Scleral Shape and Asymmetry as Measured by OCT in 78 Normal Eyes

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Introduction

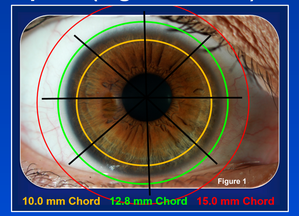
Historically, scleral topography has been a difficult anatomical feature to measure due to its lack of reflective properties. Recently a number of new instruments have emerged with ability to quantify scleral shape. These instruments accomplish their measurements through Scheimpflug imaging, projected moiré profilometry or optical coherence tomography (OCT).

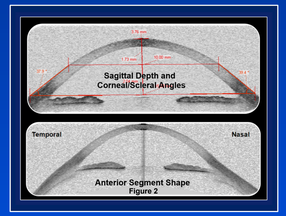
Visante Anterior Segment OCT

Optical Coherence Tomography (OCT) provides clinicians with a 360 degree, non-invasive technique for measuring the sagittal height of the eye out to a chord 15.0 mm.

Study Purpose

The purpose of this study was to use OCT to measure and describe the shape of the anterior sclera in each of the 8 primary meridians: superior, supero-nasal, nasal, infero-nasal, inferior, infero-temporal, temporal and supero-temporal (Figure 1 and 2).





Materials and Methods

Thirty nine normal eye subjects (78 eyes) participated in this study. Sagittal height was measured in all eight meridians of the cornea, limbus and sclera at chords of 10.0, 12.8 and 15.0 mm. The inclusion criteria consisted of normal eyes free of any corneal or conjunctival pathology.

Results

Lower numbers indicate the quadrant of greatest elevation Higher numbers indicate the quadrant of least elevation

Sagittal Height at 10.0 mm

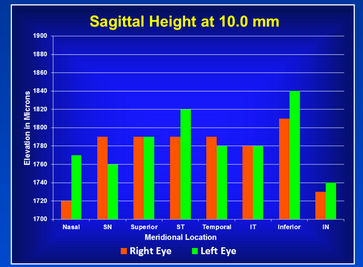
	RE Sag	SD+/-	LE Sag	SD+/-
Nasal	1,720 um	0.08	1,770 um	0.08
Temporal	1,790 um	0.09	1,780 um	0.10
Supero-Nasal	1,790 um	0.09	1,760 um	0.07
Infero-Temporal	1,780 um	0.10	1,780 um	0.09
Superior	1,790 um	0.08	1,790 um	0.09
Inferior	1,810 um	0.09	1,840 um	0.08
Supero-Temporal	1,790 um	0.08	1,820 um	0.09
Infero-Nasal	1,730 um	0.08	1,740 um	0.09

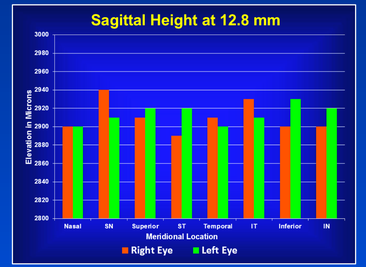
Sagittal Height 12.8 mm

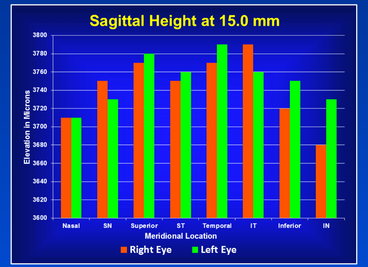
	RE Sag	SD+/-	LE Sag	SD+/-
Nasal	2,900 um	0.15	2,900 um	0.17
Temporal	2,910 um	0.15	2,900 um	0.17
Supero-Nasal	2,940 um	0.18	2,910 um	0.16
Infero-Temporal	2,930 um	0.18	2,910 um	0.16
Superior	2,910 um	0.15	2,920 um	0.15
Inferior	2,900 um	0.15	2,930 um	0.15
Supero-Temporal	2,890 um	0.14	2,920 um	0.14
Infero-Nasal	2,900 um	0.14	2,920 um	0.14

Sagittal Height at 15.0 mm

	RE Sag	SD+/-	LE Sag	SD+/-
Nasal	3,710 um	0.21	3,710 um	0.22
Temporal	3,770 um	0.22	3,790 um	0.24
Supero-Nasal	3,750 um	0.24	3,730 um	0.22
Infero-Temporal	3,790 um	0.25	3,760 um	0.23
Superior	3,770 um	0.20	3,780 um	0.20
Inferior	3,720 um	0.20	3,750 um	0.20
Supero-Temporal	3,750 um	0.19	3,760 um	0.18
Infero-Nasal	3,680 um	0.20	3,730 um	0.18







At the 10.0 mm chord (cornea):
The average sagittal height difference between the two principle meridians was 45 um on the right eyes and 40 um on the left eyes. This is equivalent to approximately 1.00 D. of corneal astigmatism.

At the 12.8 mm chord (limbus):
There was no meaningful sagittal height differential between principle meridians. At the 12.8 mm chord the ocular surface can be best described as spherical (rotationally symmetric).

At the 15.0 mm chord (sclera):
The sclera shows a small amount of asymmetry in the 8 meridians with the nasal meridians being the highest and the temporal being the lowest. Scleral toricity (height differential) was approximately 105 um between two perpendicular meridians. There was a higher degree of toricity in the right eyes (130 um) vs left eyes (80 um).

Conclusion

These data appear to indicate that scleral asymmetry starts at the more symmetrical limbus and increases in asymmetry towards the extraocular muscles. Therefore, small scleral lens designs of 14.5 mm or less can be rotationally symmetric. Scleral lens designs larger than 14.5 mm may benefit from a toric haptic and/or a quadrant specific design with less elevation nasally and greater elevation temporally.

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