

Linh Chieu OD, David Libassi OD, FAAO, Eva Duchnowski OD, FAAO

INTRODUCTION

Scleral lenses (SL) have an advantage over rigid gas permeable (RGP) lenses by enhancing comfort while maintaining vision for irregular corneas. However, patients may continue to feel discomfort despite a seemingly adequate fit through assessment in the slit lamp or anterior segment OCT images. The following cases all utilized the Oculus Pentacam® Corneal Scleral Profile (CSP) to map the topographic contour of the sclera and cornea. These cases demonstrate that there is value in utilizing CSP technology with conventional fitting techniques to troubleshoot apparently flawless fits and to accelerate the fitting process.

CASE 1

30 yo WM presented with moderate keratoconus OD and mild keratoconus OS. The patient has a history of crosslinking OD, strabismus surgery at age 1, and a longstanding right exotropia causing headaches and eyestrain. OS was successfully fit in a soft contact lens. The patient originally wore a soft contact lens OD and then transitioned into a RGP for improved vision. He was eventually fit into a SL in 2016 due to RGP intolerance. For 4 years, he struggled with the discomfort of SL due to: lens edge awareness, the sensation of tightness, and pressure in the eye after lens removal. These problems led to only 4 hours of wear every other day. Despite this, he remains highly motivated to continue because he is less symptomatic of eyestrain and headaches in SL. The original SL appeared to be fitting his eye with well-aligned edges; however, leakage and discomfort had always been a problem despite multiple alterations to the toric edges. A CSP was conducted and an extremely irregular scleral profile with an oblique meridian was observed. We ordered a quadrant specific OneFit MED lens with Hydra-PEG®. This lens was chosen due to its thin profile with the goal of decreasing lens awareness. Mild changes to the initial lens led to increased wear time to 12-16 hours every day. The patient is very satisfied with the vision and comfort of his new lens.

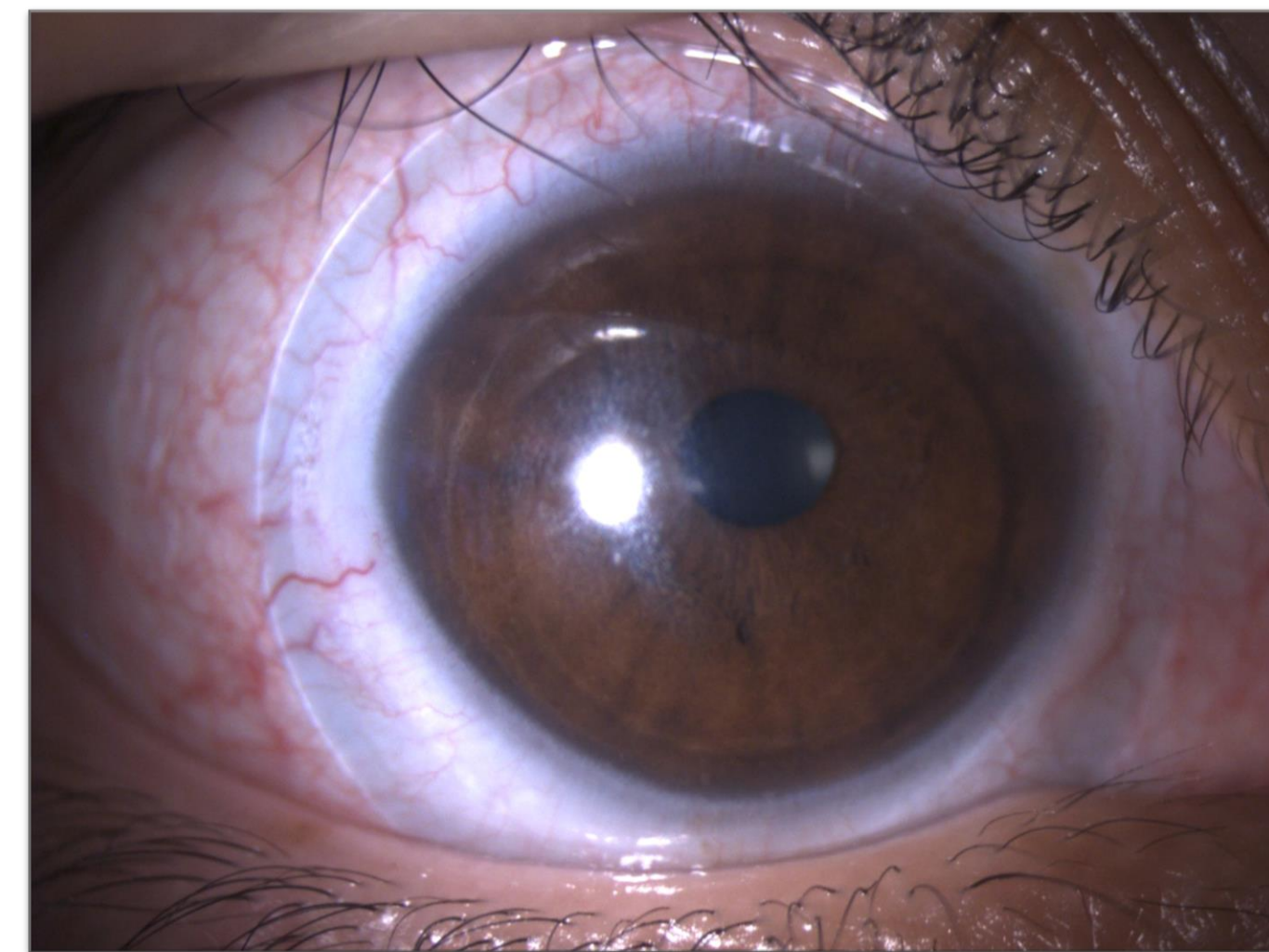


Figure 1A: final right lens

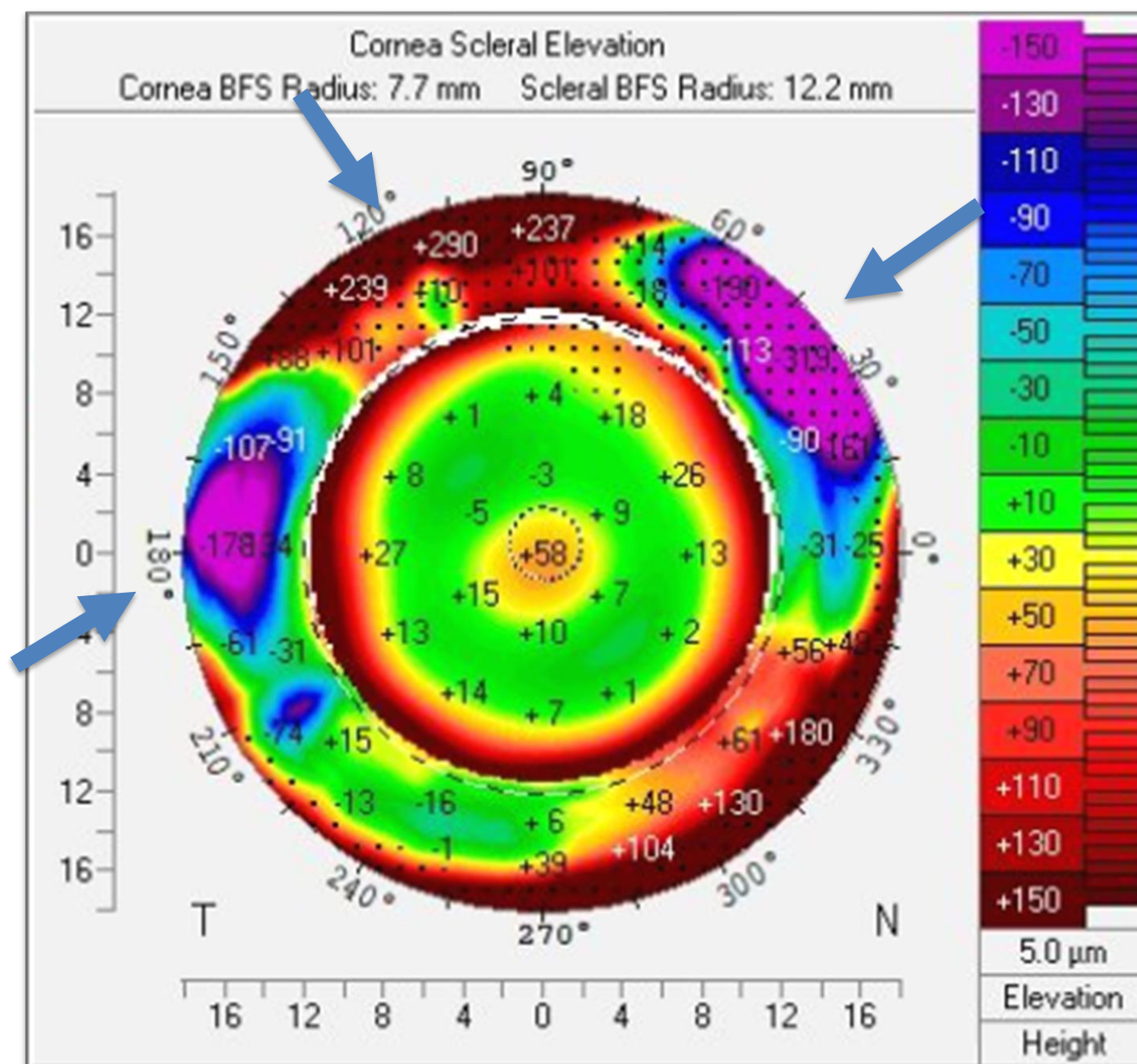


Figure 1B: CSP of the right eye showing irregular scleral toricity

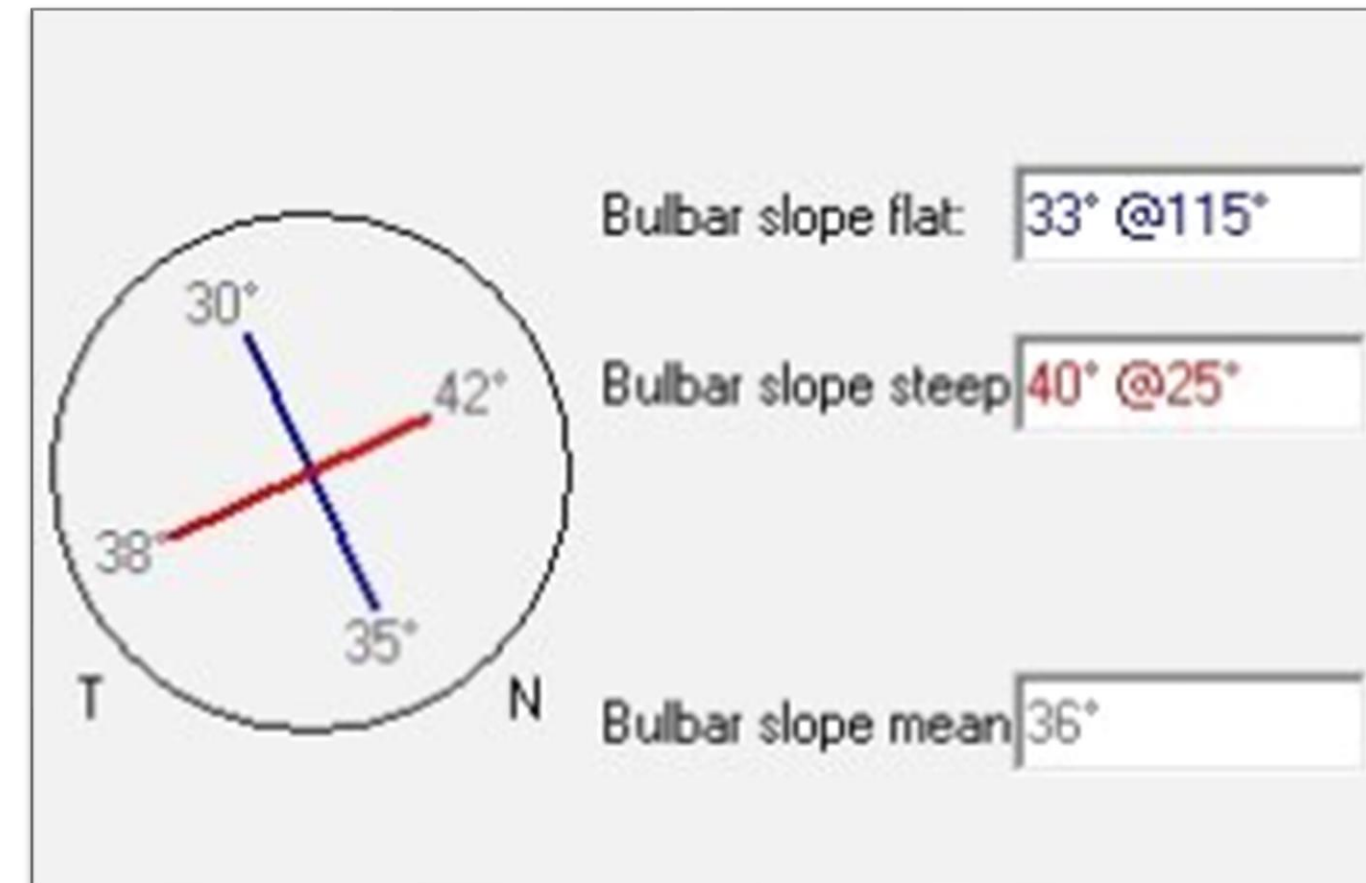


Figure 1C: scleral bulbar slopes at 15.0 mm chord

| | Lens | Power | BC | Sag | Dia | Edges | VA |
|-----------------|-----------------|----------------|-----|------|-------|---|---------|
| Presenting lens | Zenlens Prolate | +2.50-1.00x120 | 8.4 | 4800 | 17.00 | STD | 20/25 |
| Final lens | Onefit MED | +4.00-1.50x130 | 8.5 | 4150 | 15.60 | 0°: -75 90°: STD 180°: -25 270°: -50 | 20/25+1 |

CASE 2

31 yo AF has a history of LASIK OU and flap dislocation after trauma with failed re-approximation OD only. OS had a successful outcome. She was symptomatic of dryness OU and dizziness from the asymmetric vision between both eyes. She was fit in a quadrant-specific Zenlens™ Oblate lens. There were multiple unsuccessful attempts to troubleshoot the discomfort with her presenting SL, which caused decreased lens wear to 1-2 hours per day. We performed a CSP map OD and found an irregular scleral profile that indicated a very different quadrant-specific design from her presenting SL. Note how rotation of the lens matched perfectly with the meridian of elevation in the map. OS was fit in a daily disposable soft contact lens to equalize the vision. Immediately, she noticed an improvement in comfort. However, OD was still symptomatic of mid-day fogging and dry-ness despite no noted leakage of the edges. The patient was advised to fill her SL with a concoction of saline and Refresh Celluvisc®, start Ketotifen 1 gtt BID OU, and Xiidra® 1 gtt BID OU. The patient reported major improvements in mid-day fogging and comfort.

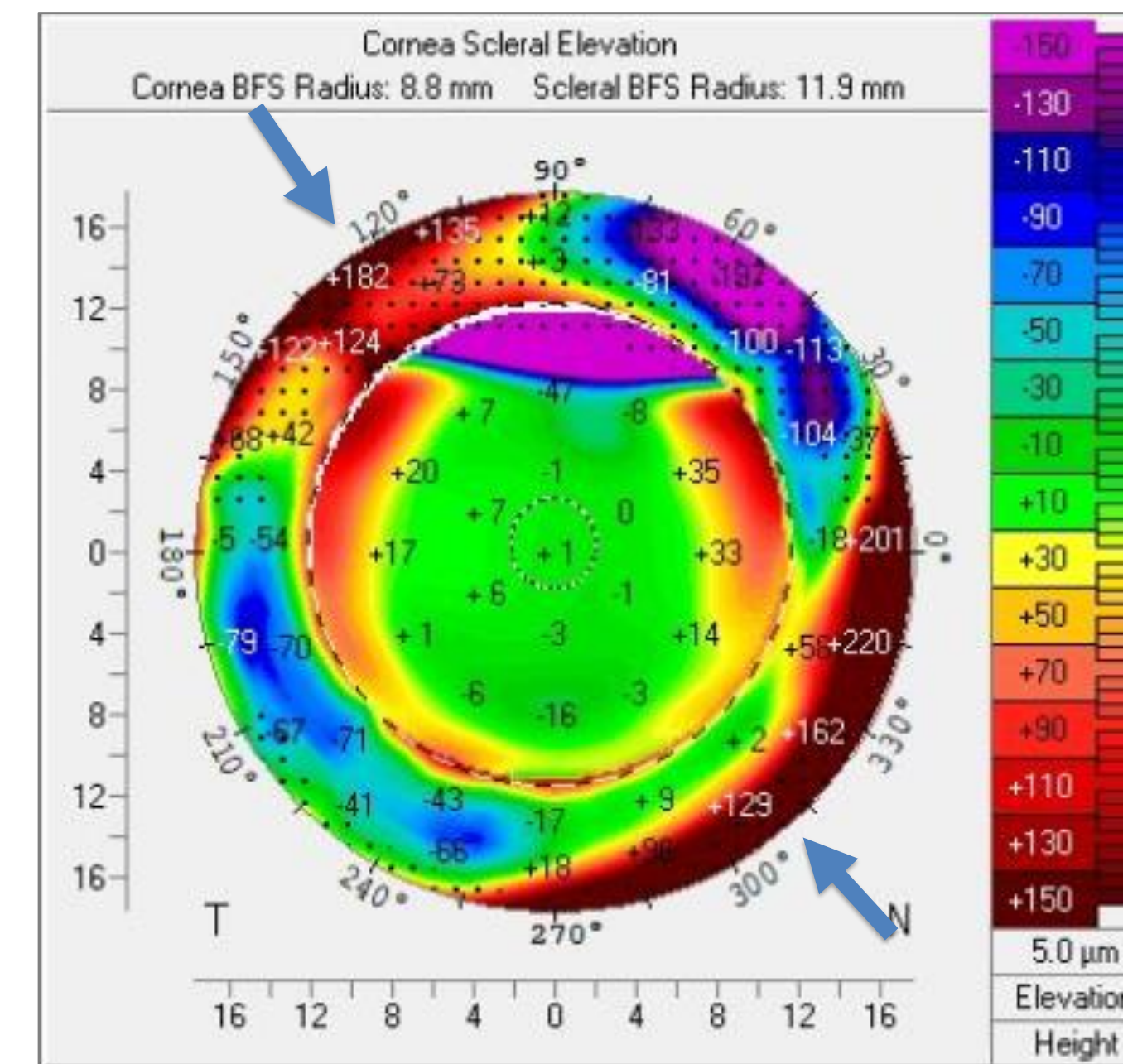


Figure 2A: CSP of the right eye showing irregular scleral toricity with patches of steepening

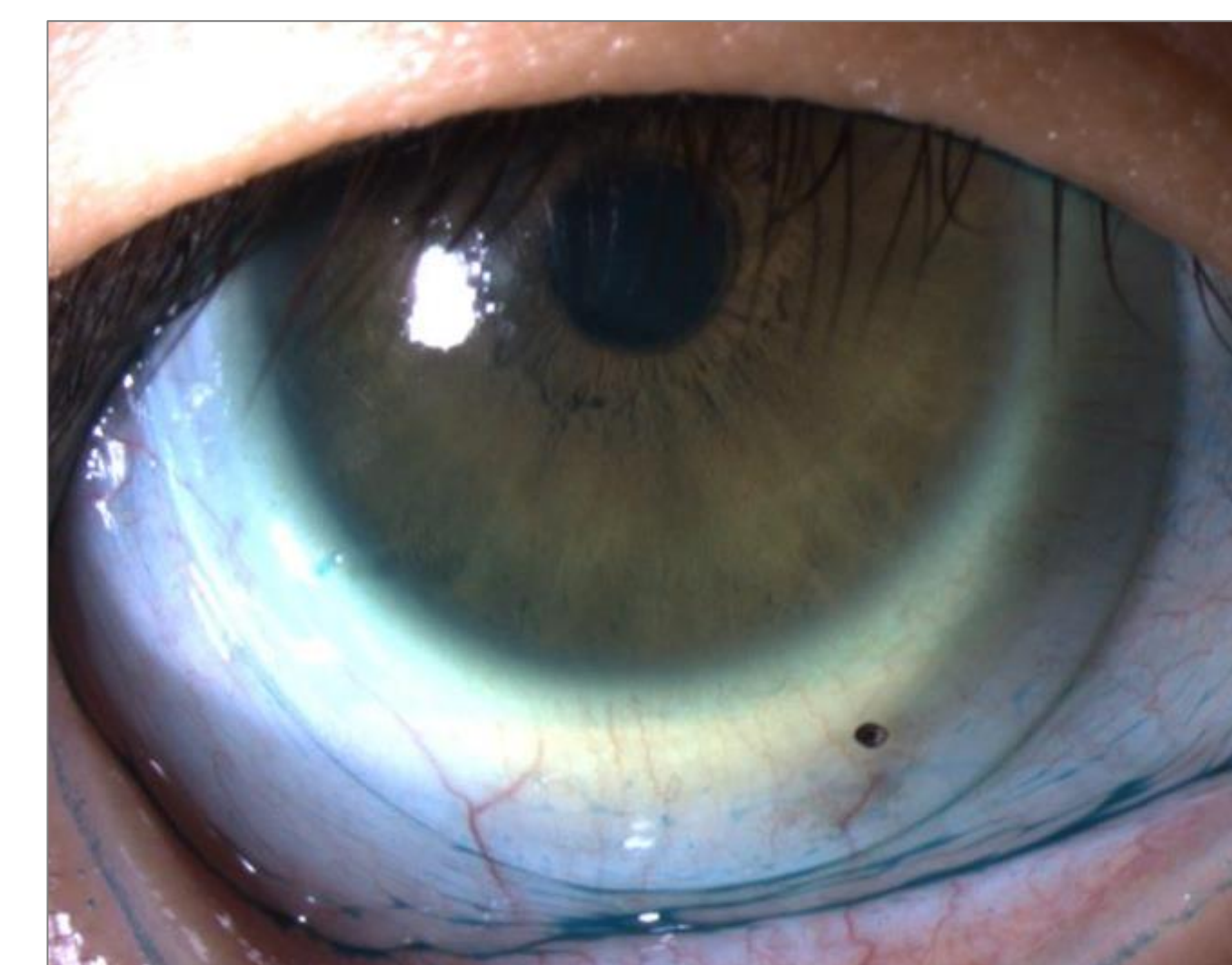


Figure 2C: final right lens inferior edge

| | Lens | Power | BC | Sag | Dia | Edges | VA |
|-----------------|----------------|------------------|------|------|-------|---|---------------------|
| Presenting lens | Zenlens Oblate | +1.50 sph | 10.0 | 4050 | 16.00 | 0°: STP3 90°: STP1 180°: STP3 270°: STD | 20/20 ⁻¹ |
| Final lens | Zenlens Oblate | +1.50 - 0.75x035 | 10.0 | 3800 | 16.00 | 0°: STP7 90°: FLT1 180°: STP8 270°: FLT4 | 20/20 |

CASE 3

60 yo WF with history of radial keratotomy and astigmatic keratotomy OU presented only using the right SL when critical vision was needed due to discomfort. She rarely wore the left SL due to suboptimal vision. The patient is very visually critical and is very sensitive to any foreign body sensation. She complained of a superotemporal patch of discomfort despite slit lamp examination showing a well-aligned edge in that area. Multiple attempts to adjust the edge was not successful. A CSP map showed an advanced steepening in the superotemporal quadrant OD in comparison to the overall contour of her sclera. This justified the patient's long-term complaint of discomfort in that area. A Zenlens with quadrant-specific edges was ordered. Improvement in comfort was so drastic that she requested to be re-fitted OS as well. Again, CSP indicated an area of elevation superior-nasal consistent with the patient's longstanding complaint. She is now able to tolerate over 9 hours of wear due to improved vision and comfort OU.

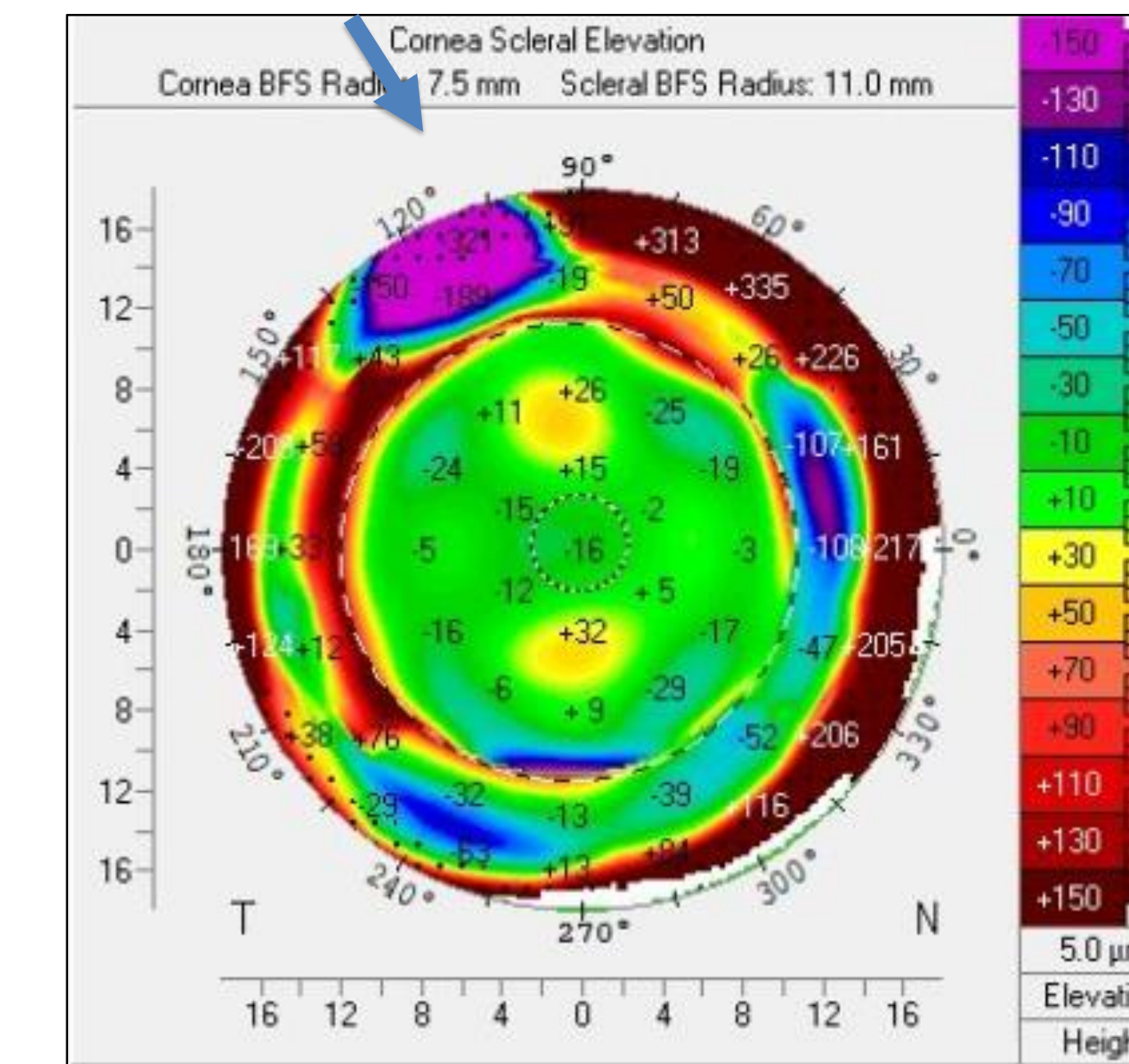


Figure 3A: CSP of the right eye showing irregular scleral toricity with a patch of steepening superior-temporal

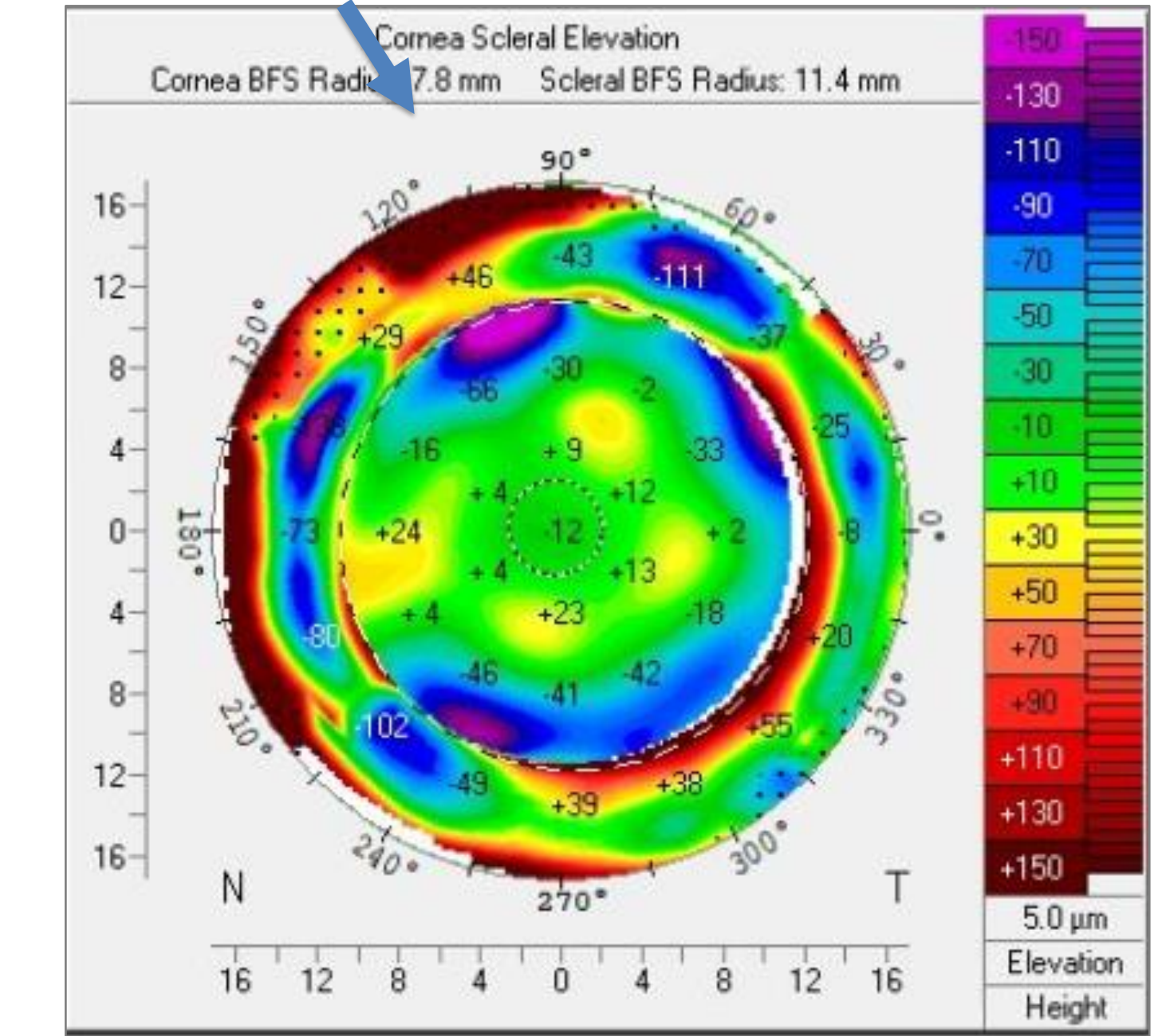


Figure 3B: CSP of the left eye showing irregular scleral toricity with patches of elevation superior-nasal

| | Lens | Power | BC | Sag | Dia | Edges | VA |
|---------------|----------------|----------------|------|------|-------|---|-------|
| First OD lens | Zenlens Oblate | +4.50 sph | 9.50 | 4525 | 16.00 | H: STP1/ V: STP 3 | 20/50 |
| Final OD lens | Zenlens Oblate | +5.75-0.50x040 | 9.50 | 4525 | 16.00 | 0°: FLT7 90°: STP7 180°: FLT2 270°: STP1 | 20/20 |

DISCUSSION

"Corneo-Scleral-Profile" (CSP) is a term first introduced by Meier and Gaggioni¹. The profile outlines the contour of the cornea, sulcus, and sclera. CSP is gaining importance in routine SL fitting practice to help with initial SL selection. Research has shown that there are differences between anterior and limbal scleral shape not only between eyes, but also within the eye and between meridians⁴. And often there is no correlation between the mean corneal eccentricity and mean scleral radius nor between the central corneal radii and scleral radii¹. The nasal scleral is more elevated compared to the temporal sector, as shown by Bandlitz et al. Similarly, the superior nasal quadrant is found to be the flattest of all eight quadrants with the temporal quadrant being the steepest¹. Ill-fitting edges on an asymmetric sclera may be a potential factor to consider when presented with the following issues: inferior temporal decentration, compression of the sclera, discomfort from lens wear, mid-day fogging, frequent conjunctival inflammatory and hypertrophic events, and poor visual results from multifocal and higher order aberration lenses^{2,3}. To avoid such problems, toric or quadrant-specific edges should be utilized. This is even more relevant for larger diameter lenses as scleral toricity is even more dramatic beyond the 15 mm chord length⁴.

CONCLUSIONS

There are multiple instances when slit lamp assessment of lenses and patients' discomfort do not correlate well with one each other. The majority of these cases were expected to be simple fits due to mild corneal presentations. However, without further imaging, irregular scleral profiles would have been difficult to assess and even more challenging to properly fit with scleral lenses. Frustration and chair time can be decreased by starting off with a CSP map to help navigate initial lens selection and to help troubleshoot. Sometimes, the patient may not be overly critical. Instead, it may be due to a poor lens design down to the micrometer!

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