Scleral Lenses

Melissa Barnett, OD, FAAO
Department of Ophthalmology & Vision Science
University of California, Davis
Disclosures

Acculens
Alcon
Allergan
B + L
Nidek
SynergEyes
Vistakon
Scleral lenses are large diameter gas permeable lenses that rest beyond the limits of the cornea and extend onto the sclera.
• First used in late 1800s and early 1900s
• Manufacturing process now more reproducible
• Modern scleral lenses
  – Don Ezekiel, O.D.
  – Perry Rosenthal, M.D. Boston Scleral Lens
Lens Classification

- Corneal
  - All lens bearing on the cornea
    - 8.0 - 12.5mm
    - No tear reservoir
# Scleral Lens Terminology

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Alternative Names</th>
<th>Diameter</th>
<th>Bearing</th>
<th>Tear Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneal</td>
<td></td>
<td>8.0 to 12.5 mm</td>
<td>All lens bearing on the cornea</td>
<td>No tear reservoir</td>
</tr>
<tr>
<td>Corneoscleral</td>
<td>Corneal-Limbal</td>
<td>12.5 to 15.0 mm</td>
<td>Lenses share bearing on the cornea and the sclera</td>
<td>Limited tear reservoir capacity</td>
</tr>
<tr>
<td></td>
<td>Semi-scleral Limbal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Full) Scleral</td>
<td>Haptic</td>
<td>15.0 to 25.0 mm</td>
<td>All lens bearing is on the sclera</td>
<td>Somewhat limited tear reservoir capacity</td>
</tr>
<tr>
<td></td>
<td>Mini-scleral</td>
<td>15.0 to 18.0 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large-scleral</td>
<td>18.0 to 25.0 mm</td>
<td></td>
<td>Almost unlimited tear reservoir capacity</td>
</tr>
</tbody>
</table>
Scleral Lens Classification

- Full Scleral
  - Scleral bearing and maximal corneal clearance
    - 18.1 - 24.0mm
    - Almost unlimited tear reservoir capacity
Scleral Lens: Indications

• Corneal ectasias
  • Primary corneal ectasias
    – Advanced (notably decentered) keratoconus
    – Keratoglobus
    – Pellucid marginal degeneration
  • Secondary corneal ectasias
    – Post-LASIK
    – Post-PRK
    – Post-RK
Scleral Lens: Indications

• Corneal transplants
• Trauma
• Corneal scars

• Corneal degenerations or dystrophies
  – Salzmann’s nodular degeneration
  – Terrien’s marginal degeneration
Scleral Lens: Indications

• Persistent epithelial defects
Scleral Lens: Indications

- Severe dry eyes
  - Graft versus host disease
  - Sjogren’s syndrome
  - Stevens Johnson syndrome
  - Neurotrophic keratopathy
Scleral Lens: Indications

- Inflammatory conditions
  - Limbal stem cell deficiency
  - Ocular cicatricial pemphigoid
- Neovascularization with hybrid lens designs
- Poor comfort with traditional gas permeable designs
- High refractive error
Scleral lenses: Contraindications

- Corneas with significant edema from reduced endothelial cell count
Are Scleral Lenses comfortable?

They are so big!
Emma 32 year old Hispanic female

- History of severe dry eyes
- Status Post Lasik OU for myopia (8 years prior to visit)
- Red, burning eyes since surgery.
- Poor vision since surgery.
- Poor fit with hybrid contact lenses.
- Unable to work due to poor vision.
- Referred by optometrist outside UCD.

- Ocular medications
  - Topical cyclosporine 0.05% two times a day
  - Non-preserved artificial tears 30 times a day.
  - No improvement with any eyedrops.
Emma

Entering uncorrected VA
OD 20/500    PH 20/60
OS 20/400    PH 20/50-1

Corneal topography Sim Ks
OD 54.00 @ 151 / 46.49 @ 061
OS 58.83 @ 063 / 40.47 @ 153

Inferior steepening and irregular astigmatism OU
Emma Slit Lamp Examination

• 2+ meibomian gland dysfunction OU
• Lasik flap with superior hinge OU
• OD 1+ central scarring, OS no scarring
• 2+ central and inferior PEK OU
• Normal intraocular pressures
• Normal dilated examination
Emma

• Diagnosis
• Corneal ectasia status post LASIK OU
• Irregular astigmatism OU
• Severe dry eyes OU
• Meibonitis OU

• Plan
• Scleral lens fitting
Emma Scleral Lenses

Jupiter scleral lenses
OD 51.00 / -9.75 / 18.2  20/20-1
OS 49.00 / -7.00 / 18.2  20/20-2

Bubbles under lenses

Changed to 16.0mm lenses
Bubbles still present
Emma Scleral Lenses

Jupiter scleral lenses
OD 50.50 / -8.75 / 15.6 20/20-1
Toric periphery
OS 40.00 / -8.75 / 15.6 20/20-2
Toric periphery

No more bubbles!
Emma

• Improvement with ocular dryness.
• No dry eye symptoms while wearing scleral lenses.
• Very happy with vision and comfort with scleral lenses.
Pringle, 84 year old Caucasian female

- Blurry vision and monocular diplopia left eye.
- History of significant astigmatism left eye.
- History of corneal scar due to pseudomonas infection (keratitis and scleritis) 3 years prior to exam.
- Status post cataract surgery and YAG left eye.
- Herpes zoster right eye.
- Tried soft colored contact lenses 1 year ago with no improvement for the left eye. Was not interested in gas permeable lens at that time.
Pringle

• Medical history – arthritis, hypertension
• Family history – no significant history
• Social history – retired
• Ocular Medications – none
• Systemic Medications – ASA, HCTZ
Pringle

VA (uncorrected)
OD 20/40-2
OS 20/60-2

Manifest Refraction
OD +0.50+1.25x020 20/20-1
OS -3.75+5.25x173 20/30+2
Pringle

Lids / Lashes - 1+ blepharitis and meibonitis OU
Conjunctiva - clear OD, thin inferotemporal OS

Cornea
OD clear
OS inferotemporal scarring approaching visual axis

Lens
OD 2+ nuclear sclerosis
OS PC IOL centered, stable

Posterior Segment - normal OU
Pringle

- Diagnosis - corneal scar OS due to prior pseudomonas keratitis and scleritis
- Monocular diplopia OS
- History of herpes zoster OD
- Nuclear sclerosis OD, not visually significant
- PC IOL stable OS
Pringle Scleral Lens Fitting

Best fitting lens
OS Jupiter 41.00 / -1.00 / 18.2
With +3.00DS 20/20-1

Ordered OS
Jupiter 39.00 (2D reverse) / +3.50 / 18.2 / 7.85x0.2 / 9.0x0.1 12.25 / 14.50

Reverse ordered to clear mid-peripheral cornea.
Pringle Scleral lens dispense

OS Jupiter 39.00 (2D reverse) / +3.50 / 18.2 / 7.85x0.2 / 9.0x0.1 / 12.25 / 14.50

Fit OD Air Optix for Astigmatism 8.7 / +4.25-1.25x110 for (Near)

Vision - prefers monovision
Comfort - good OU

VA
OD J2    with -2.50DS  20/20-1
OS 20/20-1  SOR pl
Pringle - Final Lenses

OD Air Optix for Astigmatism 8.7 / +4.25-1.25x110 (Near)
OS Jupiter 40.00 (4D reverse) / +3.25 / 18.2 / 12.25 / 14.50

Vision - good distance and near, happy with monovision
Comfort - good OU

VA
OD J2 with -2.50DS  20/20-1
OS 20/20-1  SOR pl
Scleral Lens Design

a. Optical zone
b. Transition zone
c. Landing zone
d. Toric lenses
e. Diameter
f. Clearance – central and limbal
g. Lens edge
Basic Scleral Lens Design

The Transition Zone

The Optical Zone

The Landing Zone
Scleral Lens Design

- **8.2mm Optical Zone**: 54.00 BC or 6.25 Radius
- **PC 1 with 2.0mm travel**: 6.85 Radius
- **PC 2 with 1.0mm travel**: Limbal Bridge 8.80 Radius
- **PC 4 with 1.5mm travel**: Scleral Haptic 12.25 Radius
- **PC 5 with 0.5mm travel**: Edge Lift for tear exchange 14.50 Radius
- **Chord Diameter = 18.2mm**

**Material:** Tyro 97 with UV Protection

- **Hofocen A**
- **dK=97**
- **Specific Gravity=1.122**
- **Wetting Angle=23**
Optical Zone

• Creates the desired optical effect.
• Zone is the center of the lens.
• Front surface optics may be either spherical or aspheric.
• Apheric may reduce aberrations.
• Back surface approximately align with cornea but does not touch the cornea.
Transition Zone

- Zone between optical zone and landing zone.
- Also called mid-peripheral or limbal zone.
- Determines sagittal height of lens.
- When fitting with diagnostic scleral lenses, moving up or down in height means changing the transition zone.
The Transition Zone

- With corneo-scleral lenses, the lens rests on the limbus, thus the shape of the transition zone should align with the limbal shape to minimize mechanical pressure.
Transition Zone

• For some lens designs, the shape of the transition zone can be adjusted.
• Other designs use various peripheral curves to adjust this zone.
Landing Zone

- Also called the scleral zone or haptic zone.
- Defined as a flat curve, or a series of curves ranging from 13.5mm to 14.5mm.
- The area where the lens rests and aligns with the anterior ocular surface.
The Landing Zone

- Even pressure distribution is needed in the landing zone in order to provide complete corneal clearance.
Landing Zone

• The back surface must align with the sclera when fitting full scleral lenses.
• The back surface must align with the limbus when fitting corneo-scleral lenses.
Toric Lenses

- Front, back, or bitoric scleral lenses.
- Back toric
  - Landing zone is made toric to improve the lens fit.
  - Does not include the central lens zone.
- Front toric
  - Located in central optical zone of the lens.
- Bitoric
  - Combines the features of front and back toric lenses.
Toric Lenses

- The anterior surface of most eyes is nonrotationally symmetrical
- Toric lenses lead to better ocular health
  - Less localized pressure
  - Less conjunctival blanching
  - Especially for larger diameter lenses
Toric Lenses

- Quadrant specific designs also available.
Diameter

• Practitioner preference
• May be able to alter the diameter within the same lens design
• If the diameter is changed significantly, may need a different lens design
Diameter

• Larger lens diameter
  – Able to create a larger tear reservoir
  – More clearance
  – Useful if there is a significant difference in corneal sagittal height (ectasia)
  – Larger area of bearing in landing zone, may improve comfort
  – May decenter temporally due to flat sclera nasal
Diameter

• Small lens diameter
  – Easier to handle
  – More normal corneas
  – Less expensive
Clearance

• Clearance is a key advantage of scleral lenses
• Sagittal height is adjusted to increase or decrease clearance
• Increasing the sagittal height increases the clearance or vault of the lens
• Different terminology is used rather than flat and steep
Sagittal Depth

- Sagittal depth is the measurement from the flat plane to the highest point of a concave surface.
- If sagittal depth is too high, leads to central bubbles.
- If sagittal depth is too low, leads to excessive central touch and bubbles in sclera.
Excessive sagittal depth - bubbles centrally

Excessive mid-peripheral clearance - bubbles in mid-peripheral / limbal zone
Clearance

• There is not a set amount of central corneal clearance
• 100 microns is a good rule of thumb
• Corneo-scleral lenses may only need 20-30 microns
• Larger diameter scleral lenses may go up to 500 microns
Clearance

• Useful as comparison and a reference
• Average corneal thickness is 530 microns (centrally) and 650 microns (peripherally)
• Central lens thickness can also be used as a reference
• A thin optic section with white light (both with and without fluorescein) is helpful to evaluate clearance
Clearance

• Amount of clearance varies with the condition
• Keratoconus with large difference in corneal sagittal height - larger sagittal height
• Keratoglobus - larger sagittal height
• Post-corneal graft or corneal scar - smaller sagittal height
• Ocular surface disease - larger sagittal height
Clearance

• Allow scleral lenses time to settle and “sink” into conjunctiva
• Wait at least 30 minutes before evaluating a lens on the eye
• Keep in mind that lenses may settle more with time
Clearance

- After central cornea clearance is determined, the peripheral corneal clearance is adjusted.
- Base curve radius changes affect the sagittal height of the lens.
- Flattening the base curve will reduce the sagittal height of the lens.
- These changes are often already compensated by the manufacturer.
Clearance

• Sagittal height is also dependent on lens diameter.
• If lens diameter is increased (keeping back optic zone radius stable), total sagittal height increases.
• If lens diameter is decreased (keeping back optic zone radius stable), the sagittal height decreases.
Clearance

- Limbal clearance also important
- Stem cells are located at the limbus
- Stem cells form new epithelial cells for the entire cornea
Materials

- High Dk materials
- Thicker than small diameter GP lenses
- Often 0.4mm to 0.6mm which reduces Dk / t

- Plasma treatment to improve wettability
Handling - Lens Insertion

• Goal “bubble free” insertion
• Patient bends over so that patient’s face is parallel to the horizontal plane
• May use target for patient to look at (such as Amsler grid) when training
Scleral Lens Insertion

• Fill scleral lens fully with fluid
Handling - Lens Insertion

• Goal “bubble free” insertion
• Patient bends over so that patient’s face is parallel to the horizontal plane
• May use target for patient to look at (such as Amsler grid) when training
Solutions - Application

• Single dose unit of non-preserved 0.9% sodium chloride inhalation solution
• Prescription medication
• Patient to obtain from pharmacy
• Rinse off conditioning solution on lens with non-preserved saline prior to lens insertion
Name:__________________________________________________________
Address:________________________________________Date:__________

R 0.9% NaCl Inhalation saline for ophthalmic use
Dispense: 1 box (100 count) 3 ml vials
Sig: Use as directed with ocular prosthetic device

Refills:_________
Solutions – Unisol 4

- Sterile, buffered isotonic saline solution
- Contains sodium chloride, boric acid and sodium borate
- Does not contain any preservatives
Solutions – Unisol 4

• Same pH as eye’s natural tears
• Sterile in unopened container
• Does not remain sterile indefinitely after opening
• Should not be used as an eyedrop
• Does not contain chlorhexidine, thimerosal
Solutions - Application

• Non-preserved carmellose sodium (Celluvisc) or carboxymethylcellulose sodium (Optive or Theratears)

• Celluvisc may be helpful if there are handling issues or if patient is elderly
Scleral Lens Insertion
Scleral Lens Insertion

- Use plunger or three finger approach to hold the lens
- Three finger method
- Three fingers are thumb, index, and middle fingers (may use ring finger also)
- Hold eyelids open
- Place the lens on the eye
Handling - Lens Insertion

- Plunger method
- Hold eyelids open
- Place the lens on the eye
- Release plunger if plunger is used
- Prefer large plunger for insertion
Sodium Fluorescein to Evaluate Lenses

- Initial evaluation
- Dip fluorescein strip into fluid filled bowl of lens
- Evaluate lens at slit lamp in order to evaluate initial fit and make sure that bubbles are not present
- Allow lens to settle for at least 30 minutes
- Reevaluate lens fit
Sodium Fluorescein to Evaluate Lenses

- Evaluation at dispense appointment
- Allow patient to wear lenses for four hours
- Then evaluate if fluorescein is still apparent
- If fluorescein is not present, apply fluorescein strip to conjunctiva to evaluate for fluorescein uptake under lens
Train and retrain application and removal
Handling - Lens Removal

- Manual two finger method
- Have patient look down
- Move lower eyelid outward while applying mild pressure to eyeball
- Then gently push lower eyelid with index finger underneath the lower edge of the lens
- Remove the lens
Handling - Lens Removal

- Plunger method
- Squeeze plunger to induce suction
- Apply plunger to periphery of lens (not to center of lens)
- Twist and pull away from eye
- Remove the lens
Wet surface of plunger before use
Replace plunger

Old plunger may be leaving residue on lens surface
Other Considerations

- Age
- Living alone
- Dexterity
- Systemic health status
Training Challenges
Training Challenges
Sea Green Lens Inserter

- Dalsey Adaptives
- Green LED light helps center the scleral lens for insertion
- Stand hold plungers and lenses securely prior to insertion
Sea Green Lens Inserter

- Helps for unsteady hands
- Helps for those who need to hold lids open with both hands
EZ Scleral Lens Applicator

• One finger lens insertion
• Lens self-positioning
• Less air entrapment

• http://ezibyqcase.com/
Useful Resource

- Scleral lens education society video
- Scleral Contact Lens Insertion, Removal, Troubleshooting and Lens Care
- http://www.sclerallens.org/how-use-scleral-lenses
Solutions - Disinfection

- GP lens disinfection solutions
- GP multipurpose solutions
Solutions - Disinfection

- Peroxide systems
- Large container
Solutions - Cleaning

• Manual cleaning with alcohol-based cleaner
• GP lens cleaning solutions
• Soft lens multipurpose solutions
Solutions - Cleaning

• Occasional cleaning with 2-component cleaner with sodium hypochlorite and potassium bromide
Solutions - Storage

• Do not store lenses in saline due to risk of microbial keratitis
Denise, 41 year old Caucasian Female

- History of Salzmann’s nodular degeneration both eyes
- History of soft and gas permeable contact lens wear
- Has not worn contact lenses for 5 years
- Blurry vision for distance with glasses
- History of dry eyes
- Uses non-preserved artificial tears as needed
- Uses fluorometholone 1% and ketorolac 0.5% daily in both eyes
Denise

Corrected VA with glasses
OD 20/30-2
OS 20/40

Manifest Refraction
OD -6.75+6.25x123  20/40+2
OS -8.50+6.25x059  20/20-2
Denise

Corneal topography Sim Ks
OD 34.90 @ 117 / 25.40 @ 027
OS 42.56 @ 066 / 30.74 @ 156

Irregular astigmatism OU
Denise Scleral Lens Fitting

Started with 18.2mm Jupiter scleral lenses
Unable to insert lenses

Changed to 16.6mm Jupiter scleral lenses

Ordered Jupiter scleral lenses Optimum Extra
OD 47.00 / -10.75 / 17.0
OS 46.25 / -8.00 / 17.0

9.0mm chamber both eyes
Denise Scleral Lenses

Jupiter scleral lenses Optimum Extra
OD 44.00 / -7.75 / 17.6 / 9.0 OZ / 9.0x2.1 / 8.3x.9 / 12.75 / 14.25
20/20-2

OS 44.25 / -6.50 / 18.2 / 9.0 OZ / 8.54x2.0 / 8.6x1.0 / 12.75 / 14.25
20/20+2
Denise

• “Extreme improvement” with ocular dryness
• Eyes no longer sensitive to light
• Eyes no longer watery
• Good vision
• Lenses very comfortable
Martha, 58 year old Caucasian female

- History of dry eyes
- History of posterior subcapsular cataract right eye
- Status post blepharoplasty for the upper and lower eyelids of both eyes.
- Red, burning, tearing, and photophobic eyes since her surgery.
- History of soft contact lens wear (both daily and two week replacement lenses).
- Ocular medications topical cyclosporine 0.05% one to two times a day and bottled artificial tears one to two times a day. No improvement with eyedrops.
Martha

Corrected VA with glasses
OD 20/25+1      PH 20/20+1
OS 20/40-2      PH 20/25+1

Manifest Refraction
OD -10.25+1.00x160  20/20-2
OS -8.50+0.75x091   20/20-2
Martha

Corneal topography Sim Ks
OD 42.35 @ 065 / 42.24 @ 155
OS 42.72 @ 098 / 41.82 @ 008

OD irregular astigmatism
OS regular astigmatism
Martha Slit Lamp Examination

- 1+ meibomian gland dysfunction OU
- 2+ conjunctival staining OU
- 1+ conjunctival chemosis OU
- Reduced tear meniscus OU
- Corneal staining OU, right eye worse than the left
- Tear break up time OD 2 seconds OS 4 seconds
- Normal intraocular pressures
- Trace nuclear sclerosis OU
- 1+ posterior subcapsular cataract OD
- Optic nerves and maculae were normal OU
Martha Scleral Lenses

Jupiter scleral lenses
OD 44.00 / -10.75 / 16.6     20/20
OS 44.00 / -10.00 / 16.6     20/20+2

Additional lens
OD 44.00 / -8.50 / 16.6 (near)     J1+
Martha Scleral Lenses

• Fit OU
• Good central apical clearance, good peripheral fit, no blanching, no sebaceous tear debris
Martha

• “Tremendous improvement” with ocular dryness.
• No dry eye symptoms while wearing scleral lenses.
• Happy with vision and comfort with scleral lenses.
• With the lenses on, does not need to use artificial tears.
• Without lenses, uses artificial tears and cyclosporine 0.05% twice a day.
Lens Flexure

• If complaints of blurred vision, evaluate for lens flexure
• Need to increase thickness to reduce warpage
• Keratometry or topography over lens to determine if lens is flexing
• If lens flexure, need to increase thickness
Flexure

- **Cause**
  - Lens too thin
  - Lens too flat

- **Remedy**
  - Increase center thickness
Peripheral Lens Flexure

- Thicken lenticular flange may be indicated when
- Flange is thinned
- 1. Reduce lens flexure
- 2. Reduce lens flexure over corneal graft
- 3. Inflamed and congested conjunctiva
John, 51 year old Caucasian Male

- History of KCN since 30 years old
- Sister also has KCN
- Tried soft, hard and hybrid contact lenses (most recently 10 years ago) without success.
- Rigid lens improved vision OD, however unable to tolerate lens.
- Right eye vision is deteriorating.
- Left eye vision is very poor.
- Lights have rings around them like halos.
John

- Medical history – seasonal allergies
- Family history – no significant history
- Social history – state office worker, lots of computer work.
- Hobby - reading
- Ocular Medications – none
- Systemic Medications – Claritin, steroid nasal spray, MVI
John

VA corrected with glasses
OD 20/30+2
OS 20/150 -1    PH 20/60+2

Manifest Refraction
OD -4.75+3.00x170   20/25
OS -9.25+4.50x120   20/60
Cornea
OD - iron line inferiorly, paracentral inferior thinning

OS - Vogt’s striae centrally, inferior iron line, paracentral inferior thinning
Corneal topography Sim Ks
OD 48.43 @ 036 / 40.23 @ 125
OS 60.39 @ 069 / 52.82 @ 159
John

- Pachymetry OD 491 µm OS 446 µm
- Dilated examination – normal OU
- Diagnosis - Keratoconus OU
- Plan – refit to Jupiter scleral lenses
John

- Much improved vision except sees shadows when reading very small letters up close.
- Happy with monovision.
- Much improved vision except sees shadows when reading very small letters up close.
- Very good comfort.

OD Jupiter 49.00 / -8.50 / 18.2
VA 20/25+2  SOR -0.25 20/20-2

OS Jupiter 50.50 / 7.25 / 18.2 (near)
VA 20/70 J1+ with -1.50DS 20/25+2
John Scleral Lenses

Auto Ks over scleral lenses
OD 40.03 @ 090 / 41.50 @ 170
OS 40.05 @ 083 / 41.13 @ 178

Lens Flexure both lenses!

OD Jupiter 49.00 / -8.50 / 18.2 CT = 0.60
VA 20/20+2       SOR pl

OS Jupiter 50.50 / 7.25 / 18.2 (near) CT = 0.55
VA 20/70       J1+   with -1.50DS 20/20+2

No more shadows when reading small letters up close.
No corneal or conjunctival complications with increased CT.
Corneal Complications - Diffuse Staining

-**Toxic**
  - Minimize preservatives if possible
-**Hypoxia**

- Important to evaluate cornea without the lens with sodium fluorescien to look for staining
Corneal Complications - Localized Staining

- Handling
- Insertion technique - air bubble causing staining
- Removal technique - if lens edge touches cornea may cause corneal abrasions
- Fenestration holes - if tear reservoir is too minimal
- Damaged lenses
Corneal Complications - Limbal microcystic edema

• More likely to occur due to mechanical stress or lens adhesion
• Increase limbal clearance if needed
• High Dk/t materials may reduce corneal edema
• Monitor lens thickness
• Ask patients about decreased visual acuity after hours of contact lens wear
Corneal Complications

- Caution if low endothelial cell count
- < 1,000 cells / mm\(^2\)
- Contraindication to scleral lens wear
Conjunctival Complications - Blanching

• Caused by pressure on the conjunctiva
Conjunctival Complications - Blanching

- Circumferential
  - Due to a landing that is too flat or too steep
  - If blanching under entire area of scleral lens, may need to increase landing zone by increasing lens diameter
  - If blanching under scleral lens edge, may cause conjunctival staining and hypertrophy over time
Conjunctival Complications - Blanching

- Caused by pressure on the conjunctiva
- Sectoral
  - May be due to irregular scleral shape
  - Pinguecula
- Loosen periphery of lens
- Non-rotationally symmetrical lens
- Notch in lens
Conjunctival Complications - Blanching

- Notch in lens
Conjunctival Complications - Impingement

- Lens edge pinches conjunctiva
- Negative pressure builds behind scleral lens with blink
Conjunctival Complications - Impingement

- Scleral lens flattens with blink, fluid escapes tear layer
- Staining after lens removal
- Conjunctival hypertrophy
Chamber Debris

- Mucous buildup in reservoir behind lens
- Common problem
- More common in lenses 18mm or larger due to larger fluid reservoir and slower fluid turnover
- Less common with smaller diameter scleral lens, perhaps due to smaller tear reservoir
- Vision and comfort can be affected
- GP lens solutions may enhance lens debris
Chamber Debris
Troubleshooting: Chamber Debris

• Advise patients to remove lens, manually clean or rinse and reinsert one to two times during the day
• May need more frequent lens replacement
• Decrease lens clearance if possible
• Increase viscosity of contact lens solution before application
Troubleshooting: Chamber Debris

- Loosen peripheral curves to increase fluid exchange or tighten peripheral curves to reduce excessive fluid exchange.
- Refit patients into smaller diameter lenses.
- Off-label topical 10% mucomyst (acetylcysteine) one to two times per day to reduce mucous accumulation.
Troubleshooting: Chamber Debris

• If complaints of debris are only in the morning, soak the eye with an eye cup before applying lenses
  Disinfect eye cup after use
• Treat underlying lid disease
• Remove punctal plug
Lens Surface Debris

• Caused by mechanical irritation and / or allergic or toxic reaction
Troubleshooting: Lens Surface Debris

- Ask patients about hand soap
- Change soap to contact lens handsoap or acne treatment handsoap
- Ask patients about face and eye creams
- Make sure patients are applying makeup after lens insertion
Troubleshooting: Lens Surface Debris

• Solutions
• Change to peroxide based solutions
• Plasma treatment of lenses
  (Do not plasma treat crazed lenses)
• Re-evaluate care and handling of lenses
• Consider enzymatic cleaner
Constant Wetting Defects—Consider Plasma
Troubleshooting: Lens Surface Debris

- Polish front surface of lenses BUT remove plasma surface
- On-eye surface cleaning using a saline moistened cotton swab or eye shadow applicator
- Increased lubrication use over the lens throughout the day
- Punctal occlusion
- Advise patients to remove lens, manually clean or rinse and reinsert one to two times during the day
Corneal Staining after Lens Wear

Before lens wear

After 4.5 hours lens wear
• Even in cases of severe dry eye, staining should be less after scleral lens wear.
Microcystic Corneal Edema

Microcystic Edema (our view in)

Sattler’s Veil (pt’s view out)
Microcystic Corneal Edema

• Evaluate solutions used with lens care
• Evaluate topical drops, medications and lubricants
• Eliminate suction of lens, refit if necessary
• Increase diameter of lens to provide more tear exchange
• Increase Dk of material
• Fenestrate to eliminate suction and increase oxygenation
Roque, 28 year old Mexican Male

- History of KCN since 2006
- Intacs OD 5/2009, superior segment removed
- Tried soft, hard and hybrid contact lenses without success
- Glare and halos OD very disruptive, even with Intac removal
- Presented without glasses or contact lens correction
Roque

Uncorrected VA
OD 20/400 PH 20/100
OS 20/150 PH 20/70

Manifest Refraction
OD -5.00+6.50x153 20/50
OS -3.25+2.75x055 20/40
Roque

Corneal topography Sim Ks
OD 47.34 @ 158 / 40.96 @ 068
OS 45.00 @ 014 / 40.13 @ 104

Inferior steepening with kissing bird sign OU, OD > OS

Cornea
• OD intac implant inferiorly in stroma, no distinct cone, clear
• OS slight thinning inferiorly, clear
Roque

Dilated examination within normal limits

Diagnosis
Pellucid marginal degeneration OU, OD > OS
S/P Intac with partial removal OD

Plan
Scleral Lens Fitting OU
Roque Scleral Lenses

Jupiter scleral lenses
OD 49.00 / -9.25 / 18.2  20/30+2
OS 46.00 / -5.50 / 18.2  20/25+1

1+ sebaceous tear debris OU

Keratometry over contact lenses
OD 41.00 / 43.00 / 074
OS 41.25 / 43.00 / 094
Roque

• Overall good fit and comfort with Jupiter contact lenses.
• Cylindrical overrefraction, thus contact lens flexure OU.
• Mild sebaceous tear debris OU.

• Ordered new Jupiter scleral lenses
  OD: 49.00 / -9.50 / 18.2 / 12.75 / 15.0 CT 0.50
  OS: 46.00 / -5.50 / 18.2 / 12.75 / 15.0 CT 0.50

• Center thickness increased to reduce contact lens flexure.
• Reviewed contact lens solutions.
• Advised non-preserved artificial tears PRN.
Roque

Final Lenses
   – “best lenses that I have ever had”

• OD 49.00 / -10.00 / 18.2 / 12.75 / 15.0  20/20-1
• OS 46.00 / -5.50 / 18.2 / 12.75 / 15.0  20/25
<table>
<thead>
<tr>
<th>Radius</th>
<th>Curve Width</th>
<th>Diameter</th>
<th>Sagittal Value</th>
<th>Sagittal Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.18</td>
<td>8.6</td>
<td>8.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.38</td>
<td>1.7</td>
<td>12.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.70</td>
<td>0.9</td>
<td>13.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.75</td>
<td>0.5</td>
<td>14.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.25</td>
<td>0.4</td>
<td>15.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Diameter: 15.6
Total Sagittal Depth: 4.3441

<table>
<thead>
<tr>
<th>Radius</th>
<th>Curve Width</th>
<th>Diameter</th>
<th>Sagittal Value</th>
<th>Sagittal Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.34</td>
<td>8.6</td>
<td>8.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.50</td>
<td>1.9</td>
<td>12.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.50</td>
<td>0.9</td>
<td>14.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.75</td>
<td>0.5</td>
<td>15.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.25</td>
<td>0.4</td>
<td>16.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Diameter: 4.3441
Total Sagittal Depth: 4.3441

Plot Area
Scleral Lens Education Society

www.sclerallens.org
Thank You!

Please feel free to contact me with any questions
Melissa Barnett, OD, FAAO

[Email]
[Phone]