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# Novel Keratoconus Classification Based on Corneal Scheimpflug Imaging Asymmetry Indices

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A. John Kanellopoulos and George Asimellis, *Revisiting keratoconus diagnosis and progression classification based on evaluation of corneal asymmetry indices, derived from Scheimpflug imaging in keratoconic and suspect cases. Clinical Ophthalmology 2013;7:1539-48*



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# Financial Disclosure

- We have the following financial interests or relationships to disclose:
  - AJK: Consultant for Alcon/WaveLight, Avedro
  - GA: Consultant for Alcon/WaveLight



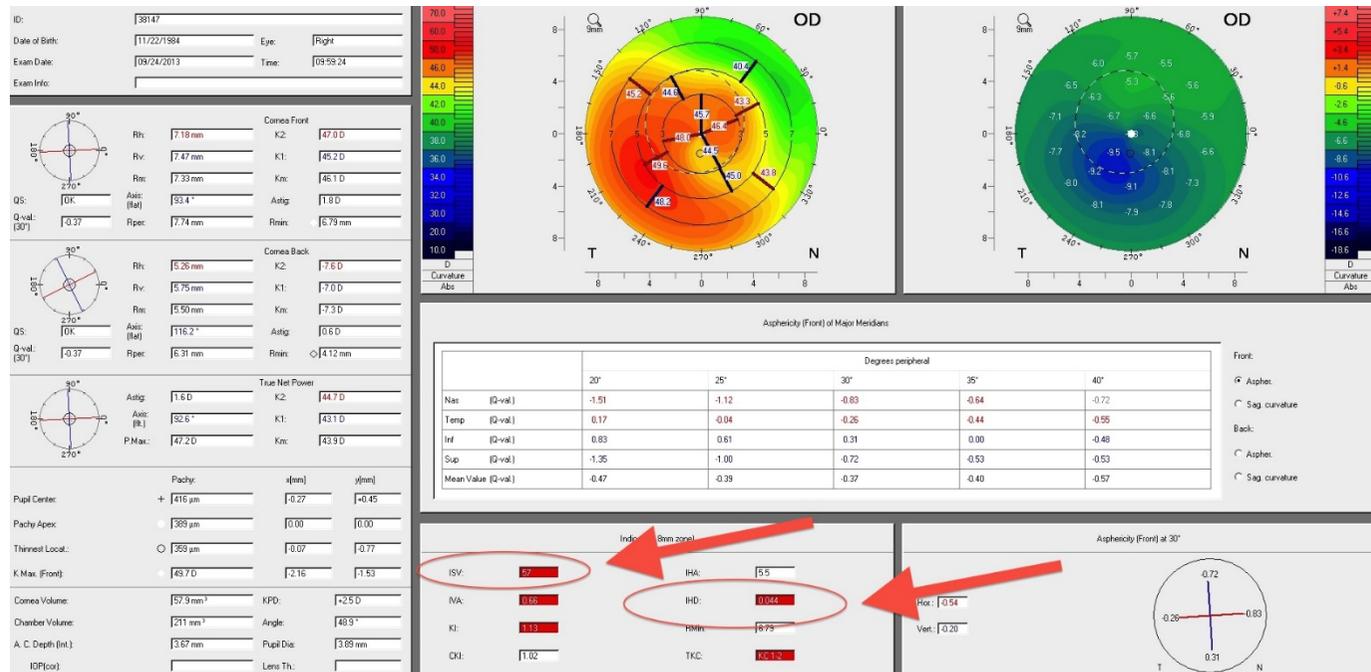
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# Purpose

- To survey the standard keratoconus grading scale (Pentacam-derived stages based on Amsler & Krumeich criteria) in view of seven corneal irregularity indices obtained by Scheimpflug imaging analysis.



# Background

- ISV: the standard deviation of individual corneal sagittal radii from the mean curvature.
  - an expression of the corneal surface irregularity.
- IHD: the value of the decentration of elevation data in the vertical direction; calculated from a Fourier analysis.
  - provides the degree of decentration in the vertical direction, calculated on a ring with radius 3 mm. An IHD value larger than 0.014 is considered abnormal, and larger than 0.016 is pathological.
- Objective Scheimpflug data



# Traditional Criteria

- Visual acuity (CDVA, CDVA)
- Refraction
- Pachymetry (thinnest, center)
- Keratometry (flat & steep K)
- Anterior inferior asymmetry (SRI)
- Amsler-Krumeich criteria



# Methods

- 212 keratoconic cases were evaluated for:
- KCN grading, anterior surface irregularity indices (measured by Scheimpflug imaging)
- Subjective refraction (measured by CDVA) and Cornea Pachymetry and steepest keratometry.
- The correlations between CDVA, keratometry, and the Scheimpflug keratoconus grading and the seven anterior surface Pentacam-derived topometric indices – index of surface variance, index of vertical asymmetry, keratoconus index, central keratoconus index, index of height asymmetry, index of height decentration, and index of minimum radius of curvature
- Analysis was performed using paired two-tailed t-tests, coefficient of determination ( $r^2$ ), and trend-line linearity.



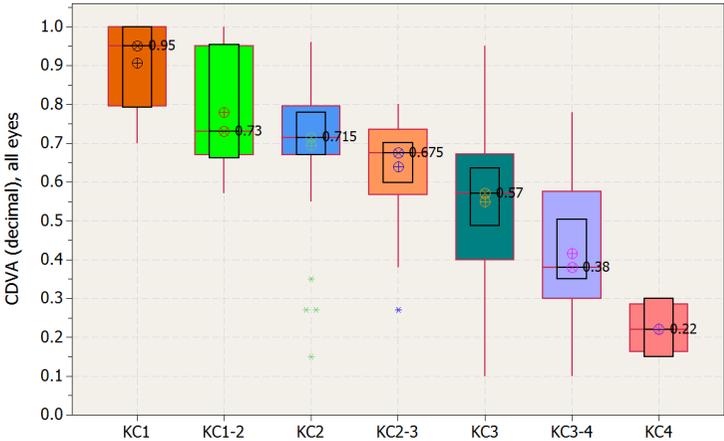
# Results

- Average  $\pm$  standard deviation CDVA (expressed decimally) was  $0.626 \pm 0.244$  for all eyes (range 0.10–1.00)
- Mean flat meridian keratometry (K1)  $46.7 \pm 5.89$  D; average steep keratometry (K2)  $51.05 \pm 6.59$  D.
- The index of surface variance (ISV) and the index of height decentration (IHD) had the strongest correlation with topographic keratoconus grading ( $P < 0.001$ ).
- CDVA and keratometry correlated poorly with keratoconus severity.



# Vision, Ks, pachymetry irrelevant in 700 KCN cases test ISV and IHD!

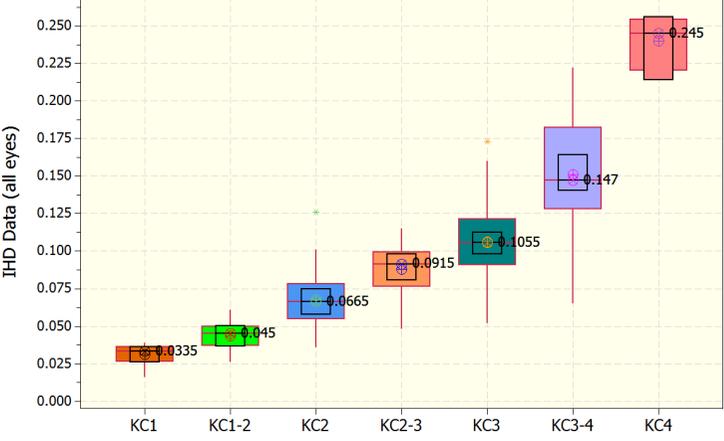
CDVA vs Keratoconus Grading



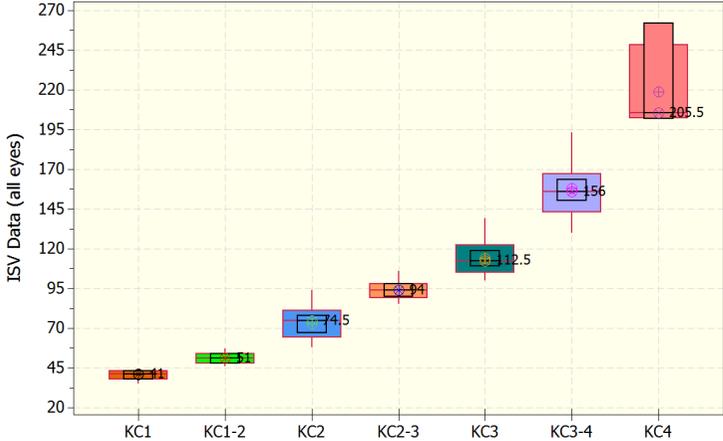
CKI vs Keratoconus Grading



IHD vs Keratoconus Grading



ISV vs Keratoconus Grading



# Conclusions

- The index of surface variance (ISV) and the index of height decentration (IHD) had the strongest correlation with topographic keratoconus grading ( $P < 0.001$ ).
- CDVA and keratometry correlated poorly with keratoconus severity.
- These are compelling data and suggest that we have to reconsider the KCN diagnosis and progression benchmark indicators.

