Scleral Lenses in the Management of Ocular Surface Disease

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Disclosures

- Research Support: Valley Contax; Springfield OR
- Paid Consultant: Valley Contax; Springfield OR
Learning Objectives

• Review scleral lenses as a treatment in OSD

• Review commonalities in scleral lens fitting

• Discuss challenges to scleral lens wear and review how to maximize treatment success

• Review clinical cases
Ocular Surface Disease (OSD)

Collection of disorders primarily affecting the corneal and conjunctival tissues. These conditions result in chronic inflammation, desiccation, and loss of tissue function.
<table>
<thead>
<tr>
<th>OSD family of conditions</th>
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<tbody>
<tr>
<td><strong>Dry Eye Syndrome</strong></td>
</tr>
<tr>
<td>- Non-Sjogren</td>
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<tr>
<td>- Sjogren</td>
</tr>
<tr>
<td>- GVHD</td>
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<tr>
<td><strong>Stem Cell Deficiency</strong></td>
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<tr>
<td>- Stevens-Johnson</td>
</tr>
<tr>
<td>- Ocular Cicatrical</td>
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<tr>
<td>- Pemphigoid</td>
</tr>
<tr>
<td>- Chemical Exposure</td>
</tr>
<tr>
<td><strong>Neurotrophic</strong></td>
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<tr>
<td>- Cranial Nerve 5 injury</td>
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<tr>
<td>- Post-Herpetic</td>
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<tr>
<td>- Idiopathic</td>
</tr>
<tr>
<td><strong>Exposure</strong></td>
</tr>
<tr>
<td>- Ectropion</td>
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<tr>
<td>- Proptosis</td>
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<tr>
<td>- Paralytic</td>
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</tbody>
</table>
Treatment Strategies

- Environmental Modifications, Preserved Artificial Tears, Warm Compress
- Preservative-free AT, Steroids, Omega-3
- Punctal Plugs, Cyclosporine A, Oral Tetracyclines
- Scleral Lenses, Autologous Serum Tears, Surgical Intervention
Scleral Lenses and Ocular Surface Disease

- Indicated in moderate-severe ocular surface disease to improve:
  - Visual acuity
  - Patient comfort
  - Epitheliopathy
  - Ocular surface protection

- Low incidence of complications reported

- Clinically efficient treatment option
  - 115 subjects
  - Average of 3 visits
  - 1.4 lenses/eye to achieve successful fit (range 1-4)
5 hours after lens wear

Courtesy of Lynette Johns OD, FAAO
Persistent epithelial defect

Central defect unresponsive to frequent PFAT, cyclosporine BID, and punctal occlusion

Day 1: initial presentation          Day 8: after scleral lens wear

20/400                              20/20-
Scleral Lens Anatomy

- Pre-Corneal Fluid Reservoir
- Optic Zone
- Transitional Zone
- Sclera
- Cornea
- Haptic (Bearing zone)
Structure ➔ Function

- **Fluid Reservoir:**
  - Continuous hydration over corneal epithelium
  - Neutralize corneal irregularity

- **Physical Protection**
  - Reduced exposure
  - Reduce contact between eyelids and ocular surface
Pre-Fit Evaluation
Why Scleral Lenses?

- Current Management?
- Symptoms?
- What is the impact on activities of daily living?
- Consider Symptom Surveys
  - Ocular Surface Disease Index (OSDI)
OSDI

- 12-item questionnaire
- Rapid OSD assessment
- 3 categories of questions
  - Ocular symptoms
  - Vision-related function
  - Environmental triggers
- Scored 0-100
- Good to excellent reliability, validity, sensitivity, and specificity.
**OSDI grading**

<table>
<thead>
<tr>
<th>Number of Questions Answered</th>
<th>Sum of Scores for All Questions Answered</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Normal</td>
</tr>
<tr>
<td>12</td>
<td>10.4</td>
</tr>
<tr>
<td>11</td>
<td>14.8</td>
</tr>
<tr>
<td>10</td>
<td>12.5</td>
</tr>
<tr>
<td>9</td>
<td>13.9</td>
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<tr>
<td>8</td>
<td>15.6</td>
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<tr>
<td>7</td>
<td>17.9</td>
</tr>
<tr>
<td>6</td>
<td>20.8</td>
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<tr>
<td>5</td>
<td>25.0</td>
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<tr>
<td>4</td>
<td>31.3</td>
</tr>
<tr>
<td>3</td>
<td>41.7</td>
</tr>
<tr>
<td>2</td>
<td>62.5</td>
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</table>

*Values to determine dry eye severity calculated using the OSDI formula.*

**OSDIP** = \( \text{sum of scores} \times 25 \)

\( \text{(# of questions answered)} \)

Note: This grading scale is used to assess dry eye severity in patients.
Before you touch a lens...

- Thorough ocular surface evaluation
  - Tear production
  - Vital dyes

- Establish Goals
  - Ocular surface protection
  - Improve comfort
  - Improve vision
  - Decrease drop frequency

- Discuss expected challenges
Case #1

• 27 YO Hispanic Male

• Dx: Graft vs. host disease
  - CC: Gritty, dry, irritated eyes with poor visual quality and debilitating glare x 4 years

• Current management:
  - Punctal Occlusion
  - PFAT q 5-10 minutes
  - Restasis BID
  - Autologous Serum QID
  - Total drops per day = up to 90 / eye

• OSDI: 73

• Goal: Decreased dependency on drops
<table>
<thead>
<tr>
<th><strong>Slit-Lamp Exam</strong></th>
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</thead>
<tbody>
<tr>
<td>• Lids: clear</td>
</tr>
<tr>
<td>• Conjunctiva: 2+ diffuse injection</td>
</tr>
<tr>
<td>• Tear Film: minimal</td>
</tr>
<tr>
<td>• Schirmer: 3 mm OD, 1 mm OS</td>
</tr>
<tr>
<td>• Cornea: 2+ PEE OD, 3-4+ PEE OS, extensive circum-limbal neovascularization</td>
</tr>
</tbody>
</table>
3 Months Later

- 2+ PEE OD, 3-4+ OS → **Clear to NaFL**
- 20/25 OU → 20/20 OD, OS
- Restasis BID → DC
- Autologous Serum QID → DC
- PFAT q 5-10 minutes → QID

Courtesy of Priscilla Sotomayor OD, FAAO
Scleral Lens Fitting
Clearance
Scleral Assessment
Notation
What are we looking for?

- **Step 1: Central Clearance**
  - ~250-400
  - Why not more?
    - Corneal Hypoxia
    - Tear film debris
  - Why not less?
    - Corneal touch over time

- **Step 2: Limbal Clearance**
  - ~50-100 microns

Photo: Michigan College of Optometry
Step 3: Scleral Assessment

Alignment

• Even distribution of weight

• Vessels course without interruption
Step 3: Scleral Assessment

1. Compression
2. Impingement
3. Edge-lift
Step 3: Scleral Assessment

Compression

- Location: within landing zone/haptic
- Appearance: conjunctival vessel blanching
- Consequences: rebound hyperemia, soreness, lens suction
- Fix: flatten transition/limbal zone
Step 3: Scleral Assessment

Impingement

- Location: edge of lens
- Appearance: conjunctival indentation, vessel blanching
- Consequences: conjunctival laceration/staining, conjunctival hypertrophy
- Fix: Flatten peripheral/scleral curves
Step 3: Scleral Assessment

Edge-Lift

- Location: edge of lens
- Appearance: shadow, fluorescein accumulation, bubble formation
- Consequences: discomfort, excess tear exchange → debris
- Fix: steepen peripheral/scleral curves
Edge-Lift
Notation

1. Touch
2. Edge-lift
3. Compression
4. Impingement
5. Edge-lift with exchange
Remove the lens and look at the eye!

<table>
<thead>
<tr>
<th><strong>Cornea</strong></th>
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<tbody>
<tr>
<td>• Microcystic edema/stromal edema</td>
</tr>
<tr>
<td>• Any staining?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Conjunctiva</strong></th>
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</thead>
<tbody>
<tr>
<td>• Lens suction with removal</td>
</tr>
<tr>
<td>• Rebound hyperemia</td>
</tr>
<tr>
<td>• Conjunctival impression/staining/laceration</td>
</tr>
<tr>
<td>Case #2</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td><strong>58 YO Caucasian Female</strong></td>
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<tr>
<td><strong>Dx: Idiopathic Limbal Stem Cell Deficiency, OS</strong></td>
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<tr>
<td>• CC: Blurry vision constantly x 3 years</td>
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<tr>
<td><strong>Current management:</strong></td>
</tr>
<tr>
<td>• PFAT q hr</td>
</tr>
<tr>
<td>• Previous PTK with AMT</td>
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<tr>
<td>• Punctal Occlusion</td>
</tr>
<tr>
<td>• Previous failure with Restasis and Topical Corticosteroids</td>
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<tr>
<td><strong>Goal: Improve vision</strong></td>
</tr>
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</table>
Exam findings, OS

- BCVA: 20/800
- Lids: 1+ debris, lid thickening
- Conjunctiva: trace injection
- Cornea: See picture
- Lens: 2+ PCO, 2+ NS

Annotation Note Descriptions:
1. Significant corneal neovascularization 360
2. Central stromal opacity
3. Extensive PEE
Case #2

- **Initial Fitting**
  - BCVA 20/800 → 20/60
  - Good initial comfort and fit potential

- **2 months later**
  - BCVA 20/40
  - Cornea: improved PEE, otherwise stable
Challenges

Scleral Toricity
Debris
Lens Handling
Microbial Keratitis
Scleral Toricity

Inferior-temporal

Superior-temporal
Scleral Toricity

- Non-rotationally symmetrical lens designs
  - Toric
    - Flat and Steep Meridians
  - Quadrant Specific
    - 4 independently manipulated lens sectors
  - PROSE and EyePrint PRO
    - Highly specific lens designs
    - Generally reserved for advanced cases/other lens failures
Debris

- Front Surface:
  - Protein/Lipid accumulation on anterior lens surface

- Steps to decrease:
  - Treat eyelids aggressively
  - Review cleaning regimen
  - Change lens material
  - PFAT over lens
Debris

- Tear Reservoir\textsuperscript{7}:
  - Debris accumulation posterior to lens
  - Occurs in 20-33\% of scleral lens patients
  - More common in OSD patients

- Steps to decrease:
  - Treat lids aggressively
  - Rinse eye prior to insertion
  - Check for inadequate scleral alignment
  - Decrease central clearance
  - Change filling solution: High-viscosity PFAT at insertion
OCT: 4 hours after application

Initial Fit

Toric Scleral Zone

2 drops PFAT + Saline
Lens Handling

- Major barrier to scleral lens utilization
  - Both patient and physician

- Steps to decrease handling issues:
  - Use smallest diameter that provides acceptable fit
  - Use adaptive devices when needed
  - Include brief training at each visit
  - Use insertion/removal videos
  - Stepwise approach: especially useful in pediatric/autistic/intellectually delayed
Microbial Keratitis

- Likely low incidence
  - Infrequent case reports

- OSD population at higher risk
  - Compromised epithelium
  - Immunosuppressive therapies

- Consider AB prophylaxis
  - Vigamox: preservative free

- Stress hygiene compliance
Case #3

- 34 YO Caucasian Female
- **Dx**: 1. DES, OU 2. Compound Myopic Astigmatism
  - Minimal wear time in soft CLs, blurry vision, dryness
- **Current management**:  
  - Has tried 4 different CL brands in the past 2 years  
    - Low wear time: 3-4 hrs  
    - Poor/fluctuating vision: BCVA 20/20- OD, 20/25 OS  
    - No relieve with AT, Punctal plugs
- **Goal**: Increase wear time
1 Month Later

Fit in bitoric scleral lens

- **Wear time:**
  - 4→14 hrs
- **Vision:**
  - OD: 20/20- → 20/20
  - OS: 20/25→ 20/20
  - “Stable”

30 degrees left
Are scleral lenses properly placed in OSD treatment?

- **Case 1:** Decrease dependency on drops
  - 90 gtts/day → QID

- **Case 2:** Improve vision
  - BCVA 20/800 → 20/40

- **Case 3:** Increase wear time
  - 4 hr → 12 hr
**Title:** Scleral Lenses in the Management of Ocular Surface Disease

**Abstract:**

Ocular surface disease is a commonly encountered condition affecting a relatively high percentage of the population. Despite conventional treatment approaches, there are a subset of patients whose symptoms or clinical signs necessitate more aggressive treatment strategies. The role of scleral gas permeable lenses in the management of ocular surface disease has continued to expand over recent years. Advances in lens materials, lens designs and fitting strategies have resulted in more widespread applications for a treatment that was once reserved to only the most severe forms of ocular surface disease. With a more complete understanding of scleral lens indications, fitting strategies, and complication mitigation, practitioners may provide an advanced care option for their patients who have failed to respond to conventional therapies.