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Difference in corneal asphericity and sagittal height between emmetropes and myopes

Byki Huntjens; Kristina Mihic; Chris C Hull

+ Author Affiliations & Notes

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Abstract

Purpose : Corneal shape and sagittal height play an important role in the successful fitting of large diameter gas permeable contact lenses. The purpose of this study is to evaluate anterior corneal surface asphericity and sagittal height difference related to refractive error.

Methods : Topography data from the right eye of 90 participants (mean age 21.1 ± 3.2 years) were grouped according to their refractive error (mean spherical equivalent MSE −1.31 ± 1.77 D, corneal astigmatism ≤ -2.00 D). Three groups included 43 emmetropes (range MSE -0.50 to +0.50 D); 26 low myopes (-0.75 D to -3.00D) and 20 moderate myopes (-3.25D to -6.00D). The Medmont E300 topographer was used to collect 4 repeated measures of radius of curvature and asphericity (Q-values in flatter and steeper meridians) over a 9.35 mm chord. Difference in sagittal height (*ΔSag*) between both meridians was calculated over the same chord.

Results : The average radius of curvature of the anterior corneal surface was 7.76 ± 0.20mm for emmetropes, 7.78 ± 0.27mm for low myopes and 7.71 ± 0.35mm for moderate myopes (P=0.66). Corneal astigmatism amount and direction did not vary between the groups (P>0.05). Low myopes had a significantly smaller corneal asphericity (Q -0.39 ± 0.15) compared to emmetropes (-0.52 ± 0.19) and moderate myopes (-0.52 ± 0.17; P=0.009) for the flat meridian only. Sag did not vary significantly between the three groups in either flat (P=0.61) or steep meridians (*P*=0.65). The percentage of participants with *Δ*Sag >40 μm was lower in low myopes (17%) compared to emmetropes (48%) and moderate myopes (35%), although this difference was not statistically significant (*P*=0.15). There was a weak but significant correlation between Q-values and *Δ*Sag (r=-0.22, *P*=0.041).

Conclusions : Moderate myopes showed significantly more corneal flattening towards the periphery compared to low myopes over a chord similar to the diameter of an orthokeratology lens. This could not be explained by the amount of corneal astigmatism or its direction. Even though corneal astigmatism was low, the relatively high percentage of *Δ*Sag >40 μm in the moderate myopic group indicates the potential clinical need for a toric orthokeratology lens. Further investigation is required to understand the effect of peripheral topography data beyond the 7mm chord in patients requiring large diameter contact lenses.

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