Fitting a Scleral Lens on a Complicated Cornea

A Case of Radial Keratotomy, Post-Penetrating Keratoplasty and Limbal Stem Cell Deficiency

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Introduction

Radial keratotomy (RK) is a refractive surgery formerly used to correct myopia by applying radial stromal incisions into the cornea to induce corneal flattening.[1] Known complications of RK include irregular astigmatism, diurnal fluctuations in refractive error and neovascularization of incision sites.[3] Severe complications can necessitate corneal transplantation. Repeated surgical trauma and chronic use of topical medications can iatrogenically induce limbal stem cell deficiency (LSCD). LSCD is characterized by structural and/or functional loss of limbal stem cells resulting in impaired corneal healing, neovascularization and conjunctivalization of the cornea.[4,6] Scleral lenses have been shown to improve visual function and ocular surface integrity in the conditions presented above.[3,5]

This case report describes fitting a scleral lens on a cornea affected by these diagnoses. The patient described here received RK in Taiwan in both eyes and first presented to the OSU Havener Eye Institute in 2010 for consultation for a corneal transplant in the left eye.

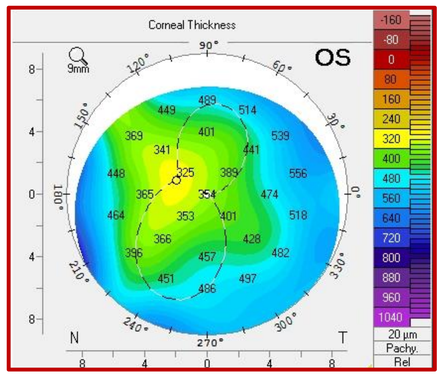

Figure 1. Pentacam corneal topography, corneal thickness map of the left eye. The thinnest point measured 320 microns.

Case History

Pertinent Exam Findings	
Ocular History	***Anterior Segment*** ***Prior to 2010*** • **Radial keratotomy OU** ***2010*** • **Deep anterior lamellar keratoplasty (DALK) OS** • **Corneal ulcer OS** ***2011*** • **Penetrating keratoplasy (PK) OS** • **Cataract extraction OS** ***2013*** • **Cataract surgery OD** ***2017*** • **Limbal stem cell deficiency diagnosed OS** ***Posterior Segment*** ***2014*** • **Primary open angle glaucoma diagnosed OU** ***2017*** • **Chronic cystoid macular edema OS** ***2018*** • **Retinal vasculitis OS, treated for tuberculosis** • **Pars plana vitrectomy OS**
Slit Lamp Exam	**OD: 8 dense, linear RK scars** **OS: Intact corneal graft** **(-) KPs, (-) SEIs** **Irregular epithelium, diffuse 1+ PEE, nasal stromal haze, peripheral neovascularization**
Visual acuity	**Uncorrected OD: 20/50-2** **Corrected (scleral lens)** **OS: 20/50** • **H/O of fluctuating VA from 20/50 – 20/70 OS**
Current Ocular Medications	• **Brimonidine BID OS** • **Timolol BID OU** • **Ofloxacin QID OS** • **Prednisolone BID OS**

Scleral Lens Fit in the Left Eye

The established patient presented for a scleral lens follow-up appointment for the left eye. An increase in superior nasal and inferior nasal conjunctivalization and neovascularization was noted in the left eye compared to previous visits. The patient was refit in the 18.0 mm BostonSight SCLERAL lens with two channels incorporated into the lens design to improve tear exchange and reduce lens suction. HydraPeg™ coating was added to improve lens wettability.

At the initial follow-up visit, improved tear exchange was noted in the left eye. Best corrected acuity was 20/60^{+1} OS. A third channel was added to the lens design with no additional changes.

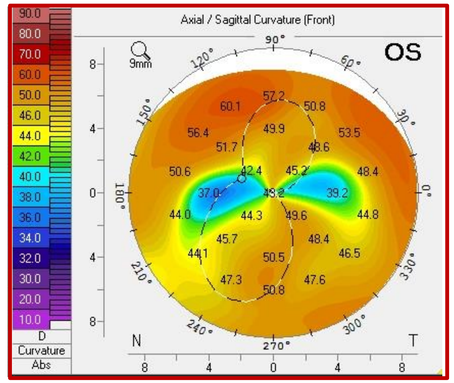

Figure 2. Pentacam corneal topography, axial map of the left eye.

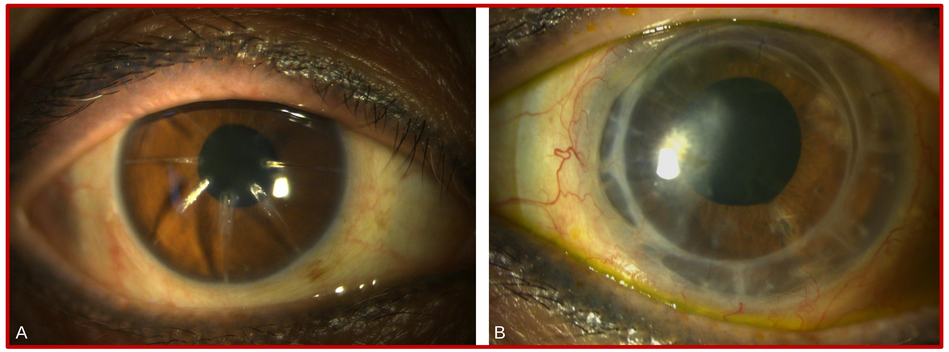

Figure 3. A. Corneal scarring resulting from radial keratotomy (RK) in the right eye. B. Scleral lens over the left eye.

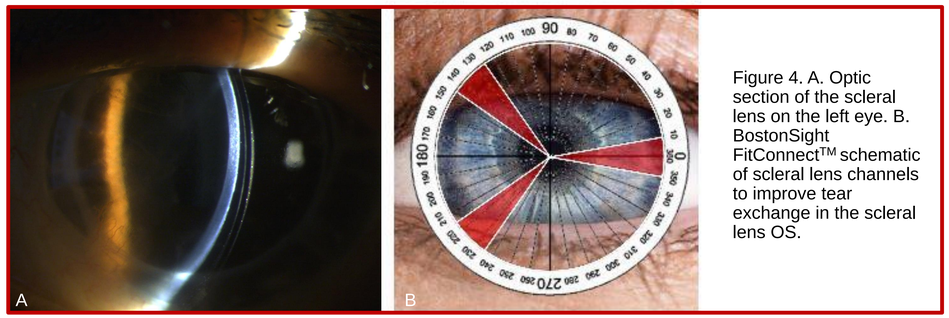

Figure 4. A. Optic section of the scleral lens on the left eye. B. BostonSight FitConnect™ schematic of scleral lens channels to improve tear exchange in the scleral lens OS.

Discussion

There are multiple complications of RK including progressive hyperopic shift, fluctuation in refractive error, and irregular astigmatism.[2] RK incisions permanently weaken the biomechanical integrity of the cornea and may result in subepithelial fibrosis and corneal scarring.[1] The resulting vision loss may necessitate corneal transplantation to improve visual potential.

Options for corneal transplantation post-RK include deep anterior lamellar keratoplasty (DALK) or penetrating keratoplasty (PK). Complications such as microperforations of Descemet's membrane and deep corneal scarring may prevent successful DALK for the post-RK patient.[3] Following her second transplant, the patient in this case report experienced dryness, epithelial breakdown and corneal opacification secondary to limbal stem cell deficiency (LSCD).

LSCD results from the partial or total loss of corneal stem cells. The etiology of LSCD may be congenital, traumatic, iatrogenic or autoimmune. This patient's LSCD likely resulted from repeated surgical trauma and chronic use of topical medications. Treatment of LSCD includes ocular surface lubrication and limbal stem cell transplantation.[4,6] The patient detailed here opted to be fit in a scleral lens rather than pursue additional surgical treatment.

Conclusion

Scleral lenses are an effective treatment for refractive correction of irregular astigmatism associated with RK and post-corneal transplantation. Scleral lenses support the health of the ocular surface by maintaining a stable tear film reservoir and providing environmental protection for the cornea. Scleral lenses can provide significant visual and functional benefits for patients with complicated corneal presentations.

Acknowledgements

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