

Corneal Diagnostics A-Z

John D. Gelles, OD

Course Abstract:

Practitioners have all the toys to diagnose and monitor the posterior segment, but what about the cornea???. This lecture will teach how to use a variety of corneal diagnostics, with focus on technologies such as topography, tomography, specular and confocal microscopy, biomechanics, aesthesiometry, genetic testing and more. Come learn how to diagnose and monitor diseases affecting the most important part of the eye!*

*BIAS OPINION

Course Learning Objectives:

1. Learn methods of corneal evaluation with multiple instruments
2. Understand metrics used to diagnose and monitor keratoconus and ectasia
3. Learn how to apply these findings to relevant real-world situations with cases

Course Outline:

1. Why care?
 - a. Clinical Decisions
 - i. Corneal based treatment vs alternatives
 1. Myopia
 - a. Early signs?
 - i. Avoid corneal based therapy
 1. Ortho K alters anterior cornea, removes the ability to early dx with Placido topography
 - a. Alternative therapy
 - i. Atropine
 - ii. Soft MF
 - iii. Defocus spectacle lenses
 2. Follow up more frequently
 - a. Pediatric population
 - i. KC signs in younger population = more likely have severe disease
2. Refractive surgery
 - a. Corneal based refractive surgery = LASIK/PRK
 - i. Early signs?
 1. Avoid corneal based surgery
 - a. Possibility of iatrogenic disease
 - b. Alternative surgical options

- iii. KC IS MORE COMMON THAN YOU THINK
- 3. Simple diagnostic factors to alert for the need for testing
 - a. Review of refraction study
 - i. Chung et al 2020
 - 1. Average axis orientation: oblique or ATR
 - 2. Cyl (refractive or K) > 1.5D should be worked up
 - b. Review of retinoscopy study
 - i. Al-Mahrouqi et al 2019
 - 1. Compare retinoscopy to Pentacam BAD D-value findings ≥ 2.69 .
 - a. The results to assess the validity and reliability.
 - 2. Retinoscope is sensitive for detection even in early KC
- 4. Topography metrics
 - a. Anterior only
 - i. Rabinowitz et al
 - 1. K (Central and Apical) > 47D
 - 2. IS > 1.4D
 - 3. Skew (SRAX) > 20deg if >1.5D
 - a. Examples
 - b. Cases
 - i. KC or surface?
 - 1. Mires matter
 - ii. Is is KC?
 - c. Clinical pearl:
 - i. Symmetry is key!
 - ii. Look out for tear film
 - 1. Corneal staining
 - 2. Treat and repeat
- 5. Tomography metrics
 - a. Full corneal metrics
 - i. Motlagh et al
 - 1. Curvature (Axial Map)
 - a. Same metrics apply
 - 2. Elevation (Posterior >20>Anterior >15)
 - 3. Pachymetry (<500)
 - a. Examples
 - ii. Li et al
 - 1. Epithelial doughnut pattern
 - a. Apical epithelial thinning and peripheral thickening
 - b. Max to min thickness: $\sim 20\mu\text{m}$
 - i. Examples
 - b. Cases
 - i. Elevations vs curves
 - ii. The KC backside
 - iii. Thickness gradient

- c. Clinical pearl:
 - i. Topo rules apply to anterior maps
 - ii. Adds posterior surface and global pachymetry!
 - 1. Focal elevations
 - 2. Thickness gradients
- 6. Aberrometry metrics
 - a. Full visual system
 - i. Li et al and Kosaki et al
 - ii. Higher-order aberrations
 - 1. Vertical COMA is the predominate aberration
 - a. Followed by Trefoil
 - iii. Normal vs Suspect vs KC
 - 1. <0.2 vs $\sim 0.2-0.3$ vs >0.3
 - a. Examples
 - b. Cases
 - i. The cornea or internal?
 - c. Clinical pearl:
 - i. Sensitive but nonspecific!!
 - ii. Coma and trefoil!
- 7. Confocal Microscopy
 - a. Images of different structural cellular layers
 - i. Comparable to histology of the living cornea
 - ii. Detection and management of infectious corneal conditions
 - 1. Acanthamoeba keratitis
 - iii. Nerve evaluation in naturopathic conditions
- 8. Specular Microscopy
 - a. Evaluation of the corneal endothelium
 - i. Polymegathism
 - ii. Pleomorphism
 - iii. Reduced cell density
 - b. Monitor
 - i. Contact lens related cellular changes
 - ii. Grafts
 - iii. Corneal dystrophies
- 9. Biomechanics metrics
 - a. Roberts et al and Dupps et al
 - i. Corneal resistance factor (CRF): Rebound
 - ii. Corneal hysteresis (CH): Elasticity (less important)
 - 1. Factors are not sensitive and specific enough to differentiate subclinical from normal
 - a. Newer devices exist internationally
 - i. Scheimpflug waveform
 - 1. Global weakness
 - b. Several devices in development

- i. Brillouin
 - 1. Focal weakness
- ii. Elastography
 - 1. Depth weakness

- b. Cases
 - i. Normal shape but super weak
- c. Clinical pearl:
 - i. Poor diagnostic value on its own
 - ii. Low corneal resistance
 - 1. Fast deformation

10. Genetic testing

- a. Cases
 - i. High-risk score and progression
- b. Clinical pearl
 - i. Assess risk before physical manifestation

11. Combine testing

- a. Cases
 - i. Need it all to figure it out
- b. Clinical pearl:
 - i. Combine for most accurate
 - ii. Think like glaucoma
 - 1. More findings = more risk
 - a. Follow up sooner

12. Monitoring

- a. Worsening of the aforementioned metrics = progression
 - i. Refer for treatment with CXL
- b. Suspicious or borderline findings?
 - i. Think like glaucoma!!
 - 1. Complete corneal work up
 - 2. Avoid corneal based treatments
 - 3. Follow up frequently
 - a. Pediatric population: every 3 months
 - i. Progression = immediate treatment with CXL