Today's Research for Tomorrow's Treatment: What is in the Pipeline

Melissa Barnett, OD, FAAO, FSLS, FBCLA
77 Cadillac Drive, Suite 101
Sacramento, CA 95825
drbarnett@ucdavis.edu

Milton M. Hom, OD, FAAO
Canyon City Eyecare
822 East Alosta #A
Azusa, CA 91702-2706
eyemage2@gmail.com

Justin Schweitzer, OD, FAAO
Vance Thompson Vision
3101 West 57th Street
Sioux Falls SD 57108-3162
justin.schweitzer@vancethompsonvision.com

Every medical breakthrough in history was born through research, and eyecare is at the zenith of research today. This lecture will touch on new strategies, technologies, and drug classes to treat chronic conditions including glaucoma drug delivery, advancements in cornea and cataract surgery, increasing myopia, Demodex infestation, meibomian gland dysfunction, and presbyopia.

Course Learning Objectives:

1. Understand why myopia is an epidemic
2. Learn about future pharmaceutical options for meibomian gland dysfunction
3. Understand new techniques for glaucoma drug delivery
4. Become knowledgeable of advancements in cataract surgical procedures
5. Discuss the implementation of novel technologies
6. Understand contact lens drug delivery

Outline

I. Myopia- new drug class (12 min)
   a. The Need
      i. Myopia is not a condition, it is an “epidemic”
      ii. Historically, there has never been a time when myopia has been so prevalent
      iii. Record-breaking numbers of myopia
   b. Current treatments
      i. Treatments
         1. Spectacle multifocals
         2. CL multifocals
         3. MiSight soft lenses
         4. Ortho-K
         5. Other
   c. Current tools
      i. Myopia management calculator
      ii. Review of myopia management
      iii. Papers
   d. The drugs
      i. Atropine and atropine derivatives
         1. Mechanism of Action (MOA)
      ii. Past clinical studies
      iii. Current clinical studies

II. Demodex- new drug class (12 min)
   a. The Need
      i. Demodex is the most common ectoparasite in humans
      ii. 100% prevalence 70 years old +
   b. Current treatments
      i. Tea Tree oil
         1. “100% tea tree oil was found to have the most rapid kill time when compared to all other treatments, including 100% caraway oil, 100% alcohol, 10% povidone-iodine and 4% pilocarpine.”
         2. MOA
         3. Tea tree symptoms – burning, stinging, hurts
         4. Corneal damage risk
      ii. Ivermectin
         1. MOA
   c. The drug(s)
      i. Studies From Veterinary medicine
      ii. Paralysis of the mite
      iii. Video

III. Meibomian gland dysfunction (MGD)- new drug class? (12 min)

a. The Need
    i. Most dry eye is MGD
b. Current treatments
    i. Obstruction vs Anti-inflammatory
    ii. Mechanical device treatments
c. The drugs
    i. Novaliq
    ii. Hovione
        1. Tetracycline class: minocycline
        2. MOA
        3. Relevant studies

IV. Innovations in Glaucoma Drug Delivery (20 min)
a. Overview of the various glaucoma drug delivery devices being evaluated in the space
b. Patients' attitudes towards drug delivery
    i. Wang et al. Digit J Ophthalmol. 2018;24(3): 16-23
c. Glaucoma Drug Delivery Procedures
    i. Microdose latanoprost
        1. Phase 2 study results – Pasquale, et al.
    ii. Punctal Plug Delivery Systems
        1. Latanoprost and Travoprost designs
        2. Intracanalicular insert
            a. Bioresorbable sustained-release travoprost (Preservative free)
    iii. Bimatoprost SR – FDA approved
        1. 10-microgram bimatoprost sustained-release implant
        2. Craven et al. Drugs 2020 – 24 month Phase I/2 Clinical Trial data
    iv. Travoprost intraocular implant
        1. Resides in AC, anchored behind the TM
        2. 36 month data update
    v. Travoprost intracameral implant
        1. Bioresorbable sustained-release implant injected into AC
        2. Phase 1, prospective trial data
d. Topical Glaucoma Medications
    i. Omidenepag Isopropyl (OMDI)
        1. Selective, non-prostaglandin, prostanoid EP2 receptor
        2. Phase 3 AYAME Study
        3. Advantage – no PGA side effects

V. Advancements in Cornea (12 min)
e. Descemetorhexis (without EK)
    i. Patient selection – presence of central guttae and clear peripheral cornea
    ii. Recovery – mean time around 3 months
    iii. Intracameral fibroblast growth factor
f. IOTA Cell Therapy
    i. Definition and description of the procedure

g. New treatments for NK
    i. dHGF
        1. accelerates healing
        2. anti-fibrotic
        3. neurotrophic
        4. anti-inflammatory

VI. Advancements in Cataract Care (12 min)

h. IOL Technology
    i. Trifocal Technology
        1. The goals and the designs
    ii. Light Adjustable Lens
        1. How it works and how treatments are performed
    iii. Modular IOL systems
    iv. Small Aperture lens designs
    v. Accomodating IOL's
        1. Juvene
        2. FluidVision
        3. Lumina

VII. Reversal Mydriasis (5 min)

a. Is it necessary?
    i. 6 to 24 hours of impaired vision that includes
        1. Inability to focus, photophobia, cycloplegia, etc
    ii. Phentolamine
        1. Alpha – 1 blocker so only affects the iris dilator muscle. Decreases pupil size independent of the iris sphincter or ciliary muscle.
        2. Safety Profile - No systemic effects, Minimal headaches
        3. Summarize the MIRA FDA Clinical Trials (MIRA-2 and MIRA-3

VIII. Presbyopia (5 min)

a. Phentolamine ophthalmic solution (POS) 0.75%
    i. MOA is on the iris dilator inhibition
        1. Evening drop
        2. Moderate pupil reduction
b. Low Dose Pilocarpine (0.4%)
    i. MOA on sphincter and ciliary muscle
        1. Daytime drop
c. Review of the VEGA-1 Study

VIIII. Contact Lenses for Drug Delivery (15 min)

a. Overcome the limitations of eyedrops
    i. Extended residence time
    ii. Decreased pulsatile delivery
    iii. Controlled delivery
    iv. More local delivery to the posterior segment
b. Contact Lens Drug Delivery Systems Currently in Development (per Publicly Available Information)

i. Seasonal allergic conjunctivitis - Johnson & Johnson Vision with etafilcon A contact lenses with 0.019 mg ketotifen
ii. Latanoprost (glaucoma) and dexamethasone (inflammation) - Ciolino et al.
iii. Prostaglandins for glaucoma - Leo Lens
iv. Anti-inflammatory and antibiotic agents - OcuMedic

c. Scleral lenses
    i. Persistent epithelial defects
        1. With non-preserved antibiotics
    ii. Corneal infiltrates
        1. With fortified non-preserved antibiotics
    iii. Corneal neovascularization
        1. Anti-VEGF agents
    iv. Chemical burn
        1. Stem cells on a scleral lens carrier - animal model

d. Case examples

2. Smart Contact Lenses (5 min)
    a. Component containing lenses
        i. Soft
            1. Polarizer and micro lens
                a. Combine with smartglasses
            2. Deformation wire
                a. Establish diurnal variation correlated with IOP
        ii. Scleral lenses
            1. AR scleral