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Parameters:

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<th>Flat and Steep Meridian SLZ</th>
<th>Base Curves</th>
<th>Diameter</th>
<th>Power</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000 to 4600 µm in 100 µm steps</td>
<td>Both meridians available 28 to 50 in steps of 2</td>
<td>7.4 to 9.2 mm in 0.2 mm steps</td>
<td>14.0 to 17.5 mm in 0.5 mm steps</td>
<td>-25.00 to +25.00 D in 0.25 D steps</td>
<td>Menicon Z and Contamac Optimum Extreme</td>
</tr>
</tbody>
</table>

Front Toric Parameters:

<table>
<thead>
<tr>
<th>Axis</th>
<th>Cylinder Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° to 180° in 1° steps</td>
<td>-0.75 to -3.00 D in 0.25 D steps</td>
</tr>
</tbody>
</table>
The SynergEyes VS lens is an innovative scleral lens with a distinctive bi-tangential periphery. The lens completely vaults the cornea and limbus landing entirely on the sclera. The toric periphery of the lens may be precisely controlled in both flat and steep meridians, aligning with the sclera for ease of landing and stability.

This non-rotationally symmetric lens design combines two key innovations to maximize comfort and optimize lens performance: linear landing zones and bi-tangential toricity.

The linear landing zones are designed to follow the linear (rather than curved) shape of the sclera accommodating a toric sclera, which is present in 95% of cases. The adjustable scleral landing zone (SLZ) in the flat or steep meridians aims to distribute the lens pressure more equally on the sclera to improve the scleral lens fit.

Background

Research data suggests that toricity is more pronounced in the scleral area than in the limbal area, irrespective of the toricity of the cornea. Van der Worp, et al found in most cases, the shapes of the limbus and anterior sclera were linear rather than curved. This information was the basis for designing a scleral lens with a bi-tangential (non-rotationally symmetrical) periphery. The objective of a scleral lens with tangential fitting is to reduce the adhesive pressure on the eye, to achieve greater tolerance and prolong the daily duration of use. The ability to adjust the flat or steep meridian of a bi-tangential design distributes the lens pressure more equally on the sclera and improves the scleral lens fit.

A special thank you to Henny Otten of Visser Contact Lens Practice for many of the images.
The SynergEyes VS lens is designed to fully vault the cornea and the limbus and gently land on the sclera. A well-fit lens exhibits the following characteristics:

- The linear scleral landing zone has edge alignment without vessel blanching.
- Apical corneal clearance of approximately 200 µm after settling.
- Limbal clearance of about 100 µm.

The design of the SynergEyes VS lens uses peripheral toricity and linear scleral landing zones as primary elements. Over 95% of the scleral lenses prescribed have a toric periphery. After a quick check for central touch or excessive clearance, observe the scleral landing zone. After 30 minutes, align the scleral landing zone with the sclera and then observe the sagittal depth.

The following lens parameters affect how the lens fits:

<table>
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<tr>
<th>Lens Location</th>
<th>Observation</th>
<th>Adjust</th>
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<tr>
<td>Scleral Landing Zone (SLZ)</td>
<td>Edge Lift and Blanching</td>
<td>Flat Meridian SLZ, Steep Meridian SLZ</td>
</tr>
<tr>
<td>Central Optic Zone</td>
<td>Apical Clearance</td>
<td>Sagittal Depth</td>
</tr>
<tr>
<td>Mid-periphery Limbal Zone</td>
<td>Limbal Clearance</td>
<td>SLZ (first) Base Curve (second)</td>
</tr>
</tbody>
</table>

### Diagnostic Lenses

The diagnostic lens set consists of 16 SynergEyes VS lenses with a diameter of 16.0 mm, a base curve of 8.4 mm and plano powers. All lenses have toric peripheries and the toricity is expressed in two meridians in the scleral landing zone (SLZ): a flat meridian landing zone and a steep meridian landing zone. In the fitting set, the landing zone difference for all lenses corresponds with a height difference between the flat and steep meridians of about 180 µm at the edge of the lens.

### Lens Identification:

The diagnostic lenses are laser marked.

### Scleral Lens Markings

- Sagittal depth (µm)
- SLZ flat meridian
- SLZ steep meridian

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**Fitting Philosophy**

The diagnostic lenses are laser marked.
There are three ways to choose an initial diagnostic lens:

1. Start with a 3600 µm sagittal depth, 36 flat meridian, 42 steep meridian. This is the most prescribed lens. Select 3800 µm, 36 flat meridian, 42 steep meridian for the other eye.
2. Use Rx Fitting Resource to determine a starting lens.
3. Select a lens based on experience and this fitting guide which is based on the fitting protocol of the Visser Contact Lens Practice.

A. Selecting Initial Flat and Steep Meridian Scleral Landing Zones (SLZ):

To select the initial flat meridian SLZ, start with 36 in the flat meridian or assess the scleral profile. A normal scleral profile ranges from 34 to 38. For a flatter scleral profile, use 28, 30 or 32. For a steeper scleral profile, use 40 and above. All diagnostic lenses have a steep meridian SLZ that is 180 µm greater than the flat meridian SLZ.

<table>
<thead>
<tr>
<th>Sclera Profile</th>
<th>Flat Meridian SLZ</th>
<th>Percent Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat Profile</td>
<td>28 - 32</td>
<td>8%</td>
</tr>
<tr>
<td>Normal Profile</td>
<td>34 - 38</td>
<td>80%</td>
</tr>
<tr>
<td>Steep Profile</td>
<td>40 - 50</td>
<td>12%</td>
</tr>
</tbody>
</table>

Tip: There is a 60µm change for each SLZ number.

B. Selecting Sagittal Depth:

The most common sagittal depth of the SynergEyes VS scleral lens is 3600 µm. Similar to other scleral lenses, the desired sagittal depth varies with condition. A keratoconus patient may have a deeper cornea profile and require a greater increase in sagittal depth compared to a normal eye, while a post-corneal graft or post-refractive surgery patient may require a more shallow depth. Corneal profile may be assessed upon visual inspection. Another option is to use the Rx Fitting Resource which accesses corneal topographer measurements, estimates corneal height and recommends a starting sagittal depth.

<table>
<thead>
<tr>
<th>Cornea Profile</th>
<th>Sagittal Depth</th>
<th>Percent Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow</td>
<td>3000 µm to 3300µm</td>
<td>10%</td>
</tr>
<tr>
<td>Normal</td>
<td>3400 µm to 3800µm</td>
<td>75%</td>
</tr>
<tr>
<td>Deep</td>
<td>3900 µm to 4100 µm</td>
<td>10%</td>
</tr>
<tr>
<td>Very Deep</td>
<td>4200 µm to 4400 µm</td>
<td>5%</td>
</tr>
</tbody>
</table>
Initial Lens Evaluation

Clean and condition the diagnostic lens. Place the selected lens on eye filled with non-preserved saline and fluorescein. Upon insertion, perform a quick check for central touch or excessive clearance and then evaluate the scleral landing zone (SLZ) and look for scleral alignment.

The lens should be well-balanced with gentle movement upon a push-up test.

Allow lens to settle for 30 minutes.

The diagnostic lenses have hash marks to indicate the flattest meridian. Measure the axis by projecting a narrow beam from the slit lamp parallel to the engravings on the scleral lens. The axis can be read from the axis gauge. Make note of the position of the flat meridian. Hash marks will align with flattest meridian.

Assess Scleral Landing Zone (SLZ)

Assess the lens initially in primary gaze, holding lids away to assess the periphery. Shift gaze in all directions for final assessment for lens movement and potential binding. Extreme gaze shift may show false readings.

Check scleral landing zone for alignment with the sclera by observing blanching or edge lift. If blanching exists decrease the SLZ number (flatten) in the corresponding meridian. If edge lift exists, increase the SLZ number (steepen) in the corresponding meridian.

If SLZ is too tight (too steep) decrease the SLZ number (flatten)

Lens edge too steep.
Lens too tight.
Decrease SLZ by 2.
Blanching.
Lens too tight.
Decrease SLZ by 4.
Extreme edge tightening around entire lens. Decrease SLZ by 6 in both meridians.
Assess Scleral Landing Zone (SLZ)

If SLZ is too loose (too flat)  
**increase the SLZ number (steepen)**

<table>
<thead>
<tr>
<th>Observation</th>
<th>Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blanching:</strong></td>
<td>Decrease flat meridian SLZ by 4 and decrease steep meridian SLZ by 4.</td>
</tr>
</tbody>
</table>
| Lens edges in both meridians are too steep (too tight) | **Example:** Flat meridian SLZ: 36 to 32  
  Steep meridian SLZ: 42 to 38         |
| **Edge Lift:**                       | Increase flat meridian SLZ by 4 and increase steep meridian SLZ by 4.       |
| Lens edges in all meridians appear too flat (too loose) | **Example:** Flat meridian SLZ: 38 to 42  
  Steep meridian SLZ: 44 to 48         |
| **Edge Lift:**                       | Keep the flat meridian SLZ the same. Increase steep meridian SLZ by 4.     |
| Lens edges are too flat (too loose) in the steep meridian and ideal in the flat meridian | **Example:** Flat meridian SLZ: 36 stays at 36  
  Steep meridian SLZ: 42 to 46         |
| **Blanching:**                       | Decrease flat meridian SLZ by 4 and keep the steep meridian SLZ the same. |
| Lens edges are too steep (too tight) in the flat meridian and ideal in the steep meridian | **Example:** Flat meridian SLZ: 38 to 34  
  Steep meridian SLZ: 44 stays at 44  |
Assess the apical clearance at the highest point of corneal elevation using an optic section with a white light or an anterior segment OCT. The ideal apical clearance is approximately 200 µm. The diagnostic lens thickness is 350 µm.

Apical clearance may be adjusted by increasing or decreasing the sagittal depth of the lens. In the case of inadequate apical clearance, increase the sagittal depth of the lens the appropriate amount.

**Tip:** The clearance can be estimated by comparing the lens thickness (350 µm at plano) to the tear reservoir under the lens. This can be evaluated by a narrow slit lamp beam moved from limbus to limbus at an angle of 45°.

Excessive clearance will make it more difficult to insert the lens without air bubbles. In eyes that tend to accumulate debris behind the lens, a shallower sagittal depth should be chosen. A deeper sagittal depth may be necessary in eyes that are prone to progressive ectasia.
Assess Limbal Clearance

**Tip:** If the SLZ and the sagittal depth are correct, most lenses don’t require a change in base curve.

Assess the limbal clearance with fluorescein, as seen below, or by using white light or an OCT. It is important that there is no touch of the lens on the limbus. Ideal limbal clearance is about 100 µm. This may vary circumferentially.

When landing zones and sagittal depths are correct, the limbal clearance is adjusted by changing the base curve.

If there is bearing or less than 50 µm of clearance, it’s important to re-assess the landing zone. If the SLZ is too flat, as demonstrated by edge lift, you will observe a decrease in limbal clearance. An increase in the SLZ should provide the ideal limbal clearance.

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**Bearing in limbal area. Flatten base curve.**

**Excessive clearance in limbal area. Steepen base curve.**

**Ideal clearance in limbal area. Maintain base curve.**

Before changing the base curve, check the landing zone. If there is edge lift, increase SLZ number by 2.

**Tip:** Changes in the base curve should always be accompanied by a lens power change. SynergEyes VS lenses are available in base curve increments of 0.2 mm. A 0.2 mm flattening of the base curve requires a power adjustment of +1.00. A 0.2 mm steepening of the base curve requires a lens power adjustment of -1.00.

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Lens Diameter

The 16.0 mm diameter provided in the diagnostic set will suffice for a majority of patients with average to smaller corneas. The lens diameter should be approximately 1.5 to 2.5 mm beyond the limbus or 3.0 to 5.0 mm greater than HVID.

Lens diameter is available from 14.0 to 17.5 mm in 0.5 mm steps.

*Photo: H. Otten*
Perform an over-refraction after the optimal diagnostic lens has settled on the eye. The power in the diagnostic lenses is plano.

The SynergEyes VS is a non-rotational lens that stabilizes over the flat meridian at the hash marks allowing for cylinder availability at any axis. An axis adjustment may be necessary to compensate for position.

**Tip:** All diagnostic and toric lenses have hash marks. They align with the flattest meridian.

Locate and assess the hash marks. They align with the flattest meridian. If the lens is correctly fit, the hash marks will be stable and remain in a constant position.

To compensate for misalignment, note the axis location of the hash marks and the axis of the over-refraction. Subtract the hash mark axis from the over-refraction axis. If the resulting number is positive, that is the cylinder axis to order (see example). If the resulting number is negative, subtract that number from 180 and that is the axis to order (see formula).

**Formula:**

- Over-refraction axis – hash mark axis = + X  \( X = \) Cylinder axis lens order;
- Over-refraction axis – hash mark axis = – X  \( 180 - X = \) Cylinder axis lens order

**Example:**

Hash mark settles at 30°

To compensate for misalignment from 180° axis:
- Hash mark: 30°
- Over refraction is -1.00 -1.00 x 140.
- 140-30=110
- Order: SynergEyes VS: -1.00 -1.00 x 110

**Tip:** SynergEyes Consultation is available to help with adjustments if the location of the hash marks and the toric over-refraction are provided.
### Troubleshooting Tips

<table>
<thead>
<tr>
<th>Observation</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tight lens fit: Blanching, compression or tight edge in landing zone in</td>
<td>Mild: Decrease SLZ in the specific meridian by 2 (60 µm). Moderate: Decrease SLZ by 4 (120 µm). Note: The change of an SLZ will also change SLZ on the opposite side of the lens.</td>
</tr>
<tr>
<td>either the flat meridian or steep meridian</td>
<td></td>
</tr>
<tr>
<td>Blanching is circular (around the entire lens)</td>
<td>Mild: Decrease SLZ in both meridians by 2 (60 µm). Moderate: Decrease SLZs in both meridians by 4 (120 µm).</td>
</tr>
<tr>
<td>Loose lens fit: Too much edge lift or scleral standoff or too much movement</td>
<td>Mild: Increase SLZ in the specific meridian by 2 (60 µm). Moderate: Increase SLZ in the specific meridian by 4 (120 µm). Note: The change of an SLZ on one side of the lens will also change the SLZ on the opposite side of the lens.</td>
</tr>
<tr>
<td>Excessive movement</td>
<td>If landing zone looks good and the lens has too much movement, increase diameter.</td>
</tr>
<tr>
<td>Excessive central clearance</td>
<td>Reduce sagittal depth to allow for 200-250 µm of clearance.</td>
</tr>
<tr>
<td>Insufficient central clearance</td>
<td>Increase sagittal depth to allow for 200-250 µm of clearance.</td>
</tr>
<tr>
<td>If mid-peripheral or limbal clearance too thin or too deep</td>
<td>Increase or decrease base curve and adjust lens power. Ideal limbal clearance is 100 µm.</td>
</tr>
<tr>
<td>Cylinder over-refraction</td>
<td>Note where hash marks line up, order a front toric.</td>
</tr>
<tr>
<td>Visual fluctuations</td>
<td>Check surface quality (wettability and deposits). Reduce sagittal depth, increase diameter, verify lens stability.</td>
</tr>
<tr>
<td>Lens surface deposits</td>
<td>Use appropriate cleaning solutions. If deposit is protein, use a protein remover. Check and treat ocular causes (GPC, MGD). If cleaning system is not sufficient, change material.</td>
</tr>
<tr>
<td>Vision is blurry</td>
<td>Perform over-refraction to identify residual astigmatism. Order a front toric. Record lens stability in degrees at follow-up visits to follow lens stability over time.</td>
</tr>
<tr>
<td>Debris in tear layer</td>
<td>Remove, clean and rinse lens if vision is blurred. Improve SLZ alignment to prevent debris from getting under the lens. Check and treat ocular causes (GPC, MGD). Optimize lens solutions. Rinse the eye with saline or other rinsing solution before inserting the lens. Reduce clearance.</td>
</tr>
<tr>
<td>Inferior decentration</td>
<td>Minor decentration is acceptable. First, check vertical scleral fit and SLZ alignment. Then, increase diameter.</td>
</tr>
<tr>
<td>Bubbles under the lens</td>
<td>Reinsert lens to eliminate “insertion bubbles”. Consistent central bubbles can indicate over-vault. Decrease vault. Consistent bubbles in mid-periphery can indicate the base curve is too flat. Steepen base curve. If bubbles arise after correct insertion this may indicate SLZ is too flat.</td>
</tr>
<tr>
<td>Lens discomfort</td>
<td>Initial lens will have some awareness, but should not be uncomfortable. Check edge lift. Increase SLZ in the specific meridian. Check central clearance. Increase sagittal depth if clearance is insufficient.</td>
</tr>
</tbody>
</table>
Perform over-refraction. If front cylinder is required, an axis adjustment may be necessary to compensate for rotation. SynergEyes consultation is available to help with adjustments if the location of the hash marks and the toric over-refraction are provided.

Lens diameter should be 1.5 - 2.5 mm beyond the limbus or 3.0-5.0 mm greater than HVID. Diagnostic lens diameter is 16.0 mm.

NOTE: A 0.2mm change in base curve requires a +/- 1.00 D power adjustment.

Before changing the base curve, check the landing zone. If there is edge lift, increase SLZ number by 2.