Two Steps to Receive CE Units

- Complete the course evaluation
- Hand in your course ticket at the conclusion of this course

Speaker Disclosures

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A Little Vocabulary

- **Referral**: A doctor sends a patient to another doctor or specialist to manage and treat a particular problem including a complete transfer of care.
- **Consult**: A doctor sends a patient to another doctor or specialist to evaluate a particular problem and issue a report back to the primary physician; transfer of care does not occur.
- **Co-Management**: The planned transfer of care during the global period from the operating surgeon to another qualified provider when clinically appropriate.
Valid Co-Management

- Transfer of Care
  - The transfer of care from the surgeon to the co-managing optometrist can only occur when it is medically acceptable.
  - Determination of medical acceptability must be made by the surgeon AND the patient.
  - The specific date for transfer of care must be officially documented prior to the surgery.

- Informed Consent
  - The patient must sign a written agreement to be co-managed.
  - Both the surgeon and the co-managing provider must keep a signed copy of the agreement in the patient’s medical file.

Billing Co-Management Services

- Reimbursement for post-operative care of ophthalmic procedures is 20% of the surgical fee allowance.
- If more than one doctor provides post-operative care, payments will be divided based on the number of days for which each doctor was responsible.
- Commercial payors may have different guidelines and some commercial plans may not allow for co-management.

Billing Co-Management Services

- The surgeon must initiate the process by submitting the claim for surgery with the medical insurer.
  - The 54 modifier is added if the patient will be co-managed.
  - Ex: Cataract Surgery (Right Eye) = 41094 RT 54

- The co-managing provider submits a claim after the first visit at which the patient is examined.
  - Date of service is the date of surgery.
  - 55 modifier is required.
  - Date of transfer of care must be noted in box 19.
  - Ex: Cataract Surgery (Right Eye) = 41094 RT 55.

The (Almost) Game-Changer

- In 2014 CMS issued a bulletin implementing a plan to move all surgical procedures to a global period of 0 days.
- Targeted cardiovascular, orthopedic, and ophthalmological surgeries.
- Stiff resistance encountered from organized medicine.
- Congress passed MACRA in 2015.
- Ended the sustainable growth model for Medicare.
- Banned CMS from implementing their plans for surgical global periods.
- Directed CMS to obtain data from a "representative sample of physicians" to determine proper reimbursement (begins 1/1/2017).

Co-Management of Common Ophthalmic Procedures

Cataract Surgery Statistics

- 3.6 million cataract surgeries performed in 2015.
  - Approximately 19,000 practicing ophthalmologists in the U.S.A.
  - Approximately 9,000 ophthalmologists perform cataract surgery.
Modern Cataract Surgery

- May utilize femtosecond laser technology
- May utilize intraoperative aberrometry to guide lens selection
- "Drop-less" protocol reduces post-operative costs
  - A combination of steroids and antibiotics are injected into the vitreous and sub-Tenon’s space to reduce post-op inflammation and discomfort

Modern Cataract Surgery

- Multitude of IOLs
  - Toric (AcrySof IQ, Tecnis Toric, Staar Toric)
  - Helpful Hints
    - Every degree of misalignment results in a 3.3% reduction in cylinder correction
    - Consider dilating toric IOL patients on day 1 to quickly identify a misaligned IOL

Modern Cataract Surgery

- Multifocal correction
  - Multifocal IOLs (Acrysof Restor, Tecnis Multifocal)
  - Accommodative IOLs (Crystalens, AcrySof Toric IOL)
  - Every degree of misalignment results in a 3.3% reduction in cylinder correction
  - Patients must wear UV blocking glasses
  - Extended Depth of Focus Lenses (Toric Symfony)
    - Elongated focal point intended to smooth out dips in the defocus curve
    - Less glare and halos but near vision slightly less than that of multifocal IOLs

New IOL Option

- Light Activated Lens
  - Allows for customization based on patient’s resultant Rx following post-operative healing
  - Requires 2-3 light delivery treatments to finalize Rx
  - Patients must wear UV blocking glasses until final treatment is delivered

LAL: The Process

- Patients must be able to be fully dilated to 7-8 mm in order to receive the full treatment
- Failure to wear UV blocking glasses may cause the lens to prematurely “lock”
- Extra visits
General Complications

- Corneal Edema
  - Very common near incision sites
  - Self-limited unless endothelium is compromised
- Elevated IOP
  - 18-45% of patients have IOPs >21 mmHg immediately after surgery
  - In healthy patients IOPs need to be treated when approaching 40 mmHg
    - Typical anti-glaucoma meds (alpha-agonist, CAI, beta-blocker)
    - Wound paracentesis

Burping the Wound

Potential Complications

- Retained Lens Material
  - Fragments may be residual from nucleus or cortex
  - More common in high myopes and those with miosis/pupils

Proper Management

- Identification
  - Fragments present in the anterior chamber (must rule out fragments in angle)
  - Corneal edema that fails to resolve
  - Intraocular pressure despite treatment
- Treatment
  - Switch to prednisolone acetate if not currently in use
  - Increase predacetate 1% to q2h
  - Refer to surgeon for possible removal of retained material if condition fails to resolve
    - Cortex is phagocytosed, nucleus must be surgically removed

Post-Operative Complications

- Cystoid Macular Edema
  - Most common cause of decreased vision in patients after cataract surgery (1-3%)
  - 50% chance of occurrence in fellow eye if present in first eye
  - Causes
    - Vascular
    - Identify high-risk patients
      - Diabetes
      - Vascular Occlusions
      - Uveitis

Arachidonic acid cascade

[Diagram of the arachidonic acid cascade]
Proper Management

• Identification
  • Commonly presents between 2-4 weeks post-operatively
  • Unable to correct patients to expected visual acuity; OR
  • More hyperopic refraction post-operatively than expected

Proper Management

• Treatment
  • Prophylactic – injectable anti-inflammatories at time of surgery
  • Initial Presentation – switch to prednisolone acetate or Durezol and add NSAID
  • Recalcitrant Cases – refer to retina specialist for Sub-Tenon’s or intravitreal injection
  • Rare (but possible) to require anti-VEGF injections

Post-Operative Complications

• Endophthalmitis**
  • Onset 3-7 days following surgery
  • Corneal edema, blurred vision, A/C reaction with hypopyon
  • Vitreous is clear

• Toxic Anterior Segment Syndrome (TASS)
  • Onset 1-3 days following surgery
  • Corneal edema, blurred vision, A/C reaction with hypopyon
  • Vitreous is clear

Co-Management of Keratoconus

International Keratoconus Academy of Eye Care Professionals
www.keratoconusacademy.com

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Mission: To promote and develop the knowledge base and awareness of the state of the art pertaining to the diagnosis and management of keratoconus and other forms of corneal ectasia. And further to promote the awareness and understanding of the most appropriate and effective treatment strategies for the management of these diseases.

MEDICAL ADVISORY BOARD
Optometry: Barry Weisman, Louise Skalens, Christine Deahl, Jeff Seminos, Lynett Johns, Robert Davis, Tim Edrington, Melissa Barrett, Susan Grooms, Ryan McGinnis, Ed Bennett, Steven Girnkar, Jan Bergmanson.
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**Corneal Hydrops**
**Munson's sign**
**Apical Scarring**
**Pachymetric Anomalies**
**Post. Corneal/Elevation**
**Biomechanical/Weakness**
**Fleischer's Ring**
**Vogt's Striae**
**Irregular Mires**

**Early Keratoconus: Causes**

- Genetics
  - 1 in 10 chance of a blood relative of a keratoconic patient developing keratoconus
- Environmental
  - Eye Rubbing
  - Allergies
  - Oxidative Stress

**CXL: A Little History...**

- Cross-linking has been used for centuries to tan leather
- Dentists have used it for 25 Years to stiffen plastic materials
- Dermatologists have used it to tighten collagen fibers in sagging skin
- Why not use it on weakened corneas to arrest keratectasias?

**CXL: Mechanism of Action**

- Corneal CXL is a medical procedure that incorporates photothermal principles
  - Light source + photoactivating agent
  - UVA absorption by riboflavin generates singlet oxygen essential for formations of new corneal links

- Cross-linking:
  - Creates new corneal collagen cross-links
  - Early results show shortening & thickening of collagen fibrils
  - Leads to the stiffening of the cornea

**CXL: Then and Now**

- Liquid formula
- UV Light

**Riboflavin + UVA vs. Riboflavin Only (30min Treatment)**

- Anterior View
- Posterior View

**Notes: Cross-linking has been used for centuries to tan leather. Dentists have used it for 25 Years to stiffen plastic materials. Dermatologists have used it to tighten collagen fibers in sagging skin.**
CXL IN THE USA

• Avedro received FDA approval in 2016
  - Progressive KC (04/16)
  - Post-refractive surgery ectasia (07/16)
  - Photrexa Viscous/Photrexa + KXL System

CXL IN THE USA

INDICATION AND USAGE
Photrexa Viscous and Photrexa are photoenhancers indicated for use with the KXL System in corneal collagen cross-linking for the treatment of progressive keratoconus.

CONTRAINDICATIONS
None

WARNINGS AND PRECAUTIONS
Ulcerative keratitis can occur. Monitor for resolution of epithelial defects.

ADVERSE REACTIONS
The most common ocular adverse reactions in any CXL-treated eye were corneal opacity (haze), punctate keratitis, corneal striae, corneal epithelium defect, eye pain, reduced visual acuity, and blurred vision.
CXL IN THE USA

- Epi-Off
  - Removal of epithelium prior to application of riboflavin
  - Ensures penetration of riboflavin throughout cornea
  - Potential complications
    - Delayed healing time
    - Increase in pain
    - Potential for scarring

Epi-Off Complications

- Retrospective review from 2007-2012 in Europe:
  - 286 eyes in 180 patients
  - 28 complications in 23 eyes
    - Delayed epithelial healing (6 eyes)
    - Hyperproliferative epithelial healing (2 eyes)
    - Stromal infection (3 eyes)
    - Infection (2 eyes)
    - Microbial infection (1 eye)
    - Corneal edema (1 eye)

TX Emergent Adverse Events (TEAEs)

- In 293 KC eyes, the most common ocular AE in CXL-treated eyes were corneal opacity (haze), punctate keratitis, corneal striae, corneal epithelium defect, eye pain, reduced visual acuity, and blurred vision

TX Emergent Adverse Events (TEAEs)

- During Mth 1: Majority of adverse events reported resolved
  - Up to Mth 4: Corneal epi-defect, corneal striae, punctate keratitis, photophobia, dry eye and eye pain, and decreased visual acuity
  - Up to Mth 12: Corneal opacity or haze
  - In 1-2% of patients, corneal epithelium defect, corneal opacity and corneal scar continued to be observed at 12 Mths

Epi-On Complications

- Question of Efficacy
  - Up to 5X more corneal stiffening in lab animals with epi-off
  - Progression of KCN noted in early retrospective review
- Early Conclusions
  - Loading time of 60-80 minutes required
  - Questionable results
  - Riboflavin mixed with Dextran cannot permeate the intact epithelium

Epi-On: The Solution

- Riboflavin
  - Develop hypotonic formulations without Dextran
- Treatment of Epithelium
  - Break hemidesmosome with pharmaceuticals
- Patient Evaluation
  - Evaluate patients for riboflavin penetration rather than reliance on rigid timing rules
EPI-ON: THE PROCEDURE

- Epi-On
  - Epithelium is softened through application of anesthetic
  - Riboflavin is alternated with the anesthetic for 45-60 minutes
  - Treatment to ensure full penetration of riboflavin

EPI-ON: OUR PROTOCOL

- Modified Epi-On Procedure
  - Removal of 5 microns of tissue with the excimer laser
  - 25 minutes of riboflavin loading
  - Patient evaluation prior to treatment
  - Epi-off required for corneal thicknesses less than 400 microns
    - Ensures maximal stromal swelling to protect against UV damage

SELECTION OF CANDIDATES

- Avedro (FDA criteria)
  - 14 years of age or older
  - Progressive keratoconus
  - Ectasia post-refractive surgery

- CXLUSA
  - At least 9 years of age (mirrors European criteria)
  - KCN/Ectasia/Pellucid
  - Post-RK Visual Fluctuation

PRE-OPERATIVE MANAGEMENT

- Management of Expectations
  - No inherent refractive correction
  - Stabilization of corneal structure
  - Pain Management

- Refractive/Contact Lenses
  - No contacts for four days prior to final pre-op exam
  - No contacts for 1 week prior to procedure
  - No contacts for 10-14 days following the procedure

POST-OPERATIVE MANAGEMENT

- The “Givens”
  - Steroid
  - NSAID
  - Antibiotic
  - Bandage CL
  - Preservative Free Artificial Tears
**POST-OPERATIVE MANAGEMENT**

- The “Nuances”
  - When do you remove the bandage CL?
  - How do you handle complications?
  - What are effective pain management techniques?
  - Does the type of procedure require alterations to the treatment plan?

- Epi-Off CXL
  - The use of the bandage lens is recommended until re-epithelialization occurs.
  - Stop the NSAID after 1 week.
  - Stop the antibiotic once epithelium is intact.
  - Balance the use of the steroid so as to eliminate scarring vs. inhibiting re-epithelialization.
  - Use copious amounts of artificial tears.

- Epi-On CXL
  - Bandage CL can typically be removed next day.
  - Stop the NSAID after 1 week.
  - Taper the steroid over 2 weeks.
  - Use artificial tears liberally.

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**Congenital Cataracts**

- Incidence
  - Affects 1 in 1,000 children from birth to adolescence.
  - More than 200,000 children are blind from an unoperated cataract.

- Etiology
  - Approximately 50% of childhood cataracts are the result of genetic mutations in the genes that code for proteins involved in lens clarity and structure.
  - Trauma.
  - Other.

- Types
  - Congenital/Infantile.
  - Juvenile/Acquired.

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**Co-Management of Complex Ocular Cases**

- Red Flags
  - Opacity on red reflex test at 6-8 weeks.
  - Lack of a strong red reflex.
  - Leukocoria.
Pediatric Cataract Surgery

- Post-Operative Medical Management
  - Topical steroids for 4-8 weeks
  - Topical antibiotics for 1-2 weeks
  - "Dr. Pierre has been taking advantage of sub-Tenon's injections and utilizing generic Maxitrol BID x 4 weeks"

Pediatric Cataract Surgery

- Post-Operative Refractive Management
  - Failure to correct the child properly will result in deprivation amblyopia similar to that if the cataracts had been left in place
  - Soft Contact Lenses
    - scleral = Silsoft (B&L)
  - Children and Adolescents = Proclear Compatibles and Biofinity XR
  - Corneal RGP's
  - PedoLites

Pediatric Co-Management

- A 2-month-old female is referred for evaluation of possible congenital cataracts
- Presence of cataracts is confirmed in conjunction with iris colobomas
- Surgery is scheduled within two weeks for the right eye followed by the left eye two weeks later

Pediatric Co-Management

- Post-Operative Results
  - Uncomplicated removal of cataracts
  - Recalcitrant IOP = 45 mmHg at 1 week post-op
  - Patient placed on Codiocan BID and goniotomy to be performed at time of left eye cataract surgery
Pediatric Co-Management

- Patient referred for contact lens fitting
- Prior to referral baseline information allowed for the ordering of initial RGP's
- Refractive Data
  - +10.00 DS OU/10.00 WTB / 45.50 X 45.00 approx OU
- Lens Parameters
  - 7.76/9.0/+25.00 DB

Pediatric Co-Management

- Initial Dispensing
  - Right eye exhibited 2.5D of residual myopia = perfect
  - Left eye exhibited a slightly flat fit
  - Over-refraction of +0.50 DS
- Final Lenses Dispensed
  - OD: 7.76/9.0/+25.00
  - OS: 7.67/9.0/+26.50

Pediatric Contact Lenses

- Billing
  - No co-management fee as post-operative visits were managed by Dr. Pierre
  - Fitting of Aphakic Contact Lenses
    - 92311 – one eye
    - 92312 – bilateral
    - V2510 (2 units) – corneal RGP's

Pediatric Co-Management

Co-Management of Ocular Trauma
Prevalence of Ocular Trauma

- Prevalence of ocular trauma has remained stable over past 20 years
- 500,000 people blind worldwide from ocular trauma
- 40% of monocular blindness related to trauma
- Most common traumatic event is related to fireworks

Ocular Trauma

- Four major types of trauma
  - Primary injury – eye is damaged from the shockwave itself
  - Secondary injury – eye is damaged by fragments or shrapnel
  - Tertiary injury – eye is injured due to the individual contacting another object
  - Quaternary injury – eye is injured by indirect forces or burns

PATIENT HISTORY

- 46 year old male s/p black powder explosion at home
- Diffuse embedded foreign bodies deep within the corneal stroma of each eye
- Had attempted corneal RGPs at another practice but found them uncomfortable
- Complains of excessive glare and halos while driving

REFRACTIVE INFORMATION

- Spec Rx:
  - OD: -1.25 -3.75 x 030 20/30 (with ghosting)
  - OS: -1.00 -0.50 x 100 20/20 (with ghosting)
- Keratometry:
  - OD: 43.50/45.37
  - OS: 43.50/44.00
- Pupil Size – Approx. 2.75-3.00 mm
- Corneal Diameter: Approx. 11.75 mm

SLIT LAMP IMAGES

TOPOGRAPHY

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EVALUATION OF LZ
“TOE DOWN” ALL AROUND

LENS FITTING: 400 um clearance

LENS PARAMETERS

- TROUBLESHOOTING FROM TRIAL LENS
  - Decrease peripheral curve by two steps in both meridians
  - Lower numbers = flatter approach to sclera
  - Decrease vault by 200 microns
  - Determined by observing suggested first trial lens

- LENS ORDERED:
  8.40/16.0/+1.75 -1.50 x 040
  - PCs: 34/40 (initial 36/42)
  - Vault: 3400 (initial 3600)
  - Material: Menicon Z

FINAL LENS IMAGES: 188 um

FINAL LENS IMAGES

Scleral Lenses for Surgical Complications

- 68 year old female presents secondary to poor vision after cataract surgery
- Surgery initially appeared to be uncomplicated
- Vision steadily decreased over the first 24 hours following surgery
Endothelial Burns

• The End Result
  - Uncorrected VA = 20/100
  - Spectacle BCVA = 20/70

Scleral Lenses and Surgical Complications

• Specific Challenges
  - Compromised Endothelium
  - Small Apertures
  - Decreasing Dexterity
  - Use a Corneal GP
    - Well, we tried...
    - Patient was unable to tolerate several corneal designs

• Michaud Criteria
  - To ensure adequate oxygen supply (and reduce hypoxic stress) the following should be followed:
    - Lens thickness of no more than 250 microns
    - Clearance of the cornea by no more than 200 microns
    - Utilize a high-dK material

• Which lens design most closely holds to this philosophy?
  - OneFit platform
    - 7.50/15.2/+4.00 DS  110 CCR  Optimum Extra

• Results
  - Patient is able to obtain 20/25 vision during waking hours
  - Smaller overall diameter which improved ability to properly apply the lens
  - Oxygen delivery is maximized

Co-Management of Ocular Trauma

• 12 year old female was attending a family barbecue
• Mother opened the door for a family member, and...
  - Skewered her daughter's left eye
Late on a Saturday night the following was performed:
- Repositioned iris
- Removal of traumatic cataract and insertion of PCIOL
- Suturing of cornea and repair of ruptured globe

1 Month Post-Op
- MR: 3.75 - 3.25 x 175 (BCVA 20/70)
- No evidence of endophthalmitis
- Loose suture removed from inferior cornea
- Referred for contact lens fitting to improve vision
  - Wears -6.00 DB daily CLs in right eye

Elevation Differences
- Differences of greater than 100 microns on Pentacam have difficulties with corneal RGP

Corneal Physiology
- Certain endothelial loss due to trauma
- Concerns about oxygen delivery to cornea through contact lens

Corneal Sutures
- Poor fitting lens may mechanically irritate corneal sutures
Plan of Action

- Scleral Lens
  - In order to manage the differences in corneal elevation while properly managing physiologic concerns an attempt at fitting a scleral lens was made with the following goals:
    - 100-200 microns of clearance at the end of the day
    - Hyper-K material
  - Even a scleral lens was unable to meet the proper clearance criteria due to the differences in corneal elevation

Final Solution

- EyePrint Pro

3-D Scans

Final Results

- Final EyePrint Parameters
  - 7.67/17.0/-2.50 DS
  - Optic Zone of 10.3 mm
  - Optimum Extreme material (DK/1 125)
  - 20/15 vision

Co-Management of Ocular Trauma

- No co-management fee related to surgery
- Medical office visits billed every time
- EyePrint = $$

More Trauma
Damage Control

- Despite our best attempts the cornea became densely scarred
- 20/80 BCVA
- Patient complained about chronic discomfort
- Utilized a soft lens to eliminate discomfort until sutures could be removed

Why end on a down note?

- Without the “downs” we would not appreciate the successes
- Cherish your successes
- Celebrate with patients

Take Home Message

- In order to effectively co-manage one must…
  - Be familiar with the procedures being performed
  - Adept at identifying complications
  - Confident in your abilities

Thank You!