

A Case of Multiple Graft Failures Following Scleral Contact Lens Wear in a Keratoconic Eye

R. Amaral BSC, OD, L. Prokopich OD, MSc, N. Furtado OD, FAAO

Introduction

- This case report describes an incident of graft failure due to endothelial decompensation status post penetrating keratoplasty (PKP) as a suspected complication of post-surgical scleral contact lens (CL) wear
- The safety and efficacy of scleral CLs following PKP is discussed as well as alternative options for refractive correction

Background

PKP has been the ideal treatment for advanced keratoconus for many years. Although it demonstrates great success at visually rehabilitating eyes with various forms of keratopathy, it frequently results in high degrees of irregular astigmatism and anisometropia.

Scleral CLs are becoming a popular choice of optical correction for highly irregular corneae:

- A stable fit is easier to achieve and maintain as the lens vaults over the uneven corneal surface
- A high level of patient comfort is preserved

However, there is a lack of evidence evaluating the long-term safety of these lenses post-PKP, including the association of CL wear with graft failure due to induced corneal hypoxia.

Case Presentation

A 40-year-old Caucasian man presented for a scleral contact lens progress check in September 2019

Chief complaint:

- Fluctuating hazy central vision OS starting 20 minutes after scleral CL insertion
 - Started 1 month ago; gradually worsening in severity and frequency
 - Lens removal and re-insertion does not improve symptoms
 - Ophthalmology consult 1 week prior: haze deemed a CL complication, not graft failure. Current treatment: topical fluorometholone 0.1% QID OS

Ocular history

- Scleral CL wearer since 2010 for advanced keratoconus OS>OD
- Acute hydrops OS 2014 and OD 2016 & 2017
- PKP OS 2018

Medical History

- Unremarkable
- No medications

Clinical Findings

OD		OS
20/25 (PH 20/20)	VA (with CLs)	20/40 (PH NI)
- Central scarring & Vogt striae (4.5 x 1mm) - Neovascularization 360 degrees (1.5mm encroachment superiorly, 0.5mm inferiorly)	Anterior Segment	- s/p PKP – ring of prominent circumferential haze at graft-host junction - Moderate diffuse microcystic edema and stromal haze of graft (Figure 1B)
Pupils: ERRL (-) RAPD		

Clinical Findings (cont)

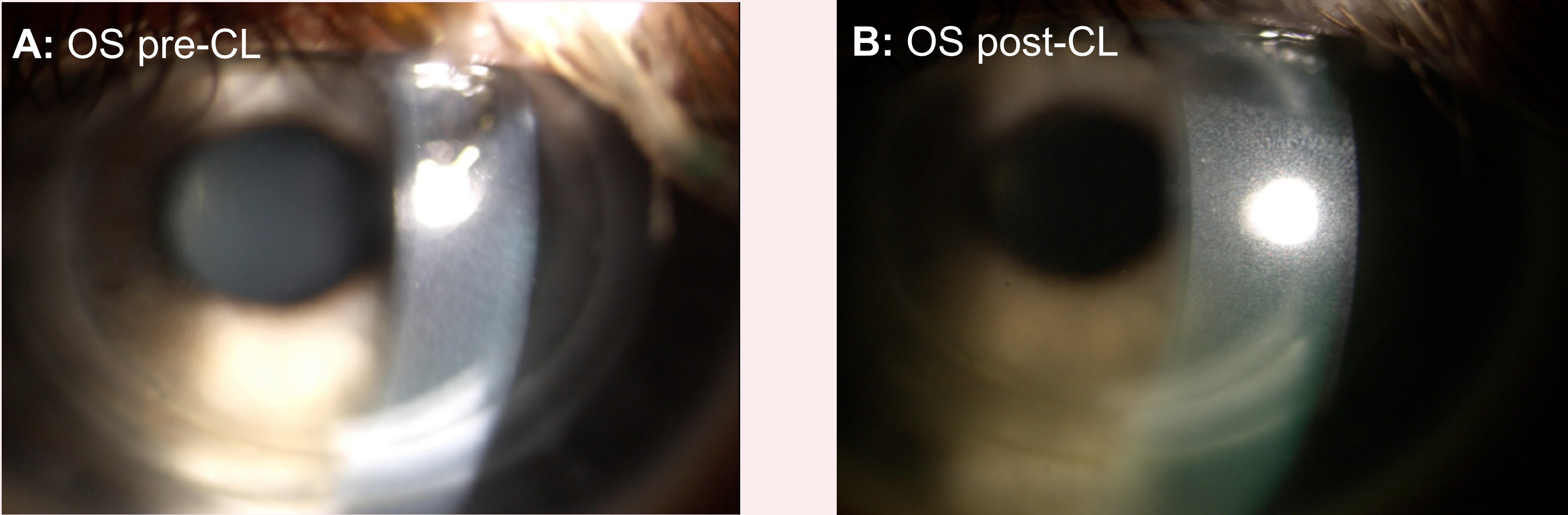


Figure 1. September 2020. (A) OS cornea prior to CL insertion and (B) OS cornea 15 minutes after CL insertion showing significant microcystic edema and stromal haze.

Contact Lens Fit & Management

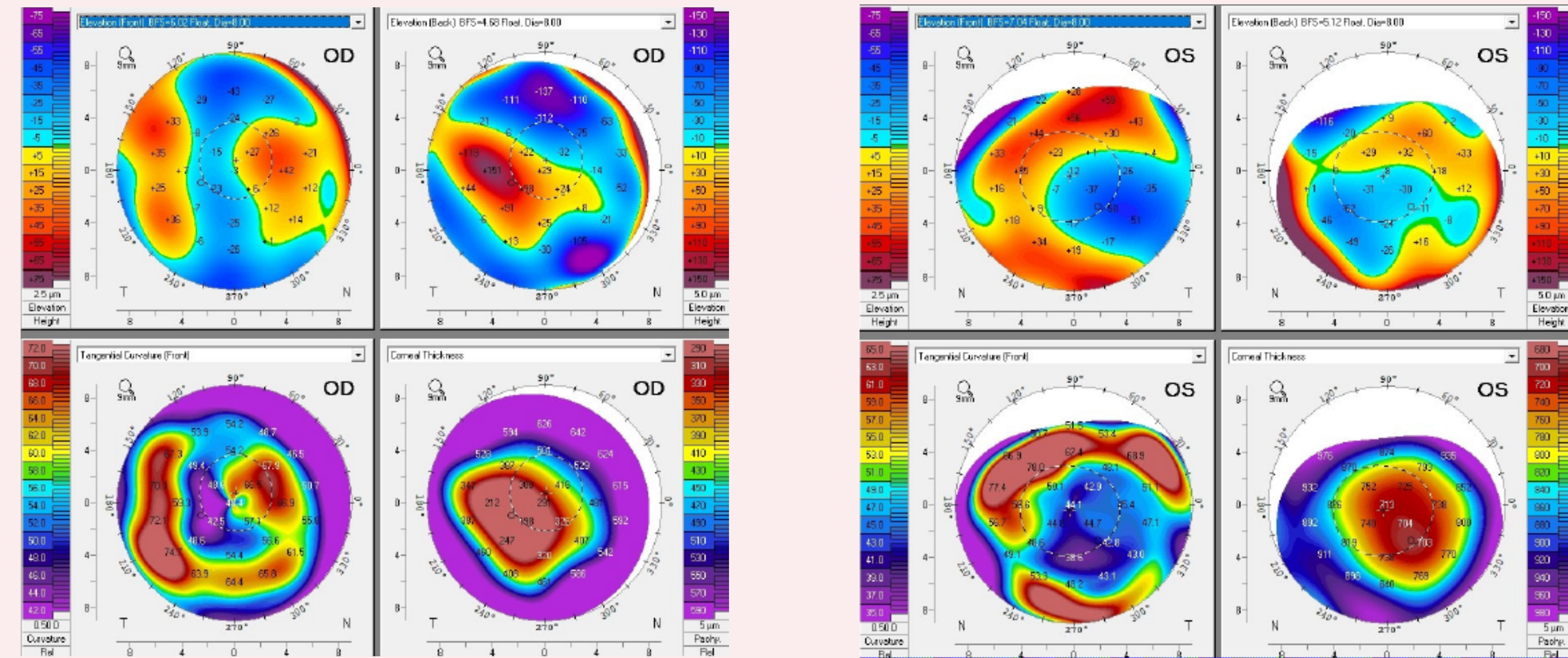


Figure 2. Corneal topography scans with Pentacam ©

Table 1. Current CL parameters

OS Contact Lens: Prolate GP Scleral Sphere

Sagittal Depth	Horizontal/Vertical SLZ	Base Curve	Diameter	Center Thickness	Power
4800 µm	STD / STD	7.54 mm	15.6 mm	0.19 mm	- 9.50 D

OS CL Fit:

- Moderate blanching temporal > nasal
- No tear exchange 10+ minutes after fluorescein installation
- Approximately 175 µm central clearance
- Adequate mid-peripheral and limbal clearance 360 degrees

Table 2. CL Modifications

OS Contact Lens: Prolate GP Scleral Sphere

Sagittal Depth	Horizontal/Vertical SLZ	Base Curve	Diameter	Center Thickness	Power
4800 µm	+75 µm / +25 µm	7.54 mm	15.6 mm	0.19 mm	- 9.50 D

- Scleral landing zone was flattened in order to reduce conjunctival blanching, allow for tear exchange and subsequently reduce corneal hypoxia.
- At future visits, several scleral CLs are ordered to improve fit and reduce hypoxia

Future Visits

- Over the next 2 months, symptoms continued to worsen; the corneal edema began to occur without CL insertion.
- Graft failure developed due to endothelial decompensation.
- Descemet Membrane Endothelial Keratoplasty (DMEK) OS (June 2020) was unsuccessful (see Figure 3).

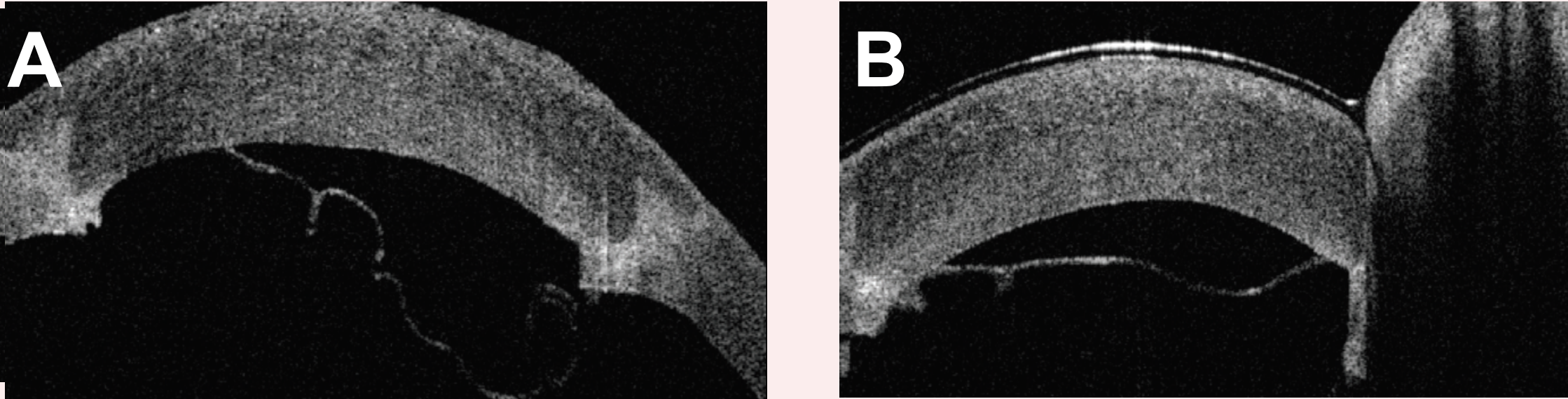


Figure 3. August 2020. Anterior segment OCT OS following DMEK along (A) 180° meridian and (B) 90° meridian.

- A large corneal abrasion developed due to misalignment of the host and graft tissue (see Figure 4). Visual acuity reduced to CF @ 3 meters.

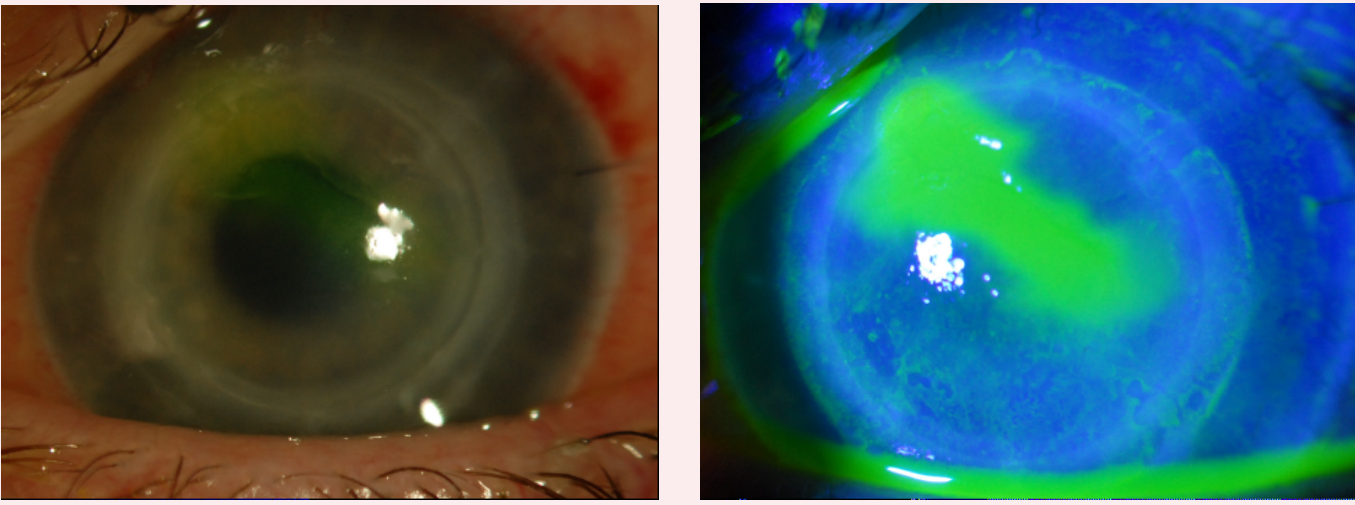


Figure 4. Large corneal abrasion OS (June 2020).

- A Descemet Stripping Automated Endothelial Keratoplasty (DSAEK) procedure was completed September 2020. Final BCVA OS of 20/25.

Discussion

The average PKP graft survival rate over 10 years is 80% with endothelial decompensation being one of the most common causes of graft failure.¹ There is no established minimum cell density required to fit a scleral lens s/p PKP, but most practitioners agree that a cell count of 800 – 1000 cells/mm² is appropriate.²

Several other factors are also associated with post-surgical endothelial failure, including surgical technique, donor status, recipient age, and graft size.^{3,4} Only a few retrospective studies have evaluated the safety and efficacy of scleral lenses in post-PKP eyes. In Severinsky et al., only 6% of patients in scleral CLs developed endothelial decompensation and subsequent graft failure 9 years post-surgery, but sample size was small and underlying corneal pathology varied widely.⁵

With proper peripheral curve alignment in all quadrants, there is potential for complete seal-off which prevents tear exchange, increasing the risk of hypoxia-related corneal stress.⁶ Tear exchange can be increased in several ways⁶:

- Incorporating channelled or loosened peripheral curves (as attempted in this case)
- Adding fenestrations to the lens
- Reducing tear reservoir thickness
- Reducing center thickness of the lens
- Improving oxygen permeability of the lens material

In summary, although there is no evidence to suggest that scleral CLs directly cause graft failure, longitudinal data is needed to better understand this association and guarantee patient safety. In cases where graft failure is imminent, switching to a lens modality that allows for increased oxygen delivery to the ocular surface – such as corneal RGPs – may be prudent. Baseline measurements of endothelial density should also be considered.

References

- Thompson R.W., Price, M.O., Bowers, P.J., & Price, F.W. (2003). Long-term graft survival after penetrating keratoplasty. *Ophthalmology*, 11(7), 1396-1402.
- Chang, C. & Daloss, K. (2018). Contact lenses after corneal transplantation: a road map to success through the challenging journey of fitting lenses post-keratoplasty. *Contact Lens Spectrum*, 33, 36-41,51.
- Mengyua, L. & Hong, J. (2018). Risk factors for endothelial decompensation after penetrating keratoplasty and its novel therapeutic strategies. *Journal of Ophthalmology*, 2018.
- Nishimura, J.K., Hodge, D.O., & Bourne, W.M. (1999). Initial endothelial cell density and chronic endothelial cell loss rate in corneal transplants with late endothelial failure. *Ophthalmology*, 106(10), 1962-1965.
- Severinsky, B., Behrman, S., Fruch-Pery, J., & Abraham, S. (2013). Scleral contact lenses for visual rehabilitation after penetrating keratoplasty: long term outcomes. *Contact Lens and Anterior Eye*, 37(2014), 196-202.
- Langis, M. & Vincent, S. (2019). Scleral lenses and hypoxia: a balanced approach. *Contact Lens Spectrum*, 34, 38,40-42.
- Holden, B.A., Williams, L., & Zantos, S.G. (1985). The etiology of transient endothelial changes in the human cornea. *Investigative Ophthalmology and Visual Science*, 26(10), 1354-1359.