Changes of corneal biomechanics with keratoconus

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Abstract

Purpose: To perform advanced analysis of the corneal deformation response to air pressure in keratoconics compared to age and gender matched controls.

Design: Single centre, case controlled, prospective study.

Participants: 37 keratoconics and 37 age (mean 36 years) and gender matched controls with healthy corneas.

Method: The Ocular Response Analyzer was used to measure the air pressure-corneal deformation relationship, averaged across 4 profiles. Version 2.0 software was used to analyse 42 parameters of the profiles. Corneal topography and pachymetry was performed with the Orbscan II. The severity of the keratoconus was graded based on anterior corneal curvatures, difference in astigmatism in each meridians, anterior Best Fit Sphere and posterior Best Fit Sphere.
**Main Outcome Measures:** Air pressure-corneal deformation profiles

**Results:** Many of the biomechanical characteristics of keratoconic eyes were significantly different to normal eyes (p<0.001) and several were also significantly correlated to keratoconus severity. The principal factors which accounted for keratoconus severity were central corneal thickness ($r^2 = 0.23$), tear film quality (total $r^2 = 0.38$), the width of the applanation ‘peak’ (total $r^2 = 0.41$) and length of the corneal shape recovery ‘peak’ (total $r^2 = 0.46$). Sensitivity was 73% and specificity 90% for the detection of keratoconus using these factors.

**Conclusion:** Characteristics of the air pressure-corneal deformation profile are more affected by keratoconus than the traditionally extracted corneal hysteresis and corneal resistance factors. However, they only accounted for about half of the linear variance in clinical and topographical signs of keratoconus.