

## Anterior Segment Biometric and Corneal Endothelial Alterations in Keratoconus: A Comparative Study

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### PURPOSE

To investigate anterior segment biometric parameters and corneal endothelial characteristics in keratoconus patients compared to healthy controls, and to assess structural changes associated with the disease.

### STUDY DESIGN

**Prospective Comparative** | **60 KC** | **60 Controls** | **3 Instruments** | **Statistical Analysis**

**Inclusion:** Age >=18 | Sirius-confirmed KC | Right eyes | Complete records

**Exclusion:** Prior surgery | Contact lens wear | Ocular surface disease

**Ethics:** Institutional ethics committee approved. Helsinki Declaration adhered.

### METHODS

- **Sirius (Scheimpflug-Placido):**  
Corneal curvature, Kmax, central corneal thickness (CCT)
  - **Lenstar LS 900:**  
Axial length (AL), anterior chamber depth (ACD), lens thickness (LT)
  - **Tomey EM-4000 (Specular microscopy):**  
Endothelial cell density (ECD), coefficient of variation (CV), hexagonality (6A), average cell area (AVE)
- Statistics:** Independent t-test, Pearson correlation coefficient (p<0.05)

Parameter	KC (n=60)	Control (n=60)	p-value
ACD (mm)	3.48 +/- 0.31	3.12 +/- 0.24	<0.001 *
Lens thickness (mm)	3.61 +/- 0.28	3.78 +/- 0.22	<0.001 *
CCT (um)	468 +/- 42	542 +/- 28	<0.001 *
Kmax (D)	52.4 +/- 4.8	43.2 +/- 1.4	<0.001 *
ECD (cells/mm2)	2687 +/- 312	2756 +/- 284	0.186 NS
CV (%)	34.2 +/- 6.8	28.4 +/- 4.2	<0.001 *
6A Hexagonality (%)	54.3 +/- 8.6	62.8 +/- 6.4	<0.001 *

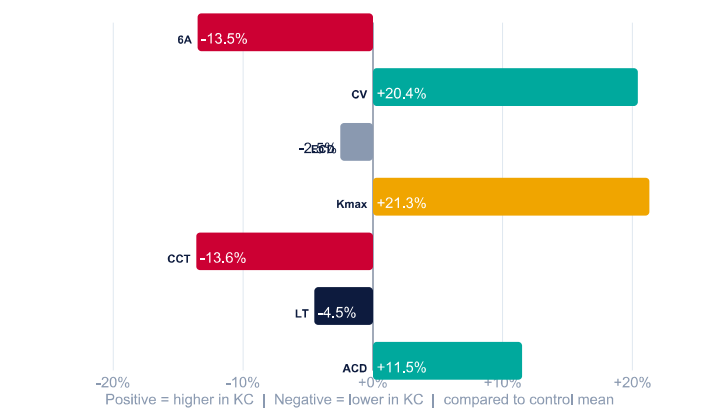
Key correlation: Kmax ↔ ACD  $r = 0.68, p < 0.001$

Keratoconus eyes showed significantly deeper anterior chambers and thinner corneas. While endothelial cell count was preserved, morphological analysis revealed increased polymegathism and reduced hexagonality, indicating cellular stress independent of cell loss. The strong Kmax-ACD correlation suggests structural remodelling extends beyond the cornea.

### KEY FINDINGS

<b>ACD UP</b> 3.48 vs 3.12 mm p<0.001	<b>LT DOWN</b> 3.61 vs 3.78 mm p<0.001	<b>CCT DOWN</b> 468 vs 542 um p<0.001
<b>ECD =</b> 2687 vs 2756 p=0.186 NS	<b>CV UP</b> 34.2 vs 28.4% p<0.001	<b>6A DOWN</b> 54.3 vs 62.8% p<0.001

### % CHANGE VS CONTROL (mean)



### CONCLUSIONS

1. Keratoconus is associated with significantly deeper ACD and reduced lens thickness, reflecting biomechanical ectasia that extends beyond the cornea into the entire anterior segment.
2. CCT is markedly reduced and Kmax significantly elevated, consistent with progressive corneal thinning and steepening.
3. Despite preserved endothelial cell density, significant morphological changes (increased CV, reduced hexagonality) indicate ongoing cellular stress.
4. Strong Kmax-ACD correlation (r=0.68, p<0.001) underlines global anterior segment remodelling in keratoconus.
5. These findings have implications for disease monitoring, cross-linking candidacy and pre-keratoplasty evaluation.

### CLINICAL IMPLICATIONS

- Biometric parameters support structural KC staging
- Endothelial morphology monitoring essential even when ECD is preserved
- ACD measurements may complement Kmax in longitudinal follow-up
- Findings inform pre-CXL and keratoplasty surgical planning

### KEYWORDS

- Keratoconus
- Anterior chamber depth
- Specular microscopy
- Endothelial polymegathism
- Scheimpflug imaging
- Corneal ectasia