

The Impact of Keratoconus Apex's Slope on Visual Acuity and Contrast Sensitivity

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Abstract

Background: The image optical quality is affected by changes in corneal shape of patients with keratoconus. The goal of this study was to explore which corneal parameters determine the visual quality in keratoconus subjects, which corneal slope parameter has the strongest correlation with visual quality and contrast sensitivity.

Methods: The study covered eyes of 77 subjects, graded from the first to third keratoconus stages. To characterize the shape of cornea, we obtained measurements in two ways: (a) projected two perpendicular axes onto a cornea – the main axis passed through the central point of the cornea (visual axis projection) and keratoconus apex, while the second axis was perpendicular to the main axis – and read elevation values at points on these axis; (b) projected circles with different diameters around the central part of the cornea (1, 2 and 3 mm) and read elevation values at points equally displaced on these circles. The measurements were used to calculate various elevation change (slope) parameters.

Results: According to the acquired data, the visual acuity of a corrected eye does not have a strong correlation with the measured keratoconus apex slope. Contrast sensitivity displayed a strong correlation with keratoconus slope in the central part of the cornea (with a radius of 1 mm).

Correlations in different spatial frequencies ranging from 0.47 to 0.6.

Conclusion: Contrast sensitivity is more important parameter which describes the visual quality of keratoconus subjects than visual acuity. The most important region which determines the visual quality in keratoconus subjects is the region with a 1 mm radius of the corneal centre in the opposite direction of keratoconus apex.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed.

However, the manuscript can be downloaded and accessed as a PDF.

Tables

Due to technical limitations, Tables 1-3 are provided in the Supplementary Files section.

Figures

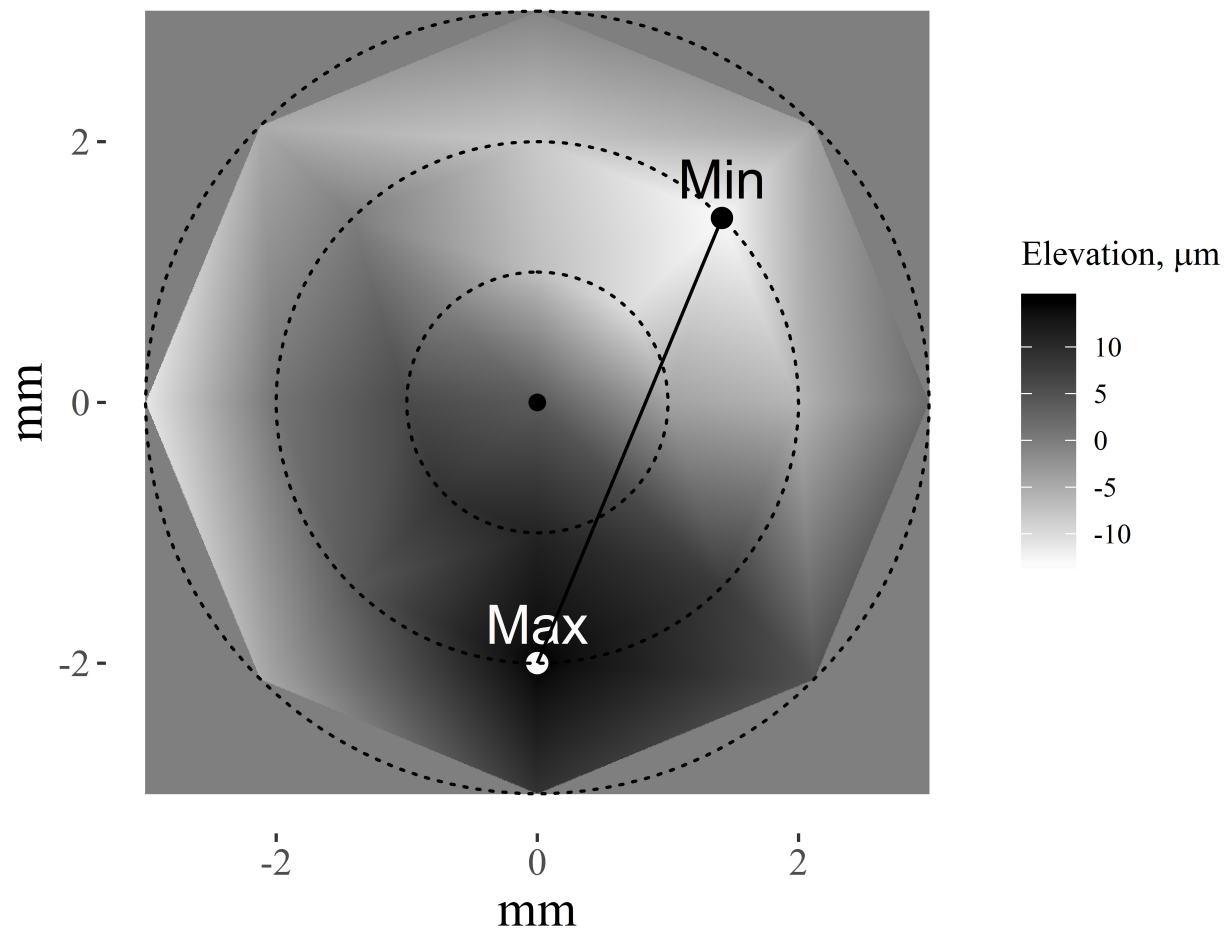


Figure 1

A schematic illustration of the corneal anterior surface demonstrates a real corneal surface elevation from an ideally spherical corneal surface, i.e. each point in the graph represents an elevation (measured in micrometres) from the imaginary ideally spherical corneal surface. The particular image also shows the maximum (Max) and the minimum (Min) elevation points. Dotted circular lines represent the analysed circles of 1, 2 and 3 mm radius. Darker color represents higher points while lighter colour – lower points.

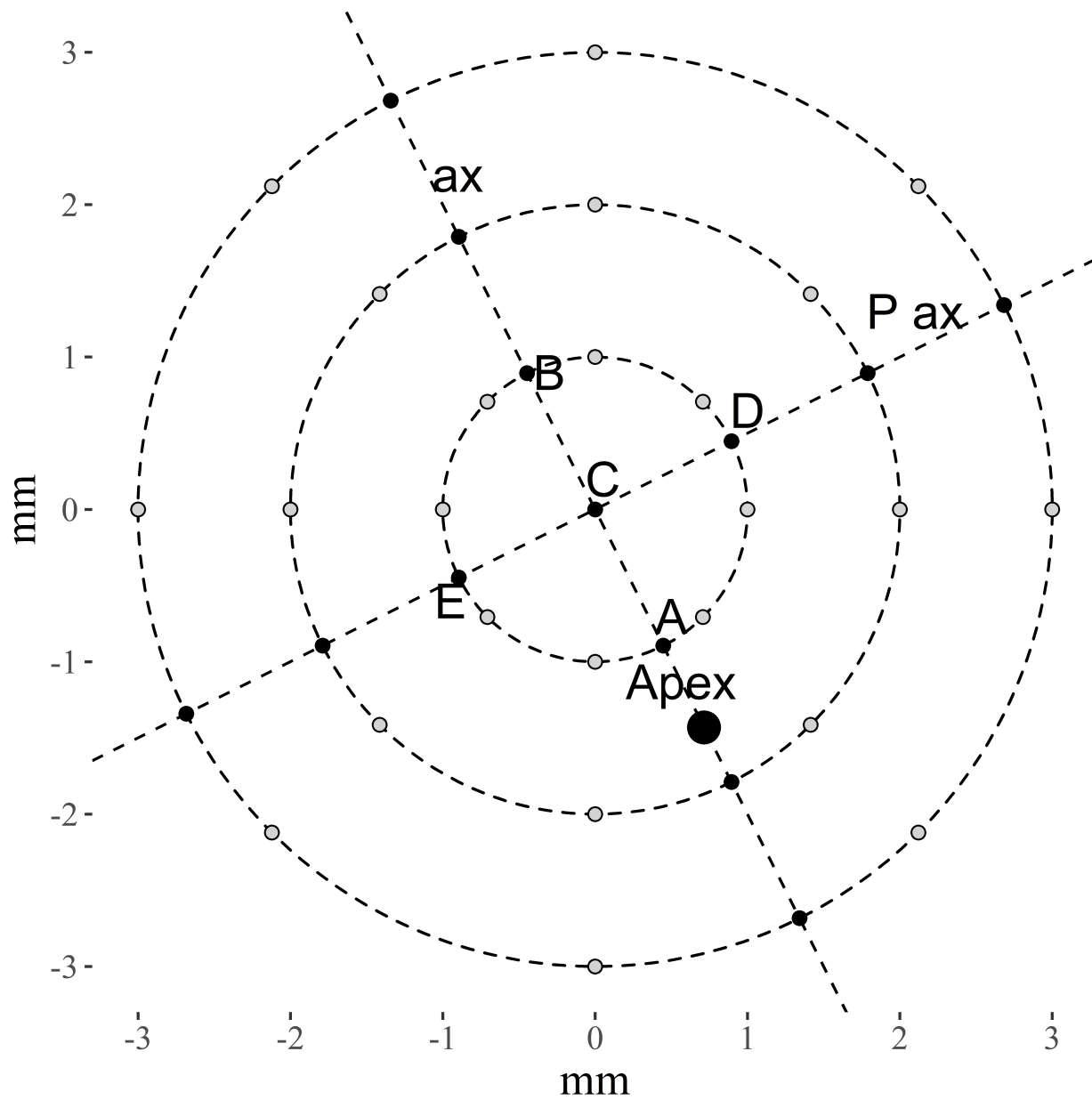


Figure 2

A schematic example of the locations of measurement points.

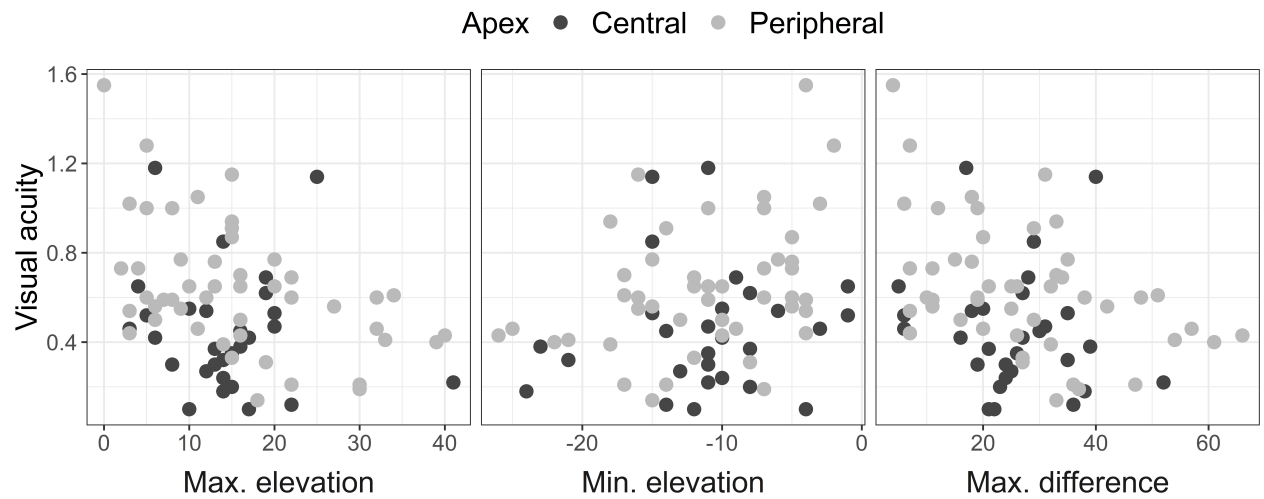


Figure 3

Data regarding correlation of the visual acuity with the maximum and minimum corneal points of the corneal anterior surface and the difference between both points in keratoconus subjects.

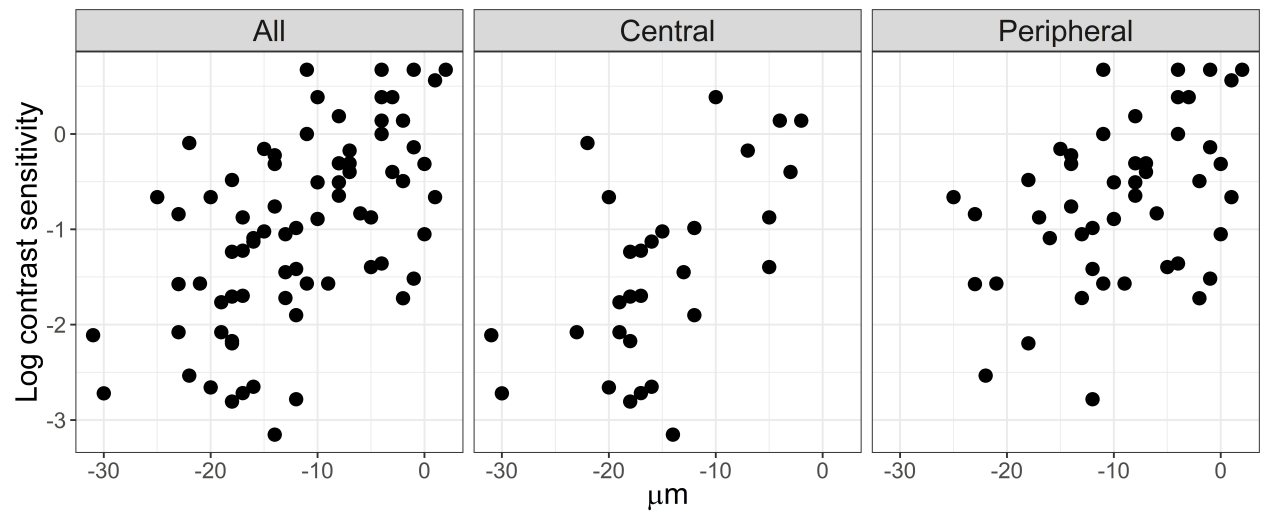


Figure 4

Data of individual keratoconus subjects at 7 cpd regarding correlation of the log-contrast sensitivity with the corneal elevation in the direction (CB) within 1 mm radius from the corneal centre.

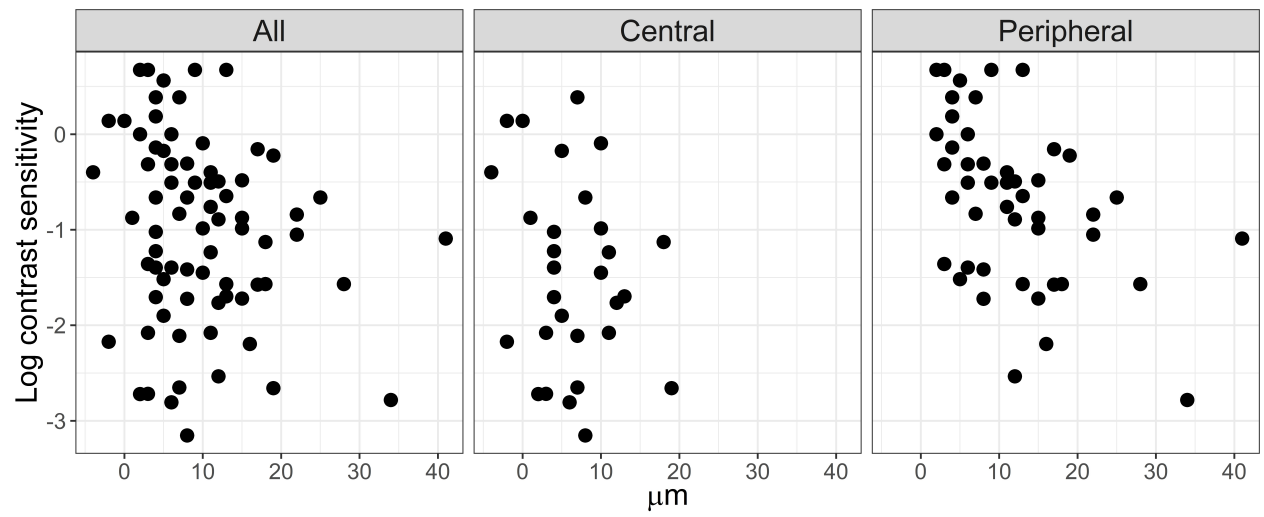


Figure 5

Data of individual keratoconus subjects at 7 cpd regarding correlation of the log-contrast sensitivity with the corneal elevation in the direction (CA) within 1 mm radius from the corneal centre.

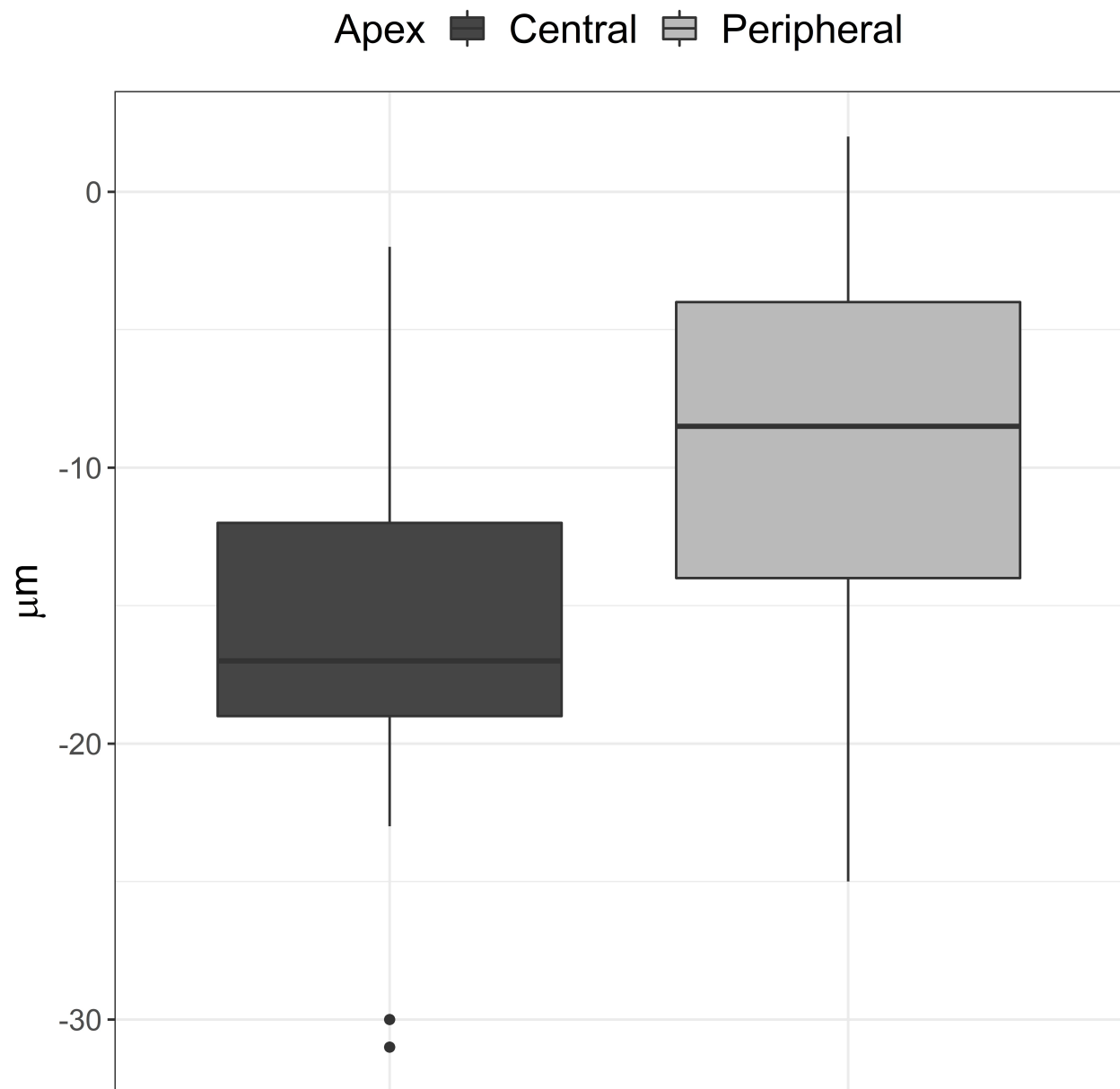


Figure 6

Changes in the corneal elevation in opposite direction of the apex (1 mm radius) depending on the location of the apex. The image shows that the elevation decreases more in the subjects with central keratoconus apex than in the subjects with peripheral keratoconus apex.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

[Table 3.pdf](#)

[Table 1.pdf](#)

