected if more samples can be provided.

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Abbreviations: BSCVA = the best spectacle-corrected visual acuity, PPCD = posterior polymorphous corneal dystrophy.

INTRODUCTION

Posterior polymorphous corneal dystrophy (PPCD) is a rare, bilateral, and inherited disorder affecting the corneal endothelium and Descemet's membrane. This condition is characterized by dystrophic endothelial cells with polymorphous opacities at the level of Descemet's membrane.[1] PPCD is usually asymptomatic and hence in most cases does not require clinical treatments. Although the detailed pathogenesis of PPCD remains to be unclear, recent studies have gradually revealed the initiation of the inherited disease on the genetic level. Myopia is a common eye ametropia disease in yellow race. Multiple myopia genetic loci have been identified, making this eye disease as a common complex disorder. As for the pathogenesis, numerous studies have demonstrated that long-term image blur combined with extensive near work can initiate myopia progression by axial elongation.[2,3] Our study reports a case of a 6-year-old Chinese boy presenting with PPCD, resultant high myopia and developing regular corneal astigmatism. Informed consent was obtained from the patient's father.

CASE REPORT

A 6-year-old boy was first referred to our department 7 years ago, complaining of bilateral poor vision. He had no abnormal medical histories and his father only had mild myopia. Slit-lamp examination revealed bilateral small aggregates of apparent vesicles at the level of Descemet's membrane (Figure 1), along with an abnormal endothelium. A stromal thickening, without epithelial edema, was present. The anterior chamber was deep, with angle open. The lens and vitreous body were clear. Fundus examination showed a normal fundus in both eyes.

In vivo confocal microscopy (ConfoScan2, Nidek Technologies, Japan) scanning showed several typical features of PPCD, including some vesicular lesions and patchy hyperreflectivity at the level of Descemet's membrane around the lesions (Figure 2). Endothelial polymorphism and polymegathism were also noted within some of the vesicular lesions. The endothelial densities were 1139 cells/mm^2 in the right eye and 1165 cells/mm^2 in the left eye.

Upon cycloplegic refraction examination, the best spectacle-corrected visual acuity (BSCVA) was 6/12 in the right eye with -5.00Ds-3.00Dc $\times$ 165° correction and 6/12 in the left eye with -3.00Ds-1.75Dc $\times$ 165° correction (Figure 3). Corneal Orbscan II topography (Bausch & Lomb, Rochester, NY) revealed steep and with-rule-astigmatism corneas bilaterally with keratometry readings of 44.2D $\times$ 46.3D @ 103° in the right eye and 44.8D $\times$ 47.9D@ 76° in the left eye. The corneal thickness was 701 μm in the right eye and 711 μm in the left eye. The intraocular pressure was measured at 15 mmHg in the right eye and 18 mmHg in the left eye by noncontact tonometer

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The authors have no conflicts of interest to disclose.
An informed consent was given by patient's father.
This study was performed with the approval of Ethics Committee of the First Affiliated Hospital, College of Medicine, Zhejiang University.

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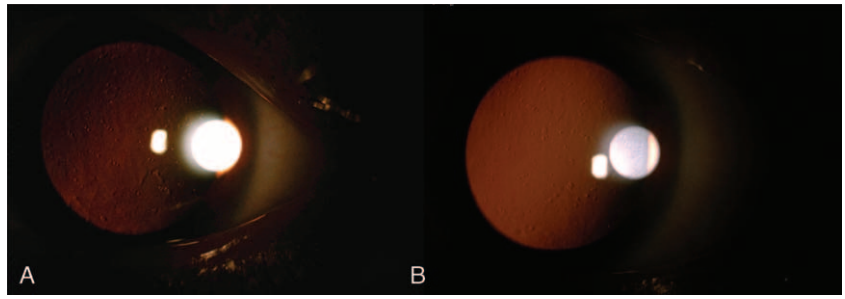

FIGURE 1. Slit-lamp photographs show bilateral small aggregates of apparent vesicles at the level of Descemet's membrane (retro-illumination): right eye (A); left eye (B).

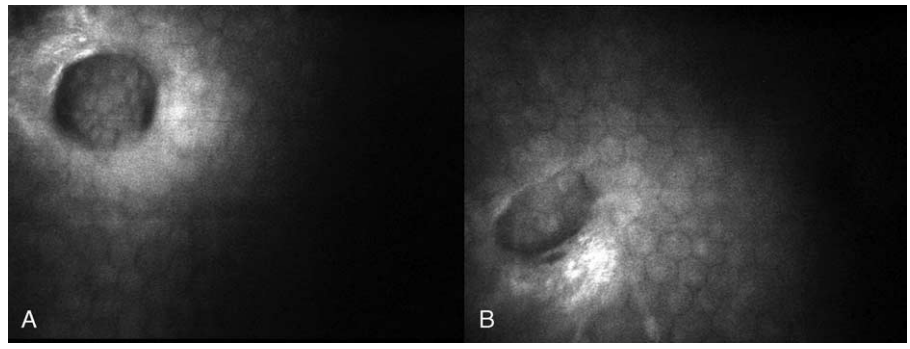

FIGURE 2. Confocal microscopy showing bilateral hyperreflective lesions around the vesicles: right eye (A); left eye (B).

(NIDEK NT2000, Japan). The corrected IOP was 9.1 mmHg in the right eye and 11.8 mmHg in the left eye.[4]

Ocular examinations were performed annually to follow up with the patient in the past 7 years. Slit-lamp and confocal microscopy examinations indicated that the posterior corneal anomaly remained stable with a mild decrease in endothelial density (1108cells/mm^2 in the right eye and 1065cells/mm^2 in the left eye at the 7th-year follow-up visit), whereas optometry examinations suggested a sharp increase in both spherical and cylindrical equivalent power (BSCVA was 3/12 in the right eye with -10.50Ds-6.00Dc $\times$ 175° correction and 3/12 in the left eye with -9.50Ds-5.50Dc $\times$ 175° correction at the 7th-year follow-up visit) (Figure 3). Meanwhile, the corneal Orbscan II topography examinations showed a progressive increase in corneal with-the-rule astigmatisms (44.3D $\times$ 49.3D @ 95° in the right eye and 44.5D $\times$ 48.9D@ 92° in the left eye at the 7th-year follow-up visit), but no apparent change in the corneal thickness bilaterally (Figure 4). Fundus examination showed a myopic tigroid fundus in both eyes. The axial lengths of the globes detected at the last follow-up were 26.38 mm in the right eye and 25.42 mm in the left eye by IOL master. (IOLMaster V.5.02, Carl Zeiss Meditec Ltd, Jena, Germany).

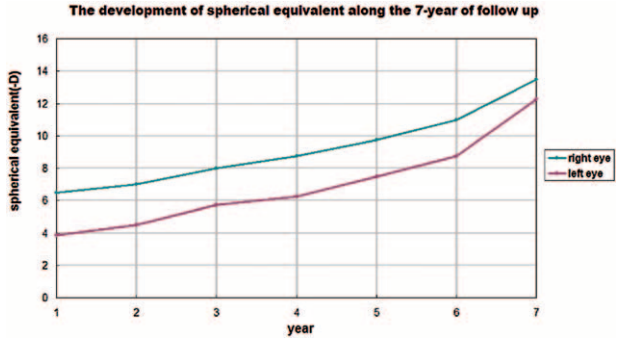

FIGURE 3. The development of spherical equivalent along the 7-year of follow-up.

Based on the clinical examinations and ancillary testings performed on annual follow-up visits, it is easy to make a definitive conjoint diagnosis of PPCD and resultant high myopia. The images of the corneal Orbscan II topography examination do not support a diagnosis of keratoconus.

DISCUSSION

The essential features of this PPCD case were steepening corneal curvature and excessive axial elongation at an early age, which caused a rapid development of myopia. Two previous studies described videokeratographic corneal steepening in PPCD patients, which were similar to our case. Corneal steepening might be a consequence of the abnormality in Descemet's membrane.[5,6] Excessive axial elongation was found in 5 of 35 eyes in Irving M.'s research, whereas whether there was a potential relationship between the abnormality in corneal endothelium and ocular length had not been mentioned in the literature.[6] We suggest that several factors, including corneal astigmatism, various aberrations induced by the great asymmetry of PPCD, as well as the corneal opacification, might initiate the myopia in PPCD patient's infancy. Insufficient accommodation caused by the chronically ambiguous blur signal drove the eye to be in a relatively hyperopic state during near work. As a result, the myopia occurred and developed, accompanied by axial elongation.[2,3,7]

Coexistence of corneal stromal dystrophy and pathologic myopia has been reported previously in 4 members of a Turkish family and 2 non-twin Romanian sisters, which indicates a

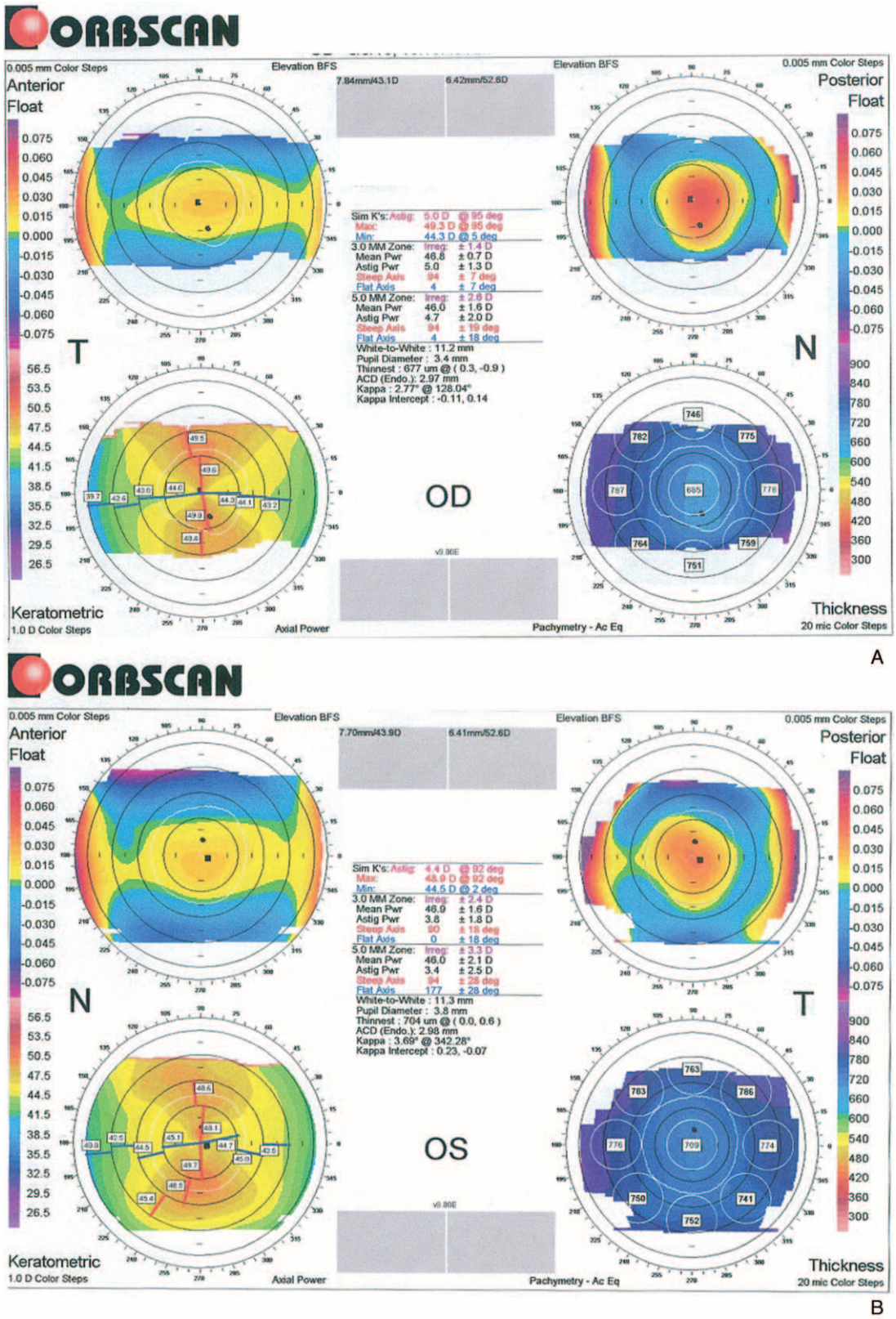

FIGURE 4. Corneal Orbscan II topography of both eyes at the last follow-up reveals severe corneal with-the-rule astigmatism: right eye (A); left eye (B).

possibility of this pathological coexistence being the description of a rare syndrome.[8,9] Endothelial lesions, steep corneal curvature, and axial elongation, the 3 clinical features in our case are probably attributed to defects on a shared etiological pathway or to a common genetic background. We speculate alterations in the collagens expression in different ocular tissues represent different parts of a spectrum of 1 rare syndrome clinically. Heretofore, 3 PPCD-related genes have been identified: *VSX1, COL8A2* and *TCF8*.[10] It is interesting to note that gene *COL8A2* encodes α1 chain of type VIII collagen and gene *TCF8* is a transcriptional regulator for the expression of several types of collagen, including collagen type I, IV.[10,11] Mutations in *COL8A2* would directly lead to disturbances in translation or protein folding of collagens. Comparably, abnormal expression of transcriptional regulator would widely affect its downstream genes. Changes in collagens IV and VIII chains have been detected in PPCD corneas.[12] Previous literatures suggested that the alteration of the corneal curvature in PPCD patients might be a consequence of the collagen abnormality in the Descemet membrane.[5] For myopia, the altered collagen expression in the scleral tissue may contribute to biomechanical changes, which renders the sclera more extensible. Therefore, it is much easier to induce axial elongation under normal intraocular pressure.[13]

The severity and rapid progression of the corneal with-rule astigmatism in this case was another prominent clinical feature that drew our attention. High corneal astigmatism (>4D) has also been found only in 2 eyes in Irving M.'s research.[5] Comparably, our patient has a higher nonkeratoconic corneal astigmatism at an earlier onset age. Corneal vesicular lesions might be 1 factor altering the corneal astigmatism. The exact pathological mechanism is not clear. As far as we know, there are few studies focusing on genetic associations between PPCD and nonkeratoconic corneal astigmatism. The genetic test would help understand the potential genetic linkage between PPCD and severe regular astigmatism if more samples can be provided.

We confirm that PPCD patients should undergo thorough scrutiny of the endothelium and overall ocular ancillary testing at close follow-ups. The refractive alterations in PPCD patients would indirectly reflect the progression of the corneal lesions to some extent. We cannot exclude that the pathological coexistence in our isolated case is just a morbid coincidence unless the genetic test is performed. It is regrettable that the genetic test could not be performed because the parents of the boy declined to. We are looking forward to conduct the advanced genetic search to understand the genetic interaction and interrogate the underline mechanism if more samples can be provided.

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