Minimizing Hypoxia in Scleral Lenses on a Post-Infectious Cornea with Neovascularization
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Abstract
A 26 year old male presents with significant stromal scarring and neovascularization of the right cornea. Careful considerations were taken to fit scleral contact lenses that improve vision and minimize hypoxic conditions.

I. Case History
   a. Patient demographics
      YH, 26 year old Asian male with history of viral keratitis OD
   b. Chief complaint
      Poor vision with glasses OD, interested in being fit in rigid contact lenses OD
   c. Ocular, medical history
      1. Viral keratitis (2009)
         • Managed in China with unknown topical medications
         • Sequelae include central stromal scar OD and significant neovascularization of the cornea OD
         • Misdiagnosed as keratoconus in 2010 by doctors in China
      2. Unremarkable medical history
   d. Medications
      Thera Tears preserved artificial tears 1-2 gtt OU PRN

II. Pertinent Findings
   a. Clinical
      1. Monocular subjective refraction and VA:
         • OD: -1.00 -2.00 x043  20/100
         • OS: -4.00 -2.25 x172  20/15
      2. Anterior segment evaluation
         • OD: large inferocentral stromal scar with iron deposition, 3-4 mm of neovascularization from 8:00-1:00, (-)NaFl staining
         • OS: papilloma on upper lid margin, otherwise unremarkable
      3. Pentacam imaging
         • OD: oblate with inferocentral flattening (corresponding to stromal scar), keratometry: 35.20@161.1/45.10@71.1, minimum pachymetry: 465 um
         • OS: regular with-the-rule astigmatism, keratometry: 41.40@167.4/43.40@77.4, minimum pachymetry: 566 um

III. Differential Diagnosis
   a. Primary: corneal scarring and neovascularization secondary to viral keratitis OD
      • Patient reported a previous diagnosis of unilateral keratoconus OD. The diagnosis was reconsidered and replaced with post-infectious scarring after slit lamp evaluation and Pentacam imaging.
   b. Secondary: other causes of corneal scarring/irregular astigmatism
      • Infectious (e.g., post-viral keratitis, acanthamoeba)
      • Trauma
      • Post-surgical (e.g., penetrating keratoplasty)
      • Keratoconus, pellucid marginal degeneration, keratoglobus
      • Exposure keratopathy

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IV. Diagnosis and Discussion
   a. Elaborate on the condition
      • Post-infectious keratitis resulting in corneal scarring can change the
topography of the cornea, thus creating an irregular surface. Typically, glasses
or soft contact lenses have limited therapeutic benefit because they cannot
adequately correct irregular astigmatism. Gas permeable contact lenses can
eliminate or minimize these irregularities and ultimately improve vision.

   b. Unique features
      • Although stromal scarring is a limiting factor for best potential acuity, vision
can still improve once the irregularities of the cornea are reduced.
      • Hypoxia has always been a concern with scleral lenses, especially in
compromised corneas.
         o This patient presents with a significant amount of corneal
neovascularization that can be exacerbated under hypoxic conditions.
Increased neovascularization may lead to further vision loss and may
reduce the patient’s candidacy for a corneal transplant.
         o Important factors to consider that will minimize hypoxic environments
while fitting scleral contact lenses:
            ▪ Hyper Dk material
            ▪ Minimal tear reservoir that still vaults the cornea
            ▪ Minimal central lens thickness that avoids flexure

V. Treatment and Management
   a. Treatment and response to treatment
      • Scleral contact lenses were determined to be the best option to provide
adequate vision and ocular comfort.
      • Scleral lenses are large diameter lenses that improve vision similar to other
smaller diameter gas permeable lenses, but with the added benefit of
increased comfort.
      • Several theoretical studies have determined the ideal scleral lens conditions to
minimize corneal swelling due to hypoxia. While differences vary in clinical
versus theoretical practice, the suggested recommendations were considered
during the fitting of this patient’s cornea.
         o Lenses for this patient were manufactured with a center thickness of
350 microns in Boston XO material (Dk 100).
         o Several parameters were altered to achieve a vault over the cornea of
approximately 150 microns.
         o Vision with the scleral contact lens improved from 20/100 to 20/25 OD.

   b. Bibliography
      • Segal, O., et al. Scleral Contact Lenses May Help Where Other Modalities
      • Michaud, L., et al. Predicting estimates of oxygen transmissibility for scleral
lenses. Contact Lens Anterior Eye (2012),
http://dx.doi.org/10.1016/j.clae.2012.07.004
      • Bergmanson, J., et al. Guest editorial: Scleral contact lenses and hypoxia
      • Jaynes, J., et al. Predicting scleral GP lens entrapped tear layer oxygen
      • Compañ, V., et al. Oxygen Diffusion and Edema With Modern Scleral Rigid
VI. Conclusion
   a. Clinical pearls, take away points
      • It is critical to have proper diagnostic tools to critically evaluate a patient and establish a proper diagnosis.
      • Irregular corneas – even with significant corneal scarring – can drastically benefit from scleral contact lenses.
      • It is important to consider the risks of hypoxia with scleral lenses and to fit lenses that minimize hypoxic environments to the cornea.