CONTACT LENS OPTIONS AND FITTING STRATEGIES FOR THE MANAGEMENT OF THE IRREGULAR CORNEA

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Consultant/Advisor/Speaker

- Accufocus
- Alcon
- AMO
- Bausch + Lomb
- Bruder Healthcare
- EyeBrain
- Optovue
- Revision Optics

Irregular Cornea
Contact Lens Options

- Standard Soft Lenses
- Custom Keratoconic Soft Lenses
- Corneal Gas Permeable Lenses
- Intra-Limbal Gas Permeable Lenses
- Piggyback and Recess Systems
- Scleral Gas Permeable Lenses
- Hybrid Lenses

Types of Irregular Corneas

- DEGENERATIONS
  - Keratoconus
  - Keratoglobus
  - Pseudopatellar marginal degeneration
  - Terrien’s marginal degeneration
  - Salzmann’s nodular degeneration
  - Ehlers-Danlos syndrome
- AFTER SURGERY
  - Cornea transplant (PK, PKP)
  - Radial keratotomy (RK)
  - Photorefractive keratectomy (PRK)
  - Epikeratophakia
- DYSTROPHIES
  - Cogan’s dystrophy
  - Bowman’s dystrophy
  - Corneal dystrophy
  - Lattice corneal dystrophy
  - Keratoconus dystrophy
- CORNEAL SCARRING
  - After infection
  - After trauma

CL Options: Soft Lenses

- Advantages:
  - Comfort
  - Centration (draping)
  - Corneal Protection

- Limitations:
  - Vision (due to draping effect)
  - Dehydration
  - Hypoxia /microbial contamination

CL Options: Custom Soft KC Lenses

- Hydrokone (Visionary Optics)
- NovaKone (Visionary Optics)
- Kerastar (Accufocus, & Advanced Vision, & SLIC Labs)
- Continental Kone (Continental)
- Keratoconus lens (Galileos)
- Softk (X-Cel)
- Ocu-Res X (Ocu-Ease, Optech)
- UCL - SS (United)
- Flexibles Keratoconus (X-Cell)
- *** Others
CL Options: Corneal GP Fitting Goals

- “Avoid Apical Bearing!”
- Match the periphery of the cornea (if normal)
- “Size Matters”: larger more decentered areas of irregularity require larger lenses & OZ
- Address Vision Needs: irregularity, astigmatism, presbyopia

CL Options: Tandem/Piggyback CL

- Soft lens component contributes about 20% of its power in air to the system
- Typically low power (+/-0.50) has negligible influence on GP fit or net system power
- Use of + power to somewhat mask corneal irregularity and possibly forestall GP centration. Use of approx. +6 = +1.2D Net effect
- High DK material
- Can combine with any GP design

CL Options: New Hybrid CLs

- Combination GP center & Soft periphery
- Advantages:
  - Vision of GP / Comfort of SCL
  - One lens to handle
  - High Oxygen Transmission
  - Design Options (Neg-Cornea, MFL, KCH, Rev. Geom)

CL Options: New Hybrid CLs

- Historical Disadvantages:
  - Lens tightening over time*
  - Secondary inflammatory response*
  - More difficult with larger and more decentered cones/Irreg. C’s
  - Design limitations (fit & vision)

UltraHealth Lens Design

- Reverse Geometry
- Aspheric Box-Curve
- Variable Lift Zone
- Rigid Inner Landing Zone
- Soft Outer Landing Zone
Intro To Scleral Lenses
Scleral Classifications: New Nomenclature

<table>
<thead>
<tr>
<th>Lens Type</th>
<th>Description</th>
<th>Definition of Bearing Area</th>
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</thead>
<tbody>
<tr>
<td>Corneal</td>
<td></td>
<td>Lens Rests Entirely On Cornea</td>
</tr>
<tr>
<td>Corneo-Scleral</td>
<td>Lens Rests Partly on Cornea &amp; Partly on Sclera</td>
<td>Up to 6mm &gt; HVID</td>
</tr>
<tr>
<td>Scleral</td>
<td></td>
<td>Lens Rests Entirely on Sclera</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large Scleral More than 6 mm &gt; HVID</td>
</tr>
</tbody>
</table>

Adopted from nomenclature introduced by Scleral Lens Education Society (June 2013).

Intro To Scleral Lenses
Risk and Benefit Ratio

- Fitting complexity increases despite subjective comfort
- I/R skills
- Dk/t
- Lens flexure
- Conjunctival tissue modulus
- Scleral Toricity
- Scleral Obstacles
- Wearing angle
- Debris entrapment
- Tear exchange
- Limbal clearance

Intro Scleral Lenses
Potential Indications: A Growing List

Ocular Surface Protection & Therapeutic

- OSD (Sjogren’s, KCS, Dry eye, PTPN, OCP, DED, Chemical/thermal burns, Stem Cell failure, Neurotrophic keratitis, Severe epithelial, corneal melting, Ectropion, Photophobia, Scleral-Mucosa Patch Grafts...)
- Malignant/Inflammation
- Off label - Drug delivery/retention?

Optical Rehabilitation

- KC, Keratoconus
- PMD, Keratoconus
- PKP and other post-surgical corneas (ie, RK)
- Scarring (ie, Post-infectious corneal scarring)
- Corneal dystrophies
- Presbyopia/Ortho-K/Aphakia/High Ammetropia*

Cosmesis

- Scleral Prosthesis
- Painted Iris?
- Lid Ptosis Crutch?

Scleral Lenses

- Becoming extremely popular for all irregular corneal conditions
- Great comfort
- Remarkable acuity
- Becoming easier to fit

Scleral Indications

- Steep KC corneas
- Flat, post refractive surgery corneas
- The wide array of post graft cornea shapes
- Small corneas and large corneas
This example shows the difference in base curve and shape of Zenlens prolate and oblate designs. Note both lenses have the same sag.

**Prolate lens with 7.30 BC**

**Oblate lens with 9.50 BC**

**Attribute #3**: The Smart Curve

- Lens adjustments will not affect the rest of the lens fit
- If fitter wants something changed, they just ask for the change and everything else remains consistent, e.g.:
  - Can change SAG without having to change base curve
  - Can increase limbal clearance without having to change the SAG
  - Can modify the shape of the lens without altering the SAG.

**Attribute #4**: Generous scleral landing area

**Design Attribute #3**

- Moving the fit points:

**Design Attribute #4**
Design Attribute #5

- Toric PCs are available to order
  - Scleral landing curves are available in 30 micron steps—flatter or steeper
  - You can mix and match them to create the toricity you desire
- Front toric optics can be added to the anterior OZ
  - With back surface scleral zone toricity or with front surface dual elliptical stabilization for rotational stability

Evaluate the Corneal Clearance

Intro To Scleral Lenses
If All Starts in the Center: VRM
Evaluate the Limbal Clearance

Figure 5: Unsatisfactory limbal bearing

Figure 6: Clear limbal bearing

Insufficient Limbal Clearance:

- Request additional microns of clearance added to standard:
  - +50 microns if limbal touch is within one quadrant
  - +100 microns if touch/bearing is in two quadrants
  - +150 microns if it’s in three quadrants
  - If 360 degrees of touch, try a larger diameter lens

Additional microns can be requested in any amount. Displayed values are suggestions.

Evaluate the Scleral Landing Zone

Scleral impingement

Blanching:
- 3 & 9 o’clock
- Ordered toric APS

Toric APS
Keratoconus Challenge
CL Options: Scleral Haptic
Evaluation

Edge too steep: compression

Keratoconus Challenge
CL Options: Scleral Haptic
Evaluation

Optimal landing

Keratoconus Challenge
CL Options: Scleral Haptic
Evaluation

Intro To Scleral Lenses
It All Starts in the Center!

- SAG estimation after "proper" settling (± NaFL)
  - Optic Section (~45°)
  - OCT
- Design variables
- Patient variables


Josh Lotoczky, OD; Chad Rosen, OD; Craig W. Norman, FCLSA (Vision Research Institute, Michigan College of Optometry)

Fitting the Zenlens

Over-Refract to determine final lens power
- Adjust over-refraction for vertex distance
- Factor in D0 power of the Dx lens
- If modifying SAG value from the Dx lens, Base Curve can remain constant, so no need to adjust lens power for SAG
- If cylinder is present in over-refraction, use topography or keratometry to check for lens flexure
- Refer to cylinder correction chart

Shadowing of the Lens Edge

- Easy way to assess the edges for excessive lift
- Position slit beam across lens and view the far lens edge
Patient AG

- AG: 45 year old Hispanic male
- History of keratoconus
- Had Keret transplant 2015 in OS
- Advanced keratoconus in OD- contact lens failure
- Having corneal transplant in OD next month

Fitting the Zenlens

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Solutions</th>
</tr>
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<tbody>
<tr>
<td>Bedding water Instructional text:</td>
<td></td>
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<tr>
<td>- Recommend pre-pair medication</td>
<td></td>
</tr>
<tr>
<td>- Check for visual acuity; may require tollic or deeper PC</td>
<td></td>
</tr>
<tr>
<td>- Mitomycin F, 0.02%</td>
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</tbody>
</table>

- May need to loosen PC
- If occurring between meridians, consider less PC
- Clear stroma correlated in axial disease
- Small base lens correlated

- Posterior corneal surface in clear
- A pill is present in the corneal interface, refer to the Cylinder Central Optic and topmost edge of the lens
**Patient AG**

<table>
<thead>
<tr>
<th>Sphere</th>
<th>Cylinder</th>
<th>Axis</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP</td>
<td>-27.50</td>
<td>-4.00</td>
<td>92</td>
</tr>
<tr>
<td>OS</td>
<td>-8.75</td>
<td>-1.00</td>
<td>90</td>
</tr>
</tbody>
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**Four Step Lens Evaluation Process**

- **Evaluate Central Clearance**
  - Adjust clearance in microns
  - Each lens in diagnostic set is 100 µm different

- **Evaluate Mid-Peripheral Clearance**
  - If central clearance is ideal, base curve adjustments can increase normal mid peripheral clearance and decrease excessive mid peripheral clearance

- **Evaluate Limbal Clearance**
  - Adjust clearance in microns
  - Lower clearances (without touching) aid in centration

- **Evaluate Advanced Peripheral System landing on conjunctiva**
  - Flatten or steepen APS in 30 µm steps
  - Toric peripheries are available

**Final Result**

- Visual acuity OS: 20/25 +2
- Able to wear lens full day with good comfort
- Anxious to have transplant on OD

**Patient MP**

- 64 year old WR
- History of Fuchs dystrophy
- Had PKP OD: 2006, OS 2014
- Wearing RGP’s for past 10 years
- Comfort has decreased and vision not stable
- Wearing time has decreased to 9 hours per day
Exam Findings

Contact Lens Fit:

OD:  7.7 Base curve / 46.50 sag / 13.0 mm dia / Flat 3 edge / Plano
OS:  7.1 Base curve / 52.00 sag / 13.0 mm dia / Flat 3 edge / +0.50

MP Final Evaluation

Visual acuity with Scleral Contacts
OD: 20/20
OS: 20/20

Wearing time 14 hours per day
Very comfortable
Patient comments on how clear her vision is
26 year old Hispanic male
Referred to our office due to drastic vision change
Seen by two other eye doctors who could not determine the problem with his eyes and could not provide glasses which worked
Pentacam confirms diagnosis of keratoconus

Slit Lamp shows mild thinning inferiorly OU
Topography shows more aberration in visual axis OD
Pentacam shows inferior posterior distortion
Went over options for visual correction: Glasses, soft lenses, RGP’s, Hybrids, Sclerals

Patient decides to go with scleral contacts
Dispense Blanchard One Fit 2.0, a good design for early cones

Final lenses:
One Fit 2.0: OD: 8.0 BC / 14.9 / -3.75 / steep 1
OS: 8.0 BC / 14.9 / -2.25 / steep 1
Patient OV

- Visual acuity with contacts: OD 20/20, OS 20/15
- Wearing time 12-14 hrs per day
- Patient very happy with crispness of vision as well as comfort