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Glaucoma surgical considerations for PROSE lens use in patients with ocular surface disease

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ABSTRACT

Purpose: To examine challenges of Prosthetic Replacement of the Ocular Surface Ecosystem (PROSE) treatment in patients with glaucoma drainage implants (GDI) and the surgical management of patients where both GDI and PROSE treatment are indicated.
Methods: A retrospective noncomparative observational study was performed to investigate the outcomes of 7 eyes of 6 patients that required PROSE lens wear and GDI implantation.
Results: Group A consisted of 2 cases where PROSE lens wear was problematic due to scleral surface irregularities following GDI placement. These included changes in surface morphology caused by the elevated scleral patch graft tissue adjacent to the corneal limbus in one case and the presence of two anteriorly located shunts in the other. Group B consisted of 3 eyes where the previously placed GDI led to poor lens alignment due to the proximity of the lens edge to the scleral graft. Group C consisted of 2 cases where both patients underwent placement of the GDI in the pars plana and insertion of the drainage tube 3–3.5 mm from the limbus in order to facilitate PROSE lens use. The posterior location of the tube and patch allowed for proper PROSE device alignment over the ocular surface.
Conclusions: Surgical considerations and prior planning for GDI placement allows PROSE lens use for management of ocular surface disease. Pars plana tube placement with a posteriorly placed patch graft, instead of anterior chamber tube positioning with more anterior graft, enables adequate lens wear in scleral-lens-dependent patients.

1. Introduction

Ocular surface disease (OSD) is common in patients with glaucoma [1] and occurs independently with the disease or as a result of medical treatment [2,3]. Its severity has been correlated with the use of increasing number of intraocular pressure (IOP) lowering medications. Exposure of the corneal surface to preservatives in IOP-lowering drugs is one of the factors contributing to this relation. Importantly, the presence of OSD results in poorer quality of life in patients with glaucoma [4]. Therefore, concurrent management of both OSD and glaucoma is essential.

Scleral lenses play an important role in the management of a variety of OSD, and can provide improved vision in patients with corneal irregularity [5–7]. This type of lens is supported by the sclera so that it vaults the cornea and limbus and thereby eliminates the distorted topography in cases of surface irregularities, protecting the entire cornea in an aqueous environment [8]. Many reports have shown scleral lens wear has resulted in improvement of ocular symptoms, with an improvement in the Ocular Surface Disease Index, in visual acuity (VA) and in quality of life [9,10].

The Prosthetic Replacement of the Ocular Surface Ecosystem (PROSE) (Boston Foundation for Sight, Needham, MA) device is one type of scleral lens that was approved in 1994 by the Federal Drug Administration for management of corneal disorders. The PROSE device has a diameter that ranges from 16 mm to 23 mm and overlies the scleral surface, vaulting the limbus and cornea [10]. Adequate fitting and alignment of the scleral device is essential for a successful outcome. Various factors must be evaluated to achieve

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proper function on the ocular surface. This includes appropriate base-curve radius to allow clearance of the cornea and ensure there is no contact between the device and the cornea. It also entails customization of the posterior haptic surface to avoid a complete seal, which can result in lens suction, corneal edema and chemosis of adjacent conjunctiva [8]. The PROSE device utilizes a computer-aided design and manufacturing program to create customized scleral lenses for individual eyes and has been used in the treatment of OSD, and especially for graft versus host disease, Stevens–Johnson Syndrome, dry eye syndrome (DES), and epithelial defects [7,10,11]. It has also shown success in improving VA and visual function in patients with these conditions [6,10,12].

Glaucoma drainage implants (GDI) have extensively been used in the treatment of refractory glaucoma to control intraocular pressure [13–15]. For patients with glaucoma where GDI is indicated, placement of the drainage tube in the anterior chamber alters the ocular surface adjacent to the corneal limbus. When there is also concurrent indication for scleral lens wear, alteration of the scleral architecture can cause difficulty in fitting the lens and specifically in achieving reasonable alignment or "seal" between the haptic of the lens and the sclera. Modifications of the prosthetic device may enable adequate fitting in these patients, but complications such as conjunctival erosion in the area overlying the tube shunt have been reported [16].

The surgical approach can be tailored to accommodate the patients' need for PROSE lens wear, in order to provide comfort and decrease the risk of complications. Therefore, the purpose of the present study is to describe the challenges of PROSE lens use in patients with existing GDI and also to describe surgical considerations for PROSE lens wearing patients undergoing GDI placement.

2. Methods

A retrospective chart review including patients attending the Glaucoma Clinics at the Doheny Eye Institute and the University of Southern California, between January 2013 and January 2014 revealed a series of 7 eyes from 6 patients with concurrent need for GDI and PROSE scleral lens treatment. This study was conducted with approval from the University of Southern California Health Sciences Institutional Review Board. Information collected in the chart review included patient demographics, ocular diagnoses, VA before and after PROSE treatment, pre- and post-operative intraocular pressure, reports from PROSE follow up visits, and anterior segment photography with the PROSE device in place.

3. Results

The following case reports describe the technical challenges and management of patients with coexisting OSD or corneal abnormalities and glaucoma requiring surgical intervention. Group A (unable to fit) consisted of 2 cases where PROSE lens wear was unsuccessful due to scleral surface irregularities following tube shunt placement. Group B (fit achieved but not physiologic) consisted of 3 eyes from 2 patients where previously placed GDI led to challenging lens wear due to the proximity of the lens edge to the scleral patch graft. Group C (fit achieved with good physiologic outcome) consisted of 2 cases where PROSE lens wearers underwent placement of the GDI in the pars plana allowing for continued PROSE lens wear without complications.

3.1. Group A (unable to fit)

3.1.1. Patient 1

A 32-year-old female with a history of keratoconus suffered chronic angle-closure glaucoma secondary to penetrating keratoplasty (PKP) for the right eye. Because IOP was uncontrolled with maximal medical therapy, the patient underwent surgical management with a Baerveldt glaucoma implant (BGI). The implant was placed in the superotemporal quadrant with the tube in the anterior chamber and a donor sclera patch. Preoperative average IOP was 45 mmHg with topical and oral treatment and decreased to 17 mmHg postoperatively with timolol. The patient was unable to tolerate a rigid gas permeable (RGP) lens and was evaluated for the PROSE scleral lens one year after GDI implantation. Due to the proximity of the scleral patch to the corneal limbus, the PROSE lens overlaid the scleral patch. Because of the irregularity in the conjunctival surface created by the scleral patch and the elevation of the patch graft in the area close to the limbus, the PROSE device could not be fitted.

3.1.2. Patient 2

A 52-year-old monocular female, with a history of enucleation of the right eye due to neovascular glaucoma, presented with silicone oil-induced glaucoma in her left eye. Her past ocular history was significant for panretinal photocoagulation for proliferative diabetic retinopathy, vitrectomy with silicone oil and scleral buckle for retinal detachment repair, herpes simplex (HSV) keratitis and bullous keratopathy. IOP was uncontrolled with maximal medical therapy and the patient underwent surgical management with BGI in her only eye. The implant was placed in the superotemporal quadrant with the tube in the anterior chamber and covered with donor sclera patch. Preoperative IOP decreased from 22 mmHg preoperatively to 17 mmHg postoperatively. Two years later, she underwent implantation of a second tube shunt in the anterior chamber with the plate superonasally and with the tube covered by a sclera patch graft. Preoperative average IOP was 18 mmHg on maximum topical treatment and it came down to 13 mmHg postoperatively with drops. The patient later underwent PKP combined with an anterior chamber intraocular lens implantation and was evaluated for PROSE treatment due to chronic severe DES and poor vision. The VA was hand motion, correctable to 20/200 with the PROSE device. The lens measured 16.5 mm in diameter. The lens haptic impinged on the scleral patches located at the superotemporal and superonasal quadrants, and the resulting edge lift on the superior section

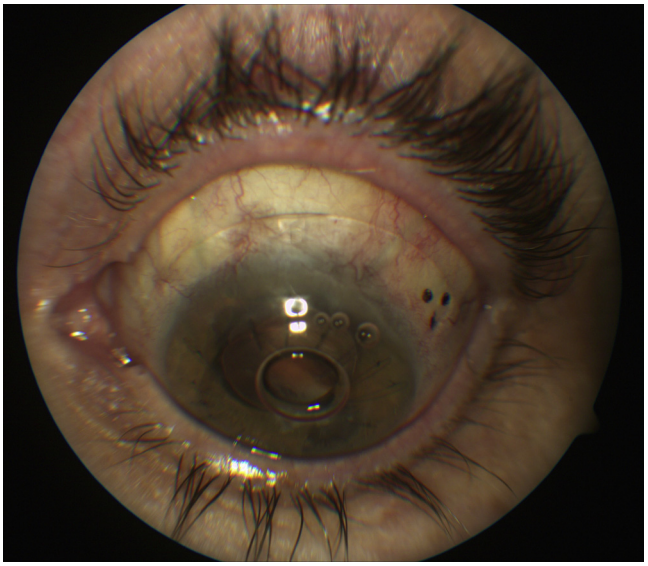

Fig. 1. Patient 1 (Group A) that was unable to wear the PROSE lens: the patient was unable to tolerate the PROSE lens for an extended amount of time due to persistent bubble formation that disrupted vision and caused discomfort. Bubbles are introduced under the lens due to poor alignment of the lens with the ocular surface.