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## INTRODUCTION

Corneal edema is a known possible complication of scleral lens wear which may result in reduced tolerance of lens wear and leave patients at increased risk for complications.<sup>1,2</sup> Bullous corneal edema induced by scleral lens wear, while transient and resolves in absence of scleral lens wear<sup>3</sup>, poses a risk of corneal erosion and potential subsequent complications due to bullae rupture.

Fenestrations can be considered to mitigate corneal edema with lens wear.

## BACKGROUND

A 72-year-old Caucasian male with filamentary keratitis (FK) from ocular graft versus host disease (oGVHD) presented for follow-up of prosthetic replacement of the ocular surface ecosystem (PROSE; BostonSight, Needham, MA) treatment. They continued with daily wear of their PROSE device (PD), a highly customizable scleral lens. The patient had history of poor tolerance of scleral lens wear with limbal microcystic edema (MCE) for both eyes. The tolerance improved with a larger diameter and haptic back-surface channels scleral lens design (Figure 1A, Table 1).

They presented for their 1-month follow-up with complaint of recurrent poor tolerance to PD wear for the right eye.

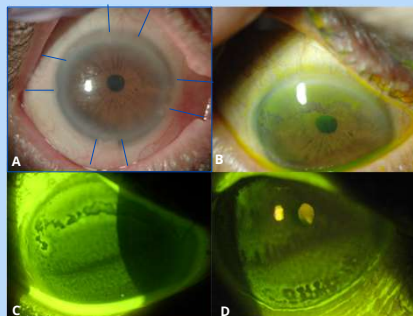
## CASE DESCRIPTION

- **Chief complaint:** poor tolerance of PD wear OD. No complaints OS.
- **Ophthalmic medications:** cyclosporine 0.05% BID OU, bimatoprost 0.01% QHS OU, preservative-free artificial tears PRN
- **Surgical Ocular Hx:** CE IOL OU 1 year prior
- **BCVA:** 20/25-1 OD, 20/20-2 OS
- **IOP:** 14/14 with GAT
- **Fit assessment:** ~250 microns apical clearance, ~100 microns limbal clearance 360 with aligned haptics 360, OD (Figure 1A) and OS
- **SLE (upon PD removal):**
  - OD: peripheral corneal bullae from 9:00 to 3:00 and 4:00 to 6:00, no punctate staining, (Figure 1 B,C,D)
  - OS: peripheral mapdot epithelium superior > inferior, no corneal bullae, no edema, no punctate staining

## CASE (CONT'D)

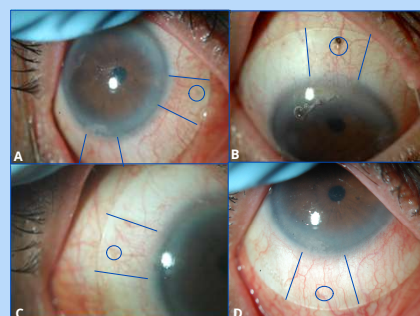
Four haptic fenestrations, one in each meridian were added (Figure 2, Table 1). The bullous edema resolved (Figure 3) and the patient's tolerance to wear improved. At 18 months, they had no recurrence of intolerance or bullous edema and continued with 20/20 BCVA for each eye with average wear time of 12 hours/day.

**Figure 1:** Right eye with habitual PD and upon removal



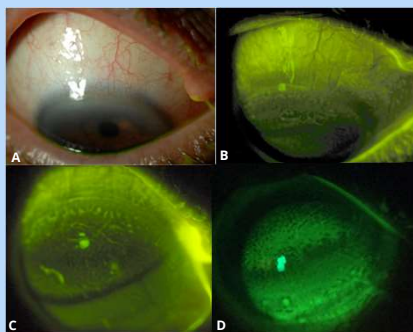
A) Right eye with PD in place. The blue lines highlight the outline of the back-surface channels. B) Right eye with sodium fluorescein with blue light and yellow Wratten filter (C and D) upon PD removal with observable peripheral bullae.

**Figure 2:** Modified PD with haptic fenestrations on eye



Modified right PD with four haptic fenestrations in varying gaze: A) primary, B) inferior, C) medial, and D) superior. The blue lines outline the width of back-surface channels. The blue circles highlight the location of the haptic fenestrations.

**Figure 3:** After removal of fenestrated PD



Right eye upon removal of modified PD removal in diffuse white light and down gaze (A) and sodium fluorescein with blue light and yellow Wratten filter (B,C,D). There is resolution of corneal bullae.

**Table 1:** Design Parameters

Right Eye (OD)	Diameter (mm)	Sag (microns)	BC (mm)	Power (D)	Material	CT (mm)	Notes
Habitual	19.5	3005	8.5	+1.50 sph	Contamac Infinite	0.3	4 channels
Final	19.5	3005	8.5	+1.50 sph	Contamac Infinite	0.3	4 channels, 4 fenestrations

Parameters of habitual versus modified PD for the right eye. No change was made to the fit except for addition of haptic fenestrations, to mitigate bullous edema.

## CASE REVIEW

- The patient had baseline peripheral mapdot epitheliopathy consistent with epithelial basement membrane dystrophy (EBMD).
- The suction force of lens in adjunct with poor epithelial junctions resulted in bullous edema with wear.
- Despite an optimized large diameter design, the patient developed bullous corneal edema in the right eye.
- The corneal bullae subsided after the addition of haptic fenestrations.

## DISCUSSION

- Transient corneal bullae with scleral lens wear has been reported in patients with compromised corneas.<sup>3</sup>
- Patients with poor adherence of epithelium to the basement membrane, i.e. EBMD, are more susceptible to bullous edema with scleral lens wear.<sup>3</sup>
- Corneal edema can be mitigated by maximizing Dk/t, facilitating tear exchange (i.e. via channels) or increasing oxygen delivery (i.e. via fenestrations).<sup>1-5</sup>
- Prior to modern gas permeable lens materials, fenestrations were commonly utilized for mitigating suction and increasing air exchange to reduce hypoxia.<sup>4,5</sup>

## CONCLUSIONS

In patients with recalcitrant corneal edema, fenestrations should be considered when other scleral lens design modifications have failed. This case demonstrates that the placement of haptic fenestrations can mitigate bullous corneal edema with scleral lens wear.

Further studies investigating the impact of haptic fenestrations on corneal edema are warranted.

## REFERENCES

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## DISCLOSURE

B. Asghari: Salaried employee of the non-profit, 501c3 BostonSight. No proprietary interest in any BostonSight lens technologies.