Anterior Synechiae After Penetrating Keratoplasty In Infants And Children With Peters' Anomaly

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Research Article

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Abstract

Purpose: To evaluate anterior synechiae (AS) after penetrating keratoplasty (PK) in patients with Peters' anomaly using anterior segment optical coherence tomography (OCT).

Methods: A retrospective cross-sectional study was performed. The medical records of patients diagnosed with Peters anomaly who underwent PK between 2013 and 2018 were reviewed. In addition to basic ophthalmic examinations, images of anterior segment structures were obtained via spectral-domain OCT at baseline and during the postoperative follow-up period. The profiles of postoperative AS and multiple potential risk factors were analyzed.

Results: Seventy-one eyes of 58 patients, aged 5 to 23 months, were included. Various extent of postoperative AS were observed in 59 eyes (83.1%). OCT findings revealed graft-host junction synechiae, peripheral anterior synechiae and a combination of both. Disease severity and malapposition of the internal graft-host junction (GHJ) were significantly associated with the formation of postoperative AS. Multivariate regression analysis found that preexisting iridocorneal adhesion (ICA) (odds ratio [OR]=16.639, 95% confidence interval [CI] 1.494-185.294, $p=0.022$) was positively correlated with postoperative AS, whereas anterior chamber depth (OR=0.009, 95% CI 0.000-0.360, $p=0.012$), and graft size (OR=0.016, 95% CI 0.000-0.529, $p=0.020$) were negatively correlated with postoperative AS. In addition, quadrants of preexisting ICA and the width of the host corneal bed were identified as risk factors for increased postoperative AS.

Conclusions: Postoperative AS is a relatively common occurrence in Peters' anomaly patients following PK and is found to be associated with preexisting ICA, a shallow anterior chamber, small graft size, GHJ malappositions and grafts closer to the corneal limbus. These data indicate the need for careful consideration when performing PK on these patients.

Introduction

Peters' anomaly is a rare, congenital ocular malformation characterized by central corneal opacity with corresponding defects in the posterior stroma, Descemet's membrane, and endothelium.^{1,2} Typically, iris strands extend from the collarette to the periphery of the corneal leukoma.^{3,4} The degree of visual deprivation depends on the size, location, and density of the opacity. When the corneal opacity obstructs the visual axis, penetrating keratoplasty (PK) may be the necessary first step in preventing irreversible loss of visual function. Pediatric keratoplasty is a challenging and demanding procedure because of the technical difficulties encountered while performing the surgery, the high rate of complications, and the threat of amblyopia. A better understanding of intra- and postoperative problems has enabled us to achieve a higher level of anatomical success.

Anterior synechiae (AS) is a common postoperative complication in younger patients who undergo PK due to low scleral rigidity, increased fibrin reaction, and positive vitreous pressure. In adults, previous studies have indicated that AS formation after PK may occasionally cause intraocular pressure (IOP)

elevation,⁵ and this is one of the risk factors for graft rejection.⁶ However, little is known about the features, the associated factors and the potential influences of postoperative AS in pediatric patients with Peters' anomaly. The ophthalmic examination of infants and children is often challenging owing to poor cooperation. In addition, eyes may have varying degrees of corneal clouding due to edema or retain peripheral opacity after PK, making it difficult to evaluate the entire anterior segment structures with a slit lamp and a gonioscope. As a fast, high-resolution, and noninvasive imaging technique, anterior segment optical coherence tomography (OCT) has proven to be valuable in pre- and intra-operative examinations of children with congenital corneal opacities.⁷⁻⁹ The information obtained in this way could be useful in clarifying diagnoses, categorizing Peters' anomaly and guiding surgical intervention.⁷⁻⁹

The purpose of this study was to evaluate the corneal grafts and AS after PK in patients with Peters' anomaly using anterior segment OCT.

Materials And Methods

Participants

This study was approved by the Ethics Committee of Eye and ENT Hospital of Fudan University and conformed to the Tenets of the Declaration of Helsinki. Written informed consent was obtained from all study participants and their legally authorized representatives.

Fifty-eight patients diagnosed with Peters' anomaly who underwent PK from December 2013 to April 2018 were included. Ophthalmic evaluations performed at the initial presentation included a slit-lamp examination of the anterior segment, an IOP measurement (Tono-Pen XL; Reichert Technologies, DePew, New York, USA), and indirect ophthalmoscopy of the posterior segment when feasible, or B-scan ultrasonography if the fundus was invisible because of corneal opacity. The clinical diagnosis was histopathologically confirmed in each eye that underwent PK. We defined disease severity in terms of three categories, mild, moderate, and severe, based on intraoperative and histopathological findings, as previously described by Hong et al.⁹ As part of systemic work-ups, patients were referred to a pediatrician to identify any systemic anomalies. Data were gathered by a retrospective review of medical records, operative reports and pathology reports.

Imaging instrumentation

A spectral-domain OCT (iVue 100-2; Optovue, Fremont, California, USA) was used for imaging of the anterior segment structures. OCT was performed under general anesthesia, before corneal transplantation or before suture removal. The cross-line scan mode (scanning width of 6 mm, and resolution of 5 μ m) was adopted to visualize the peripheral cornea, the graft-host interface, and the anterior chamber angle at an interval of 45°. The recorded OCT images were analyzed by two experienced observers (JX and YY) regarding the overall visibility of the anterior segment structures, such as iridocorneal adhesion (ICA) and anterior chamber depth (ACD).

Surgical technique and postoperative care

All keratoplasties were performed under general anesthesia by one surgeon (JJX), with a standard technique as previously described.¹⁰ The graft size was 6.0 to 7.5 mm in diameter. Overall, a graft-host disparity of 0.25–1.0 mm was maintained. The majority of the grafts (n=62, 87.3%) were 0.5 mm larger than the host cornea bed. Synechiolysis was performed when ICA was observed. Lens surgery, combined with anterior vitrectomy, was performed if cataract or corneal lenticular touch was identified. Excised host corneas were sent for histopathological examination.

Routine postoperative medications included topical corticosteroids, topical antibiotics and a topical immunosuppressant. Anti-glaucoma eye drops were prescribed when the IOP was continuously elevated over 21 mmHg or threatened graft survival. Suture removal was performed under general anesthesia when suture loosening or exposure was observed, as soon as wound healing permitted. The median time interval from corneal transplantation to initial suture removal was 2 months (mean: 2.7 months, range: 0.5–12 months).

Statistical analysis

Data analysis was performed using SPSS V.21.0 software (SPSS Inc., Chicago, Illinois, USA). Basic descriptive statistics were calculated based on all data gathered, and values were reported as means $\pm$ standard deviation. For comparative purposes, a Mann-Whitney U test was used for continuous parameters, and a chi-square test was used for categorical variables. A stepwise logistic regression analysis was performed to assess potential risk factors for postoperative AS. All the tests were two-tailed, and a p-value <0.05 was considered statistically significant.

Results

Clinical demographics

Fifty-eight patients with Peters' anomaly who were aged 5 to 23 months were assessed in this study. Of these patients, 28 (48.3%) were female and 30 (51.7%) were male. Twenty (34.5%) had unilateral disease, and 38 (65.5%) had bilateral disease. A total of 71 eyes underwent PK. Four patients had associated systemic anomalies including cardiopulmonary anomaly (n=3) and developmental delay (n=1).

Ocular characteristics

Six eyes (8.4%) were classified as having mild disease, 58 (81.7%) were moderate, and seven (9.9%) were severe. The mean IOP value was 17.9 ± 6.7 mmHg in all affected eyes. Corneal vascularization was observed in 43 eyes (60.6%). The horizontal and the vertical corneal diameters of the affected eyes were measured as 9.6 ± 0.8 mm and 8.9 ± 0.8 mm, respectively. Using anterior segment OCT, we observed various degrees of preexisting ICA, and a shallow anterior chamber was detected. The mean value of ACD

was measured to be 1.2 ± 0.4 mm, which was relatively smaller as compared with that in normal infants (3.1 mm).¹¹ Detailed clinical features are summarized in Table 1.

Table 1
Clinical findings of patients with Peters' anomaly before and after penetrating keratoplasty

Variables	Total(n=71)	Mild (n=6)	Moderate (n=58)	Severe (n=7)
Age (month)	9.6±4.1	8.5±2.4	9.5±3.9	11.3±6.3
Intraocular pressure (mmHg)	17.9±6.7	15.3±4.2	18.2±7.2	17.3±2.8
Anterior chamber depth (mm)	1.20±0.41	1.34±0.22	1.27±0.36	0.53±0.29
Preexisting ICA				
None	7 (9.9%)	6 (100%)	0	1 (14.3%)
1,2 quadrants	26 (36.6%)	0	26 (44.8%)	0
3,4 quadrants	38 (53.5%)	0	32 (55.2%)	6 (85.7%)
Corneal diameter (mm)				
Horizontal	9.6±0.8	10.1±0.7	9.6±0.8	8.9±0.8
Vertical	8.9±0.8	9.8±0.8	8.9±0.8	8.5±0.8
Graft size (mm)	6.6±0.3	6.8±0.4	6.6±0.3	6.4±0.2
Corneal vascularization				
None	28 (39.4%)	1 (16.7%)	24 (41.4%)	3 (42.9%)
Associated	43 (60.6%)	5 (83.3%)	34 (58.6%)	4 (57.1%)
Surgery				
PK	68 (95.8%)	6 (100%)	58 (100%)	4 (57.1%)
PK+ECCE	3 (4.2%)	0	0	3 (42.9%)
Postoperative anterior synechiae				
None	12 (16.9%)	4 (66.7%)	8 (13.8%)	0
1,2 quadrants	36 (50.7%)	2 (33.3%)	31 (53.4%)	3 (42.9%)
3,4 quadrants	23 (32.4%)	0	19 (32.8%)	4 (57.1%)
ICA= iridocorneal adhesion; PK=penetrating keratoplasty; ECCE=extracapsular cataract extraction.				

Postoperative anterior synechiae

Postoperative OCT scans showed AS formation in 59 eyes (83.1%). Table 2 compares the baseline characteristics of eyes with and without postoperative AS. The results showed that disease severity ($p=0.002$), ACD ($p=0.003$), corneal diameter ($p=0.009$), graft size ($p=0.001$), and preexisting ICA ($p=0.003$) were significantly different between the two groups. A univariate logistic regression analysis also demonstrated that these covariates had statistically significant associations with postoperative AS (Table 3). In the multivariable model, small graft size (odds ratio [OR]=0.016, 95% confidence interval [CI] 0.000–0.529, $p=0.020$), preexisting ICA (OR=16.639, 95% CI 1.494–185.294, $p=0.022$), and small ACD (OR=0.009, 95% CI 0.000–0.360, $p=0.012$) were found to be independent risk factors for postoperative AS (Table 3).

Table 2
Baseline characteristics of eyes undergoing penetrating keratoplasty with and without postoperative anterior synechiae

Variables	Postoperative AS (+)	Postoperative AS (-)	p-value
Age (months)	9.5±4.0	10.2±4.8	0.424*
Sex			0.366 [†]
Male	33 (86.8%)	5 (13.2%)	
Female	26 (78.8%)	7 (21.2%)	
Severity			0.002 [†]
Mild	2 (33.3%)	4 (66.7%)	
Moderate	50 (86.2%)	8 (13.8%)	
Severe	7 (100%)	0	
ACD (mm)	1.14±0.42	1.50±0.23	0.003*
Corneal diameter (mm)	9.5±0.8	10.1±0.6	0.009*
Graft size (mm)	6.5±0.3	6.9±0.3	0.001*
Graft-host disparity (mm)	0.53±0.12	0.48±0.07	0.180*
Width of host corneal bed (mm)	2.9±0.7	3.2±0.5	0.107*
Preexisting ICA			0.003 [†]
Yes	56 (87.5%)	8 (12.5%)	
No	3 (42.9%)	4 (57.1%)	
Internal GHJ Alignment [§]			<0.001 [†]
Well-apposed	56 (24.8%)	170 (75.2%)	
Malapposed	150 (43.9%)	192 (56.1%)	
Lens abnormality			0.209 [†]

* *P* values are based on Mann-Whitney U test; *p*<0.05 considered statistically significant.

† *P* values are based on chi-square test; *p*<0.05 considered statistically significant.

§ Excluded were the data from eyes without GHJ synechiae.

AS=anterior synechiae; ACD=anterior chamber depth; ICA=iridocorneal adhesion; GHJ=graft-host junction.

Variables	Postoperative AS (+)	Postoperative AS (-)	p-value
Yes	7 (100%)	0	
No	52 (81.3%)	12 (18.7%)	
Stromal vessels			0.411 [†]
Yes	37 (86.0%)	6 (14.0%)	
No	22 (78.6%)	6 (21.4%)	
* <i>P</i> values are based on Mann-Whitney U test; <i>p</i> <0.05 considered statistically significant.			
† <i>P</i> values are based on chi-square test; <i>p</i> <0.05 considered statistically significant.			
§ Excluded were the data from eyes without GHJ synechiae.			
AS=anterior synechiae; ACD=anterior chamber depth; ICA=iridocorneal adhesion; GHJ=graft-host junction.			

Table 3
Associations between baseline covariates and postoperative anterior synechiae formation

Variables	Univariable Model			Multivariable Model		
	Regression Coefficient	OR (95%CI)	p-value*	Regression Coefficient	OR (95%CI)	p-value*
Age	-0.038	0.963 (0.833, 1.112)	0.604	—	—	—
Sex (female vs male)	-0.575	0.563 (0.160, 1.979)	0.370	—	—	—
Corneal diameter	-0.999	0.368 (0.158, 0.860)	0.021	0.555	1.743 (0.376, 8.075)	0.478
Graft size	-3.156	0.043 (0.005, 0.366)	0.004	-4.126	0.016 (0.000, 0.529)	0.020
Width of host corneal bed	-0.621	0.537 (0.217, 1.332)	0.180	—	—	—
Preexisting ICA (yes vs no)	2.234	9.333 (1.757, 49.591)	0.009	2.812	16.639 (1.494, 185.294)	0.022
ACD	-3.058	0.047 (0.005, 0.471)	0.009	-4.732	0.009 (0.000, 0.360)	0.012
Stromal vessels (yes vs no)	0.520	1.682 (0.483, 5.862)	0.414	—	—	—
Suture retention time	-0.136	0.873 (0.669, 1.140)	0.320	—	—	—
*P values are based on logistic regression analysis; $p < 0.05$ considered statistically significant.						
ICA=iridocorneal adhesion; ACD=anterior chamber depth; OR=odds ratio; CI=confidence interval.						

The types of AS noted on the OCT images included synechiae at the graft-host junction (GHJ) in 30 (50.8%) eyes, synechiae at the peripheral host cornea in 7 (11.9%) eyes, and a combination of both sites in 22 (37.3%) eyes (Figure 1). A total of 568 GHJ sections were analyzed. All the GHJs had a continuous smooth epithelial surface, while 342 of them (60.2%) showed malappositions of the internal surface in the forms of gapes, steps and protrusions (Figure 2), as previously described by Kaiserman et al.¹² GHJ synechiae were presented in 150 (43.9%) of the malapposed junctions, and in 56 (24.8%) of the well-apposed junctions. A chi-square test showed a significant difference ($p < 0.001$) between the two groups

(Table 2), suggesting that the internal malapposition of the corneal wound was associated with AS formation.

Among the eyes presented with postoperative AS, 36 had synechiae in one or two quadrants, and 23 had three or four quadrants involved. Findings from the logistic regression analysis identified that larger areas of preexisting ICA (OR=9.609, 95% CI 1.872–49.329, $p=0.007$) and the width of the host corneal bed (OR=0.311, 95% CI 0.109–0.885, $p=0.029$) were independent risk factors for increased postoperative AS (Table 4). Here we defined the host corneal bed as the residual part of the recipient cornea after trephination (Figure 3). Eyes with grafts closer to the corneal limbus had narrower host corneal beds.

Table 4

Associations between baseline covariates and postoperative anterior synechiae >2 quadrants

Variables	Univariable model			Multivariable model		
	Regression Coefficient	OR (95%CI)	p-value*	Regression Coefficient	OR (95%CI)	p-value*
Age	-0.008	0.992 (0.868, 1.134)	0.905	—	—	—
Sex (female vs male)	-0.331	0.718 (0.248, 2.079)	0.542	—	—	—
Corneal diameter	-1.190	0.304 (0.126, 0.735)	0.008	—	—	—
Graft size	-0.658	0.518 (0.077, 3.490)	0.499	—	—	—
Width of host corneal bed	-1.341	0.262 (0.098, 0.701)	0.008	-1.170	0.311 (0.109, 0.885)	0.029
Preexisting ICA>2 quadrants (yes vs no)	2.463	11.735 (2.390, 57.614)	0.002	2.263	9.609 (1.872, 49.329)	0.007
ACD	-1.083	0.339 (0.090, 1.279)	0.110	—	—	—
Abnormal lens (yes vs no)	0.840	2.316 (0.468, 11.468)	0.304	—	—	—
Stromal vessels (yes vs no)	0.818	2.267 (0.725, 7.084)	0.159	—	—	—
Suture retention time	-0.089	0.915 (0.687, 1.219)	0.545	—	—	—
*P values are based on logistic regression analysis; $p < 0.05$ considered statistically significant.						
ICA=iridocorneal adhesion; ACD=anterior chamber depth; OR=odds ratio; CI=confidence interval.						

Discussion

Previous studies have described anterior segment OCT as a valuable technique in the clinical and preoperative assessment of patients with Peters' anomaly. In this study, we performed OCT on such

patients after they underwent PK to observe the microstructure of the anterior segment during the postoperative follow-up period. We found that 83.1% of the operated eyes had postoperative AS, which varied in range and site. Over half of the cases developed synechiae within two quadrants. The adherent iris strands were most commonly seen at the site of the internal GHJs, while other sites included the peripheral host cornea with or without angle synechiae.

AS is a frequent complication encountered after PK. Peripheral AS may cause secondary angle-closure glaucoma and lead to graft failure. AS at the graft-host interface was regarded as a poor prognostic factor, being associated with the loss of graft clarity via interfering with the adequate wound healing of the posterior aspect of the cornea and promoting endothelial disturbances, retrocorneal membranes, and corneal vascularization, which facilitated immune rejection.^{13, 14} The reported incidence of peripheral AS after PK in adult patients varied between 8% and 46.7%, with or without IOP elevation.^{15–17} Our results revealed a considerably higher prevalence rate of postoperative AS in infants and children with Peters' anomaly.

Pediatric PK is more complicated and technically more difficult than adult PK due to decreased scleral rigidity, alarming posterior pressure, anterior movement of the lens-iris diaphragm and increased fibrin release, which may lead to the adherence of the iris to the peripheral cornea and the wound. The present study found that preexisting iris-corneal adhesion and a shallow anterior chamber were risk factors for postoperative synechiae. Corneal opacification, along with iridocorneal adhesions, is one of the major characteristics of Peters' anomaly. In addition, such patients have smaller anterior segment dimensions. During surgery, they are more likely to experience hemorrhages and injury to the iris, which may intensify the inflammatory response and fibrinous reaction, causing postoperative AS. On the other hand, it is hypothesized that due to long-standing adhesion, the iris may become flaccid with advanced atrophic changes and tends to retain this abnormal position, leading to the reformation of synechiae postoperatively.¹⁸ Because patients with severe disease often had larger areas of preexisting iris-corneal touch and smaller ACD values,⁹ they were found to be more susceptible to generate postoperative AS.

Preexisting iridocorneal adhesion has been identified as a poor prognostic factor. Yang et al reported that the graft failure rate was higher in eyes with preexisting iridocorneal adhesions over two quadrants in cases of Peters' anomaly.¹⁹ Other studies have found that preoperative diagnoses, such as adherent leukoma and infectious keratitis, featured with preexisting iridocorneal adhesions and inflamed floppy iris, increased the odds of postoperative AS and secondary angle-closure glaucoma.^{20–22} It is paramount to perform synechiolysis after the wound is closed to help prevent postoperative AS formation. Despite optimal synechiolysis, a high prevalence rate of postoperative AS was still observed in the current study.

Other factors contributing to the formation of postoperative AS in these patients included small corneal size and small graft size. In eyes with Peters' anomaly, the size of the donor tissue was tailored to the size of the opacity and of the host cornea. Because of the increased elasticity of the infant cornea and sclera, it is recommended that the diameter of the donor tissue be 0.5-1.0 mm larger than the recipient opening.²³ In the current study, 95.8% of the cases had a graft-host disparity within this range. Also, there

was a significant correlation between the graft size and the recipient corneal size ($p=0.005$). Eyes grafted larger donor cornea buttons may have larger corneal sizes and thus allow adequate space of the anterior segment during the process of wound healing and wound retraction, and may help reduce the risk of postoperative synechiae. Moreover, a negative correlation was identified between the width of the host corneal bed and quadrants of postoperative AS. This suggested that the narrower the host corneal bed was, the closer the surgical manipulation and the GHJs were to the corneal limbus, which may induce larger amounts of AS.

In this study, an association between malapposition of the internal GHJ and postoperative AS was also observed. The prevalence of GHJ malappositions in the patient population was 60.2%, which was similar to that previously reported in cases of adult PK.^{12,24} AS formation might follow such malapposition because the iris tends to adhere to bare stroma more readily.²⁵ Proper wound apposition and meticulous wound closure are essential to avoid iris incarceration in the wound intraoperatively and may prevent or lessen the risk of postoperative synechiae.^{17,25} However, achieving proper tissue apposition and wound closure can be difficult due to thinner and more pliable corneal tissue, anterior displacement of the lens-iris diaphragm, and wound retraction. Graft-host misalignment may be induced and increase the chances of adherence of the iris to the surgical wound.

The limitations of this study are mainly related to its short-term nature. Postoperative OCT scans were obtained only when young patients came for suture removal, due to the requirement of general anesthesia during examination. After the sutures were completely removed, we lost track of the OCT evaluations for these children. In cases where AS formation is a concern, the areas involved should be closely watched for the development of IOP elevation, graft rejection or other postoperative complications. Hence, a portable hand-held OCT device is recommended in routine and long-term follow-ups to observe the AS progression, provide precise data about the anterior segment structures, and clarify the effect of postoperative AS on the prognosis of PK in Peters' anomaly patients. Second, in cases with thick and dense opacity in the peripheral cornea and the limbus area, the current OCT scanning system (wavelength = 830 nm) limited the visualization of the structures in the anterior chamber angle. A longer-wavelength OCT modality that allows for higher penetration and reproducible measurements may be useful and complementary in prognostic analysis, as well as guiding postoperative management.

In conclusion, this retrospective study provides insights into the characteristics of anterior synechiae after PK in pediatric patients with Peters' anomaly. We demonstrated that AS was a common postoperative complication in these patients, and that several risk factors were associated with its occurrence. The results allow predictions to be made regarding which patients are more likely to form postoperative AS and help clinicians to evaluate and manage patients with this rare yet challenging disease. Still, the prognostic effects of postoperative AS on graft survival and visual success remain to be determined. Anterior segment OCT allows characterization of the type and the extent of postoperative AS, thus it is recommended during the clinical and surgical follow-up of these patients to help reduce associated morbidity.

Declarations

Data availability

The data that support the findings of this study are available on request from the corresponding author JJX. The data are not publicly available because part of them contained information that could compromise research patient privacy.

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Author contributions

YY and JJX designed the study; YY and JX performed the examinations and analyzed the data; JJX helped to interpret the data; YY wrote the original draft. All authors contributed to revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Eye and ENT Hospital of Fudan University and conducted in accordance with the Tenets of the Declaration of Helsinki. Written informed consent was obtained from all participants and their legally authorized representatives.

Consent for publication

Not applicable.

Conflict of interests

The authors have no commercial or proprietary interest in any concept or product described in this article. The authors declare that they have no competing interests.

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Figures

Figure 1

Types of anterior synechiae following penetrating keratoplasty in cases of Peters' anomaly. Anterior segment optical coherence tomography images showed graft-host junction synechiae (A, C, E), peripheral synechiae (B, D), and a combination of both (F).

Figure 2

Main types of malappositions found in the internal graft-host junctions following penetrating keratoplasty in Peters' anomaly. In addition to well-apposed junctions (A), we also noted steps, either host steps (C) or graft steps (E), protrusions such as hills (B) or tags (D), and gapes (F).

Figure 3

A 10-month-old boy with moderate Peters' anomaly had penetrating keratoplasty in his right eye. (A) A surgical microscope image of the patient's cornea is shown, with the opaque cornea trephined. (B) Three months postoperatively, the graft was well-centered and clear. The blue area shows the host corneal bed. Anterior segment optical coherence tomography images show the formation of postoperative anterior

synechiae in the nasal (D) and the inferior (E) quadrants, while no iridocorneal adhesion was observed in the superior (C) or the temporal (F) quadrants.