Scleral Lenses: How do you know what is best

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Disclosure Statement:
Nothing to disclose
Scleral Lens Indications

• Vision
  - Degenerations
  - Post Surgical
  - Dystrophies
  - Corneal Scarring

• Ocular Surface Disease
  - Severe Dry Eye
  - Neurotrophic Keratopathy
  - Limbal Stem Cell Deficiency
  - Corneal Exposure
Size Determination

- **Corneal-Scleral**
  - 12.9 -> 13.5 mm
  - Corneal bearing & Scleral touch

- **Semi-Scleral**
  - 13.6 -> 14.9 mm
  - Corneal & Scleral bearing

- **Mini-Scleral**
  - 15.0 -> 18.0 mm
  - Scleral bearing & minimal corneal clearance

- **Scleral**
  - 18.1 -> 24.0+ mm
  - Scleral bearing
Size Determination

• Mini scleral lenses are classified as less than 6mm greater than the HVID
  – Tend to be 14.0-16.5mm in diameter
Size Determination

• Smaller diameter lenses
  – less sagittal depth
  – brings vault closer to the cornea
Indications for Smaller Diameter Scleral Lenses

How complicated is the cornea?
• Early Keratoconus, Forme Fruste Keratoconus
• High cornea cylinder
• Microcornea/small HVID
• Reduced palpebral fissure aperture
  – Tarsorrhaphy
Indications for Smaller Diameter Scleral Lenses

• Scleral obstacles
  – Pinguecula, Symblepharon

• Decentration of larger diameter lens
  – Gravity
  – Low insertion of superior rectus
Indications for Smaller Diameter Scleral Lenses

- Astigmatism
- High refractive error (myopia and hyperopia)
- Aphakia
- Presbyopia
- GP intolerance
- Dryness with current lenses
Fitting Method?

• Measure HVID
• On Topography: Best fit sphere
• OCT
• Assess vault
  – Decrease until about 250-300 microns clearance of cornea, will settle back with longer wearing time
  – Must vault entire limbus
• Empirically
How Does it Land?

• Dependent on size

• Smaller diameter lens = smaller landing area
  – Watch for “stiletto heel effect”, less area to spread weight
    • As such easier to get a larger lens not to impinge

• Review common fitting guide suggestions
Advantages of Smaller Diameter Scleral Lenses

• Less intimidating
• (Perceived) Ease of insertion for patient and fitter
• Less scleral toricity to align
• (Perceived) Ease of fit/troubleshooting
Disadvantages of Smaller Diameter Scleral Lenses

• Impinge more
  – suction
• Closer to cornea and limbus
  – less comfortable
  – Don’t accommodate the more irregular corneas
Large diameter

• Criteria
  - HVID
    • Optic zone should optimally be as large as the cornea
  - Steep cone or graft
  - Proud graft
  - Ocular Surface Disease
Large diameter

• Benefits
  - Larger area of support (high vaults)
  - Larger area of coverage for OSD
  - Decreases suction
Large diameter - Case

- 57 Caucasian female
- s/p PKP OD 1998, OS 1991
- Originally fit with PROSE devices OU in 2012
Large diameter - Case

- OD: good comfort, fit, 20/20
- OS: good comfort, fit, 20/20

- Graft edema after 2-3 hours OU (observed with SLE with corresponding subjective haloes around light sources)
Large diameter - Case

Refit into:

**OD**
- BC: 8.2
- Power: -2.00 D
- Diam: 22.0 mm

**OS**
- BC: 8.2
- Power: +5.00 D
- Diam: 20.0 mm
- Air Ventilated design
Vault

- Where is it most important?
  - Limbally
    - Optimally would want clearance 360 degrees
    - Sectoral limbal touch ok?
      - Nasal and superior touch not uncommon with infero-temporal decentration
Vault – sectoral compression (case)

- 65 year old with exposure keratitis OS secondary to lagophthalmos and parietal gland resection
- Upper lid weight OS
- PROSE treatment OS 2010
- Inferior decentration from upper lid weight
- Superior Limbal compression
Limbal Compression

• M.S. 62 y.o. female with Stevens-Johnson Syndrome
• PROSE treatment 2005
• Examination in 2009 showed central neo
• Refit 2010 with higher limbal vault
• Examination in 2015 shows inactive vessels
Vault - centrally

What about central clearance?
• Relationship to corneal surface oxygen tension
  1. Certainly less oxygen at K surface with higher vaults
     • Compan et. al. 2016, Giasson, et. al. 2017
  2. But doesn’t necessarily correlate with negative corneal sequelae
     • Berkeley studies (UC Berkeley Clinical Research Center) don’t show a correlation between increased vault and corneal swelling
Vault – Case #1

- 51 year old Caucasian male
- Keratoconus OU
- h/o GP and Hybrid lens wear
- Profuse corneal haze and neovascularization
Vault – Case #1

Fit into:

**OD**
- BC: 7.9
- Power plano D
- Diam: 18.5 mm
- Vault : 550 um

**OS**
- BC: 7.3
- Power -3.25 D
- Diam: 18.5 mm
- Vault : 550 um
Case #2

• Patient N. F.: 40 year old
  - Stevens-Johnson Syndrome survivor at age 11 (amoxicillin)
  - H/O Trichiasis
  - Last visit (June 5, 2017):
    • Reports good comfort with wearing times of up to 15 hours a day
    • VA_{ccl}: 20/15 OD, 20/20+ OS
Case #2 – PROSE treatment 2008

PROSE Device OD
BC: 7.90 mm
Power: -1.50 D
Diam: 22.0 mm
Vault: > 500 um

PROSE device OS
BC: 7.90 mm
Power: -1.25 D
Diam: 22.0 mm
Vault: > 500 um
Diameter and Vault

• Smaller diameter certainly needs a lower vault
  - Small haptic landing area cannot sustain higher vaults
  - Generally smaller diameters result in a closed system, more suction
  - More suction occurs in larger diameters with less fluid exchange requiring a lower vault

• Large diameter affords more flexibility:
  - Inherent toricity will result in more fluid exchange
  - Can have wider range of vault
Vault

- Relationship between vault and corneal physiology needs to be established
- Evidence that though higher vault results in lower oxygen levels at the cornea, it is not clear how this affects physiology
- Vault should not be viewed in isolation
- Clinically, higher vaults don’t seem to have an adverse effect on the corneal physiology if fit in the correct
Conjunctival Prolapse (hooding)

- How much of a problem is it?
- How to solve it?
Toric Peripheral Curves

• Indications
  - Larger diameter
  - Compression/Impingement
  - Edge Lift
Toric Peripheral Curves

- More of an issue with larger diameters
- How much edge lift or compression is tolerable?
- Important for stabilization when incorporating front surface cylinder
- Major issue is tolerance
  - Patient education is key
Vision

• GP material provides excellent optics
• Pre-corneal fluid reservoir
  – Acts as an optical lens and fills in irregularities and correct visual aberrations
• Stable vision due to stable fit
• Re-produceable vision
Vision

• Numerous scleral lens designs available
  – Diagnostic lenses is preferable
  – Use fitting guides and consultation services

• Spherical and astigmatic corrections available

• Presbyopia lens correction lens designs
Vision-Cylinder

• Considerations
  – Flexure
  – Maximum cylinder that can be masked, may need to go larger diameter
• Add residual cylinder to front surface
  – Stabilized by toric periphery or ballasting
Residual Higher Order Aberrations

- Keratoconic patients: positive coma
- Scleral lens decentration: positive coma
- Wavefront correction
  - Review work of Yoon et al.
- Front surface eccentricity availability
- Adjusting base curve: steeper
Presbyopia and Scleral Lenses

• Many labs now offering multifocal designs
• Design review:
  – Most are center near, aspheric designs
  – Center distance designs are available
    • Role in myopia control?
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