Updates on keratoconus progression

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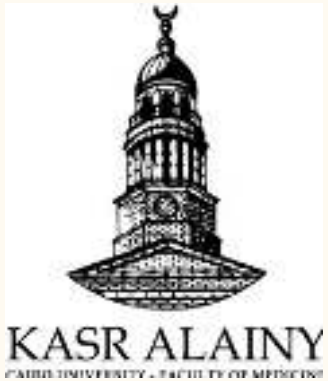

EOS 2025
EGYPTIAN OPHTHALMOLOGICAL SOCIETY

An important question ???

For cases with

Forme Fruste KC	Documented KC with	-K readings up to 55D	-BCVA better than 0.5

To decide between immediate CXL and Follow up.

Cornea, 2024

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CLINICAL SCIENCE

Definition of Progressive Keratoconus: A Systematic Review

Henriquez, Maria A. MD, MSc, PhD; Larco, Carolina MD; Izquierdo, Luis Jr MD, MSc, PhD
Author Information

Cornea ():10.1097/ICO.0000000000003777, December 12, 2024. | *DOI:* 10.1097/ICO.0000000000003777

BUY | SDC | PAP | Metrics

Abstract

Purpose:
To identify the definitions used for progressive keratoconus in the literature.

Methods:
A systematic literature review aimed to identify the definitions used for "progressive keratoconus" in the published articles. A comprehensive search from January 2018 to May 2023 was conducted across Cochrane Library, PubMed, Taylor & Francis, Web of Science, and other bibliographic databases at Oftalmosalud, Lima, Peru. The inclusion criteria were articles including patients with keratoconus without any previous surgical procedure and containing the definition of "progressive keratoconus" or "keratoconus progression" and a sample size greater than 10 eyes.

Conclusion: The present study demonstrates the **lack of unified criteria to define progression of keratoconus** and an underutilizationof the technology described.

Global consensus on KC and ectatic corneal disease (2015)

Progression = 2 or more criteria

↑ Front curvature

↑ Back curvature

↓ Corneal thickness

No cut-off values ??

Save Sight Keratoconus Registry Study (2021)

- Increase in Kmax 1 D or more
- Decrease in CCT more than 20 microns
- Increase in BAD of more than 0.42
- No role for VA ??

JCRS
Journal of Cataract & Refractive Surgery®

ARTICLE

Evaluating keratoconus progression prior to crosslinking: maximum keratometry vs the ABCD grading system

Vinciguerra, Riccardo MD; Belin, Michael W. MD; Borgia, Alfredo MD; Piscopo, Raffaele MD; Montericcio, Alessio MD; Confalonieri, Filippo MD; Legrottaglie, Emanuela F. MD; Rosetta, Pietro MD; Vinciguerra, Paolo MD

Author Information

Journal of Cataract & Refractive Surgery 47(1):p 33-39, January 2021. | *DOI:* 10.1097/j.jcrs.0000000000000475

that was not detected with Kmax. CONCLUSIONS Our study showed a significant, but moderate, correlation between the change in Kmax and the change in A and B values in progressive KC. Moreover, more than half of the cases showed documented progression earlier with the ABCD progression display than detected by standard Kmax changes. This study suggests possible

Eye & Contact Lens
SCIENCE AND CLINICAL PRACTICE

ARTICLE

Definitions for Keratoconus Progression and Their Impact on Clinical Practice

Koppen, Carina M.D., Ph.D.; Jiménez-García, Marta B.Eng., O.D., M.Sc.; Kreps, Elke O. M.D., Ph.D.; Ní Dhubhghaill, Sorcha M.D., Ph.D.; Rozema, Jos J. Ph.D.; on behalf of The REDCAKE Study Group

Author Information

Eye & Contact Lens: Science & Clinical Practice 50(1):p 1-9, January 2024. | **DOI:** 10.1097/ICL.0000000000001038

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Antwerp University Redcake study group

Using a single criterion (e.g., ΔK_{MAX} >1D) led to high values of R_{PROG}. When combining two, (K_{MAX} and A_F) led to worse I_{POP} and higher variability than (K_{MAX} and P_{MIN}); alternative criteria such as (K_{2F} and R_{mB}) obtained the best I_{POP} and the lowest variability ($P<0.0001$). ABC, as defined by its authors, obtained R_{PROG} of 74.2%. Using wider 95% confidence intervals (95% CIs) and requiring two parameters over 95CI reduced R_{PROG} to 27.9%.

Antwerp University Redcake study group

EJO,2024

EJO European Journal of Ophthalmology

Original research article- keratoconus

The HUC progression score: A new method for determining KERATOCONUS progression

European Journal of Ophthalmology
2024, Vol. 34(4) 973–979

DOI: 10.1177/11206721241247587
journals.sagepub.com/home/ejo
Sage

Beatriz de Luis Eguileor[1], Borja Santos Zorrozúa[2] and Jaime Etxebarria Ecenarro[1]

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HUC KC grading

01

Grade 1 with posterior elevation up to 40 microns.

02

Grade 2 with posterior elevation 41-75 microns.

03

Grade 3 more than 75 microns.

HUC KC progression score

	1	2	3	score
K max (D)	0.81	1.19	1.42	2,5
TCT (µm)	15.00	13.73	17.15	2,5
Max_BFS_post (8) (µm)	7.99	10.39	12.45	2
Z_3^{-1} (6) (µm)	0.19	0.25	0.56	2
HOA RMS (6) (µm)	0.20	0.30	0.39	1

A value greater than or equal to 6 indicates progression.
Maximum keratometry (Kmax), Maximum posterior elevation (max_BFS_post), Thinnest corneal thickness (TCT), Root mean square of high order aberrations (RMS HOA), Z_3^{-1} (vertical coma).

Acknowledging the value of VERTICAL COMA in monitoring progression

JCRS, 2022

ARTICLE

Correlation of the Corvis Biomechanical Factor with tomographic parameters in keratoconus

Elias Flockerzi, MD, Riccardo Vinciguerra, MD, Michael Wellington Belin, MD, Paolo Vinciguerra, MD, Renato Ambrósio Jr, MD, PhD, Berthold Seitz, MD

Purpose: To investigate the relationship between corneal biomechanics and keratoconus (KC) severity as described by tomographic parameters.

Setting: University-based German ophthalmology department.

Design: Retrospective cross-sectional study.

Methods: A total of 448 KC corneas of the Homburg Keratoconus Center and 112 healthy corneas (448+112 patients) were examined by Pentacam high-resolution and Corneal Visualization Scheimpflug Technology (Pentacam HR and Corvis ST). The KC population included a wide spectrum of disease severity based on Belin's ABCD classification. Linear regression analysis was performed between the linear term of the Corvis Biomechanical Index (CBI) (CBI beta) and the tomographic values anterior radius of curvature (ARC), posterior radius of curvature (PRC), and thinnest corneal thickness (TCT). A linear transformation of the CBI beta was performed to provide an intuitive scaling, which was referred to as the Corvis Biomechanical Factor (CBiF = −0.24294226 × CBI beta + 6.02). This scaling adjusted the CBI beta to the same scale as posterior corneal curvature (PRC).

Results: There was a high correlation of the CBI beta and its modification, the CBiF, with TCT (Pearson, $r = -0.775$), ARC ($r = -0.835$), and PRC ($r = -0.839$) in the KC population ($P < .001$). In the control corneas, the correlation between the CBI beta and ARC was weak ($r = -0.216$, $P = .022$), not significant (PRC, $r = -0.146$, $P = .125$), or moderate (TCT, $r = -0.628$, $P < .001$).

Conclusions: The linear term of the CBI was highly associated with KC severity as defined by corneal tomography. The CBiF represents a new scale based on biomechanical characteristics in KC, which could serve as a basis for a biomechanical KC classification in the future.

J Cataract Refract Surg 2022; 48:215–221

Acta Ophthalmologica, 2022

Combined biomechanical and tomographic keratoconus staging: Adding a biomechanical parameter to the ABCD keratoconus staging system

Elias Flockerzi,[1] Riccardo Vinciguerra,[2,3] Michael Wellington Belin,[4] Paolo Vinciguerra,[5,6] Renato Ambrósio Jr[7] and Berthold Seitz[1]

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EOS 2025
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Eye & Vision, 2024

Flockerzi and Seitz *Eye and Vision* (2024) 11:24
https://doi.org/10.1186/s40662-024-00392-3

Eye and Vision

REVIEW

Open Access

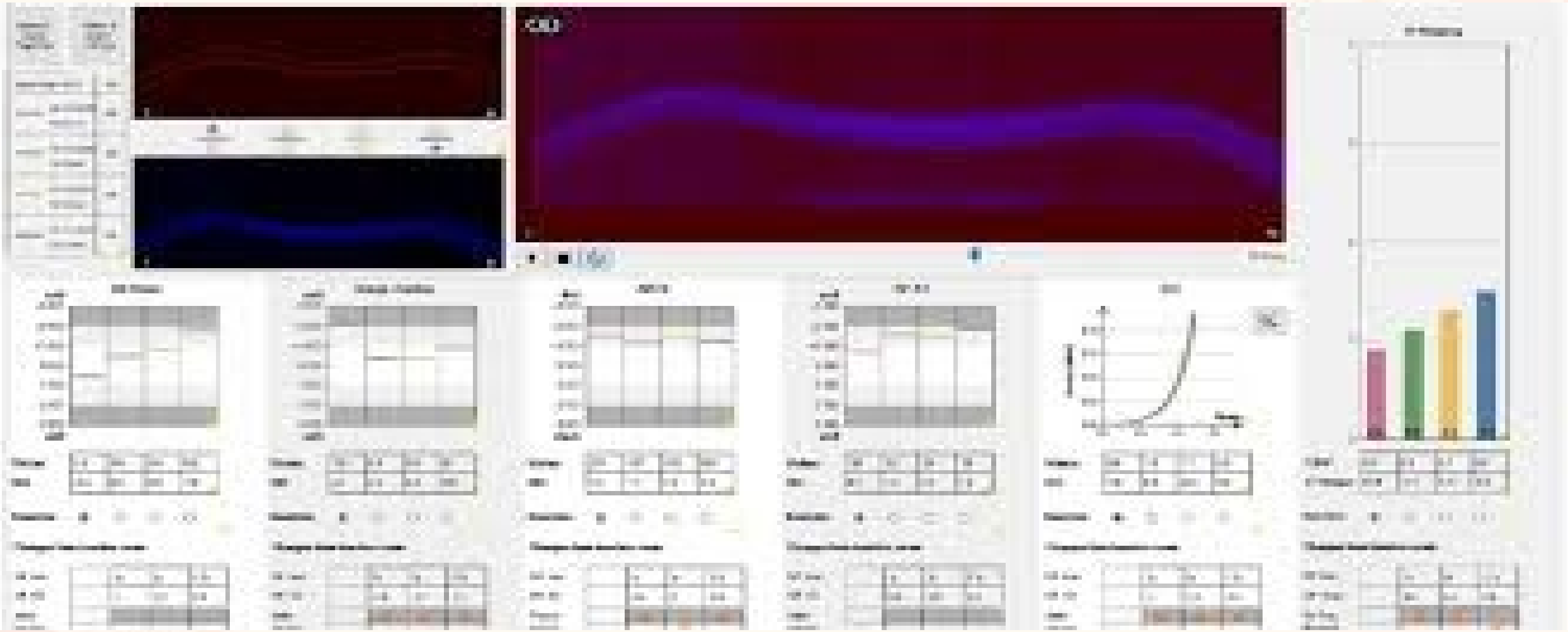
Keratectasia severity staging and progression assessment based on the biomechanical E-staging

Elias Flockerzi[1*] and Berthold Seitz[1]

Abstract

Until recently, corneal topography has been the gold standard in detecting keratectasia and monitoring its progression. The recently introduced ABCD tomographic keratoconus staging system focuses on anterior ("A") and posterior ("B") radius of curvature, thinnest corneal thickness ("C"), best-corrected visual acuity with spectacles ("D") and is supplemented with the introduction of the biomechanical E-staging (BEST, "E"). The need for biomechanical staging arose from the fact of altered biomechanical characteristics of keratectasia in comparison to healthy corneas. Ectatic

BEST



Cornea, March 2025

CORNEA
The Journal of Cornea and External Disease

CLINICAL SCIENCE

Intereye Asymmetry as a Predictor of Progression in Patients With Untreated Keratoconus: Findings From a Longitudinal Study

Arnalich-Montiel, Francisco PhD[*,†]; Ortiz-Toquero, Sara PhD[*]; Kandel, Himal PhD[‡,§]; Lewis, Noni MD[‡,¶]; Chiong Hong, Sheng MD[‖]; Downie, Nicholas MD[**]; Watson, Adam MBChB[††]; Abbondanza, Marco MD[‡‡]; Watson, Stephanie PhD[‡,§]

Author Information

Cornea 44(3):p 337-341, March 2025. | **DOI:** 10.1097/ICO.0000000000003601

Abstract

Purpose:

The purpose of this study was to evaluate interocular predictors of progression in patients with untreated keratoconus.

Methods:

This is a multicenter longitudinal observational study with real-world data collected through the

Cornea, March 2025

Methods:

This is a multicenter longitudinal observational study with real-world data collected through the Save Sight Keratoconus Registry. Patients between the period of June 2000 and September 2022 were included in this study. Parameters such as patient age, sex, ocular history, visual acuity, K2, Max-K, and thinnest corneal thickness pachymetry (TCT) were analyzed.

Results:

There were 4342 untreated eyes from 2171 patients with keratoconus. A total of 333 patients showed progression of either Max-K, TCT, or both, whereas 1838 patients showed stable parameters. Factors associated with a higher incidence of progression in Max-K were younger baseline age (HR 0.96 per year older; 95% CI 0.95–0.98, $P < 0.0001$) and a higher baseline intereye asymmetry in Max-K (HR 1.02 per higher diopter; 95% CI 1.00–1.04, $P = 0.04$). A younger baseline age was the only predictor of progression in TCT (HR 0.97 per year older; 95% CI 0.95–0.99, $P = 0.001$).

Conclusions:

Age is the most significant predictor of progression for both corneal thinning and progression of Max-K. Interocular asymmetry in Max-K at baseline could be used as part of an algorithm for determining the risk of keratoconus progression. It is recommended that patients with higher interocular asymmetry in Max-K have a closer follow-up of both eyes as they are at a higher risk of progression.

ELSEVIER

Intelligence-Based Medicine

journal homepage: www.sciencedirect.com/journal/intelligence-based-medicine

Check for updates

Stratification of keratoconus progression using unsupervised machine learning analysis of tomographical parameters

Ke Cao [a,b], Karin Verspoor [c,d], Elsie Chan [a,b,e], Mark Daniell [a,b,e], Srujana Sahebjada [a,b,1], Paul N. Baird [b,*,1]

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Next Stop…AI

tvst

Artificial Intelligence

Keratoconus Progression Determined at the First Visit: A Deep Learning Approach With Fusion of Imaging and Numerical Clinical Data

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Purpose: Multiple clinical visits are necessary to determine progression of keratoconus before offering corneal cross-linking. The purpose of this study was to develop a neural network that can potentially predict progression during the initial visit using tomography images and other clinical risk factors.

Methods: The neural network's development depended on data from 570 keratoconus eyes. During the initial visit, numerical risk factors and posterior elevation maps from Scheimpflug imaging were collected. Increase of steepest keratometry of 1 diopter during follow-up was used as the progression criterion. The data were partitioned into training, validation, and test sets. The first two were used for training, and the latter for

Next Stop...AI

Conclusion

No current global consensus on the criteria of KC progression.

Relying on the **Kmax alone is not reliable**.

Relying on **ANTERIOR curvature PLUS PACHYMETRY** changes is more accurate.

Relying on **ANTERIOR curvature PLUS POSTERIOR curvature** changes more and more accurate.

The addition of **a biomechanical parameter** provides more precise gauging of progression.

The need for Aligning world wide practice with the same GUIDELINES is MANDATORY.

Artificial intelligence is the **next solution** and is the duty of GLOBAL SOCIETIES.


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Thank you,
doctors