Most eyes with corneal astigmatism manifest a significant difference in elevation between the steep and the flat corneal meridians (Image A). Some corneas that appear spherical may also manifest a peripheral corneal elevation difference. The Paragon CRT® lens design has a fixed chord length of 8 mm (6 mm treatment zone surrounded by a 1 mm return zone width). When the elevation difference exceeds approximately 30 microns at a chord diameter of 8 mm, it may not be possible for the lens to reach the cornea circumferentially in the landing zone (Image B). This creates a weakened compressive force in the steep meridian and results in poor centration, lens flexure, and/or undertreatment. An example of an elevation map with elevation values at 4 mm from reference center in each meridian is shown in Image C.

A common rule in contact lens fitting holds that spherical lenses will always move freely along the steep meridian and exhibit restricted movement along the flat meridian. The clinician will observe that spherical lenses will touch first in the flattest meridian peripherally and rock, flex or tilt over the steepest meridian. In conventional corneal reshaping designs, the lens can only reach the peripheral steep meridian by compressing or applanating the flat meridian or by way of lens flexure. Oval treatment zones are commonly observed with peripheral corneal elevation differences.
The Paragon CRT® Proximity Control Technology™ and manufacturing system was designed to allow for independent modulation of the three zones of the lens: Base Curve (BC) Return Zone Depth (RZD), and Landing Zone Angle (LZA). The Base Curve radius controls treatment of the refractive error and remains spherical and unchanged. In the Paragon CRT Dual Axis® version, the Return Zone Depth (RZD) can be varied in selected meridians to compensate for the peripheral corneal elevation differences of an eye. Correspondingly, the Landing Zone Angle, by itself, may be varied in a second axis while the base curve and return zone depths are unchanged or both RZD and LZA may be varied in the second meridian to compensate for the peripheral corneal slope meridional differences of an eye.

In other words, when fitting a Paragon CRT Dual Axis® design, the BC remains constant throughout the treatment process, unless there is a need to correct untreated or residual power.

Using this standard CRT lens example: BC 8.7         RZD 550           LZA -33

The possible parameter alternatives for the Dual Axis product are:
1. The RZD could have a second value and the LZA would remain a single parameter (8.7/550 & 600/-33)
2. The LZA could have a second value and the RZD remains a single parameter (8.7/550/-33 & -34)
3. The RZD and LZA could both have second values (8.7/550 & 600/-33 & -34)

Corneal Topography and CRT Dual Axis® Prescribing

It is common for Placido-based corneal topographers to directly measure curvature data out to about 9-10 mm. This curvature data can be reconstructed into height data and represented as an ELEVATION MAP. Elevation maps illustrate relative height deviations from the best fit reference sphere for a particular cornea in MICRONS. On a cornea with asymmetric peripheral sagittal depth, a relative deviation from a reference sphere (RED shaded areas) can be observed between the meridian having the greatest elevation above the reference sphere and the meridian having the lowest elevation below the reference sphere (BLUE shaded areas). By placing the cursor
at a point 4 mm from the center of the plot, the local elevation may be observed along the CRT lens chord length. If the total difference is greater than 13 microns on the two meridians at the 8 mm chord, a Paragon CRT Dual Axis® option may be indicated.

When to consider Paragon CRT® or Paragon CRT Dual Axis®:

<table>
<thead>
<tr>
<th>Difference In Flat &amp; Steep Meridians at 8 mm chord</th>
<th>Suggest Using This design</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30 Microns</td>
<td>Paragon CRT®</td>
</tr>
<tr>
<td>&gt;30 Microns</td>
<td>Paragon CRT Dual Axis®</td>
</tr>
</tbody>
</table>

Calculating for CRT Dual Axis® from Elevation Differences

1. Select the elevation plot feature on the corneal topographer. Look at the elevation plot and observe the presence of significant elevation difference (BLUE vs. RED) in the periphery of the plot.

2. Place the cursor on the shallow area (BLUE in color), 4 mm from the center of the plot and record the number of microns below the reference sphere.

3. Repeat the measure 180 degrees away in the shallow area opposite to the first measurement.

4. Place the cursor on the elevated area (RED in color), 4 mm from the center of the plot and approximately 90 degrees from the shallow area and record the number of microns above the reference sphere.

5. Repeat the measure 180 degrees away in the elevated area opposite the first elevated measurement.

6. Calculate the average difference from the elevated areas to the shallow areas.

7. If the average difference is:
   - less than 30 microns, a Paragon CRT Dual Axis® lens may not be indicated.
- between 25 to 30 microns, consider prescribing a one-step (25-micron) increase in RZD.
- between 31 to 60 microns, consider prescribing a two-step (50-micron) RZD difference.
- between 60 to 90 microns, consider prescribing a three-step (75-micron) RZD difference.
- > 90 microns, consider prescribing a four-step (100-micron) RZD difference.

The average elevation differences are calculated using this best fit sphere example:

A standard two 25-micron step (50-micron) difference in the RZD, 90 degrees apart is offered to compensate for differences in peripheral corneal elevation. The recommended method of fitting is to continue the use of the RZD suggested by the Initial Lens Selector (ex: 550) and observed to provide the recommended fluorescein pattern. (Image C) This RZD continues to be recommended for the flat meridian with the respective higher peripheral elevation. An RZD increase of 50 microns (two 25-micron steps) is recommended for the steep meridian with the lower or shallower peripheral elevation. (Image D) In this case, no change is recommended in the LZA. The LZA will remain constant circumferentially. Some eyes may
manifest more than 50 microns of meridional difference in elevation at the 8 mm chord diameter. In such cases, a three-step, 75-micron or four-step, 100-micron meridional difference in the RZD may be indicated.

When fitting Paragon CRT Dual Axis®, use this chart to determine the variation of RZD or LZA in conjunction with the average elevation differences.

<table>
<thead>
<tr>
<th>If the Average Meridional Elevation difference is</th>
<th>Use This RZD in the Elevated/Red Meridian</th>
<th>Use This RZD in the Shallow/BLUE Meridian</th>
<th>Use This LZA in the Elevated/Red Meridian</th>
<th>Use This LZA in the Shallow/BLUE Meridian</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 - 60 Microns</td>
<td>RZD suggested by CRT Lens Selector (550)</td>
<td>Increased the RZD used in Flat Meridian by 50 Microns (550 &amp; 600)</td>
<td>LZA suggested by CRT Lens Selector (-33)</td>
<td>Add one degree if cdgc lift is excessive (-33 &amp; -34)</td>
</tr>
<tr>
<td>60 - 90 Microns</td>
<td>RZD suggested by CRT Lens Selector (550)</td>
<td>Increased the RZD used in Flat Meridian by 50 Microns (550 &amp; 625)</td>
<td>LZA suggested by CRT Lens Selector (-33)</td>
<td>Add one degree if cdgc lift is excessive (-33 &amp; -34)</td>
</tr>
<tr>
<td>&gt; 90 Microns</td>
<td>RZD suggested by CRT Lens Selector (550)</td>
<td>Increased the RZD used in Flat Meridian by 50 Microns (550 &amp; 650)</td>
<td>LZA suggested by CRT Lens Selector (-33)</td>
<td>Add one degree if cdgc lift is excessive (-33 &amp; -34)</td>
</tr>
</tbody>
</table>

**When to Change the LZA?**

One may observe a cornea that does not manifest a meridional elevation difference at the 8mm chord diameter but does manifest significant differences in the edge clearance circumferentially. In such cases, the Landing Zone Angle should be varied in a second axis to provide a more uniform circumferential edge clearance. The recommended method of fitting is to continue to use the LZA that appears to be correct in the meridian having proper edge clearance and increase the LZA for the alternate meridian where there is excessive edge clearance. A difference of one degree in the second meridian will be clinically significant and a difference of two degrees may be needed when there is a marked difference in the edge clearance observed in the fluorescein pattern.
Using the 16-lens trial set of CRT Dual Axis® lenses, follow these procedures:

1. After evaluating the suggested spherical lens from the Paragon CRT® Initial Lens Selector (example: 8.60/550/-33), place the dual axis lens having the nearest BCR, but same RZD, and LZA. The RZD for the deeper meridian will be 50 microns greater (8.90/550 & 600/-33). A RZD with a 75 micron difference would be for a cornea with more corneal astigmatism than normal.

2. Observe the lens on eye for the criteria for an ideal fit:
   a. A minimum of 4 mm treatment zone that is round in appearance
   b. Lens centered within 0.5 mm of pupil center
   c. Circumferential bearing under the landing zone (complete/uniform “bulls eye” pattern)
   d. Edge clearance between 0.2 and 0.5 mm

3. If the edge clearance is significantly different 90 degrees apart, consider a dual axis LZA (33 & 34) difference where the angle is increased by one degree for every 0.2 mm required decrease in the edge clearance in the respective meridian (8.90/550 & 600/-33 & -34).

4. Over-refract for the appropriate BCR and order the final Paragon CRT Dual Axis® lens. It is of critical importance that the desired meridian is identified relative to the shallow and deep RZD meridians. In some cases you may need to deepen the LZA in the same meridian that is already made deeper by the RZD increase.

Prescribing Paragon CRT Dual Axis® Lenses in the Absence of Topographic Elevation Map Options

The Dual Axis feature can be successfully used in the absence of elevation data by careful identification of corneal astigmatism on the AXIAL topography map as well as careful observation of the fluorescein pattern of the initial Paragon CRT® lens parameter suggested from the flat K and spherical refraction. The following are the indicators for a dual axis design:

- Limbus-to-limbus corneal astigmatism greater than 1.00 D (pre treatment axial map)
- Oval versus the round treatment zone observation in a best-fit Paragon CRT® spherical diagnostic lens
- Significant difference in edge clearance 90 degrees apart with a best-fit spherical Paragon CRT® diagnostic lens
- Flexure as measured by keratometry or topography over a best-fit Paragon CRT® lens
• Failure to center or complete treatment with a spherical Paragon CRT® lens using suggested parameter changes
• Decentered treatment zone on follow up with an otherwise best-fit Paragon CRT® lens

Differences of 30 microns are sufficient to cause flexure, decenteration, and undertreatment due to weakened circumferential attraction between the landing zone of the lens and the peripheral cornea. Consider use of the two RZD difference (50-micron) design when these indicators are present.

The indication of the Paragon CRT Dual Axis® design is confirmed if the treatment zone becomes more circular, flexure is eliminated, lens centration is improved, circumferential landing is observed, and the targeted treatment is achieved.

For additional information on Paragon CRT Dual Axis®, please call your Authorized CRT Laboratory Consultant, or Paragon Consultation at: 800-528-8279 option 2.

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