A Review of Scleral Shape from Scheimpflug Profilometry

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Introduction

- Use of profilometry offers accurate corneo-scleral topographic data, which has been used to estimate scleral lens (SL) parameters to provide a better initial fitting relationship in irregular eyes[1]
- Aggregated profilometric data of regular eyes into a normative cornea/scleral profile (CSP) database may better model true scleral shape.
- This data may also be exported into lens design software to generate better scleral fitting lenses based on the 3D model of the corneo-scleral shape.
- Goal - To report characteristics of scleral shape captured by scheimpflug tomography based profilometry .

Methods

- A retrospective review of 32 eyes of 22 patients without a history of contact lens wear were scanned with a scheimpflug tomography (Pentacam WAVE AXL, Oculus) based device with profilometry software (CSP Pro, Pentacam WAVE AXL, Oculus).
- Of the 32 eyes, 14 were right eyes and 18 were left eyes**.**
- Ring diameter (Chord) was set for 16.0mm for all eyes.
- The steepest and flattest axis of the sclera were derived. Slopes and sagittal depths were measured and recorded at opposite points across the axis to represent quadrant-specific data.
- A statistical analysis of this scleral shape data was then performed (Excel, Microsoft).

References

1. Barnett M, Courey C, Fadel D, Lee K, Michaud L, Montani G, van der Worp E, Vincent SJ, Walker M, Bilkhu P, Morgan PB. CLEAR - Scleral lenses. Cont Lens Anterior Eye. 2021 Apr;44(2):270-288. doi: 10.1016/j.clae.2021.02.001. Epub 2021 Mar 25. PMID: 33775380.

Disclosures

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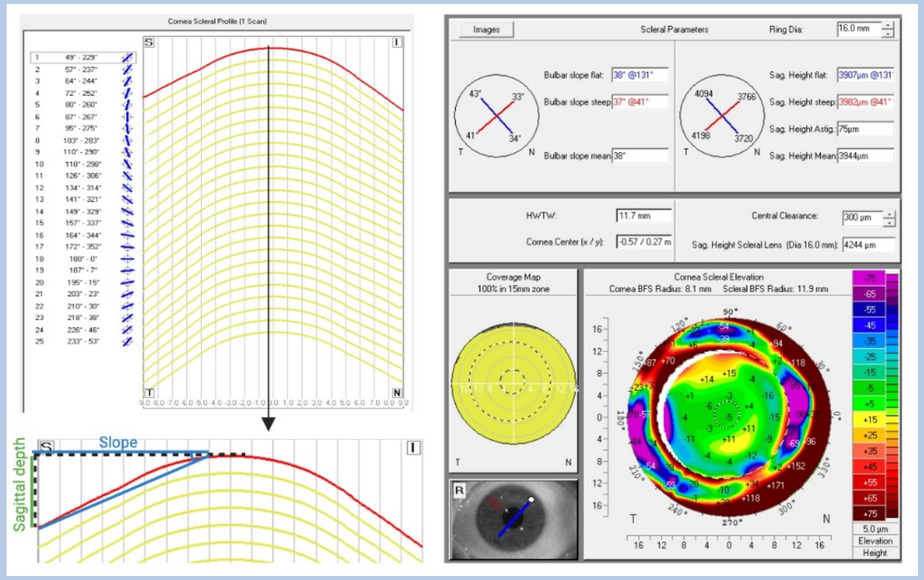

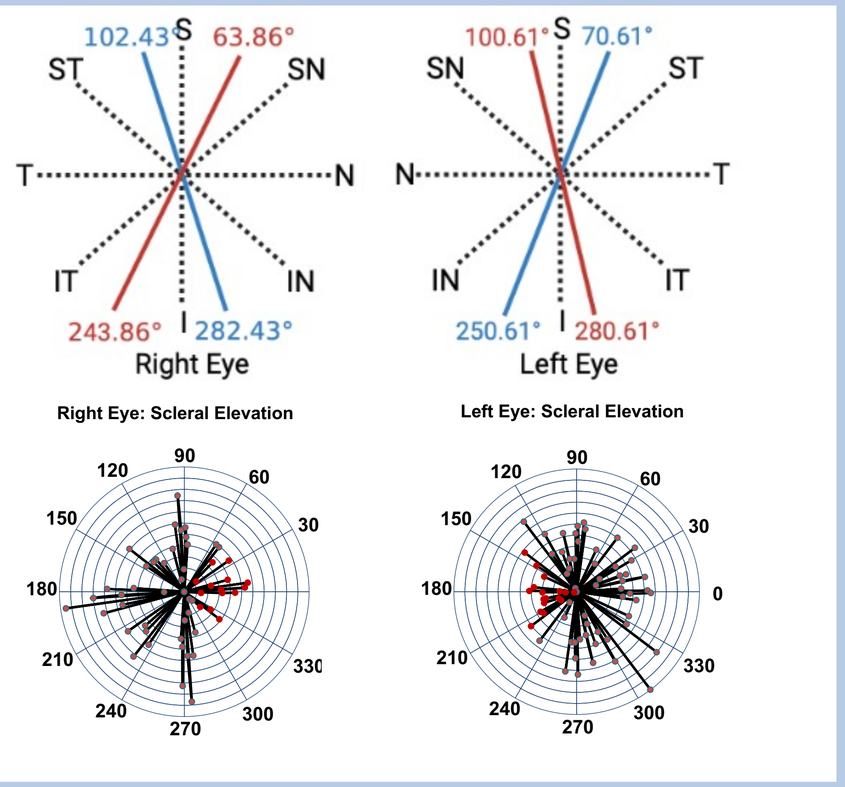

Results

Right Eye:

- Average flat axis was 102.43 (282.43°) ± 60.34°
- Average steep axis was 63.86 (243.86°) ± 45.24°
- Average horizontal white to white was 12.31 ± 0.36mm**.**
- At **flat axis 1** (102.43°): average slope was 38.71 ± 3.60° and average sagittal depth was 4127.36 ± 253.13µm.
- At **flat axis 2** (282.43°): average slope was 37.93 ± 4.12° and average sagittal depth was 4034.00 ± 286.42µm.
- At **steep axis 1** (63.86°): average slope was 38.21 ± 3.58° and average sagittal depth was 4199.71 ± 253.05µm.
- At **steep axis 2** (243.86°): average slope was 42.64 ± 3.13° and average sagittal depth was 4421.50 ± 302.90µm.

Left Eye:

- Average flat axis was 70.61 (250.61°) ± 64.79°,
- Average steep axis was 100.61 (280.61°) ± 37.92°.
- Average horizontal white to white was 12.25 ± 0.48mm**.**
- At **flat axis 1** (70.61°): average slope was 39.06 ± 4.11° and average sagittal depth was 4077.61 ± 313.80µm.
- At **flat axis 2** (250.61°): average slope was 36.56 ± 5.12° and average sagittal depth was 4029.56 ± 285.07µm.
- At **steep axis 1** (100.61°): average slope was 39.11 ± 4.06° and average sagittal depth was 4242.56 ± 258.59µm.
- At **steep axis 2** (280.61°): average slope was 42.50 ± 4.06° and average sagittal depth was 4385.06 ± 369.13µm.

Conclusions

- The non-orthogonal axis coupled with the slope and sagittal depth differences across the steep axis show large variations in scleral geometries.
- This may support the need for more customized scleral haptic designs such as freeform geometries, with limitations in quadrant-specific or toric haptic designs.
- Further studies with larger datasets are warranted.