Correlating Corneal Astigmatism and Meridional 8 mm Sagittal Height Difference for Use in Orthokeratology Lens Fitting

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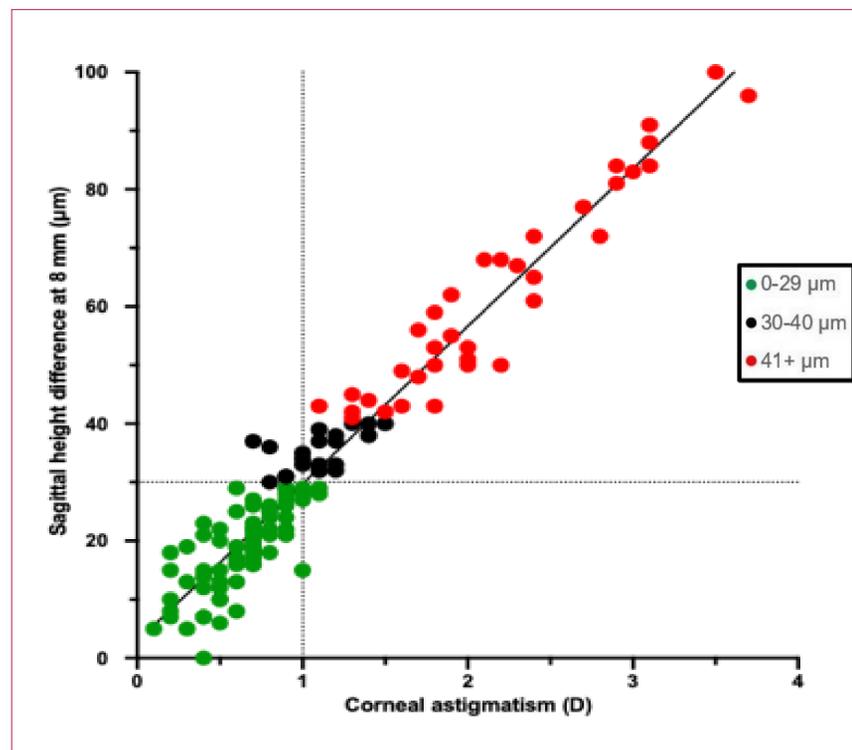SCHOOL OF **OPTOMETRY**

PURPOSE

The purpose of this retrospective clinical study was to determine the tightness of the correlation between corneal astigmatism and corneal sagittal height difference at 8 mm between major meridians. Depending on the strength of this correlation, practitioners may be able to use this information to more efficiently fit orthokeratology lenses on their patients and prescribe toric lenses when needed with just keratometry readings. Most laboratories recommend using an orthokeratology lens design with toric peripheral curves if the difference in corneal elevation is greater than 30 microns in order to improve lens centering and stability[1]. For practitioners without access to equipment that accurately determines the sagittal height difference, the ability to correctly prescribe lenses with toric peripheral curves when needed could be enhanced with this data.

METHODS

Ocular shape data was retrospectively evaluated from the OCULUS Keratograph of 126 regular corneas from 93 subjects between the ages of 6 and 18. Corneal topography scans were analyzed and selected based off the following criteria: a minimum of 70% corneal coverage, no indication of disease, and reliable scans free from blinks, improper fixation, and device malfunction. The OCULUS Keratograph measured corneal astigmatism within the central 3 mm and determined corneal sagittal height differences between the two primary meridians at an 8 mm chord diameter.

Corneal astigmatism vs. Sagittal height differences at 8mm

The graph to the left shows the general trends of the patients analyzed. The solid black line on the chart shows the tight correlation between corneal toricity and sagittal elevation difference. The dotted gray line displays the discovered relationship between variables; 1D of corneal astigmatism correlates to 30 microns elevation difference at 8mm. Note how 66 of 68 corneas under 30µm correspond with less than 1D of corneal astigmatism, and how 54 of 58 corneas greater than 30µm correlate with greater than 1D of corneal astigmatism.

MAIN CONCLUSION

Prescribing a toric orthokeratology lens is clinically indicated if corneal astigmatism is greater than 1D.
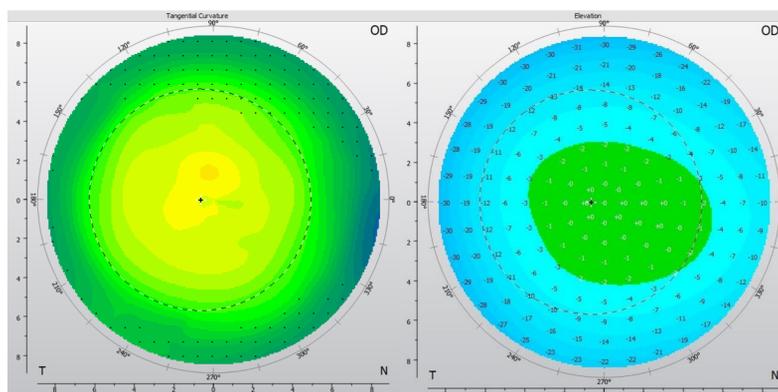
RESULTS

Corneal astigmatism is strongly correlated to corneal sagittal depth at 8 mm and was found to be highly significant (R^2 = 0.9418, P value < 0.0001). A simple linear regression line was tightly fit to the data yielding the equation [y = 26.9*x + 2.9] with y being the corneal sagittal height difference at 8 mm in microns and x being corneal astigmatism in diopters. A quick estimation method for this is 1 diopter of corneal astigmatism equates to 30 microns of elevation difference at 8 mm.
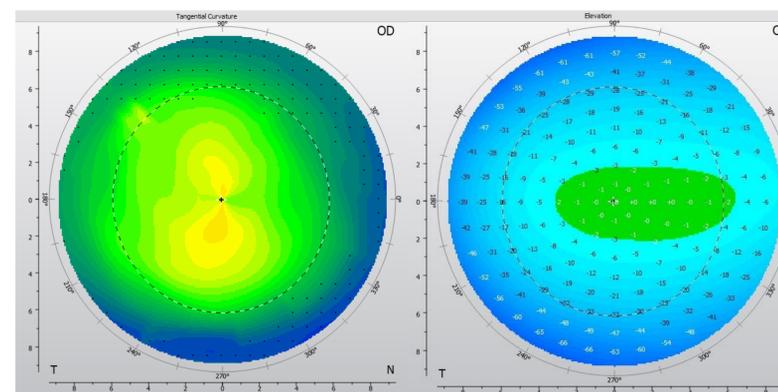
CONCLUSIONS

Corneal astigmatism is highly predictive of corneal sagittal height at 8 mm. The correlation is tight and using this information a formula for conversion can be devised. The equation listed above or a simplified version of it can be used to estimate the sagittal height difference between corneal meridians solely utilizing corneal astigmatism. Practitioners lacking the necessary equipment to assess sagittal depth in both meridians, or laboratories designing lenses with simply K's and Rx can therefore predict, with relative certainty, if a toric orthokeratology lens design should be fit, thereby minimizing clinical visits and lens changes.
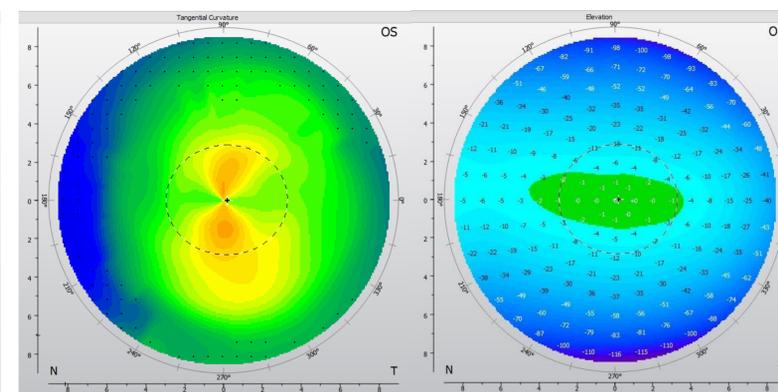
REFERENCES

1. Frogozo, M. (n.d.). Troubleshooting Orthokeratology for Myopia Management. Contact Lens Spectrum, 35 (March 2020), 31, 32, 34-37.

Patient 1: On the left, tangential curvature showing 0.2 D WTR toricity. On the right, corneal elevation map. Pt refractive error: -2.00DS. Sag Height Diff: 7µm.

Patient 2: On the left, tangential curvature showing 1.4D WTR toricity. On the right, corneal elevation map. Pt refractive error: -3.00-0.75x175. Sag Height Diff: 38µm.

Patient 3: On the left, tangential curvature showing 2.9D WTR toricity. On the right, corneal elevation map. Pt refractive error: -5.00-2.25x180. Sag Height Diff: 81µm.