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Stepwise treatment stratagem of young patient with Reis–Bücklers corneal dystrophy: A case report

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Case Report

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Abstract

Background: Reis–Bücklers corneal dystrophy (RBCD) is a rare, early-onset corneal dystrophy caused by mutations in the transforming growth factor β-induced (TGFBI) gene. It is characterized by the deposition of hyaline-like material in the Bowman's layer, resulting in recurrent corneal epithelial erosion and progressive subepithelial corneal opacity.

Case presentation: We report the long-term follow-up results of children with RBCD who developed the condition in early childhood, tracking them from 3 through13 years of age. For epithelial detachment in early infancy, we controlled corneal epithelial defects using a combination of disposable soft contact lenses (DSCL) and hard contact lenses (HCL), along with anti-inflammatory and lubricating eye drops. Concurrent amblyopia treatment achieved good visual acuity. Furthermore, during this treatment course, we confirmed that performing curettage of the erosive base at the onset of recurrence enabled removal of deposits, improved transparency, and reduced the frequency of epithelial erosion occurrence. Subsequently, as corneal opacity progressed at age 13 years, additional treatment with corneal electrolysis proved effective. Thus, stepwise treatment from early to mid-infancy contributed to maintaining good visual acuity. Based on the course of this case, we suggest a treatment strategy for patients with RBCD during early childhood and school age.

Conclusions: Given the need for long-term management, we propose a stepwise treatment strategy based on disease stage, patient age group, amblyopia prevention, and psychological burden, aimed at maintaining visual acuity throughout childhood.

BACKGROUND

Reis–Bücklers corneal dystrophy (RBCD), originally described by Reis[1] and Bücklers[2], is caused by an R124L mutation in the transforming growth factor β-induced (*TGFBI*) gene located on chromosome 5q31[3]. The disease is characterized by the deposition of hyaline-like material in the Bowman's layer beneath the corneal epithelium, leading to impaired epithelial adhesion, recurrent corneal epithelial erosion, and progressive subepithelial corneal opacity from early childhood.

In the International Committee for Classification of Corneal Dystrophies-Edition 3 classification, RBCD is categorized as corneal dystrophy of the Bowman's layer and anterior stroma (CDB type 1) associated with *TGFBI* gene mutations[4,5]. As the lesions are confined to the Bowman's layer and the superficial stroma, several surgical treatment options have been reported, including therapeutic phototherapeutic keratectomy (PTK), corneal electrolysis, and superficial keratoplasty. Although these reports describe short-term outcomes and prognosis in a relatively large case series, long-term follow-up observations of individual patients, particularly from early childhood, remain limited.

This report details the long-term course of a patient with RBCD who developed the disease in early childhood and maintained good visual acuity through continuous treatment from 3 through 13 years of age over a total follow-up period of 10 years. Herein, we describe the course of corneal electrolysis and

propose a strategy for the long-term management of RBCD, with particular attention to amblyopia prevention during early childhood.

CASE PRESENTATION

A female patient aged 3 years was referred for refractory, recurrent bilateral corneal epithelial erosion. At the initial visit, bilateral conjunctival infections and central corneal epithelial erosion were observed (Fig. 1). Best-corrected visual acuity (BCVA) was 0.52 logMAR in the right eye and 1.10 logMAR in the left eye. A first-degree relative exhibited similar clinical findings and was diagnosed with RBCD based on genetic testing at another institution. Based on these findings, the patient was clinically diagnosed with RBCD, and subsequent blood testing confirmed the R124L mutation in both the patient and the affected relative.

After the initial visit, the patient experienced multiple episodes of bilateral corneal epithelial erosion. Each episode was managed with disposable soft contact lenses (DSCL) wear. During the stable period after epithelial healing, amblyopia treatment was initiated using spectacles combined with hard contact lenses (HCL) for several hours daily.At age 5 years, the patient achieved BCVA of 0.00 logMAR in both eyes with appropriate optical correction.

Although the frequency of epithelial erosion gradually decreased, the relapse was managed by DSCL wear. The detailed clinical course in early childhood has been described in a previously published report[6].

At age 9 years, the recurrence of unilateral corneal epithelial erosion was accompanied by marked deposits at the base of the erosion. Before administering the DSCL therapeutically, the erosion base was gently scraped using a spatula and the deposits were manually removed. After epithelial repair, improvement in corneal transparency was observed at the affected site[7]. BCVA was approximately −0.08 logMAR in both eyes with HCL correction.

Subsequently, the frequency of epithelial erosion at this site decreased, but corneal opacity gradually progressed. At age 13 years, the patient exhibited decreased visual acuity after optical correction, with BCVA of 0.40 logMAR in the right eye and 0.70 logMAR in the left eye (Fig. 2a, b).

Confocal laser microscopy revealed localized deposits of highly reflective, irregular granular material within the basal epithelial layer, with similar highly reflective granular material observed replacing tissue at the level of Bowman's layer[8] (Fig. 3a–c). Due to the progression of corneal opacity, corneal electrolysis was performed during at age 13 years[9,10].

Corneal electrolysis was performed on the affected eye. Following previously reported methods[9], a 5 mV current was applied using a cornea-specific probe, gently rubbing the basal opacity of the corneal erosion while instilling physiological saline to dissolve the deposits. The procedure was terminated when the rough texture caused by the deposits disappeared. DSCL were applied to conclude the procedure.

Postoperative topical antibiotic eye drops, corticosteroid eye drops, lubricating eye drops, and antibiotic ointments were administered. The DSCL were replaced every 2 weeks and continued for 1 month postoperatively.

Epithelial healing was completed within approximately 1 week (Fig. 4). At the 2-month postoperative visit, anterior segment optical coherence tomography (AS-OCT) confirmed resolution of the central corneal opacity and smoothing of the ocular surface (Fig. 4a, b), which led to corneal transparency (Fig. 5). BCVA was 0.30 logMAR in the right eye and 0.15 logMAR in the left eye. At the 4-month postoperative visit, BCVA was 0.30 logMAR in the right eye and 0.10 logMAR in the left eye. Over the 4-month postoperative follow-up period, no recurrence of epithelial erosion or progression of corneal opacity was observed. The patient remains under regular follow-up.

DISCUSSION AND CONCLUSION

In Reis–Bücklers, corneal dystrophy and abnormal hyaline-like material are deposited primarily in the Bowman's layer and its adjacent epithelium or superficial stroma, leading to impaired epithelial adhesion and recurrent corneal epithelial erosion. During the wound-healing process following erosion, further accumulation and hardening of deposits are thought to occur, creating a vicious cycle that predisposes the cornea to subsequent erosion and progressive opacity.

In the present case, we observed the clinical course and treatment response over a prolonged period of 10 years, from 3 to 13 years of age. During early childhood, when corneal deposits are relatively soft, mechanical removal of deposits by scraping the base of the corneal epithelial erosion is effective at promoting epithelial healing and improving corneal transparency. This approach can be performed on an outpatient basis with minimal physical and psychological burden, allowing continued follow-up without inducing fear of ophthalmic examinations, even in younger patients. In addition, the combined use of DSCL and HCL during stable periods contributes to amblyopia prevention and the maintenance of good visual acuity.

Although the frequency of epithelial erosion decreased with this approach, the quantity and hardness of the deposits gradually increased over time, and eventually became difficult to remove using simple mechanical curettage. Previously reported AS-OCT findings in RBCD have demonstrated irregular reflections in Bowman's layer and the adjacent epithelial and stromal layers[11]. In the present case, preoperative AS-OCT showed opacity near the Bowman's layer. Opacity was resolved by electrophoresis. As the patient reached 13 years of age and was able to understand the disease and its treatment, corneal electrolysis was performed without significant psychological stress. In this case, epithelial healing after electrolysis was rapid and no postoperative complications, such as persistent epithelial defects or irregular astigmatism, were observed.

Regarding the use of corneal electrolysis in RBCD, Nishino et al. reported seven cases, with the youngest patient being 15 years old[9], while Kamoi et al. reported a case treated at 11 years of age[12]. The proposed

mechanism of electrolysis involves the migration of sodium ions toward the cathode, where they react with water to generate sodium hydroxide, which is thought to dissolve hyaline-containing corneal deposits[9,10]. Although potential risks, such as persistent epithelial defects or postoperative irregular astigmatism, have been reported, electrolysis offers the advantage of relatively rapid postoperative visual recovery. In our patient, electrolysis was performed as the next therapeutic step following corneal epithelial curettage, rather than as an adjunct to PTK or keratoplasty, which resulted in favorable outcomes.

RBCD manifests in early childhood and requires long-term management, necessitating careful consideration of visual development and the psychological burden on patients and their families. Based on our experience, we propose a stepwise treatment strategy involving 1) mechanical removal of deposits during epithelial erosion combined with DSCL use and topical medical therapy in early childhood, 2) amblyopia prevention using spectacles and HCL once epithelial stability is achieved, and 3) corneal electrolysis in older school-aged children or early adolescents when deposits become dense and rigid. More invasive procedures, such as PTK or full-thickness keratoplasty, should be reserved as last-resort options. Continued long-term follow-up is essential for managing this progressive disease.

Abbreviations

RBCD
Reis–Bücklers corneal dystrophy
TGFBI
transforming growth factor β-induced
PTK
phototherapeutic keratectomy
DSCL
disposable soft contact lense
HCL
hard contact lenses
AS-OCT
anterior segment optical coherence tomography

Declarations

Conflict of interest

None declared

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The procedures were approved by the Institutional Review Board of Kansai Medical University (No. 2023124) and conformed to the tenets of the Declaration of Helsinki. A signed written informed consent form was obtained from each patient for the examination procedures and the use of any data for future publications. The patients were assured of their anonymity.

CONSENT FOR PUBLICATION

Signed written informed consent was obtained from the patient's parents for the publication of the case. The patients' parents were assured of the anonymity of their reports.

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Author Contribution

KAS designed the observation and performed the treatment of this patient. MKT and RTcollected and analyzed the data and the patient's results. KAS organized thedata and drafted the manuscript. KAS and HI supervised the treatment and prepared the case report. All the authors have read and approved the final version of themanuscript.

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Data Availability

Not applicable.

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Figures

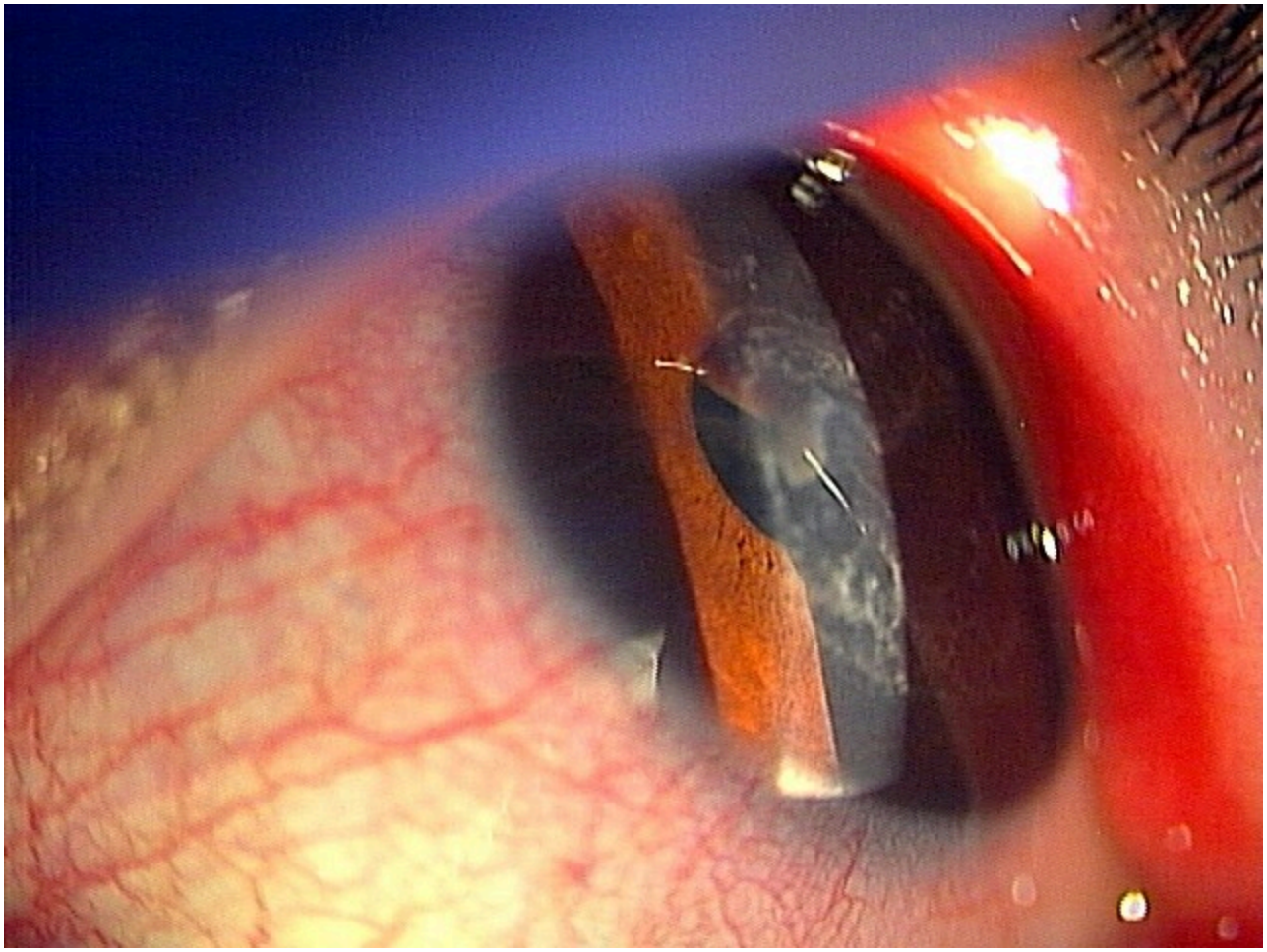


Figure 1

Left eye slit-lamp photograph at age 3

The cornea exhibited extensive erosion and marked hyperemia. White deposits were observed in some areas of corneal erosion.

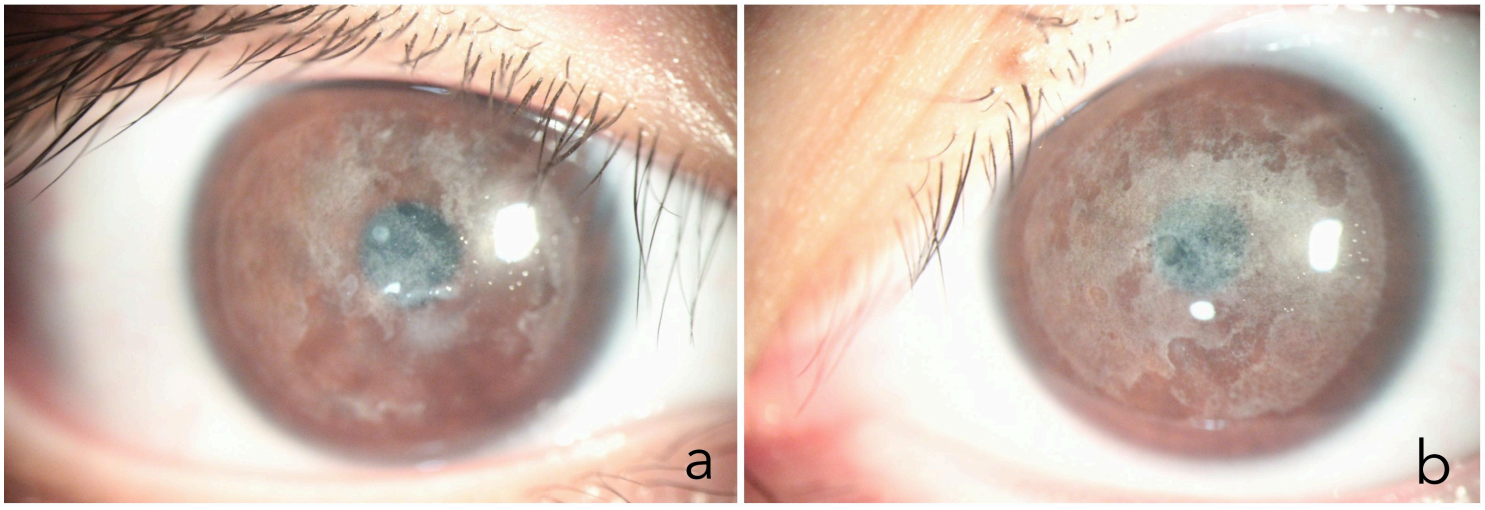


Figure 2

Slit-lamp photographs at age 12

(a) Right eye

(b) Left eye

As age progressed, the frequency of epithelial erosion decreased and subepithelial opacity became more pronounced and noticeable.

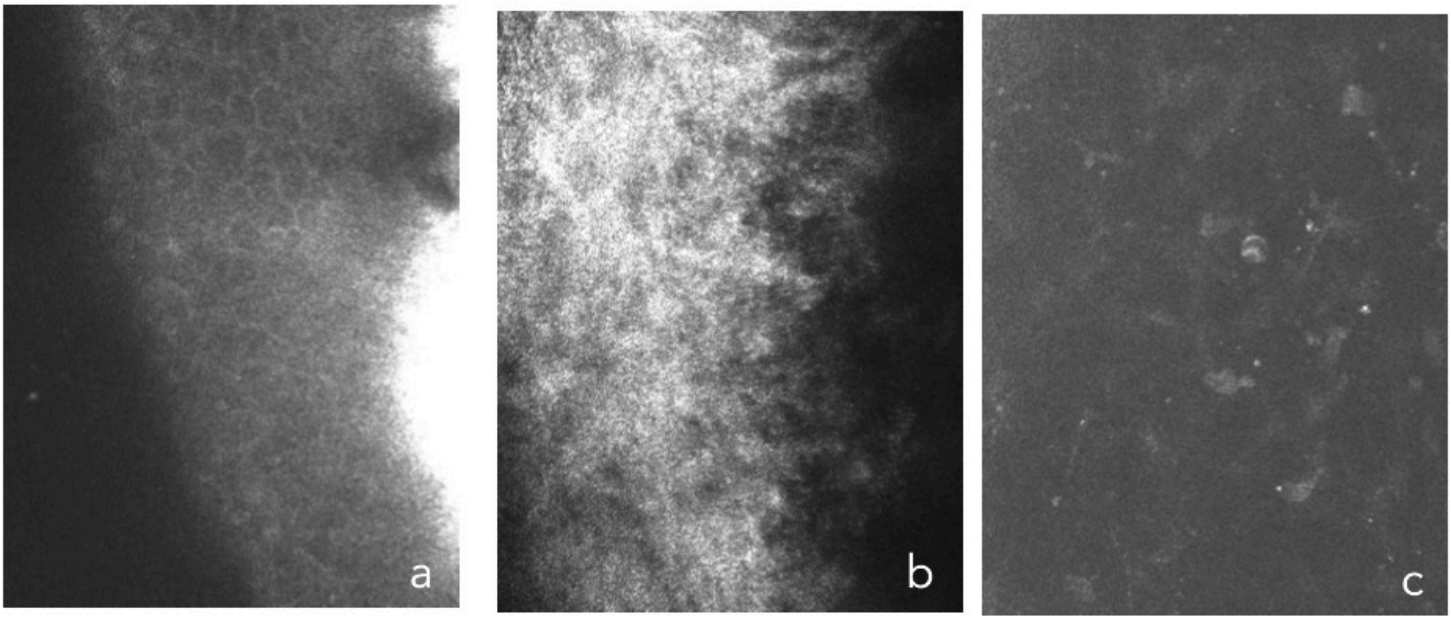


Figure 3

Confocal microscopic observation without erosion. A : epithelial side, b: Bowman's layer, c : stromal side.

High-intensity diffuse deposits were observed in the Bowman's layer (b). Epithelial cells are neatly arranged, but show slight size variations (a). Spindle-shaped parenchymal cells were also observed in the stromal layers (c).

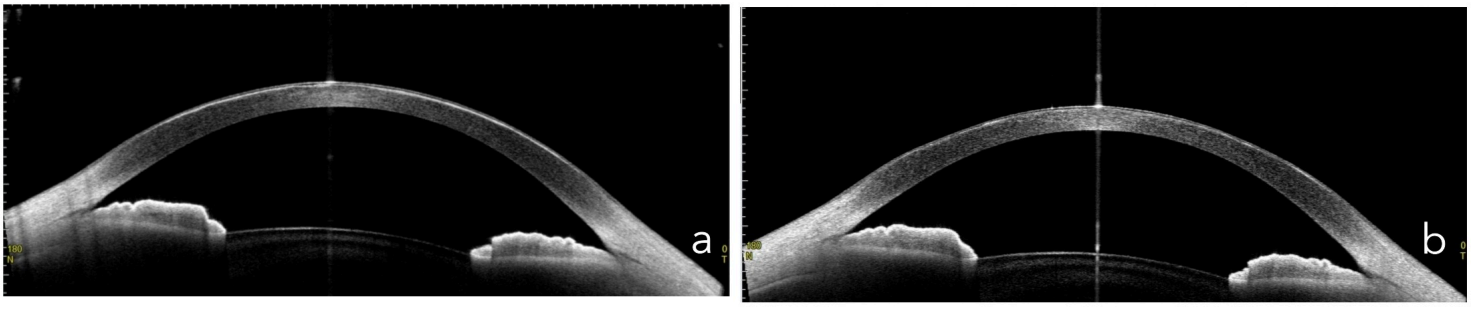


Figure 4

Anterior segment optical coherence tomography images before and after electrophoresis

Prior to electrophoresis, a high-intensity membranous deposit was observed beneath the epithelium of the central cornea (a). After electrophoresis, it is evident that the deposit decreased overall and improved (b).

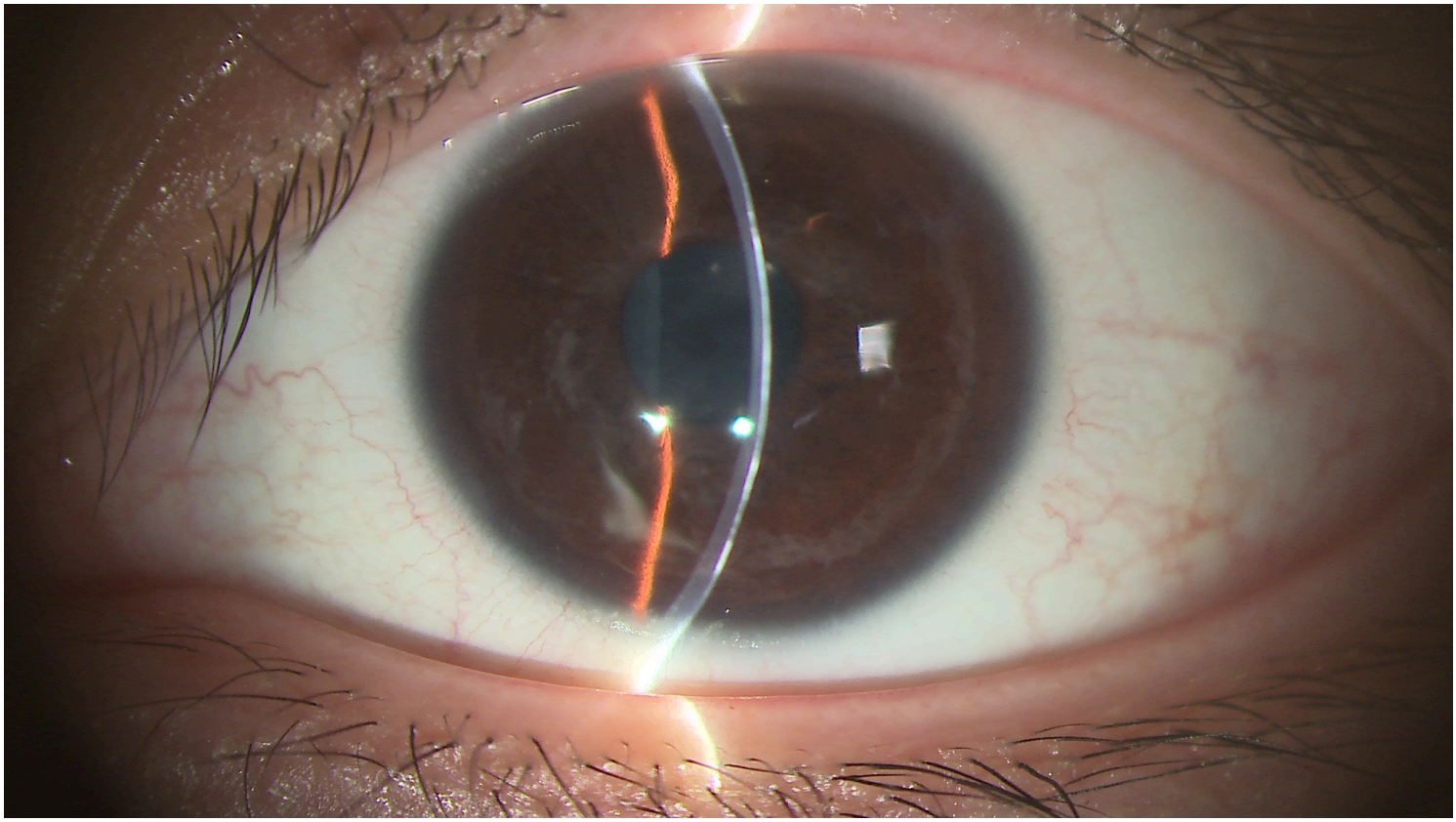


Figure 5

Slit-lamp photograph after corneal electrolysis at age 13

Although the peripheral corneal opacity persisted, central opacity improved and the epithelium was stable.