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CASE REPORT

Serratia marcescens keratitis following the use of a scleral lens for a persistent epithelial defect after penetrating keratoplasty

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Abstract

We want to present a case of *Serratia marcescens* keratitis after the use of the scleral lens with an autologous serum fluid reservoir. The epithelial defect of a 75-year-old male patient who underwent penetrating keratoplasty due to perforating eye injury persisted for 4 months post-operatively despite intensive treatment. The patient was hospitalized to perform autologous serum application in a gas-permeable scleral contact lens reservoir. After 6 days, the corneal surface was completely epithelialized. He was discharged with topical steroid drops and copious preservative-free sodium hyaluronate treatment. An appointment was made for examination 1 week later. Keratitis was detected in the patient who presented with pain and decreased vision on the 10th day after discharge. *S. marcescens* was grown in corneal scraping samples. Re-keratoplasty was performed on the patient who did not resolve stromal infiltration despite fortified topical antibiotic therapy. The application of autologous serum in the scleral lens reservoir is recommended for the treatment of persistent epithelial defects resistant to other methods. However, one should be aware of the complication of microbial keratitis when using scleral lenses. We emphasize that the use of preservative-free antibiotics in the scleral lens reservoir may be safer for infection control.

Keywords: Persistent corneal epithelial defect, Scleral contact lenses, *Serratia marcescens* keratitis

The corneal epithelium is a squamous tissue that may repair on its own and is a must for clear vision and a protective barrier against infectious agents. Not only defects, but also disorganizations in this layer can lead to haze and blurry vision. Even though corneal healing counts on limbal stem cells and remodeling of the basement membrane, typically re-epithelialization and closure occur

within 10–14 days.^[1] However, with some risk factors, such as dry eyes, neurotrophic corneal disease, limbal stem cell deficiency, or inflammatory conditions, this period may be prolonged and named as persistent corneal epithelial defects (PCED).^[2]

Conventional modalities for PCED comprise lubricants, topical cyclosporine, soft bandage contact lenses, au-



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tologous serum tears, oral doxycycline, amniotic membrane grafts, and tarsorrhaphy.^[3] When the healing fails with these therapies, gas-permeable scleral lenses (GP-SCLs) may be used to achieve the resolution of a PCED. In fact, prosthetic devices may be used for therapeutic use to enhance healing and reduce symptoms, with custom-made named Prosthetic Replacement of the Ocular Surface Ecosystem (PROSE) devices, which are approved by the US Food and Drug Administration (FDA).^[4] Even though the incidence of microbial keratitis with scleral lenses is lower than with bandage soft contact lenses,^[5] Lim et al.^[6] reported some cases of microbial keratitis who wore extended use of a PROSE device with the cause of PCED.

In this case report, we want to describe a patient who underwent re-keratoplasty due to microbial keratitis after the use of a scleral lens with a fluid reservoir of autologous serum for PCED.

Case Report

A 75-year-old male patient presented to the ophthalmology department with a central corneal laceration with a damaged anterior lens capsule. The urgent treatment involved repairing the corneal perforation and performing a lensectomy without implanting an intraocular lens, resulting after 6 months in the development of a corneal scar on the aphakic eye with an iris defect in the superior quadrant. After 6 months of trauma, he underwent penetrating keratoplasty, scleral fixation intraocular lens implantation with the Yamane technique,^[7] and pupilloplasty. In the post-operative 1-month follow-up, visual acuity improved from hand motion to finger counting at 4 m, and the corneal graft was clear. However, the corneal epithelium was dense, and the ocular surface was disorganized. One week later, the patient complained of pain and burning in his left eye. Ophthalmological examination revealed a large epithelial defect and strong, taut sutures in the central part of the cornea. The patient was administered copious lubrication, oral doxycycline 100 mg (twice a day), soft contact lens fitting, and 20% topical autologous serum eye drops, but the epithelial defect did not heal. During the 4-month follow-up period, the epithelial defect persisted despite amnion membrane transplantation 2 times in addition to the above-mentioned treatments (Fig. 1). The patient was hospitalized to perform autologous serum application in a 16.3 mm diameter GP-SCL (ICD FLEXFIT, Katt Design, UK) reservoir. At daily morning and night visits, the scleral lens was disinfected with solution (GP +Plus,

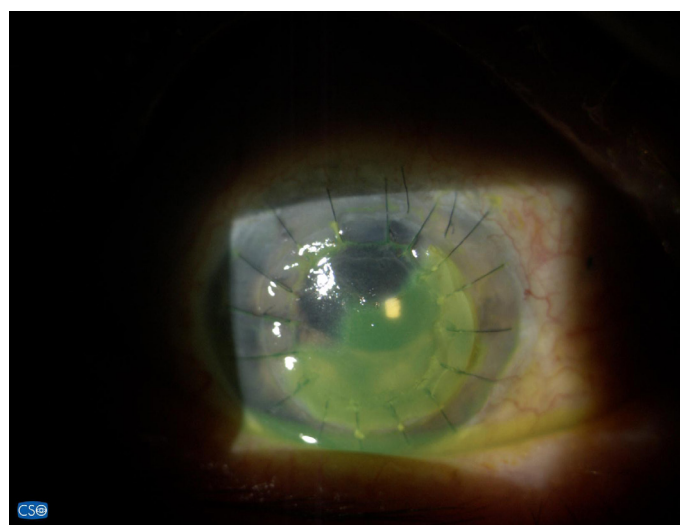


Fig. 1. Anterior segment photograph of the patient after penetrating keratoplasty with persistent epithelial defect.

Elegance), an appropriate amount of autologous serum was dropped into the lens reservoir, and then placed on the ocular surface by an ophthalmologist. When the lens was removed from the eye during disinfection, topical dexamethasone and moxifloxacin were dropped into the conjunctival sac until the scleral lens was placed and were dropped into the conjunctival sac twice while the scleral lens was worn.

Six days later, the corneal surface was completely epithelialized. The scleral lens was removed, and autologous serum was discontinued. The patient was discharged with topical dexamethasone and copious preservative-free sodium hyaluronate. After the 10th day of discharge, he presented with complaints of pain, redness, and decreased vision. Visual acuity decreased to hand movement due to stromal keratitis infiltration in the upper paracentral region accompanied by thinning of the cornea (Fig. 2). He was hospitalized, and corneal scraping samples were taken for direct staining and culture. Empirically fortified voriconazole (1%) and imipenem (0.1%) treatment was administered. The culture results of the corneal sample showed growth of *Serratia marcescens*. Since the infiltration did not improve for 5 days, the patient underwent re-keratoplasty. In addition to hourly fortified antibiotic treatment, dexamethasone drops and preservative-free sodium hyaluronate drops were used 4 times a day.

Six months after re-keratoplasty, best-corrected visual acuity was 20/40 and the corneal graft was clear and completely re-epithelialized. The cell density in specular microscopy was 3026, and pachymetry was 570 μ m (Fig. 3).

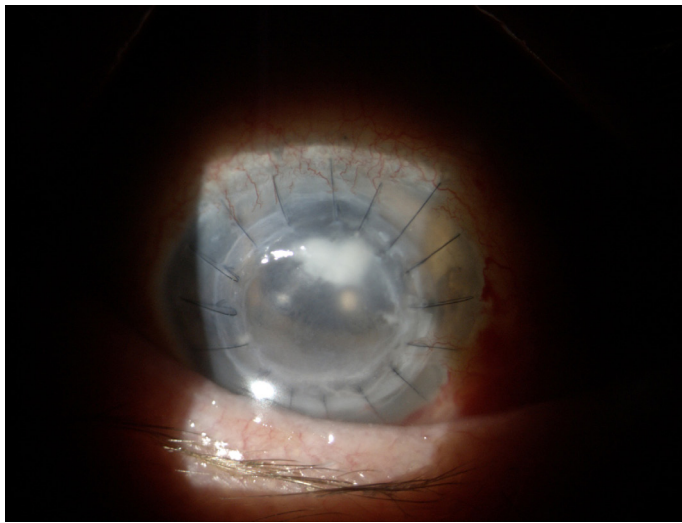


Fig. 2. *Serratia marcescens* keratitis.

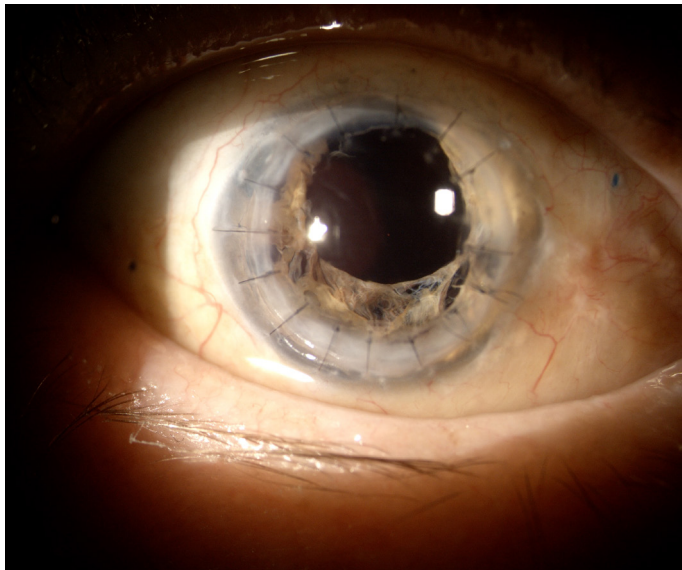


Fig. 3. Post-operative 6th month of the patient who underwent re-keratoplasty after keratitis.

Discussion

PCED are occasionally hard to manage notwithstanding therapeutic interventions. Recently, scleral contact lenses with a fluid-filled reservoir have shown efficacy in promoting re-epithelialization and healing keratopathy.^[8] It is thought that facilitation of epithelialization by creating an optimal corneal niche, protecting as a shield against eyelid blink-induced microtrauma, regulating tear evaporation, and ensuring constant fluid reservoir with sufficient oxygenation. In addition, the low rate of reservoir fluid turnover which could be observed with fluorescein-stained tears under the lens even after 24 h, maintains greater corneal time and would also apply to drugs placed in the lens reservoir.^[3]

In a study by Rosenthal in 2000, 12 of 14 eyes that had persistent epithelial defects following penetrating keratoplasty were fitted with a gas-permeable scleral contact lens. An antibiotic and corticosteroid were added to the lens fluid reservoir with a sterile saline solution. Eight of these eyes were re-epithelialized with GP-SCL extended wear with 11.5 days as an average time to resolution. However, six of these PCED failed to heal with a GP-SCL wear.^[3] In Rosenthal's study in 2005, twenty-two eyes were fitted with a GP-SCL for PED and thirteen eyes were healed refractory PED. The continuous wear was arranged with 48- or 72-h intervals and changing the fluid reservoir contained steroid and antibiotic.^[8] In our patient, a GP-SCL was fitted with a 12-h fitting time. Unlike other studies, the lens reservoir was filled with an appropriate amount of autologous serum. During the disinfection of the scleral lens, topical dexamethasone, and moxifloxacin drops were instilled into the conjunctival sac. The scleral lens was disinfected 2 times a day with a disinfection solution.

Vilares Morgado et al.^[9] reported a case of continuous wear of a gas-permeable mini-scleral contact lens with a fluid reservoir of autologous serum for PCED with severe neurotrophic keratopathy due to severe dry eye disease and chronic contact lens wear. After 2 weeks the corneal epithelium eventually started to regenerate, and 4 weeks later, the cornea was completely re-epithelialized.

In the Rosenthal 2000 series, four eyes had infectious keratitis during extended wear GP-SCL and required penetrating keratoplasty. One of these four cases was not on a prophylactic antibiotic and three cases had been treated with prophylactic early-generation fluoroquinolone. One of them was *Streptococcus pneumoniae* keratitis which was successfully treated with a penetrating keratoplasty, and the PCED has not recurred on a scleral lens daily wear schedule during a follow-up period of 24 months. Other organisms were *Staphylococcus epidermidis* and *Mycobacterium abscessus*.^[3] In the Rosenthal 2005 study, four of twenty-two eyes developed a bacterial ulcer requiring penetrating keratoplasty. This complication did not occur in the past eight cases, in which one drop of non-preserved fourth-generation fluoroquinolone was added to the fluid reservoir of the lens. The development of microbial keratitis reduced from 29% to 18% through the removal, cleaning, disinfection, and reservoir fluid replacement of scleral lenses.^[8]

In addition, Severinsky et al.^[10] reported microbial keratitis under scleral lenses with the aim of refractive correction. According to the study, two out of 33 eyes (6%) experienced

an episode of microbial keratitis under wearing a scleral lens because of the irregular astigmatism following penetrating keratoplasty. The microorganism could not be cultured, and the complication was reported probably due to poor lens compliance.

In our case as well, the elderly patient was admitted to the clinic to optimize treatment and manage the removal and cleaning procedures. Despite complete corneal re-epithelialization, the patient presented with *S. marcescens* keratitis, which did not respond to antibiotic treatment. Eventually, the condition was successfully managed with a penetrating keratoplasty, and there was no recurrence of persistent epithelial defect.

S. marcescens is a Gram-negative rod commonly associated with contact lens-related infections. These infections often arise from contaminated contact lens solutions and are known to be resistant to antibiotics and disinfectants, adhering to surfaces such as contact lenses.^[11] Chen et al.^[12] reported a case of *S. marcescens* corneal ulcer as a complication of orthokeratology treatment and the lesion healed within 1 week with topical ciprofloxacin treatment. Lim et al.^[6] and Ciralsky et al.^[13] studies are the only studies in the literature where all patients receive a preservative-free 4th-generation fluoroquinolone in the reservoir for the purpose of minimizing the risk of microbial keratitis and reported zero microbial keratitis rates.^[6-13] In our case, the non-preserved moxifloxacin could not be added to the lens reservoir due to the lack of suitable commercial non-preserved agents around our territory and probably for this reason *S. marcescens* keratitis developed.

Conclusion

PROSE devices are highly recommended for the treatment of persistent epithelial defects resistant to other modalities. However, there have been some reports that had a complication of microbial keratitis while using scleral lenses. It is considered that applying antibiotics to the conjunctival sac seems to be inadequate. We emphasize that the use of preservative-free antibiotics in the scleral lens reservoir may be safer for infection control.

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