

Lecture Title: Innovations in Diagnostic Tools & Technology

Length: 2 hours

Speaker: Jade Coats, OD, FAAO

Course Description:

This course reviews the latest innovations in diagnostic tools, imaging, and technology transforming optometric practice. Key topics include corneal and ocular surface assessment, color vision and genetic testing, binocular vision evaluation, glaucoma monitoring, contact lens advancements, and pre- and post-operative care for refractive and presbyopia-correcting IOLs. Attendees will gain practical strategies for integrating emerging diagnostics, biomarkers, and therapeutic technologies into clinical practice to improve patient outcomes, streamline care, and support evidence-based decision-making.

Course Objectives:

1. Review current and emerging diagnostic tools for corneal, ocular surface, and binocular vision disorders, including color vision testing, corneal sensitivity measurement, and point-of-care inflammatory markers.
2. Evaluate innovations in glaucoma diagnostics, including portable visual fields, ERG, tonometry, and genetic risk assessment, and their implications for early detection and management.
3. Analyze advances in pre- and post-operative care for refractive surgery and presbyopia-correcting IOLs, including co-management strategies and novel diagnostic technologies.
4. Integrate new diagnostic and therapeutic approaches for ocular surface, blepharitis, MGD, and Demodex, including IPL, thermal devices, and pharmacologic options, into clinical practice.
5. Apply clinical case-based reasoning to select appropriate diagnostic modalities and implement technology-driven care to improve patient outcomes and practice efficiency.

2-hour Course Outline:

1. Adding New Tools and Technology into Clinic Flow

- a. Patient-Centered Implementation
 - i. Workflow integration
 1. How to incorporate new diagnostics efficiently without disrupting patient flow
 - ii. Telehealth and remote monitoring
 1. Using AI/telemedicine for glaucoma, amblyopia, or myopia management
 - iii. Cost-benefit considerations

1. Which tools provide measurable clinical value vs optional “nice-to-have” technology
- b. Artificial Intelligence / Digital Innovations- Overview
 - i. AI-assisted OCT or fundus imaging for glaucoma and retina screening
 - ii. Machine learning for early keratoconus detection or predicting surgical outcomes
 - iii. Eye-tracking and digital platforms for amblyopia compliance tracking
- c. Pediatric and Special Population Considerations
 - i. Early detection and monitoring of pediatric glaucoma and keratoconus.
 - ii. Tools for non-verbal or special-needs patients (portable devices, non-contact testing).
- d. Integration of Diagnostics with Therapeutics
 - i. How diagnostic results guide treatment selection for CXL, IPL, MIGS, or IOL choice.
 - ii. Monitoring therapeutic response using advanced diagnostics (ERG, MMP-9, corneal sensitivity, imaging)

2. New Diagnostic Tools for the Office

- a. Color Vision Testing
 - i. Genetic color deficiency
 - ii. Acquired loss of color
 - iii. Benefits of color vision testing
- b. Genetic Testing
 - i. Keratoconus
 1. Prevalence
 2. Associated factors
 3. Clinical findings
 4. Genetic testing for corneal dystrophy
 - a. Impact on COVID-19 on keratoconus patients waiting for corneal cross linking
 5. Diagnostic Testing could help candidates for corneal cross linking sooner
 - a. New techniques: updates in corneal crosslinking (epi-on, combined with PRK/PTK).
 - b. Optometrists role in pre-post-operative management of CXL
 - c. Ideal candidates
 - d. Case report of keratoconus patient - recently diagnosed and concern for genetic risk of offspring
- c. Corneal Sensitivity Testing
 - i. Common etiologies of corneal hypo or anesthesia
 1. Pathologic mechanism
 2. Expected clinical manifestations of decreased sensitivity
 - ii. Assessing Neurotrophic Keratitis (NK)

1. Corneal aesthesiometer
2. Mackie Classification of NK
- iii. New in corneal sensitivity diagnostic testing?
 1. Non-contact aesthesiometer
 2. Innovations on the horizon
- d. Reducing Inflammation In Office
 - i. Measuring MMP9 in office
 - ii. Measuring other inflammatory markers in office
 - iii. Irrigating Eyelid Retractor
 1. The irrigation device delivers 10cc of saline and was shown to “statistically reduce (matrix metalloproteinase-9) MMP-9 on the ocular surface and improve patient symptoms” at 3 hours post-rinse.
 2. Further, a >70% reduction in MMP-9 and over 40% of patients converted to negative MMP-9 following a rinse using the device
- e. Emerging biometrics & point of care testing:
 - i. TFOS DEWS III Takeaways
 - ii. Tear film proteomics beyond MMP-9
 - iii. Novel ocular surface inflammatory markers and their clinical interpretation.
 - iv. Salivary or systemic biomarkers for ocular disease risk (e.g., diabetic retinopathy, glaucoma).

3. Contact Lens Innovations:

- a. Practical Implementation in Practice
 - i. Integrating new lens technologies into patient consultations
 - ii. Insurance, cost, and patient counseling considerations
 - iii. Monitoring treatment outcomes and side effects.
- b. Myopia management
 - i. Overview of the growing prevalence of myopia worldwide and its long-term ocular risks.
 - ii. Latest evidence-based strategies for myopia control: low-dose atropine, multifocal soft lenses, and orthokeratology.
 1. Atropine from Sydnexis
 - a. FDA approval in Europe, signals momentum in U.S. myopia control therapies.
 - i. 3 year study findings
 - ii. Unique formulation
 - b. Impact for co-management and upcoming adoption.
 - iii. Selecting the right myopia control modality based on patient age, lifestyle, and refractive progression.
 - iv. Monitoring strategies: axial length measurement, visual acuity tracking, and compliance assessment.
- c. Orthokeratology

- i. Current FDA-approved Ortho-K lens designs and indications.
 - ii. Ideal candidates and contraindications
 - iii. Fitting considerations: corneal topography, lens centration, and treatment zone evaluation
- d. Weekly disposable CL now available
 - i. Review of parameters
 - ii. Overview of availability, material innovations, and oxygen permeability
 - iii. Benefits for patient compliance and reduced risk of complications.
- e. B12 infused CL now available (Walmart)
 - i. Mechanism of action of B12 and the ocular surface (enhancing ocular surface health, potential anti-inflammatory effects).
 - ii. Practical considerations: availability, patient education, and clinical monitoring
- f. Emerging Trends & Future Directions
 - i. Smart lenses (e.g., lenses with embedded sensors for IOP, glucose monitoring).
 - ii. Combination approaches: myopia control + ocular surface therapy.
 - iii. Potential future therapeutics delivered via contact lenses.

4. Binocular Vision/ Amblyopia Innovations:

- a. Portable Amblyopia treatment options
 - i. Home-based digital apps and gamified therapy
 - ii. Patching compliance monitoring
 - iii. Pros: Convenient, engaging, supports remote tracking
 - iv. Cons: Dependent on patient/caregiver compliance
- b. Eye-Tracking-Based Therapy
 - i. Tracks gaze, fixation, and binocular coordination
 - ii. Provides real-time feedback and objective metrics
 - iii. Pros: Personalized therapy, remote monitoring
 - iv. Cons: Cost, learning curve
 - v. Example to offering in clinic to ideal patient
- c. Binocular / Dichoptic Therapy
 - i. Uses binocular stimuli to train both eyes simultaneously
 - ii. Targets suppression and improves stereopsis
 - iii. Age 4–9 most effective
 - iv. Pros: Promotes binocular vision, may reduce patching
 - v. Cons: Specialized equipment, motivation-dependent
- d. Emerging Diagnostic Tools
 - i. Portable VR/AR assessment devices for stereopsis and suppression
 - ii. Automated visual acuity apps for remote monitoring
 - iii. Eye-tracking metrics to quantify fixation and suppression
- e. Clinical Considerations
 - i. Patient selection by age, severity, and compliance
 - ii. Combining traditional and digital therapies

- iii. Monitor outcomes with objective metrics

5. New innovations - Demodex blepharitis (DB):

- a. Slit lamp biomicroscopy: collarettes, erythema, or debris
- b. Look at the lids
- c. Update: ASCRS Cornea Clinical Committee Pre-operative Cataract and Refractive Surgery Ocular Surface Disease Algorithm
 - i. ASCRS Pre-operative OSD Algorithm: LLPP
 - 1. Look
 - 2. Lift
 - 3. Push/Pull
 - 4. Stain
- d. Manuka Honey
 - i. Evidence based data on antimicrobial, anti-inflammatory, and antioxidant effects
- e. Lotilaner 0.25%
 - i. Long-term safety
- f. Future treatment options to help with Demodex Blepharitis?
 - i. IPL treatments to help with rosacea component
 - ii. 5-FU has shown positive effect with improving DB
- g. Diagnostic tool to measure Demodex
 - i. Why is microscopic evaluation important?
 - 1. Standard method to confirm Demodex species and density
 - ii. Emerging technologies:
 - 1. Non-invasive imaging for mite visualization
 - 2. Quantitative tools for mite load assessment
 - iii. Clinical Use:
 - 1. Determine treatment necessity and monitor response
 - 2. Guide pre-operative ocular surface optimization
 - iv. Clinical Considerations:
 - 1. Pre-operative optimization in cataract/refractive surgery to reduce post-op complications
 - 2. Combination therapy may be needed for refractory cases (lotilaner + IPL + lid hygiene)
 - 3. Patient education on hygiene, compliance, and symptom monitoring

6. New innovations - Concomitant Blepharitis/ MGD/Dry Eye Disease:

- a. Handheld multi-modal thermal heating device
 - i. FDA-cleared Tixel Thermo-Mechanical Action device
 - 1. Mechanism: thermal microchannels, meibomian gland stimulation.
 - 2. Indications: dry eye / MGD, cosmetic overlap
 - ii. Where it fits in clinic flow (in-office vs at-home care)
- b. Intense Pulsed Light (IPL)

- c. Radiofrequency (RF)
- d. OTC nutritional supplements
 - i. Curcumin
 - 1. Blink NutriTears (nutraceutical for ocular surface health) – evidence and positioning.
 - a. 2021 study from India
 - b. 2024 Study from US
 - c. Ingredient breakdown
 - i. Lutein/ Zeaxanthin
 - ii. Curcumin
 - iii. Vitamin D
 - ii. Lutein/ Zeaxanthin
 - iii. Vitamin D
 - iv. B12 vitamin
 - v. Essential Omega Fatty Acids
- e. Emerging Neutraceuticals
- f. OTC Eye drops new to market
 - i. B12 infused eye drops
 - 1. Ingredients
 - 2. Clinical relevance/studies
- g. OTC topical Winq Eyelid Serum (Tear Restore)
 - i. Ingredients
 - 1. Cooling plant extracts (menthol), hyaluronic acid, niacinamide, and caffeine
 - ii. Aimed at healthy blink rate, digital eye strain
 - iii. Eyebag and dark circle appearance
 - 1. Lasts for 2 hours

7. Pharmaceutical Advancements:

- a. Dilation advancements
 - i. Potential for spray administration?
- b. Dilation reversal eyedrop
 - i. Ideal candidate
 - ii. Review of clinical studies
- c. New Presbyopia Eye Drops on the Market
 - i. Qlosi (pilocarpine 0.4%)
 - 1. Clinical trials
 - 2. Safety, efficacy and data review
 - 3. Discussion of differences compared to 1.25% pilocarpine
 - ii. Vizz (aceclidine ophthalmic solution) 1.44) – dual mechanism, durability.
 - iii. Clinical adoption
 - iv. Patient expectations
 - v. Side effect pearls
 - vi. Review of Clinical outcomes and safety studies

- d. Semifluinated Alkanes
 - i. Perfluorohexyloctane
 - 1. Used as 100% active ingredient
 - 2. Mechanism: spreads over the tear film lipid layer, reducing evaporation and improving tear film stability.
 - 3. Clinical Evidence:
 - a. Improves signs and symptoms of evaporative dry eye.
 - b. Reduces corneal staining, tear film instability, and discomfort
 - c. Practical Considerations: suitable as standalone therapy for mild-to-moderate evaporative DED.
 - ii. Perbytalpentane
 - 1. Used as a vehicle
 - 2. Mechanism: enhances drug solubility and delivery to ocular surface.
 - 3. Clinical Evidence: improves bioavailability and tolerability of active drugs.
 - iii. Comparison and discussion between differences in these semi-fluoredated alkanes
- e. Tyrptyr
 - i. Mechanism of Action
 - 1. Activates TRPM8 ion channels, stimulating natural tear production
 - 2. Enhances lacrimal gland function via trigeminal nerve pathways
 - ii. Dosage and Administration
 - iii. Clinical efficacy
 - 1. Review of clinical studies
 - a. Onset as early as day 1
- f. Semaglutides
 - i. Potential side effects, ocular risks
 - ii. Educating patients on risks/benefits
 - iii. Role of weight loss and potential effect on refractive surgery
- g. Probiotics (Cydexa)
 - i. <https://www.zocular.com/products/cydexa-probiotics-for-dry-eye>
 - ii. Pro and Pre Biotics
 - 1. Ingredients
 - iii. Clinical evidence for dry eye
 - iv. Concerns
 - 1. Probiotics still controversial

8. Refractive Surgery Innovations and Presbyopia- Correcting IOLs:

- a. Implantable Collamer Lens (ICL)
 - i. Approved in 2011 for -3D to -15D
 - ii. EVO Toric approved for -1D to -4D of astigmatism

- iii. Not Approved for hyperopia
- b. Multifocal IOL
 - i. Full range of vision IOL (TECNIS Odyssey, Clareon PanOptix, other multifocal)
- c. Trifocal IOL
- d. Extended depth of focus IOL
 - i. EDOF: diffractive (Symfony OptiBlue)
 - ii. Beam-shaping EDOF (Clareon Vivivity)
- e. Small aperture
 - i. EDOF: small-aperture (IC-8 Aphera)
- f. LiquiLens
- g. Accommodative lenses
- h. FluidVision
- i. Monovision with enhanced monofocal (TECNIS :Eyhance, enVista Aspire)
- j. Light Adjustable Lens (2017 vs 2024)
 - i. Optometrist role in co-management of LAL

9. Glaucoma Innovations:

- a. Prevalence of Glaucoma
 - i. Early Intervention Matters
- b. SLT (Selective Laser Trabeculoplasty)
 - i. Indications
 - ii. Contraindications
 - iii. SLT efficacy - 6 years update studies
 - iv. Future of Automated SLT
- c. MIGS (Minimally Invasive Glaucoma Surgery)
 - i. Identifying ideal candidates
 - ii. Optometrists Role in Pre and Post-op Management
 - iii. Complications to watch fro
- d. Gonioscopy
 - i. Future of Automated Gonio
- e. Tonometer, Corneal Hysteresis, Corneal Compensated IOP – Future of All in 1 measurement?
- f. Portable Visual Field
 - i. Pros and Cons
 - ii. Ideal Patient
 - iii. Fitting VR technology into your practice
- g. Portable electroretinogram (ERG)
 - i. ERG measures the photopic negative response - the response specific to ganglion cells
 - ii. Can reflect the presence and severity of glaucoma
 - iii. Pros and Cons
 - iv. Recommending in office ERG measurements
- h. Genetic testing for glaucoma risk

10. Q&A / Discussion