Implementation of Vented Channels to Prolong Wear Time for a Patient with Scleral Lens-Induced Corneal Graft Edema

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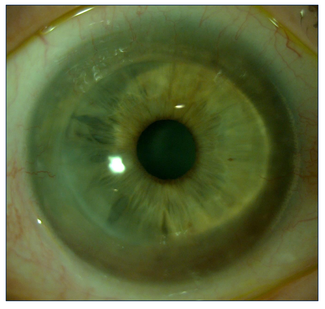
Background

- Corneal metabolism relies on an avascular oxygen supply through either direct exposure to the environment or to the palpebral conjunctiva[1]
- Corneal edema in patients wearing scleral lenses can be caused by multiple factors including hypoxic stress, increased intraocular pressure, compromised endothelial function, or lens suction[2-3]
- As corneal edema can bring about graft rejection, it is critical to monitor for signs and symptoms over the course of scleral lens fitting
- Signs and symptoms include pain, decline in visual acuity, photophobia, glare, haloes or rainbows around lights (Sattler's Veil), corneal haze, increased corneal thickness, oedema, microcystic edema, bullae[4]
- Modifications to lens design to address corneal edema include ensuring adequate limbal clearance, loosening the lens fit or adding haptic channels to promote fluid ventilation, increasing material Dk/t, reducing lens thickness, minimizing post-lens tear film thickness, or adding fenestrations
- Alternatives treatments, such as rigid gas permeable (RGP) or soft contact lenses should be considered as these may provide superior oxygen permeability and reduced suction relative to a scleral lens system

Case Description

This case describes a unique implementation of a scleral lens fenestration to eliminate lens suction and subsequent corneal graft edema.



Initial Presentation

A 64-year-old Caucasian female presents for scleral lens consultation for the right eye having previously failed rigid gas permeable and hybrid gas permeable lens fitting.

Patient's goals are to achieve binocular vision and reduce reliance on vision OS only. She reports if unsuccessful with scleral lens fitting then she will proceed with repeat corneal transplant OD.

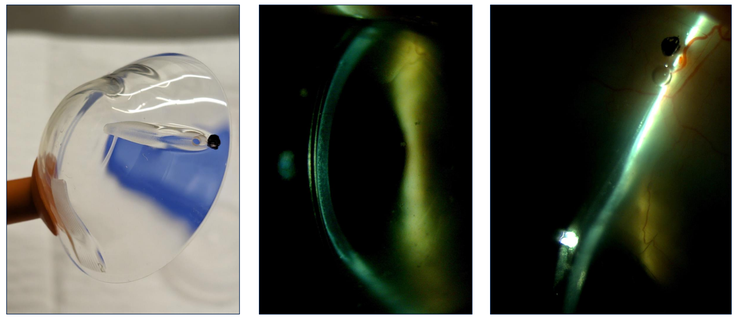
Pertinent History: Keratoconus OU, s/p penetrating keratoplasty OD (1989) OS(1971), RGP OS (1975), Dry Eye Syndrome OU

Entering VA: OD_{SC}: 20/125 PH: $20/60^{+2}$ OS_{RGP}: $20/15^{-1}$ PH: NI

Pertinent Findings OD: Oxford I staining, graft clear/compact, corneal neovascularization x360 to graft interface, haze x360 in host cornea, 50% thinning at inferior graft host interface

Treatment

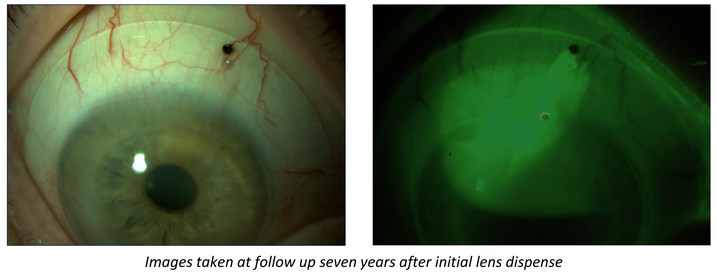
- Prosthetic Replacement of the Ocular Surface Ecosystem treatment was initiated OD only
- **Initial Lens Parameters OD**: Boston Equalens II (85Dk), Power: +0.25D/FSE1, BC:8.0mm, Diameter: 20.0mm, 8-meridian Toric Haptic, CT: 300µm, BCVA: 20/15-
- Patient reports declining visual acuity with symptoms of halos and rainbows around lights @ 2 hours wear time
- Subsequent modifications to lens design included modification of material to Boston XO2 (149Dk) and addition of haptic channels which yielded no notable improvement in symptoms
- Optic zone fenestration was attempted however fitting was unsuccessful secondary to large bubble intrusion resulting in intolerance and epithelial desiccation
- Ultimately, placing a narrow fenestrated haptic channel superiorly successfully extended wear time from two to six hours



- **Dispensed Lens Parameters OD**: Boston XO2, Power +0.25D/FSE1, BC:8.0mm, Diameter: 20.0mm, 8-meridian Toric Haptic, CT: 300µm, Channels: 87°-93°, 350°-10°, Fenestration: 90° @ 8.9mm
- **Final VA:** OD_{SGP}: $20/15^{-2}$ PH: NI OS_{RGP}: 20/15 PH: NI

Outcome

- The patient elected to proceed with limited wear OD, six hours daily, rather than proceeding with repeat corneal graft.
- **Follow up:** Seven years after initial dispense, corneal findings and visual acuity remain stable. The patient wears lens comfortably for six hours per day and has had no episodes of graft rejection



Images taken at follow up seven years after initial lens dispense

Discussion

- Fenestrations can enhance scleral lens function by effectively eliminating suction and significantly increasing fluid ventilation.
- The primary challenge of fitting fenestrated scleral lenses is management of air bubbles. Customization objectives should focus on either preventing the intrusion of bubbles or achieving a dynamic fit that enables their movement through the fenestrations on eye movement or blink. If bubbles remain stagnant in the post-lens tear film, then complications such as epithelial desiccation or erosion can occur.
- Reports indicate that adding haptic channels alone can significantly reduce lens suction. This was employed during this treatment and persisted on the final dispensed lens, potentially contributing to the overall outcome of this case.[5]
- This case demonstrates a successful approach to fenestrating a scleral lens, minimizing issues related to bubbles, and achieving a satisfactory fitting endpoint when other methods had failed. This was accomplished by employing a large-diameter lens and incorporating a fenestration along with a channel to effectively ventilate the post-lens tear film.
- Alternative treatments for corneal edema include hypertonic saline drops, topical steroids, and surgical options such as penetrating keratoplasty or lamellar keratoplasty.[4]
- Reports have shown that Rho Kinase (ROCK) inhibitors can stimulate endothelial cell migration and proliferation resulting in clearance in certain cases of corneal edema.[6-7]

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Disclosure

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