



College of Optometry
UNIVERSITY OF HOUSTON

CE in **Dallas**

April 6-7, 2024



Sunday Handouts

Conference Director

Marcus Gonzales, OD, FAAO ABO Diplomate

CE in Dallas

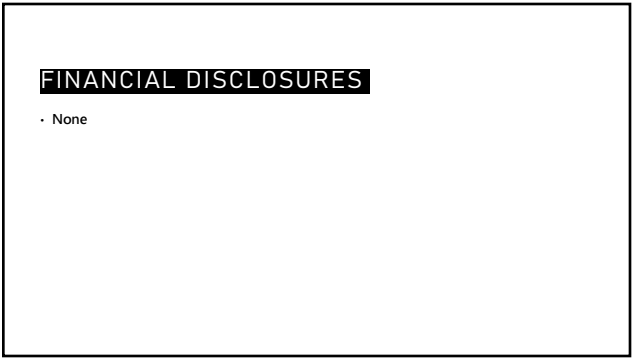
April 6-7, 2024

Sunday, April 7, 2024

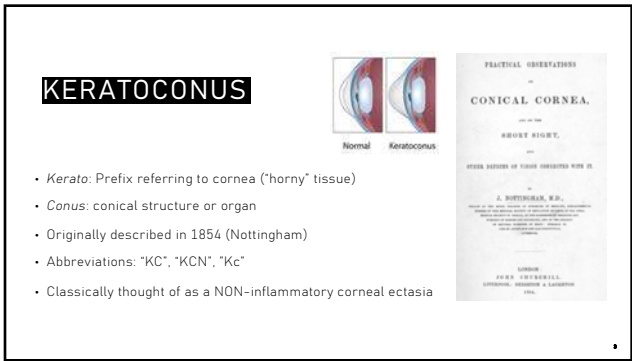
7:00 am - 8:00 am	Check-In, Continental Breakfast, & Exhibit Hall		
8:00 am - 8:05 am	Announcements & CE Credit Overview		
8:05 am - 8:55 am	Keratoconus: Disease Etiology & Management <i>Maria Walker, OD, PhD, FAAO</i>	1 D/T Hour	COPE ID # 90224-TD
8:55 am - 9:45 am	Keep It Real: Relevance of Scleral Lens Research in Clinical Care <i>Maria Walker, OD, PhD, FAAO</i>	1 D/T Hour	COPE ID # 90225-CL
9:45 am - 10:15 am	Break		
10:15 am – 11:05 am	Contact Lens Innovations & Advancements <i>Maria Walker, OD, PhD, FAAO</i>	1 GEN Hour	COPE ID # 90227-CL
11:05 am – 12:00 pm	Kids & Contacts <i>Maria Walker, OD, PhD, FAAO</i>	1 D/T Hour	COPE ID # 84509-CL
12:00 pm - 1:00 pm	Lunch		
1:00 pm - 1:50 pm	Ocular Manifestations of Herpes Virus from Cornea to Retina <i>Viviana Gonzalez, OD</i>	1 D/T Hour	COPE ID # 90015-TD
1:50 pm - 2:05 pm	Break		
2:05 pm - 2:55 pm	Ball Room 1		
	Opioids Prescribing Course <i>David Dinh, OD, FAAO</i>	1 D/T Hour	COPE ID # Pending
	Ball Room 2		
	Basics of Strabismus Surgery <i>Becky Luu, OD, FAAO</i>	1 D/T Hour	COPE ID # 90019-PO
2:55 pm - 3:05 pm	Break		
3:05 pm - 3:55 pm	Ball Room 1		
	2024 Professional Responsibility Course for Texas Optometrists <i>Andrew Kemp, OD, FAAO</i>	1 GEN/PR Hour	COPE ID # 89780-EJ
	Ball Room 2		
	Pediatrics Red Eyes and the Amblyopia that Follows <i>Becky Luu, OD, FAAO</i>	1 D/T Hour	COPE ID # 90320-FV
3:55 pm - 4:05 pm	Break		
4:05 pm - 5:00 pm	Ball Room 1		
	Identification and Response to Human Trafficking in Healthcare <i>Jason Spees, MSN, MaOM, APRN</i>	1 GEN/ HT Hour	COPE ID # 90021-PB
	Ball Room 2		
	Beyond the C/D Ratio <i>Marcus Gonzales, OD, FAAO</i>	1 D/T Hour	COPE ID # 90020-GL



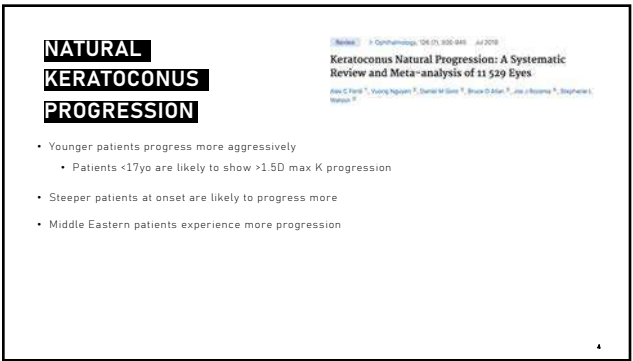
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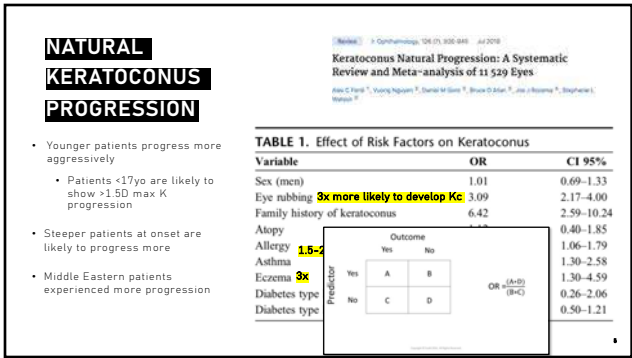
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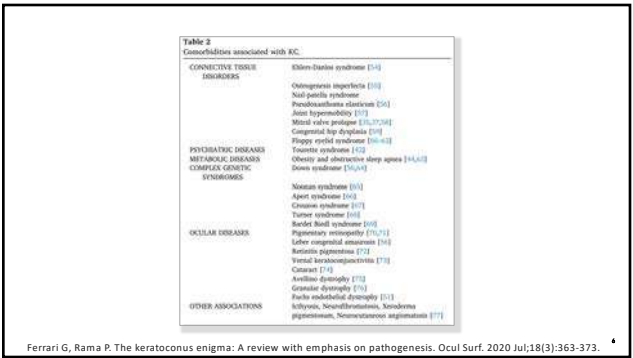
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EHLERS-DANLOS SYNDROME

- Connective tissue disease
- Reduced lumican, keratocan, and decorin
- COL2A1, COL5A1, TNXB, and ZNF469 gene variants



Fransen E et al. Resequencing of candidate genes for Keratoconus reveals a role for Ehlers-Danlos Syndrome genes. Eur J Hum Genet. 2021

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MITRAL VALVE PROLAPSE



Fig. 21. Phenotype of mitral valve prolapse in patients with keratoconus compared to controls. (A) Higher resolution / color version of this figure is available in the electronic page of this article.

- Connective tissue disease
- Occurs in 3-5% of the population
- Mitral valve leaflets and chordae are "extra stretchy"

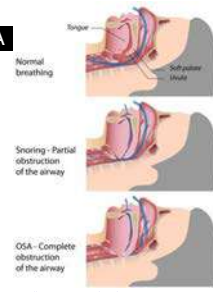
Sodi JA, Franco JC. The association between keratoconus and mitral valve prolapse: a meta-analysis. Current Cardiology Reviews. 2020;16:147-152

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OBSTRUCTIVE SLEEP APNEA

- Affects 24% KC patients
- Prevalence in KC >20x higher than in general population

Study (year)	Odds ratio	95% CI	P-value
Gilmore et al ¹ (2014)	1.408	0.548 - 3.603	478
Naderian et al ² (2015)	2.007	1.398 - 3.025	101
Philblad & Schaefer ³ (2012)	12.130	0.302 - 448.498	105
Saiki et al ⁴ (2012)	3.054	1.650 - 5.651	< .001
Woodward et al ⁵ (2016)	1.226	1.147 - 1.311	< .001
	1.841	1.163 - 2.914	.008



Philblad MS, Schaefer DP. Eyelid laxity, obesity, and obstructive sleep apnea in keratoconus. Cornea 2013;32:1232-6.

Pedrotti E, et al. Obstructive sleep apnea assessed by overnight polysomnography in patients with keratoconus. Cornea 2018;37:470-3.

Sollmann M, Benabib F, Erdmann R, Gollmann R. Obstructive sleep apnea and keratoconus: a systematic review and meta-analysis. BMC 2020; 19:57111

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OTHER SYSTEMIC ASSOCIATIONS

- Marfan syndrome
 - not supported by recent review
- Tourette disease
 - may be associated with eye rubbing
- Down syndrome
- Obesity
- Complex genetic syndromes
- Diabetes protective?
 - accelerated corneal cross-linking?
 - controversial

Table 3	Connectivities associated with KC.
CONNECTIVE TISSUE DISORDERS	Ehlers-Danlos syndrome [14]
	Osteogenesis imperfecta [15]
	Neel-Pedley syndrome
	Pseudotumor cerebri [16]
	Joint hypermobility [17]
	Mitral valve prolapse [18,19,20]
	Congenital hip dysplasia [21]
	Floppy eyelid syndrome [22-24]
	Tourette syndrome [25]
	Obesity and obstructive sleep apnea [24,26]
	Down syndrome [24,27]
PSYCHIATRIC DISORDERS	Narcolepsy [28]
	Apert syndrome [29]
	Crouzon syndrome [30]
	Tourette syndrome [31]
	Barclay-Bell syndrome [32]
	Pigmentary keratopathy [33,34]
	Leber congenital amaurosis [35]
	Keratitis pigmentosa [36]
	Familial keratoconus [37]
	Cataract [38]
	Axial myopia [39]
	Granular dystrophy [40]
	Fuchs endothelial dystrophy [41]
	Adhuc, Neuroinflammation, Syndromes
OTHER ASSOCIATIONS	psoriasis, Neuroinflammation, Syndromes

Marfan syndrome: The eye in the Marfan syndrome. Trans Am Ophthalmol Soc 1981;79:688-720

Waller RS, Kumar NL, Bhatnagar RJ, Bhatnagar DS. Keratoconus caused by eye rubbing in patients with Tourette Syndrome. Can J Ophthalmol 2011;44:83-4.

Philblad MS, Schaefer DP. Eyelid laxity, obesity, and obstructive sleep apnea in keratoconus. Cornea 2013;32:1232-6.

Naderian M et al. Association between diabetes and keratoconus: a case-control study. Cornea 2013;32:1271-3.

Rezaei S, Bhatnagar S, Bhatnagar S, Bhatnagar S. Is there an association between diabetes and keratoconus? Ophthalmology 2016;123:184-90.

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OCULAR ASSOCIATIONS

- Floppy Eyelid Syndrome
 - oxylatan fibers present and altered MMP levels seem to be present in both
- Cataracts, granular dystrophy type II, Fuchs dystrophy
 - Chance? Genetics predisposed to oxidative damage?
- Vernal keratoconjunctivitis, allergies, eczema, atopy, eye rubbing



Esra DG, Beaconsfield M, Sira M, Bunce C, Wormald R, Collin R. The associations of floppy eyelid syndrome: a case control study. Ophthalmology 2010;117:811-8.

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INFLAMMATION IN KERATOCONUS

- Elevated proteolytic activity (MMP-9, MMP-2) and reduction of MMP inhibition (TIMPs)
- Inflammation:
 - IL-6 increased
 - TNF-alpha increased
 - IL-17 increased
 - IL-12 reduced
 - CCL5 reduced
 - Zinc-alpha2-glycoprotein reduced
 - IGG kappa chains reduced
 - Lactoferrin reduced



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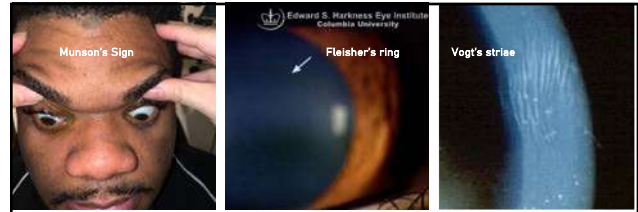
- Inferior thinning and ectasia
- Rabinowitz Criteria:
 - KISA%:
 - K value (max >47.20)
 - Inf/Sup (>1.40 Asymmetry)
- Classic Prevalence cited: 1 in 2000 individuals (Kennedy et al. 1986) [range .0003% - 2.5%]

THE HUMAN IMPACT OF KC

- Usual onset late 2nd or early 3rd decade
- Blurry vision
- Highly aberrated
- Glare
- Glasses unable to improve



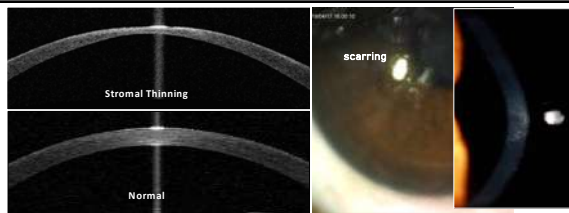
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Clinical signs of Keratoconus (KC)

- Obvious outward protrusion (Munson sign)
- Iron deposition in basal epithelium (Fleisher's ring)
- Stress lines (usually vertical) in the posterior stroma (Vogt's striae)

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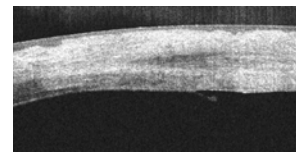
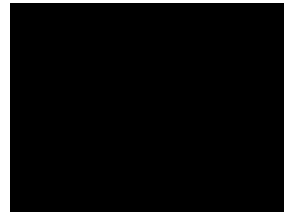


Clinical signs of Keratoconus (KC)

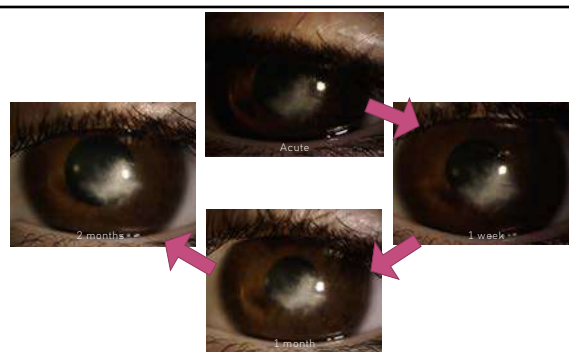
- Stromal thinning (and protrusion)
- Leads to corneal scarring in the anterior stroma (most common) and ultimately can scar all layers (epi, stroma, lesser extend endo)

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SEVERE KC CAN LEAD TO HYDROPS



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HISTOPATHOLOGY OF KC

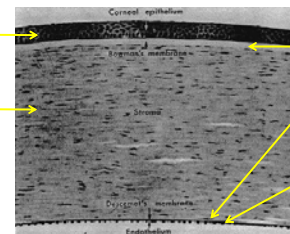
Epithelium:

- 50µm thick

- 4-6 layers of non-keratinized stratified squamous epithelial cells

Stroma:

- Primarily collagen (I)
- Proteoglycans: decorin, biglycan, lumican, keratan, osteoglycin/mimacan



- Anterior Limiting Lamina (Bowman's):
- 8-12µm thick
- Collagen fibrils weave into the stroma

- Posterior Limiting Lamina (Descemet's):
- Collagen VIII
- 5-10µm thick

- Endothelium:
- 5µm thick
- Single sheet of cuboidal cells

Normal Cornea

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THE KERATOCONUS CORNEA

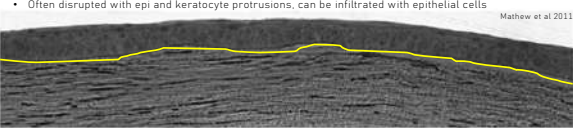
EPITHELIUM & BOWMAN'S

Epithelium:

- Superficial cells elongate
- Wing cells enlarge with large, irregular nuclei
- Variable shape changes in basal epithelium
- Thinning or thickening can occur (thinning early, thickening in late disease)

Anterior Limiting Lamina (Bowman's):

- Often disrupted with epi and keratocyte protrusions, can be infiltrated with epithelial cells



Mathew et al 2011

Jongsloed WL, Worst JFG. The keratoconus epithelium studied by SEM. Documenta Ophthalmologica 1987;47:171-181.
 Elron N, Hollingsworth JG. New perspectives on keratoconus as revealed by corneal confocal microscopy. Clin Exp Optom 2008 Jan;91(1):34-55.
 Mathew J, George J. Keratoconus: ICD-10 recorded histopathology of the keratoconus cornea. Oculon Vis Sci. 2011 Aug;88(8):988-97.

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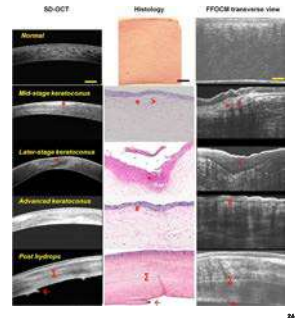
THE KERATOCONUS CORNEA

EPITHELIUM

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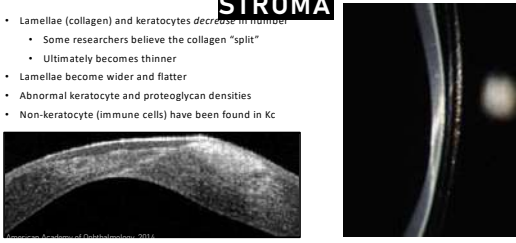
Grieve K, Georgiev C, Andreuolo F et al. Imaging microscopic features of keratoconus cornea morphology. Cornea 2016;35(12):1

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THE KERATOCONUS CORNEA

STROMA

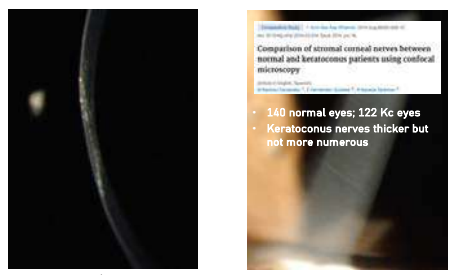
- Lamellae (collagen) and keratocytes decrease in number
 - Some researchers believe the collagen "split"
 - Ultimately becomes thinner
- Lamellae become wider and flatter
- Abnormal keratocyte and proteoglycan densities
- Non-keratocyte (immune cells) have been found in Kc



Neiderer R et al. Laser scanning in vivo confocal microscopy reveals reduced innervation and reduction in cell density in all layers of the keratoconic cornea. IOVS 2008;49:2964-70.
 Morishige N et al. Quantitative analysis of collagen lamellae in the normal and keratoconic human cornea by second harmonic generation imaging microscopy. IOVS 2010;51:9077-85.

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The Keratoconus Cornea stroma



stromal thinning/epi disruption prominent nerves

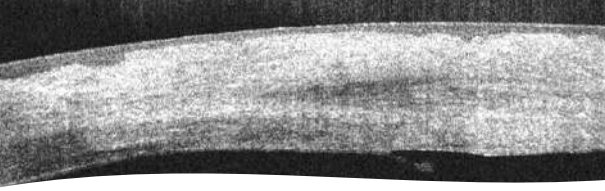
Comparison of stromal corneal nerves between normal and keratoconus patients using confocal microscopy
 (Morishige N et al. 2010)
 • 140 normal eyes; 122 Kc eyes
 • Keratoconus nerves thicker but not more numerous

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THE KERATOCONUS CORNEA

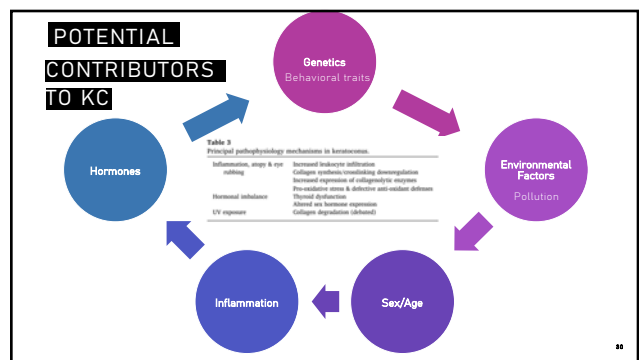
DESCMET'S & ENDOTHELIUM

- Descemet's Membrane and Endothelium:
- Signs are likely secondary
- Descemet's breaks in hydrops
- Polymegathism and pleomorphism



00 Ucakhan et al. In vivo confocal microscopy findings in keratoconus. Eye Contact Lens 2006;32:183-91.
 Fan Gaskin JC, Patel DV, McGhee CNJ. Acute corneal hydrops in keratoconus - new perspectives. Am J Ophthalmol 2014;157:921-8.

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[illegible]

ALTERED INFLAMMATORY HOMEOSTASIS

The diagram illustrates the pathogenesis of psoriasis, showing the interplay between proinflammatory and anti-inflammatory pathways. It is organized into three main sections: Proinflammatory Enzymes, Pro-inflammatory Cytokines, and Proinflammatory Enzymes, Inflammatory Modulators, Antioxidants and Other Proteins.

Proinflammatory Enzymes, Prostaglandins and Oxidative Stress: This section shows the activation of various enzymes (MMPs 1-13, Cathepsins B, G, X, S, TP, ROS/RNS, TCA) leading to oxidative stress. Oxidative stress is a key factor in the development of psoriasis.

Pro-inflammatory Cytokines: This section shows the activation of various cytokines (TNF-α, IL-1, IL-6, IL-17, IL-23, IL-22, IL-1β, IL-8, IL-10, IL-18, IL-36, IL-37, IL-38, IL-39, IL-40, IL-41, IL-42, IL-43, IL-44, IL-45, IL-46, IL-47, IL-48, IL-49, IL-50, IL-51, IL-52, IL-53, IL-54, IL-55, IL-56, IL-57, IL-58, IL-59, IL-60, IL-61, IL-62, IL-63, IL-64, IL-65, IL-66, IL-67, IL-68, IL-69, IL-70, IL-71, IL-72, IL-73, IL-74, IL-75, IL-76, IL-77, IL-78, IL-79, IL-80, IL-81, IL-82, IL-83, IL-84, IL-85, IL-86, IL-87, IL-88, IL-89, IL-90, IL-91, IL-92, IL-93, IL-94, IL-95, IL-96, IL-97, IL-98, IL-99, IL-100) leading to the development of psoriasis.

Proinflammatory Enzymes, Inflammatory Modulators, Antioxidants and Other Proteins: This section shows the activation of various enzymes (MMPs 1-13, Cathepsins B, G, X, S, TP, ROS/RNS, TCA) leading to oxidative stress. Oxidative stress is a key factor in the development of psoriasis.

The diagram also shows the role of various enzymes (e.g., MMPs, Cathepsins, TGF-β, PGE2, TNF-α, IL-1, IL-6, IL-17, IL-23, IL-22, IL-1β, IL-8, IL-10, IL-18, IL-36, IL-37, IL-38, IL-39, IL-40, IL-41, IL-42, IL-43, IL-44, IL-45, IL-46, IL-47, IL-48, IL-49, IL-50, IL-51, IL-52, IL-53, IL-54, IL-55, IL-56, IL-57, IL-58, IL-59, IL-60, IL-61, IL-62, IL-63, IL-64, IL-65, IL-66, IL-67, IL-68, IL-69, IL-70, IL-71, IL-72, IL-73, IL-74, IL-75, IL-76, IL-77, IL-78, IL-79, IL-80, IL-81, IL-82, IL-83, IL-84, IL-85, IL-86, IL-87, IL-88, IL-89, IL-90, IL-91, IL-92, IL-93, IL-94, IL-95, IL-96, IL-97, IL-98, IL-99, IL-100) and the resulting inflammatory response, leading to the development of psoriasis.

TEAR CYTOKINES IN KC

Proposed hypothesis from:

**Keratoconus at a Molecular Level:
A Review**

THORMAN L, A, VOLATIERE W, FRANCESCO C, FIDICHEREDD, and DE C. CONDONO ^{1,2*}
Institute of Ocular Medicine, Newcastle University, Newcastle upon Tyne, UK.

LYSOSOMAL HYDROLASES

- Types of lysosomes in lysosomes:
 - Proteases
 - Lipases
 - Phospholipases
 - Esterases
 - Nucleases

The diagram illustrates the pathways for the formation of lysosomes. It shows endocytosis and exocytosis at the cell surface, leading to early endosomes. Early endosomes can mature into late endosomes or fuse with lysosomes. Autophagy involves the formation of autophagosomes from mitochondria or other organelles, which then fuse with lysosomes to form autolysosomes. The diagram also shows the fusion of lysosomes with autophagosomes to form autolysosomes. A legend at the bottom identifies the components: Surface Receptor, Clathrin, Acid, LAMP-1, Mannose-6-phosphate, and Chaperone.

Lysosomes = membranous bags of hydrolytic enzymes (i.e., acid hydrolases) that degrade phagocytosed material and worn-out parts of the cell.

CATHEPSINS ARE *LYSOSOMAL PROTEASES*

- Cathepsins are lysosomal (aspartyl and cysteine) and neutrophilic *proteases*
 - Aspartyl: Cathepsin D
 - Neutrophilic: Cathepsin G
 - Cysteiny: Cathepsins B,C, F, H, K, L, O, S, V, W, X/Z
- K: expressed by surface epi and increased in Kc
- B&G: localize to corneal epithelium; degrade collagens & PG
- Can activate MMPs...
 - Some researchers think these, not MMPs, drive gelatinase activity in Kc

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SYSTEMIC DYSREGULATION??

- Cornea absorbs UV light
 - Generates free radicals
- Defense mechanisms exist
 - superoxide dismutase
 - Catalase
 - glutathione peroxidase
 - glutathione
- Study measured oxidative stress index (OSI) in blood
 - 25 Kc & 25 normal

Eye (Lund). 2014 Mar;28(3):265-9. doi: 10.1008/eye.2013.262. Epub 2013 Dec 6.

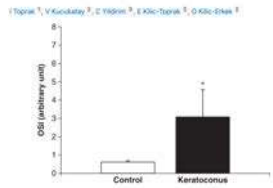
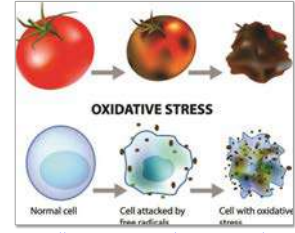


Figure 3. Oxidative stress index (OSI) values for the control and keratoconus groups. Values are expressed as mean ± standard error. *P < 0.007, Mann-Whitney U test).

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OXIDATIVE STRESS IN KC

- Kc have impaired oxidative stress response
- Increased
 - Inducible nitric oxide synthase
 - nitrotyrosine
 - malondialdehyde
 - glutathione S-transferase
- Reduced
 - extracellular superoxide dismutase
 - aldehyde dehydrogenase class 3



<https://biologydictionary.net/oxidative-stress/>

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GENETICS AND KERATOCONUS

- (+)FHx in 5-20% of patients
- Both autosomal recessive and dominant have been reported
- Candidate genes:
 - VSX1 (Visual System Homeobox 1 gene)
 - SOD1 (Superoxide dismutase 1)
 - Collagen genes: COL4A1, A2, A3, A4, and COL8A1, A2
 - ZNF469 (Zinc finger protein 469)

COL2A1, COL5A1, TNXB, and ZNF469 gene variants found in both KC and Ehlers-Danlos

Kennedy RH, Bourne WM, Dyer JA. A 18-year clinical and epidemiologic study of keratoconus. Am J Ophthalmol 1988;101:267-73.

Wang Y et al. Genetic epidemiological study of keratoconus: evidence for major gene determination. Am J Med Genet 2002;120:102-9.

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GENETICS AND KERATOCONUS

- Select gene mutations found in familial cohorts in Ireland, Equator, etc.
- LOX gene (lysyl oxidase) polymorphisms associated with KC
 - Could result in deficient cross-linking
- CAST (Calpastatin encoding gene)
 - Inhibits Calpain
- Other genes
 - Interleukin-1 genes – polymorphisms il IL-1b promoter and IL-1a in some populations
 - TGF-1b mutations – reduced expression in KC
- Mitochondrial DNA
 - Mitochondrial complex 1 gene – involved in generating ROS – mutations seen in KC

Kennedy RH, Bourne WM, Dyer JA. A 18-year clinical and epidemiologic study of keratoconus. Am J Ophthalmol 1988;101:267-73.

Wang Y et al. Genetic epidemiological study of keratoconus: evidence for major gene determination. Am J Med Genet 2002;120:102-9.

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ENVIRONMENT AND KC

- Age: most commonly onset in 2nd decade of life
 - Pediatric and geriatric KC also reported
- Eye rubbing
 - 50% of KC patients rub their eyes (or have (+) h/o rubbing)
 - Could be secondary to atopy/allergies and itching
- Contact lens use
 - Chronic CL wear may promote keratocyte apoptosis, induce cytokines

Nottingham J. Practical observations on corneal cornea, and on the short sight, and other defects of vision connected with it. London, Liverpool: John Churchill, Dighton & Loughton 1856.

Harris MS, Varley GA, Kirschner JR. Development of keratoconus after contact lens wear: patient characteristics. Arch Ophthalmol 1996;114:531-4.

Lemke J, Dyer JA, Ruiz C, Diaz-Gruber S, Azeiteiro J. Inflammatory response to contact lenses in patients with keratoconus compared with normal subjects. Cornea 2006;27:1758-63.

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ENVIRONMENT AND KC

Sun exposure – unclear evidence

- KC more prevalent in countries closer to equator
- Animal models shown corneal UV exposure associated with keratocyte apoptosis and collagen/stromal thinning
- But CXL works.?

BMI

- KC patients have increased obesity rates (+ sleep apnea & floppy eyelids)

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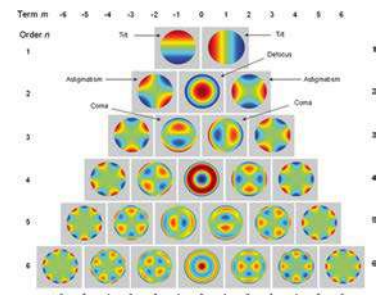
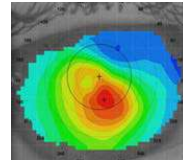
ENVIRONMENT AND KC

- Pollution
- Cigarette smoking is not a risk factor for Kc
 - May be protective (promotes cross-linking)
- Russia showed higher incidence (5x) in urban environment
 - Radiation contaminated locations
- Lower socioeconomic classes more prevalent?
- Personalities
 - Kc can be associated with obsessive compulsive behavior
 - Variable findings in the literature

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OPTICS OF KERATOCONUS

- Coma is the primary aberration associated with Kc



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CORNEAL BIOMECHANICS

Comparisons of corneal biomechanical and tomographic parameters among thin normal cornea, forme fruste keratoconus, and mild keratoconus

Optical Quality in Keratoconus Is Associated With Corneal Biomechanics

Changes of corneal biomechanics with keratoconus

Consideration of corneal biomechanics in the diagnosis and management of keratoconus: Is it important?

A review of corneal imaging methods for the early diagnosis of pre-clinical keratoconus

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HORMONES & KC

- Thyroid dysfunction related to Kc?
- Thyroxine in the tears, AH, and thyroxine receptors in keratocytes are increased
- Higher rate of thyroid gland dysfunction reported in Kc patients
- Sex hormones
 - One study found no differences
 - Another found increased mRNA expression of androgen and estrogen receptors in corneal epithelium in Kc
 - No changes in corresponding protein levels
 - One study found reduced androgen precursors and increased estrogen – together with altered Prolactin Induced Protein (PIP)

Thomas S, Dellea P, Mayer Z, Horita M, Prokash V, et al. Role of thyroxine in the development of keratoconus. Cornea 2016;35:1338-46.
Bassiri R, et al. Corneal biomechanical properties and androgen and estrogen receptors in corneal epithelium in keratoconus. Cornea 2016;35:1338-46.

46

KC MANAGMENT

- Surgical
 - Corneal cross-linking (CXL)
 - Corneal transplantation
 - PKP – full thickness for full thickness scars or greater irregularity
 - LKP – partial thickness for anterior only scarring
- Refractive
 - Spectacles (not as useful)
 - Contact lenses

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CXL considerations

- Age & stage of Kc
- K values at detection
- Co-morbidities & risks for progression
- Ethnicity

CXL Complications

- Delayed epi healing
- Haze
- Inflammation
- Stromal edema
- Endothelial damage
- Poor treatment effect

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PATIENT INFORMATION

- Office can order guides – or patient can request online
- www.nkcf.org



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REFERRAL PROCESS

- Provide options for patients:
 - Epi on / epi off options
 - Different insurance/costs
 - Clinical studies
- Written resources for patients
- Develop a plan – provide patients with actionable items

50

POST-CXL CO-MANAGEMENT

- Post-operative symptoms:
 - Photophobia, epiphora, burning, soreness, blur until re-epithelialization (at least)
 - Stinging when instilling drops
- Medications post-procedure:
 - BCL (~7 days)
 - Antibiotic 4-6x per day
 - Steroid 2-4x per day
 - Non-steroidal anti-inflammatories, topical and possibly oral
 - Preservative-free artificial tears

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POST-CXL CO-MANAGEMENT

- Written instructions typically given by the OMD
 - Important to remain consistent
- General universal recommendations
 - No swimming in open bodies of water or swimming pools/hot tubs (at least 2 weeks)
 - Tylenol can be taken for eye soreness
 - Increasing pain/redness should be treated urgently
 - Temporary stromal edema, haze are common
- Follow-up schedules
 - 1 day/week, 1 month, 6 weeks – start CL?, 6-12-month follow-up

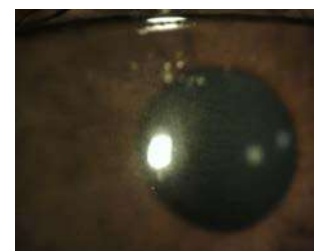
52

POST-CXL HAZE



53

POST-CXL HAZE



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LONG-TERM FOLLOW-UP

- Communicating with surgeon
- Monitor at 4-6 months evaluating progression ("no global period")
- Remaining complications
 - Haze likely to be gone at 1-year
 - Acute haze: 100%; Chronic haze: 10%
- Educating patient about follow-up needs
 - Contact lenses
 - Progression f/u only

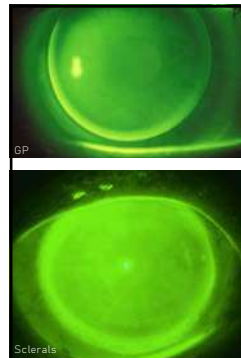
54

55

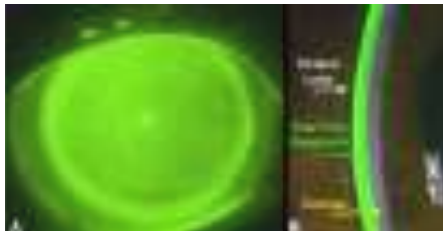
REFRACTIVE MANAGEMENT

- Spectacles or no correction
- Soft CL – commercial and custom
- Corneal gas permeable lenses: GPs
- Scleral lenses
- Hybrid lenses (rigid center, soft skirt)

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SCLERAL LENSES



56

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SUMMARY

- Keratoconus is an inflammatory-based disease that involves a complex interaction of characteristics:
 - Genetics – susceptible genes, poor protective mechanisms
 - Environment – allergies, ocular inflammation
 - Behavior – rubbing, sleep
- The primary progression treatment for KC is corneal cross-linking
 - Reducing inflammation also being implemented
- The primary refractive management for KC is rigid lenses (scleral lenses best)

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QUESTIONS?

- Maria Walker, OD, PhD
- mkwalker@central.uh.edu

59

58



KEEP IT REAL

The Relevance of Scleral Lens Research in Clinical Care

Maria Walker OD, PhD, FAAO, FSLS

1

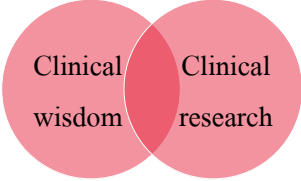
DISCLOSURES

- None

2

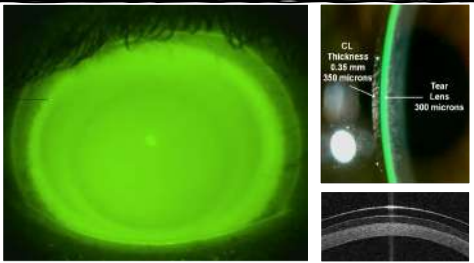
KEEPING IT REAL

The crossroads between (anecdotal) clinical wisdom and clinical research



3

CORNEAL VAULT WITH SCLERAL LENSES



4

SCLERAL LENS EVALUATION: SLIT LAMP



White light
Optic section
45 degree angle

5



SL INDICATIONS IN 2022

- Keratoconus / PMD
- Post Corneal Transplant
- Post RK
- Post LASIK/PRK
- Post Intacs
- Corneal Scarring
- Post Surgical
- Ocular surface disease
- High Rx
- Amblyopia
- Myopia control
- Prosthetics
- Aphakia

6

MOST COMMON INDICATION FOR SL IN THE US IS KERATOCONUS

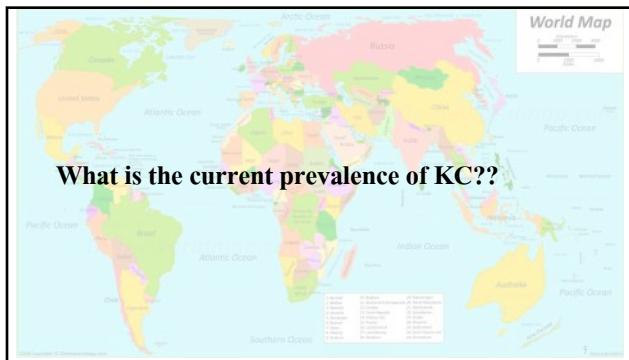


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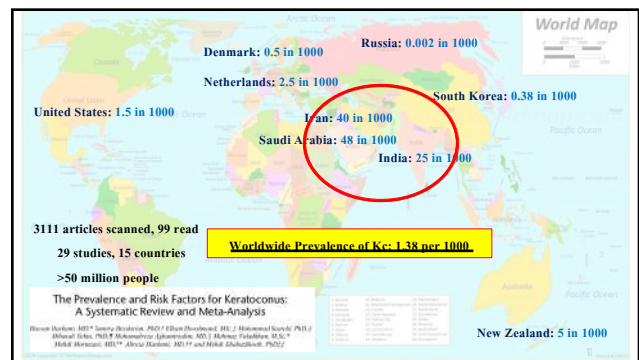
FIRST CASE SERIES: KERATOCONUS

8

What is the current prevalence of KC??



9



10

NATURAL KERATOCONUS PROGRESSION

- Younger patients progress more aggressively
 - Patients <17yo are likely to show >1.5D progression yearly
- Steeper patients at onset are likely to progress more
- Middle Eastern patients experienced more progression

Ferdi et al. Keratoconus Natural Progression: A Systematic Review and Meta-analysis of 11,529 eyes. Ophthalmology 126 (7): 935-945, 2019.

11

NATURAL KERATOCONUS PROGRESSION

- Younger patients progress more aggressively
 - Patients <17yo are likely to show >1.5D progression yearly
- Steeper patients at onset are likely to progress more
- Middle Eastern patients experienced more progression

Variable	OR	CI 95%
Sex (men)	1.01	0.69-1.33
Eye rubbing	3x more likely to develop KC	2.17-4.00
Family history of keratoconus	6.42	2.59-10.24
Atopy	1.12	0.46-1.85
Allergy	1.5-2x	1.06-1.79
Asthma	1.94	1.30-2.58
Eczema	3x	1.30-4.59
Diabetes type I	0.73	0.26-2.06
Diabetes type II	0.77	0.50-1.21

Ferdi et al. Keratoconus Natural Progression: A Systematic Review and Meta-analysis of 11,529 eyes. Ophthalmology 126 (7): 935-945, 2019.

12

PATIENT JM 35YO HM

- Last exam >2y ago
- Pt reports broken lens OD, had good comfort, fit and vision with SL OU
- Wearing scleral lenses >10y for KC
- Wears 16h per day
 - Clearcare and ScleralFil
- Manifest spec Rx:

• OD: -3.00-3.00x082	20/40
• OS: -1.00-4.00x017	20/100

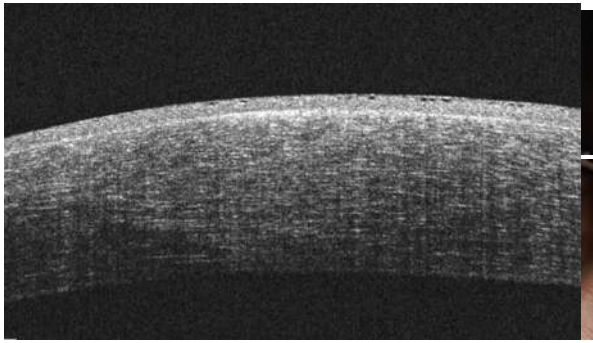
INITIAL EXAM



- Presenting Scleral Lens OS:
 - Toric prolate lens / -3.00 / 6.4
 - SAG: 5650; DIA: 16.0
 - flat 4 x steep 1 (150um difference)
 - VA: 20/40 (typical for this patient)
 - Good fit, vault <100um
- Re-ordered habitual OD, OS, set for patient to pick up lenses without dispense and return for fit in 2 weeks.

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14



15

EMERGENCY 9 DAYS LATER

- Reported lenses improved comfort; VA 20/50
- Started treatment:
 - Tobradex TID
 - Prednisolone acetate 1% TID
 - Muro 128 QPM and QAM
 - D/C scleral lens wear until healed



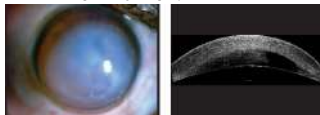
Corneal
hydrops OD

16

WHAT IS CORNEAL HYDROPS?

Acute corneal hydrops in keratoconus

- 147 eyes out of 5242 (3%)
- Young males most common
- More common in severe allergic disease
- 59% needed penetrating keratoplasty



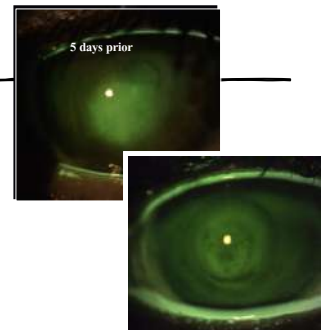
Ophthalmology 1994

Makarova PK, Sharma N, Vijayvar R. Acute corneal hydrops in keratoconus. Ind J Ophthalmol. 2014; 61(8): 461-464.

17

FOLLOW-UP: 5 DAYS POST DX

- Patient reports everything is "back to normal"
- Compliant with drops
- He had not stayed out of lenses as recommended, but tried to reduce wear
 - Wore lenses OU to appt
- Vision: 20/30- OD; 20/40 OS

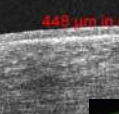


18

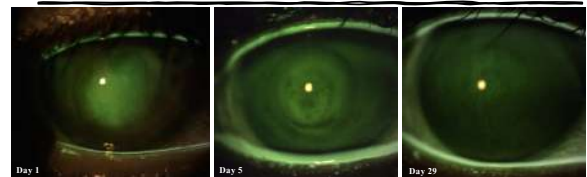
- Treatment:

-

FOLLOW-UP: 15 DAYS POST DX

- 
- Figure 1 consists of two panels. Panel (a) is a scanning electron micrograph (SEM) showing a cross-section of a glass fiber. A red vertical line is drawn across the center of the fiber, with the text "445 μm in diameter" written in red above it. Panel (b) is an optical micrograph showing the same fiber core, which appears as a bright, circular spot against a dark background.

HYDROPS RESOLUTION



Complete resolution in <30 days

Scleral lens wear throughout

Did the scleral lenses induce the hydrops?

Did the scleral lenses help in hydrops healing?

CLINICAL IMPRESSION?

1. Tuft SJ, Gregory WM, Buckley RJ. Acute Corneal Hydrops in Keratoconus. *Ophthalmology* 1994;101:1738–44.
2. Barsam A, et al. Case-control study of risk factors for acute corneal hydrops in keratoconus. *Br J Ophthalmol* 2017;101:499–502

Table 1 Univariable analysis comparing 64 cases with keratoconus who developed an acute corneal hydrops and 574 controls with keratoconus who did not have hydrops

	Risk factor	Cases (n=66)	Controls (n=176)	OR (95% CI)	p Value
VKC		9 (14.8)	7 (4.1)	4.08 (1.45 to 11.69)	0.008
Asthma		22 (34.2)	28 (15.8)	2.70 (1.34 to 5.47)	0.005
Allergic dermatitis		18 (30.3)	17 (26.6)	3.13 (1.50 to 6.56)	0.003
Previous hydrops in either eye		9 (14.7)	0 (0)	40.2 (6.2 to ∞)	<0.001
Learning difficulties		14 (21.5)	6 (3.4)	7.84 (2.86 to 21.46)	<0.001
K2-8 D (°/d)		13 (86.7)	82 (56.9)	4.91 (1.07 to 22.8)	<0.001
Visual acuity (worse eye), mean (SD)		0.83 (0.63)	0.3 (0.36)	8.76 (3.86 to 19.86)	<0.001
Univariate analysis					
	OR (95% CI)	133 (90.5)	133 (90.5)		
Soft contact lens	4 (6.4)	33 (19.1)	0.05 (0.01 to 0.19)	<0.001	
Hydro contact lens	21 (33.9)	115 (66.5)	0.08 (0.03 to 0.19)	<0.001	
Scleral lens	6 (9.7)	3 (1.7)	0.86 (0.17 to 4.21)	0.85	
Univariate analysis of risk factors for contact lens intolerance					
	OR (95% CI)	10 (16.1)	13 (7.5)	0.33 (0.11 to 1.02)	0.06
Soft contact lens	4 (6.4)	20 (11.3)	0.49 (0.07 to 3.19)	<0.001	
Hydro contact lens	21 (33.9)	113 (66.2)	0.48 (0.07 to 3.19)	<0.001	
Scleral lens	4 (9.7)	3 (1.7)	0.89 (0.17 to 4.21)	0.82	

4

RESEARCH

CLINICAL IMPRESSION?

- Occurs in 3% of patients¹
 - Scleral lenses do not increase risk of hydrops, but rigid lenses do²
 - Resolution is variable³
 - 20 – 120 days with intracameral injection (IC) injections
 - 64 – 115 days with conservative treatment
 - Can be well managed with IC inj. when Descemet's is broken³
- Greater prevalence?
 - SL as a risk factor?
 - SL improve healing time?

1. Tuft SJ, Gregory WM, Buckley RJ. Acute Corneal Hydrops in Keratoconus. *Ophthalmology* 1994;101:1738-44.
2. Barsam A, et al. Case-control study of risk factors for acute corneal hydrops in keratoconus. *Br J Ophthalmol* 2017;101:499-502
3. Maharana PK, Sharma N, Vajpayee RB. Acute corneal hydrops in keratoconus. *Ind. J. Ophthalmol.* 2014. 61(8): 461-464.

25

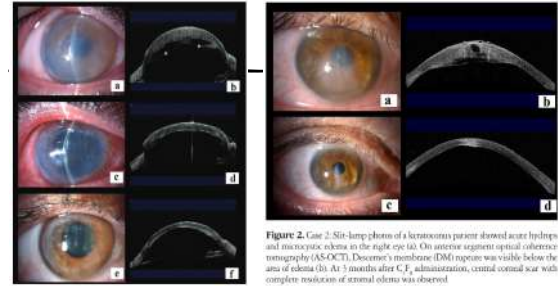


Figure 2. Case 2: Slit-lamp photos of a scleritis patient showed acute hyalitis and macular edema in the right eye (a). On anterior segment optical coherence tomography (AS-OCT), Descemet's membrane (DM) rupture was visible below the area of edema (b). At 3 months after C₁F₄ administration, central corneal scar with complete resolution of stromal edema was observed.

SURGICAL INTERVENTION WITH DESCEMET'S RUPTURE/DETACHMENT

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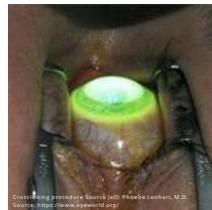
TREATMENT & MANAGEMENT OF KERATOCONUS

Progression Treatment:

- Corneal Cross Linking
- No known therapeutics (topicals or orals)

Optometry role in CXL

- Detect & refer
- Post-procedure refractive mgmt.
- Continuing to monitor disease



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Case Report: Acute Corneal Hydrops despite Accelerated Transepithelial Corneal Cross-linking

Jay J. Neugebauer, MD, MPH^{1,2*} and Anilash Chaturvedi, PhD, ScD^{3,4}

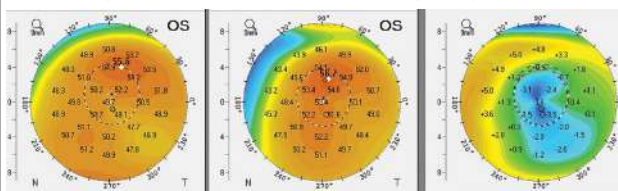
FIGURE 4. Slit-lamp photograph of dense, corneal-scar and neovascularization after resolution of edema from corneal hydrops.



FIGURE 2. Corneal ocular coherence tomography. (A) Image taken approximately 1 month after cross-linking treatment demonstrates treatment demarcation line at 232 μm and stromal thickness (337 μm). (B) Image taken after 2 years after cross-linking demonstrates internal stromal thinning with stromal thickness of 232 μm and compensatory thickening of the overlying epithelium (total corneal thickness, 338 μm).

28

Case Report: Acute Corneal Hydrops despite Accelerated Transepithelial Corneal Cross-linking

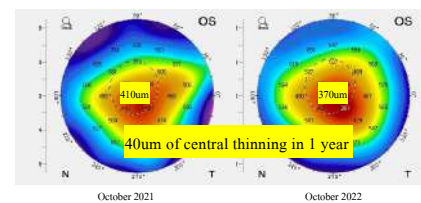
Jay J. Meyer, MD, MPH^{1,2} and Anilish Gokul, PhD, BS^{3,4}

The cornea flattened by about 3D while progressing post CXL

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PATIENT AG

- 18yo Hispanic male
- CXL in 2018



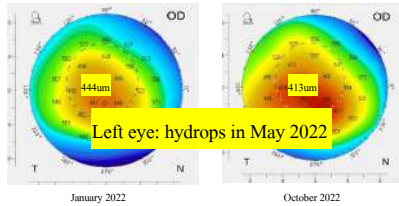
October 2021

October 2022

30

PATIENT CP

- 17yo white male
- CXL in 2020



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KC SUMMARY

- Kc prevalence is increasing in the US
- Scleral lenses may induce hydrops in susceptible patients
 - They may also help in healing
- Hydrops can occur post-CXL and all patients should be monitored with testing (tomography) and patient education
 - "Don't rub your eyes"
 - "Be gentle when applying and removing CL"
 - "Red eyes are urgent until proven otherwise"

32

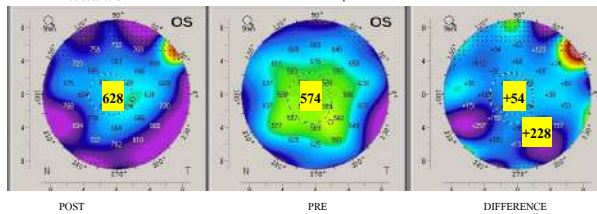
NEUTROTROPHIC KERATOPATHY

blur, redness, discomfort after several hours of lens wear

Specular microscopy

- OD 2220 cells/mm
- OS 3389 cells/mm

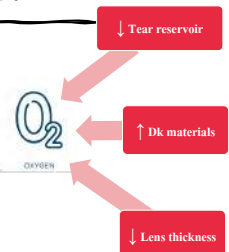
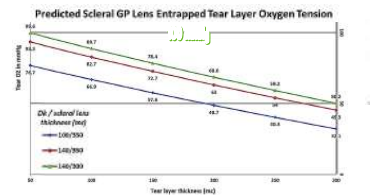
Corneal thickness maps



33

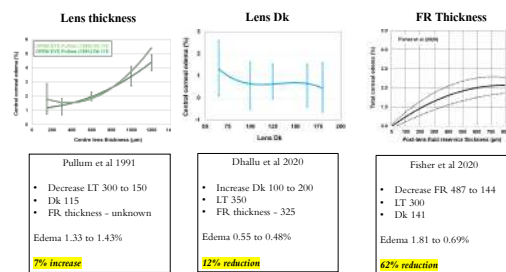
THEORETICAL MODEL CONSIDERATIONS

"May provoke hypoxic corneal effects when a lens of 100 Dk is thicker than 220-260 um and the tear reservoir is greater than 150 um"



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SL OXYGEN TRANSMISSION



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HIGH RISK PATIENTS

[Short-term daily wear in normals induces ~1% to 3% edema]

Acute corneal edema decades after penetrating keratoplasty for keratoconus in eyes wearing scleral contact lenses

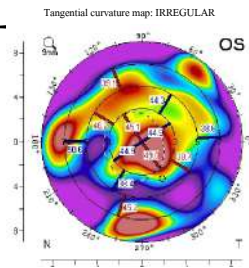
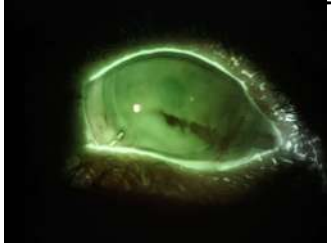
Scleral Lens-Induced Corneal Edema after Penetrating Keratoplasty

Modifiable factors:

- 1) Lens changes
 - a) Lens thickness (<1000?)
 - b) Lens Dk (>100)
- 2) Tear reservoir thickness*

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NEUROTROPHIC KERATOPATHY

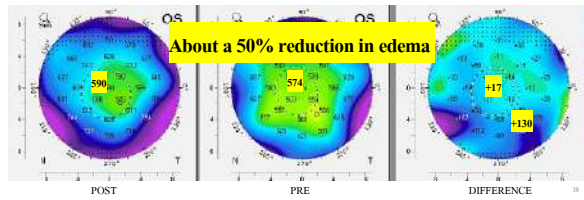


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NEUROTROPHIC KERATOPATHY

Step 1: Increased Dk to 180 (fluid reservoir thickness unchanged)

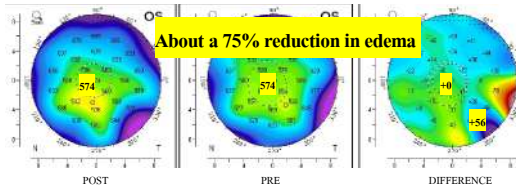
- Fluid reservoir thickness ~300



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NEUROTROPHIC KERATOPATHY

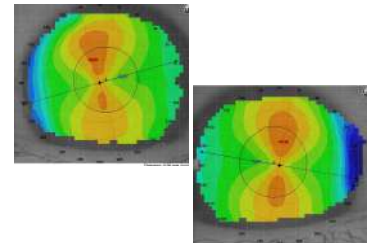
Step 2: Reduced from 300 to 100 um clearance
180 Dk lens



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MULTIFOCAL EXAMPLE

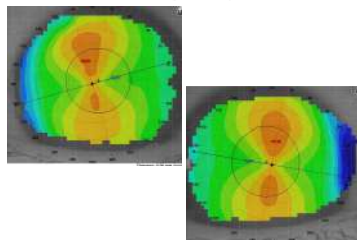
- 44 yo white female
- Denied LASIK 1y ago due to dryness
- Current Rx
 - OD: +0.75 - 4.25 x 175
 - OS: -0.25 - 3.00 x 007
- First lens: bitoric translating bifocal GPs



40

MULTIFOCAL EXAMPLE

- 44 yo white female
- Denied LASIK 1y ago due to dryness
- Current Rx
 - OD: +0.75 - 4.25 x 175
 - OS: -0.25 - 3.00 x 007
- First lens: bitoric translating bifocal GPs
- Second lens design: MF sclerals



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MONOVISION VS. MULTIFOCAL

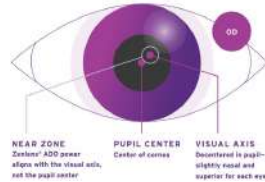
Most patients prefer multifocal to
monovision when properly fitted



42

MULTIFOCAL SCLERAL LENSES

- SL do not translate
 - Stable, simultaneous vision needed
 - Optics added to the front of lenses
- Majority center-near, some offer center-distance
- Modifiable zones:
 - Near zone size
 - Centration of optics



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MULTIFOCAL SL PATIENT: HR

- 15.4 mm diameter
- Plano distance power
- +1.00 OD, 1.5 mm near zone, dec 0.5mm SN
- +1.25 OS, 2.0 mm near zone, dec 0.5mm SN
- Toric landing to stabilize
- VA distance 20/20, near 20/20-



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SUMMARY

- Scleral lens fitting and management continues to advance
- Research and literature can be excellent guides...but
- Clinical impressions and experiences are important and patients are unique
- More clinical research is needed...

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SCLERAL LENS RESEARCH

What is the true prevalence of MK in scleral lenses?

MULTI-CENTER SCLERAL LENS STUDY

The Consortium of Researchers Investigating Sclerals (CoRIS) group is working on determining the incidence of microbal keratitis (MK) with scleral lenses. We are adding practitioners in North America to submit data for up to 25 scleral lens patients, with or without MK. We need as many practices as possible to participate!

Scan the QR code to learn about this opportunity to participate in scleral lens research!



Email mkwalker@central.uh.edu to learn about participating in this study

46

THANK YOU FOR YOUR TIME AND ATTENTION!

mkwalker@central.uh.edu

Scan the QR code to learn about this opportunity to participate in scleral lens research!



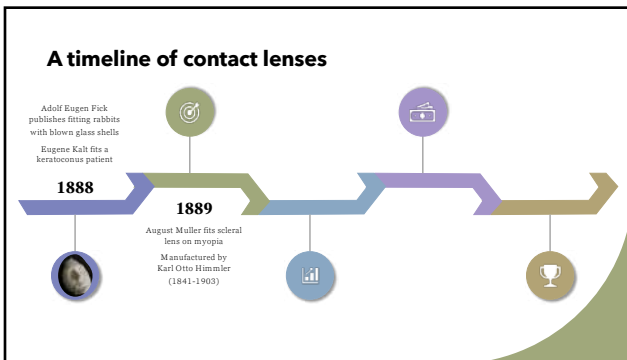
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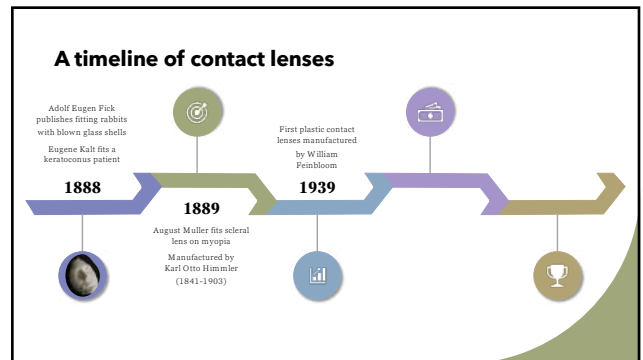
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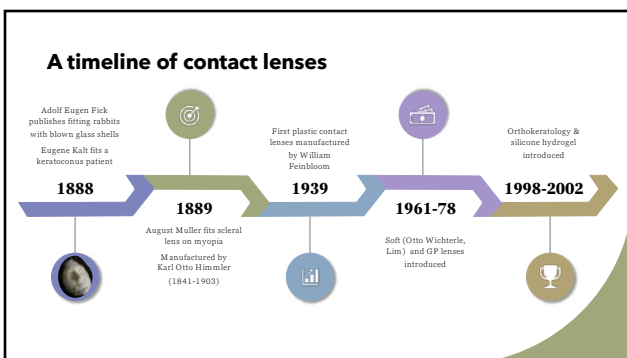
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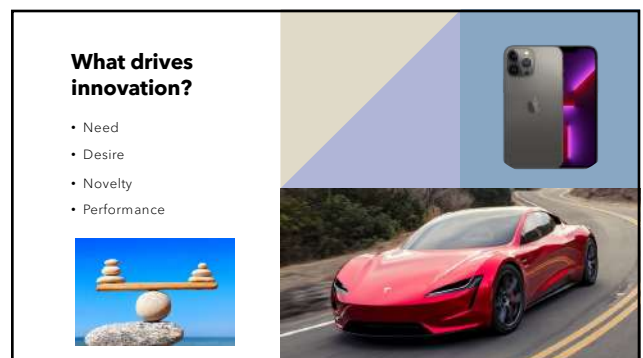
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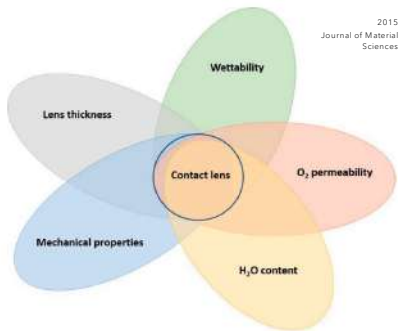


6

Contact Lens Innovation complicated by HEA

Ocular response to CL...

- Increased inflammatory mediators in tears
- Metabolic stress on the cornea → potential edema
- Higher risk for infection (epithelial compromise)
- Greater allergic type responses

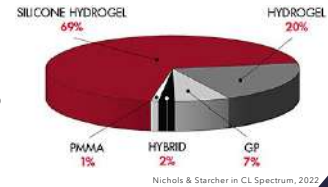


Nguyen V, Lee GA. Management of microbial keratitis in g. Australian Journal of General Practice. 2019; 49(8).

8

Soft contact lens material innovations

- Visual performance (light filtering, aberration control)
- Maximizing comfort (new surface and polymer chemistry)
- Maximizing health (high Dk, mostly disposable lenses)



Nichols & Starcher in CL Spectrum, 2022

9

Contact lens material innovations



TRIS DEWS II Management and Therapy Report
London Jones, PhD¹; Lacey E. Owens, PhD²; Donald Davis, MD³; John W. Bordenstein-Cook, MD⁴; David J. Brown, MD⁵; Stephen A. Kemp, MD⁶; Phyllis N. Singh, MD⁷; Gerson Corrojo, MD⁸; Richard Todd Hild, MD⁹; Tang Guo MD¹⁰; Richard W. Lee, MD¹¹; Joseph T. Miller, MD¹²; David S. Margolis, MD¹³; Jennifer V. Eady, MD¹⁴; James S. Hirschhorn, PhD¹⁵; Jennifer V. Eady, MD¹⁶.

Technology driven by the DEWS report

- Potassium can be beneficial to wound healing and protective against UV-B (other beneficial roles too)
- Electrolytes in general have a strong role in maintaining ocular surface homeostasis
- Bicarbonate can improve epithelial barrier function after injury
- Lipids also play a role and there are efforts to mimic them in artificial tears and CL

10

Contact lens material innovations

- Potassium can be beneficial to wound healing and protective against UV-B (other beneficial roles too)
- Electrolytes in general have a strong role in maintaining ocular surface homeostasis
- Bicarbonate can improve epithelial barrier function after injury
- Lipids also play a role and there are efforts to mimic them in artificial tears and CL



ProBalance Technology™

High Dk 134 Dk/t



Infuse, Bausch & Lomb

11

Contact lens material innovations

- Light filtering and visual performance
- Light Intelligent Technology™
 - Transitions when activated by UV
 - Also blocks up to 15% of blue light indoors and 55% outdoors
- High Dk 121 Dk/t, 38% H₂O



Acuvue Oasys Transitions™ Johnson & Johnson Vision

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Oasys Max

- Tearstable™ technology
- OptiBlue™ Light Filter
- UV filter

13

Contact lens material innovations

CooperVision MyDay lens

- Aspheric optical designs
- **Aberration Neutralizing System™**
- High Dk 100 Dk/t, 54% H₂O



The Aberration Neutralizing System™ is designed to enhance vision quality by minimizing an optical imperfection¹ commonly found in eyes.¹



Aquaform Technology locks in water—so you can have incredible comfort all day long—and helps your eyes stay clear and white, by delivering the oxygen your eyes need.²

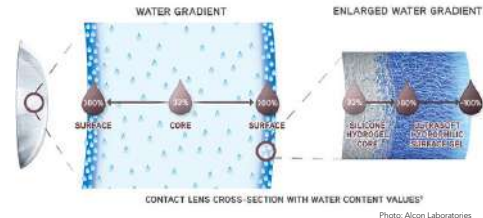


UV blocker helps protect your eyes against the transmission of ultraviolet rays, helping support your eye health.³

14

Contact lens material innovations

- Recent monthly lens innovations



15

Summary of commercial innovation

Comfort innovation

Visual innovation

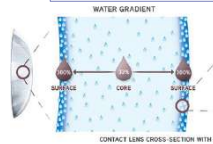


J&J Transitions



Infuse, Bausch & Lomb

Monthly lens innovation



Alcon Total30

CooperVision MyDay

16

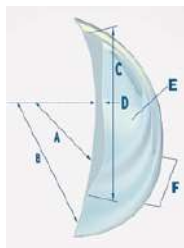
Custom Soft Contact Lenses

- Spherical and toric extended parameters
- **Very mild irregularities**
- Custom lathe-cut soft lens designs
- Aberration-control optics
- Best candidates
- **Mild irregularities**
- **Lower blur sensitivities**



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Custom Soft Contact Lenses for Kc



NovaKone

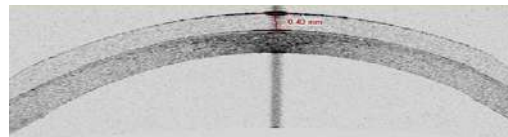


KeraSoft

18

Custom Soft Contact Lenses

Don't forget to consider oxygen in specialty soft lens fitting



SiHy lens designs
Lens settling is needed

19

Updates in custom SCL technology

- Decentering optics
- New materials and coatings
 - Higher Dk for thicker designs
 - HydraPEG coating
- Advanced optical technology



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GP material innovation

- Hyper Dk (i.e., >150) materials (that work)
 - Historically easier to scratch and more deposit prone

3 currently available in US:

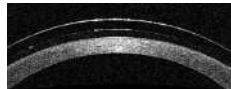
- Menicon Z (163)
- Optimum Infinite (180)
- Acuity 200 (200)



21

High Dk Materials

- Scleral lenses
- Piggyback systems
- Thick lens system**
- Overnight wear
- Ortho K**
- High refractive errors



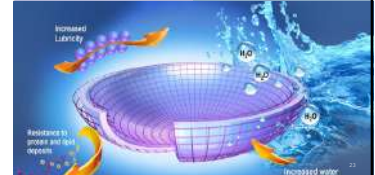
22

Surface Treatment: HydraPEG

- 90% water PEG-based polymer covalently (permanently) bonded to CL
- Any GP lens can be treated with HydraPEG after manufacture

New in 2021

- Boost Treatment indicated monthly
- Intended to replenish "topcoat" of HydraPEG
- Available direct to patient or through practice (Rx only)



23

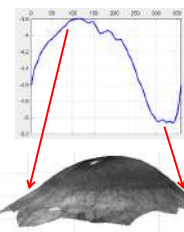
What is innovative with scleral lens designs?



24

Scleral lens shape innovation

Group	Pattern Description	N(%)
1	Spherical	8 (5.7%)
2	Toric-Regular	40 (28.6%)
3	Asymmetric High or Low Points	57 (40.7%)
4	Periodicity different from 180°	35 (25%)



DeNaeyer G, Sanders D, van der Worp E, Jodicka J, Michaud L, Morrison S. Qualitative Assessment of Scleral Shape Patterns Using a New Wide Field Ocular Surface Elevation Topographer. JCLRS [Internet]. 16 Nov 2017 [cited 5 Oct 2018];1(1):12. Available from: <http://www.jclrs.org/index.php/JCLRS/article/view/1>

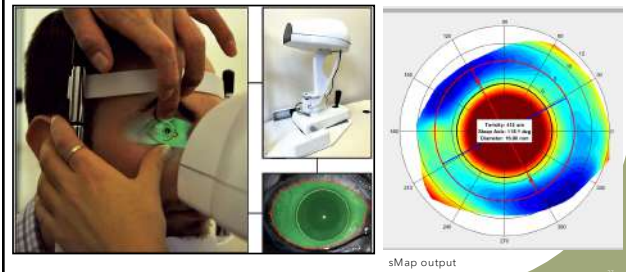
25

Scleral lens shape innovation



26

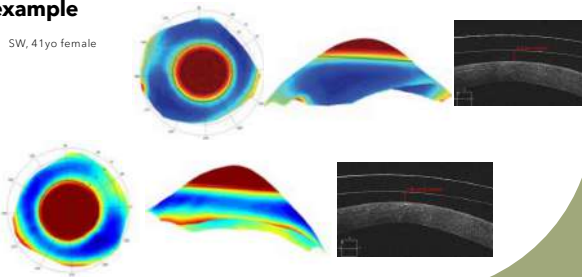
Scleral Topography



27

Scleral topography example

- SW, 41yo female



28

SL design sophistication

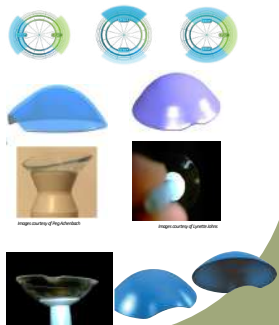
- Toric and quadrant specific available with most designs



29

SL design sophistication

- Toric and quadrant specific available with most designs
 - Channels / ripples can be used at the lens edge to vault over peripheral obstructions
- Precise and reproducible compared to hand-notching**



30

SL design sophistication

- Toric and quadrant specific available with most designs
 - Channels / ripples can be used at the lens edge to vault over peripheral obstructions
- Precise and reproducible compared to hand-notching**



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EyePrintPRO™

- Transparent prosthetic scleral device designed to match the exact contours of the individual eye.
- Impression Process
 - Takes 2 minutes
 - Captures precise curvatures of the entire ocular surface
 - Impression material has 1-2um accuracy

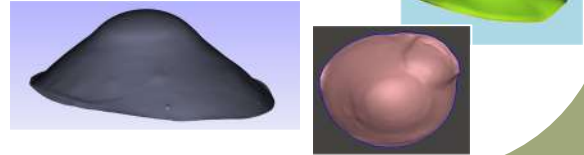


Photo credit: EyePrintPro Prosthetics

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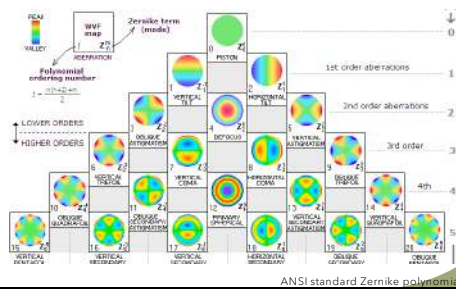
EyePrintPRO™

- Transparent prosthetic scleral device designed to match the exact contours of the individual eye.



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Advanced Optical Designs

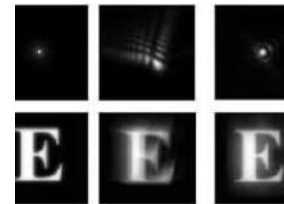


ANSI standard Zernike polynomials

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Residual Aberrations

"I can see it, but it's not clear."



35

WFG optics

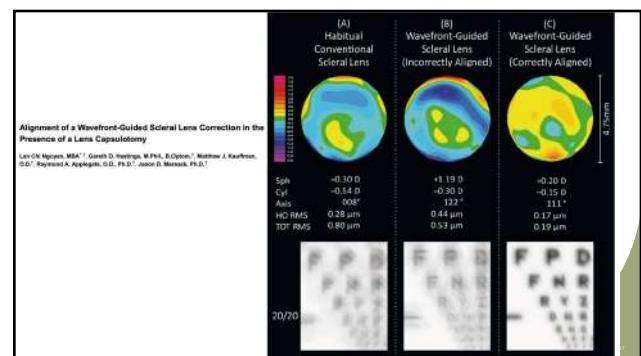
20 mins

- Apply lens and be settle for minimum 20 minutes and make sure the black dot is on the bottom half of the lens. Dots may rotate slightly.
- Select the "Base Lens with Markings" measurement option.
- Make sure to keep the room dark in order to maximize the pupil size.
- Have the patient cover their fellow eye using the occluder and look straight into the red dot.
- Complete the lens design exercise using the QWAVE™ XRAY software (optional).
- Click the "Submit Lens Order" button on the measurement results page.

HCA files are sent to QWAVE™ for verification.

QWAVE™ will then send the file to Valley Contact for Manufacturing.

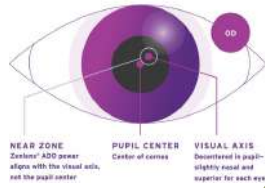
36



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Multifocal Scleral Lenses

- SL do not translate
 - Stable, simultaneous vision needed
 - Optics added to the front of lenses
- Majority center-near, some offer center-distance
 - Near zone size & centration can be altered
- Patient selection
 - Dry eye vs. irregular shape
 - Less than +0.75D of residual astigmatism is ideal



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Contact Lens Options

- Soft multifocal
- Rigid multifocal
- Ortho-K
- Atropine
- Spectacles
- Education

Myopia Management with Contact Lenses

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Longitudinal studies evaluating SCL brands

A 3-year Randomized Clinical Trial of MiSight Lenses for Myopia Control
Chamberlain, Paul BSc (Hons)¹, Peixoto-de-Matos, Sofia C. MSc¹, Logan, Nicola S. PhD², Ngo, Cheryl PhD³, Wiles, James PhD⁴, Jones, Deborah BSc, PhD⁵, Young, Graeme PhD, FRCO⁶ Author information

MiSight

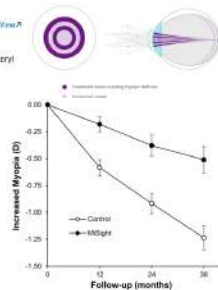
Original Investigation

August 11, 2020

Effect of High Add Power, Medium Add Power, or Single-Vision Contact Lenses on Myopia Progression in Children
The BLINK Randomized Clinical Trial

Jeffrey J. Walline, OD, PhD¹, Michael J. Walline, OD, PhD², David D. Mittleman, OD, PhD³, et al.

Biofinity



40

Optical Designs of Myopia Management contact lenses

A lens with EDOF design

Intervention Study	Duration, y	Absolute Difference in Progression Between Treatment and Control Groups	
		Refractive (D)	Axial Length (mm)
MiSight contact lens ¹²⁸	3	0.66	0.28
Extended depth of focus contact lens ¹²⁹ (4 designs tested)	2	0.27 to 0.57 (across 4 test designs)	0.14 to 0.19 (across 4 test designs)
Biofinity +2.50 contact lens ¹³⁰	3	0.45	0.23
EDOF spectacle lens ¹³²	2	0.44	0.34
Low-Dose atropine ¹³³	1	0.22	0.05
0.01%		0.35	0.17
0.05%		0.54	0.21

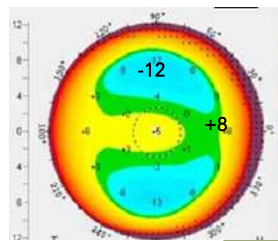
Differences between adjusted means are presented as detailed in each paper.

Optic Zone Centration

41

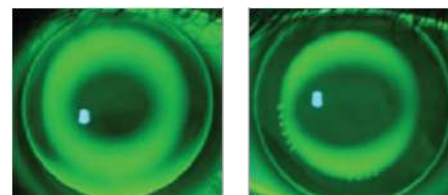
Optical Designs of Myopia Management orthoK

- Beware of asymmetric treatment zones due to toricity.
- May need toric / dual-axis ortho-k lenses for max treatment
- 20um difference (elevation) between major meridians: think dual axis!



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DUAL AXIS ORTHO-K



Spherical

Dual Axis

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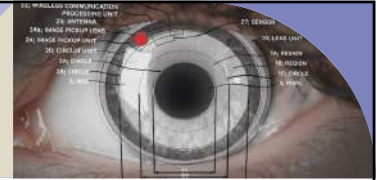
Smart Contact Lenses

- Low vision lenses
- Night vision lenses
- Virtual reality
- Medical lenses (sensing and drug delivery)
- Sports performance and analytics



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Sony lens: record what you see



Smart Contact Lenses

- Samsung
- Sony
- Google
- Mojo vision
- Innovega

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What is the best type of CL for "smart"?

- Scleral
Mojo vision lenses with electronics
14K-ppi display
- Soft
Innovega - combination soft lens and specs (eMacula®)
Augmented reality / virtual reality (AR/VR)



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Summary & Thank you!

Feel free to email me with any questions
mkwalker@central.uh.edu

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Kids and Contact Lenses

DISCLOSURES

- In the past 24 months, Dr. Walker has received research funding or honoraria from the following companies:
 - Alcon Laboratories
 - Bausch & Lomb SVP
 - ABB Optical



2

Layout of lecture

- Part 1: Specialty contact lenses in pediatric populations
 - Safety of CL in children -
- Part 2: Everyday contact lenses in kids (myopia control)

3

Specialty contact lens indications in kids

Ocular surface disease

- Stevens-Johnsons Syndrome
 - Anisometropia
 - Amblyopia
 - High ametropia

Refractive disease

- Aphakia
- Anisometropia
- Amblyopia
- High ametropia

Other

- Nystagmus
- Congenital or traumatic anatomical defect (aniridia, colobomas, albinism, achromatopsia)

4



- About 2.5 per 10,000 under the age of 1
- About 200,000 children in the world are blind from congenital cataracts
- Can be unilateral or bilateral

Congenital Cataracts

Lenhart PD, Courtright P, Wilson ME, et al. Global challenges in the management of congenital cataract: proceedings of the 4th International Congenital Cataract Symposium held on March 7, 2014, New York, New York. J AAPOS. 2015 Apr;19(2):e1-8.

5



Fig. 1 An autosomal dominant sutural/nuclear congenital cataract in a 2-year-old boy obscuring the visual axis

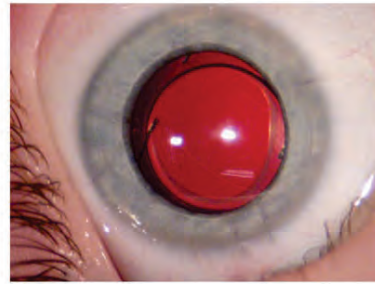


Fig. 3 The same eye as Fig. 1, 3 weeks after successful lensectomy, posterior capsulotomy and intraocular lens implantation

Congenital Cataracts

CHAN WH, BJ SWAS S, ASHWORTH JL, LLOYD IC. CONGENITAL AND INFANTILE CATARACT: AETIOLOGY AND MANAGEMENT. EUR J PEDIATR. 2012 APR;171(4):625-30.

6



Fig. 4 A unilateral congenital cataract associated with persistent fetal vasculature (PHPV). Note the prominent iris vasculature and vascularised retrolental plaque

- Reason for surgery can help predict risks for complications
- Early and late glaucoma 20-60%
 - More common in <1yo
- PCO development
- Inflammatory complications (posterior synechiae, uveitis)

Complications of cataract extraction

CHAN WH, BISWAS S, ASHWORTH JL, LLOYD IC. CONGENITAL AND INFANTILE CATARACT: AETIOLOGY AND MANAGEMENT. EUR J PEDIATR. 2012 APR;171(4):625-30.

7

Pediatric Aphakia

- I. Usually due to congenital cataracts
 - I. CLs first reported in the 1950s
 - II. Other causes: trauma, metabolic syndrome
- II. Monocular surgery – more important due to **aniseikonia**



8

Fitting aphakic infants

- Infant Aphakia Treatment Study (IATS)
 - Stanford started in 2005 – first results in 2015
 - Contact lenses are safer than IOL for infants <7mo old
 - Particularly better for monocular aphakes
- Soft CL – Silsoft™
 - Elastofilcon A; water content: 0.2%
 - Dk: 340
 - 11.3-12.5 mm dia



9

Fitting aphakic infants

- Scleral (irregular cornea) and corneal GP can also be used – may be more challenging to fit
- Baby eyes are...
 - Smaller and shorter, small fissures (11.3 dia)
 - Steeper corneas (7.5 – 7.7 BC)
- Refractive guide:

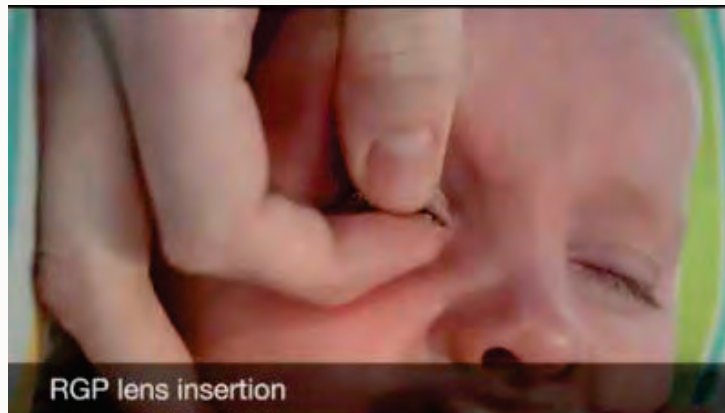
0-12 months	+29 D to +32 D
12-24 months	+20 D to +26 D
> 2 Years	+12 D to +20 D



Emory EyeCare

10

Fitting aphakic children



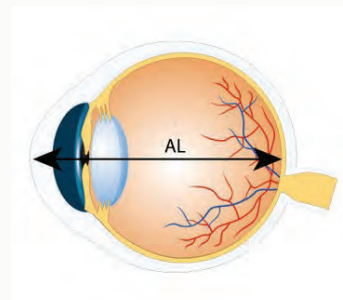
RGP lens insertion

Video from Children's Eye Care youtube page

11

Impact of early CE on emmetropization

- Ocular growth includes..
 - Axial elongation
 - Corneal and lenticular flattening
- Corneal flattening occurs mostly in first 3mo
- Most of axial elongation over first 18 months
- Causes myopic shift – therefore goal of most CE is about 9D of hyperopia (if <10 weeks at surgery)



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Pediatric Amblyopia

- About 2.5% prevalence in US
- Causes more vision loss than any other disease in people under 40yo
- Several different etiologies:
 - Refractive
 - Bilateral (>5) or unilateral ($>3D$) hyperopia
 - Bilateral ($>8D$) or unilateral ($>8D$) myopia
 - Meridional amblyopia
 - Strabismic
 - Deprivation
 - Cataracts, opacification, severe ptosis



13

Accommodative Esotropia

- Esotropia when looking near
- SCL – dailies usually work well
- Overnight (high Dk) options as needed

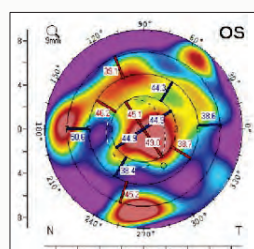


Images from the American Academy of Ophthalmology

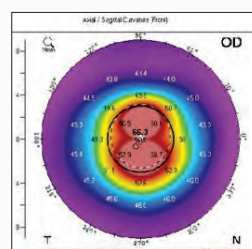
14

High pediatric ametropia

- I. Regular myopia/hyperopia/astigmatism → regular soft dailies are fine
- II. Irregularities → custom soft, corneal, hybrid, or scleral



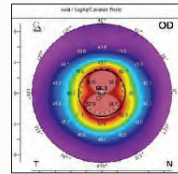
Traumatic scar



Keratoconus

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Childhood keratoconus

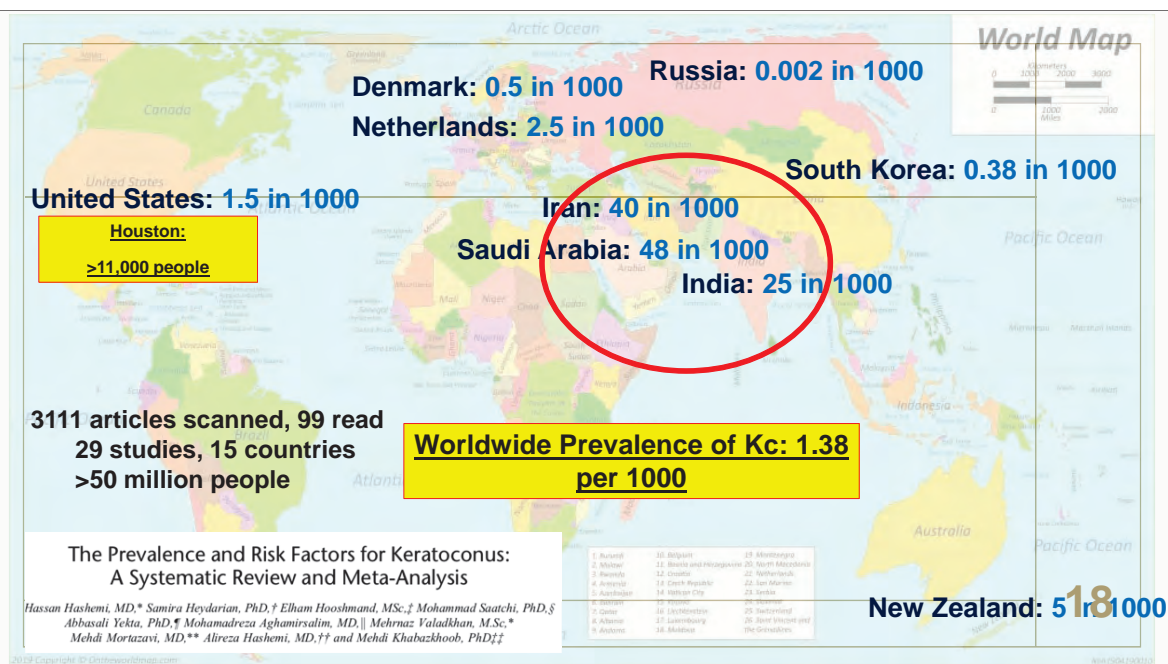


- Lower prevalence than adults, but thought to be increasing
- Almost always progresses to severe with onset <16yo Keratoconus
- CXL management is essential – may not be as effective in kids
- Contact lens management should try to reduce as much inflammation on the eye as possible

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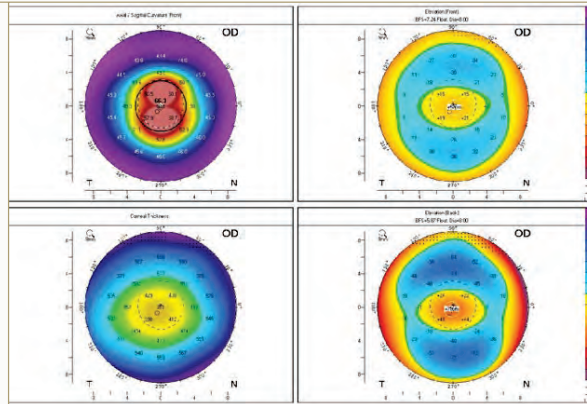


What is the current prevalence of KC??

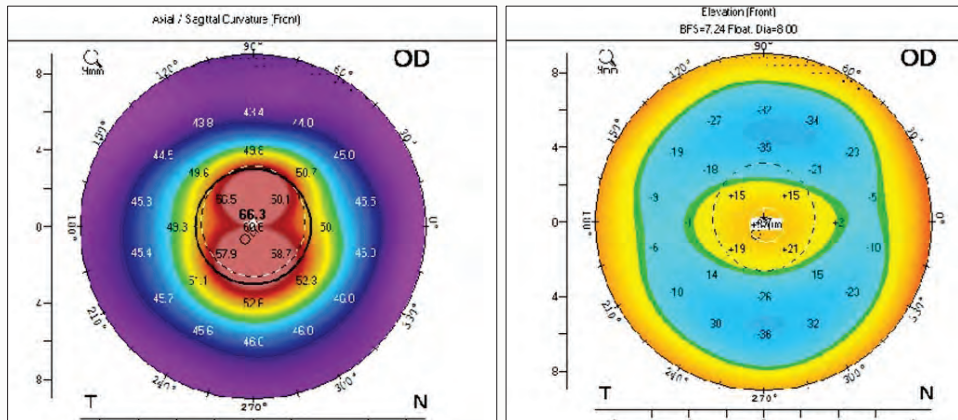


Case Example: “Michael”

- 13yo white male
- Dx with keratoconus 3 mo ago
 - Referred to UEI from corneal surgeon – CXL OD 6 weeks ago
 - Fitting OD only – CXL OS pending
- Father reports (+)hx of eye rubbing, complaining of dust getting in eyes during baseball



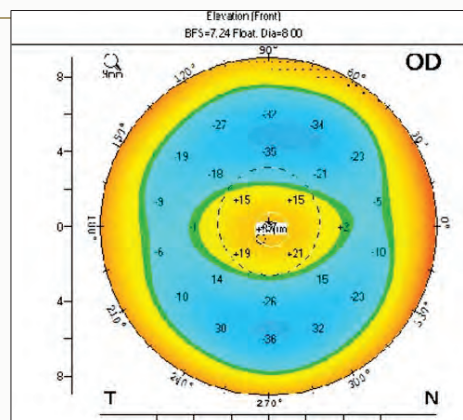
19



20

Case Example: “Michael”

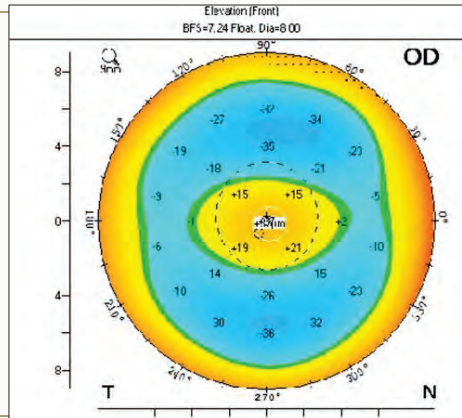
- Contact lens considerations...
- Options:
 - Custom soft
 - May be okay
 - ...”tried those thick soft ones and they were uncomfortable and couldn’t get it...”
 - Corneal GP
 - Scleral



21

Case Example: “Michael”

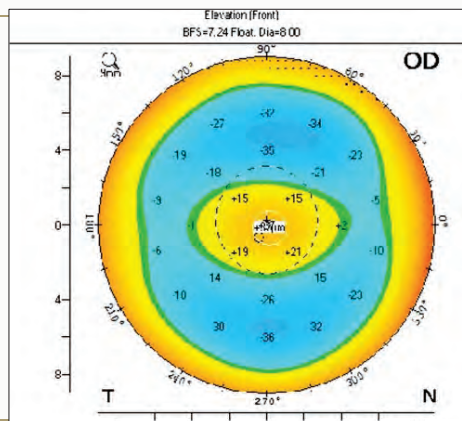
- Contact lens considerations...
- Options:
 - Custom-soft
 - Corneal GP
 - Very symmetrical cornea! (good)
 - “gets dust in eyes at baseball and constantly itching”
 - Scleral



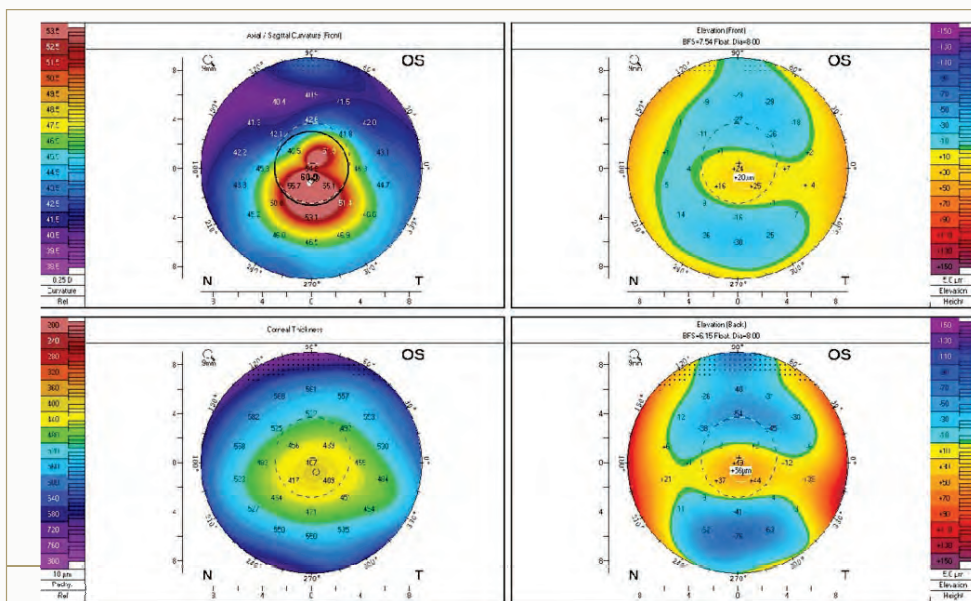
22

Case Example: “Michael”

- Contact lens considerations...
- Options:
 - Custom-soft
 - Corneal GP (maybe consider)
 - Scleral



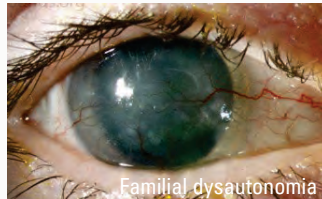
23



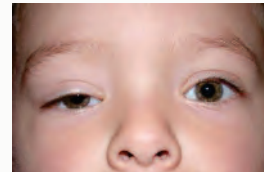
24

Scleral lenses in children

Ocular
Surface
Disease



Anatomical
eyelid
barriers



[HTTPS://WEBEYE.OPHTH.UIOWA.EDU/](https://webeye.ophth.uiowa.edu/)

25

Safety of contact lenses

- Always measuring the risk vs. benefit
- Specialty – benefits often outweighs the risk
- “Cosmetic” – different balance
- Myopia control....?



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Safety of CL in Children

- I. How safe are CL for children?
- II. Overall...safer in children in adults
- III. Complications include...

Complication	Risk with overnight wear	Risk with daily wear	Risk in general population
Microbial keratitis			
Peripheral ulcers			
Red eye (CLARE)			
Infiltrates			

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Cornea

Age and Other Risk Factors for Corneal Infiltrative and Inflammatory Events in Young Soft Contact Lens Wearers from the Contact Lens Assessment in Youth (CLAY) Study

Robin L. Chalmers,¹ Heidi Wagner,² G. Lynn Mitchell,³ Dawn Y. Lam,⁴ Beth T. Kinoshita,⁵ Meredith E. Jansen,⁴ Kathryn Richdale,⁵ Luigina Sorbara,⁶ and Timothy T. McMahon²

Ocular health of children wearing daily disposable contact lenses over a 6-year period

Jill Woods^{1,2}, Debbie Jones^{3,4}, Lyndon Jones^{5,6}, Susanna Jones⁷, Chris Hunt¹, Paul Chamberlain¹, John McNally¹

¹Centre for Ocular Research & Education (CORE), School of Optometry & Vision Science, University of Waterloo, 200 University Ave W, Waterloo, ON N2L 3G1, Canada

²Centre for Eye & Vision Research, Hong Kong

³Visioncare Research Ltd., Crown House, West Street, Potters Bar, Herts, SG9 7EN, UK

⁴CooperVision, Inc., 6150 Stoneridge Blvd SE, Pleasanton, CA 94588, United States

RESEARCH

Efficacy and safety of a soft contact lens to control myopia progression

Dr. Feng Chen^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}

Efficacy and safety of interventions to control myopia progression in children: an overview of systematic reviews and meta-analyses

Wenyan Piao^{1,2}, Anna-Lena Hardin³, Annette Forster^{4,5}, Hilmar Zuber⁶, Jannis Bruttman⁷ and Jannis Bruttman⁸

The Safety of Orthokeratology—A Systematic Review

Jae M. Lim, MD, PhD, MPH and Pyung Kim, MD, PhD

Pediatric Microbial Keratitis With Overnight Orthokeratology in Russia

Mark A. Bullimore, MD, PhD, Dmitry S. Mironov, MD, Andrei B. Kharin, MD, PhD, Leonid B. Kharin, MD, PhD, Svetlana P. Astashev, MD, Andrei N. Shadrin, MD, PhD, Kathryn Richdale, MD, PhD, and Valery V. Gorev, MD, PhD

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Cornea

Age and Other Risk Factors for Corneal Infiltrative and Inflammatory Events in Young Soft Contact Lens Wearers from the Contact Lens Assessment in Youth (CLAY) Study

Robin L. Chalmers,¹ Heidi Wagner,² G. Lynn Mitchell,³ Dawn Y. Lam,⁴ Beth T. Kinoshita,⁵ Meredith E. Jansen,⁴ Kathryn Richdale,⁵ Luigina Sorbara,⁶ and Timothy T. McMahon²

3,541 children (events in 4.3%)

TABLE 2. Diagnosis for Events by Age and Overnight Wear

	Total n (%)	EW Lens Use		Age at Event			
		EW Previous Night n (%) ^a	Any EW n (%) [†]	8–12 y n	13–17 y n	18–25 y n	>26 y n
Microbial keratitis	8 (4)	2 (25)	4 (50)	0	2	5	1
Infiltrative keratitis	110 (59)	21 (19)	39 (35)	2	33	46	29
CLPU	41 (22)	17 (41)	24 (59)	2	8	20	11
CLARE w/infiltrates	14 (8)	10 (71)	13 (93)	0	2	8	4
CLARE w/o infiltrates	13 (7)	4 (31)	5 (39)	0	5	7	1
Iritis	1 (1)	0	0	0	0	1	0
Total by age group	187 (100)	54 (29)	85 (47)	4	50	87	46

29

Ocular health of children wearing daily disposable contact lenses over a 6-year period

Jill Woods^{1,2}, Debbie Jones^{3,4}, Lyndon Jones^{5,6}, Susanna Jones⁷, Chris Hunt¹, Paul Chamberlain¹, John McNally¹

¹Centre for Ocular Research & Education (CORE), School of Optometry & Vision Science, University of Waterloo, 200 University Ave W, Waterloo, ON N2L 3G1, Canada

²Centre for Eye & Vision Research, Hong Kong

³Visioncare Research Ltd., Crown House, West Street, Potters Bar, Herts, SG9 7EN, UK

⁴CooperVision, Inc., 6150 Stoneridge Mall Rd, Pleasanton, CA 94588, United States

144 subjects → randomized to Proclear and MiSight 1-day

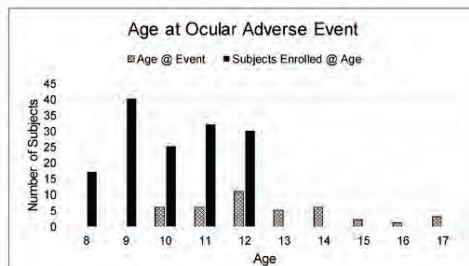


Fig. 1. Age at ocular adverse event presentation (n = 40), age of enrolment in study (n = 144).

Table 6
Study ocular adverse event summary.

	Monocular (each count = 1 eye)	Binocular (each count = 2 eyes)	# of all events considered as potentially CL related
Serious Events (n = 1)			
• Uveitis (associated with herpes zoster)	1	0	0
Significant Events (n = 2)			
• New peripheral scar	2	0	2
Non-Significant Events (n = 37)			
• Non-Significant Infiltrative Events (<Grade 2 and non-symptomatic)	4	0	3
• Papillary conjunctivitis Grade ≥2 (only if a change of 2 grades from baseline)	1	1	1
• Blepharitis	0	1	0
• Meibomianitis	1	1	0
• Localised allergic reactions	0	1	1
• Conjunctivitis: bacterial	1	1	0
• Viral, allergic	5	1	5
• Any corneal event which necessitates temporary lens discontinuation ≥1 day and <2 weeks			
Foreign body: superficial punctate keratitis; mild pterygia; corneal staining	12	7	10
• Other Non-significant event			
Eye irritation; lens removal difficulty; mild dryness; nasal hyperemia; subconjunctival haemorrhage, small epithelial opacity; episcleritis; asymptomatic burning/stinging; foreign body; asymptomatic red eye; blurry vision			

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Efficacy and safety of a soft contact lens to control myopia progression

Clin Exp Optom 2020

DOI:10.1111/ceo.13977

- 58 participants
- Randomly fitted into one of two SCL brand
- Adverse events were minimal

Group	Esencia (n = 32)	Control (n = 26)
Total number of patients	32 (100.0%)	26 (100.0%)
Corneal epithelial oedema	0 (0.0%)	0 (0.0%)
Corneal stromal oedema	0 (0.0%)	0 (0.0%)
Corneal infiltration	0 (0.0%)	0 (0.0%)
Corneal neovascularisation	3 (9.4%)	1 (3.1%)
Conjunctival hyperaemia	1 (3.1%)	0 (0.0%)
Conjunctival pressure	0 (0.0%)	0 (0.0%)
eyelid inflammation	0 (0.0%)	0 (0.0%)
Micropapillary response	3 (9.4%)	2 (6.2%)
Papillary conjunctivitis	1 (3.1%)	0 (0.0%)
Superficial punctate keratitis	2 (6.2%)	1 (3.1%)
Infection	0 (0.0%)	0 (0.0%)
Other	0 (0.0%)	0 (0.0%)
Total number of patients with adverse events	8 (25.0%)	4 (15.4%)
Two patients had more than one adverse event.		

Table 3. Adverse events during study period

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The Safety of Orthokeratology—A Systematic Review

Yue M. Liu, O.D., Ph.D., M.P.H. and Peiyang Xie, M.D., Ph.D.

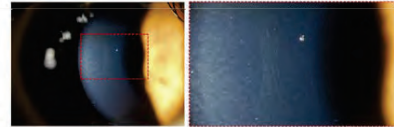


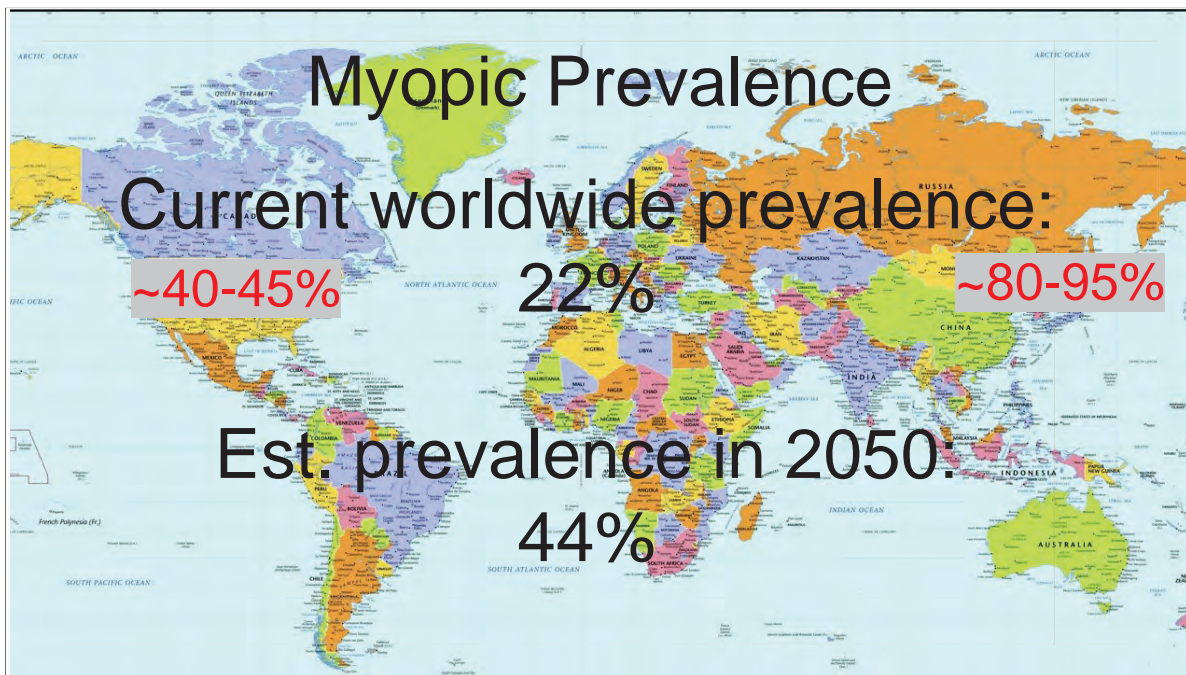
Fig. 10. Fibrillary lines associated with orthokeratology lens wear under low (left) and high (right) magnification. (Courtesy PolyU, HK).

Complication	Risk with overnight wear	Associations
Microbial keratitis	7.7 cases per 10,000 patient years	Lack of training, cases, improper fitting, poor lens care compliance
Corneal staining	common	Higher baseline myopia (not age)
Lens binding	Relatively common	Associated with staining
Epithelial lesions (iron, white, fibrillary)	Common in longtime wearers (nerve fibers?)	Associated with long duration of wear
Microcysts	Uncommon	Longer wear times, higher myopia

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Myopia management in children

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Pathologic (Degenerative) Myopia

- Axial length >26mm, R.E. >6D
- Associated with several pathologies
 - Glaucoma
 - Cataracts
 - Retinal tears/detachments
 - CNV
 - Macular atrophy
 - Choroidal degeneration...



Cataract (PSC)

-0.50 to -3.00 D reference	OR
3.00-6.00 D	1.56
-6.00-10.00 D	2.55
>10.00 D	4.55

Retinal Detachment & Retinoschisis

	OR
3.00-6.00 D	3.29 / 3.15
-6.00-10.00 D	5.37 / 8.74
>10.00 D	40.56 / 12.62

Glaucoma (OAG)

	OR
0.50 - 3.00 D	1.59
>3.00 D	2.92

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Myopic Macular Degeneration (MMD)

-0.50—3.00 as reference	OR
3.00-6.00 D	13.57
-6.00-10.00 D	72.74
>10.00 D	845.08

<https://www.specsavers-spectrum.com/profile-journal/drp-myopic-degeneration/>

Myopic CNV

	OR
3.00-6.00 D	3.14
-6.00-10.00 D	17.0
>10.00 D	70.60

Dr. Alex P. Huang, MD.
<http://imagebank.asra.org/files/0094/myopic-cnv>

Chorioretinal atrophy (and neovascularization)

	OR
3.00-6.00 D	3.48
-6.00-10.00 D	11.66
>10.00 D	74.08

40

Diagnosing Myopia

Refractive error norms:

Infants: approx +2.00D

3-5 yo: emmetropization

About +1D at 5yo

6-16 yo: slight myopic shift

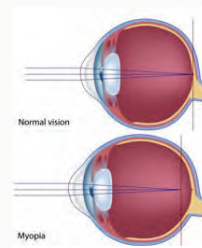


Axial length norms:

Infants: 19-21 mm

3-5 yo: 21-22 mm

6 yo: 22 - 22.75 mm



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Calculating Risk

- Age of onset
 - Independent of sex, ethnicity, school, reading time, parents
 - ...so early myopes are high risk regardless
- Genetics (3-5x greater risk w/2 parents), hormones
- Environment: outdoor time, near work, electronics, light levels
- Ethnicity
 - Asians > European & African descent

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Clinical Resource: Managing Myopia Clinical Guide



Authors
 Alex Nixon, OD, MS, FFAO
 Noel Brennan, PhD, MScOptom, FFAO

Contributors
 David Bertelsen, OD, PhD, FFAO
 Kamlesh Chauhan, PhD, MCOptom
 Xu Cheng, MD, PhD, FFAO, MBA
 David Chong, D Optom, BSc Optom, MSc Clinical Optom
 Lori Grover, OD, PhD
 Koh Liang Hwee, BSc Optom (Hons), UK, PhD
 Chui Wen Juan, B Optom Hons, M Optom, PGCO
 Chew Wai Kwong, BSc MCOptom
 Shirley Loh, B Optom, PGCO
 Michael Mayers, OD, FFAO
 Jerry Nieldigh, OD
 Erin Nixon, BS, MBA
 Andrew Pucker, OD, PhD, FFAO, FSLs, appointed by ASCO
 Kathryn Richdale, OD, PhD, FFAO, appointed by ASCO
 Tan Li Li, PhD, M MedSc (Optom), BOptom (Hons), FBCLA, FFAO
 Kan Tong, Bsc Optom
 Jeffrey Wallina, OD, PhD
 Max Zhang, MD, PhD

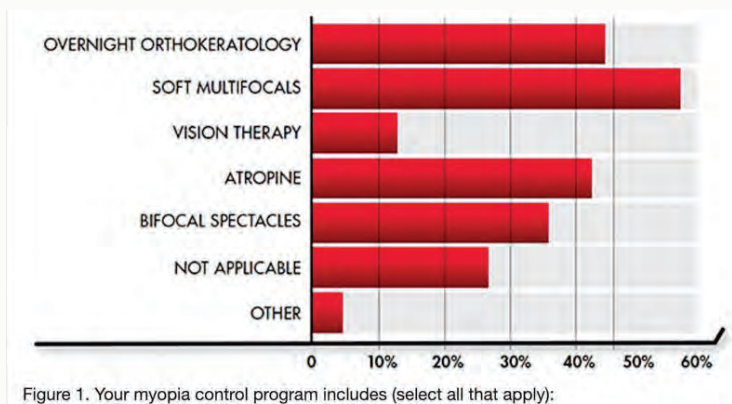


Clinical Resource: Managing Myopia Clinical Guide

Table 5: Mean progression for myopic Asians and non-Asians by axial length and refractive error across age^{2,5}

	AGE	7	8	9	10	11	12
AXIAL LENGTH (mm)	Asian	0.52	0.46	0.41	0.36	0.32	0.28
	Non-Asian	0.35	0.31	0.28	0.25	0.22	0.20
REFRACTIVE ERROR (D)	Asian	-1.12	-0.94	-0.78	-0.66	-0.56	-0.50
	Non-Asian	-0.98	-0.82	-0.69	-0.56	-0.45	-0.35

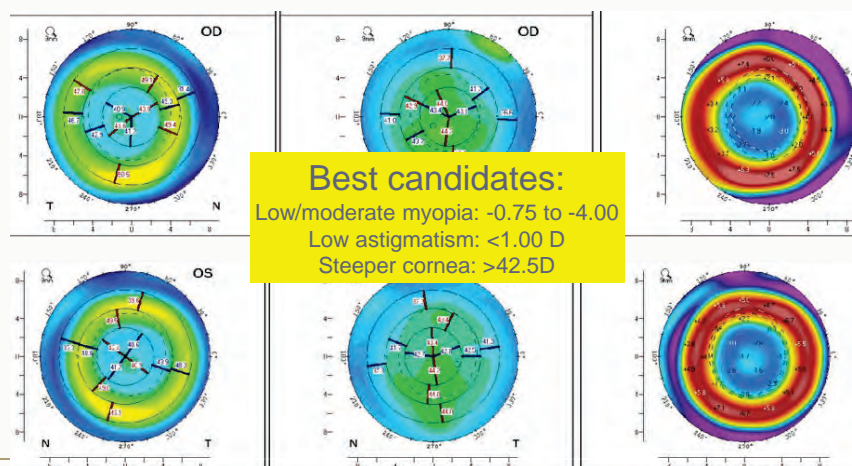
Contact lenses for myopia control



Bennett, CL spectrum, October 2022

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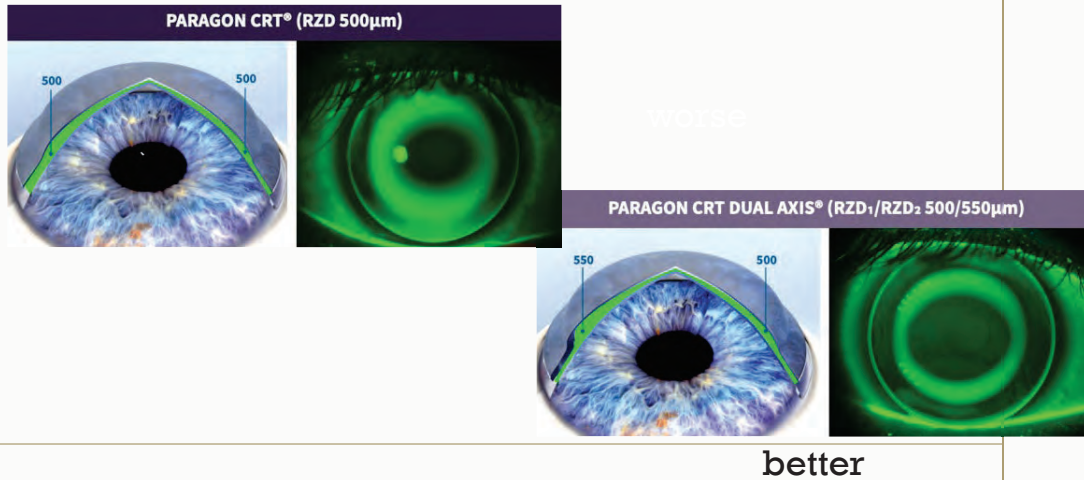
Orthokeratology



Troubleshooting orthokeratology

	LATERAL DECENTRATION	ADJUSTMENT	EXAMPLE
	FIRST	Increase Diameter	10.5mm to 11.0mm
	SECOND	Increase RZD	8.6-550-33 to 8.6-575-33
	SUPERIOR DECENTRATION		
	SMALL TREATMENT ZONE	Utilize CRT Dual Axis®	8.6-550-33 to 8.6-550/600-33
	LARGE TREATMENT ZONE	Increase RZD	8.6-550-33 to 8.6-575-33
	INFERIOR DECENTRATION		
	TIGHT EDGE LIFT	Increase Diameter + Flatten LZA	8.6-525-33-10.5 to 8.6-525-32-11.0
	0.5-1.0 MM EDGE LIFT	Increase Diameter	10.5mm to 11.0mm
	CENTRAL ISLAND		
	FIRST	Flatten LZA	8.6-550-34 to 8.6-550-33
	SECOND	Decrease RZD	8.6-525-33 to 8.6-500-33
	ASYMMETRICAL PERIPHERAL ALIGNMENT		
	FIRST	Utilize Paragon CRT Dual Axis® RZD ₁ /RZD ₂	8.6-550-33 to 8.6-550/600-33

Dual axis ortho-K



Longitudinal studies evaluating SCL for myopia

CLINICAL TRIALS SUBSCRIBED OPEN ACCESS Full-featured View

A 3-year Randomized Clinical Trial of MiSight Lenses for Myopia Control
 Chamberlain, Paul BSc (Hons)^{1*}; Peixoto-de-Matos, Sofia C. MSc²; Logan, Nicola S. PhD³; Ngo, Cheryl MBBS, MMed⁴; Jones, Deborah BSc, FAAO⁵; Yoo, J. PhD⁶

MiSight

Original Investigation
 August 11, 2020

Effect of High Add Power, Medium Add Power, or Single-Vision Contact Lenses on Myopia Progression in Children: The BLINK Randomized Clinical Trial

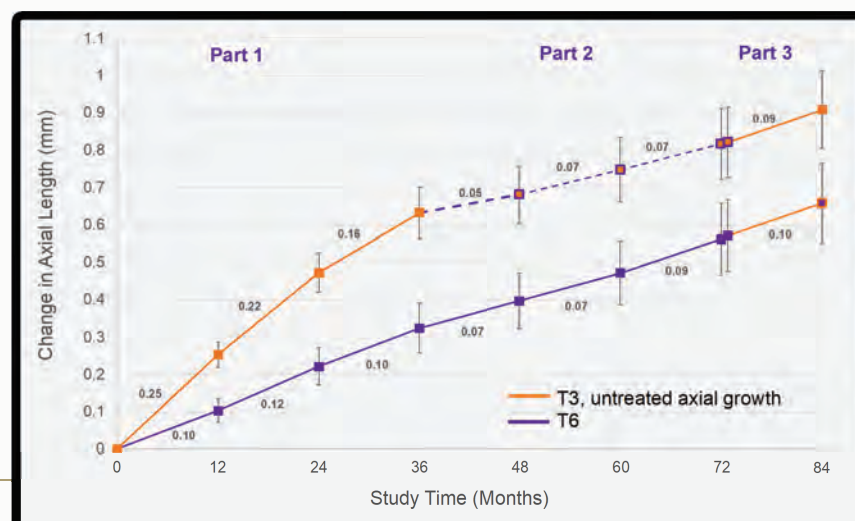
Jeffrey J. Walline, OD, PhD¹; Maria K. Walker, OD, PhD²; Donald O. Mutti, OD, PhD³; et al.

Best candidates:
 Low/moderate/high myopia: -0.50 to -10.00
 Lenses available in high toric
 Corneal curvature doesn't matter much

Biofinity

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MiSight 7-year study



Combined Therapies

Table 3. Study characteristics			Δ AXL (mm)	Δ AXL (mm)	Therapy Alone (n)	Orthokeratology section.			
Author (Year)	Age (Years)	Rx (D)				AXL (mm)	Therapy Alone (n)	Δ Rx (D)	Post VA (LogMAR)
Kinoshita et al. [51] 2018	10.6	−2.88	0.09 ± 0.12 *	0.19 ± 0.15 *	OK (20)	−0.15 *	OK (20)	NR	NR
Wan et al. [52] 2018	10.4	−4.25	0.55 ± 0.12 *	0.58 ± 0.09 *	OK (26)	−0.09 *	OK (26)	↑ 0.55 D	0.01 ± 0.01
Wan et al. [52] 2018	10.3	−4.58	0.65 ± 0.18 *	0.83 ± 0.16 *	OK (20)	−0.16 *	OK (20)	↑ 0.83 D	0.01 ± 0.01
Wan et al. [52] 2018	10.9	−6.75	0.65 ± 0.18 *	0.83 ± 0.16 *	OK (20)	−0.14 *	OK (29)	↑ 0.45 D	0.01 ± 0.01
Wan et al. [52] 2018	10.8	−6.48	0.57 ± 0.17 *	0.64 ± 0.14 *	OK (29)	−0.15 *	OK (20)	↑ 0.65 D	0.01 ± 0.00
Chen et al. [54] 2018	8.3	−2.65	0.57 ± 0.17 *	0.64 ± 0.14 *	OK (29)	−0.08 *	OK (29)	NR	NR
Tan et al. [53] 2019	9.0	−2.79	0.58 ± 0.08 *	0.40 ± 0.15 *	OK (20)	−0.03 *	OK (35)	NR	−0.03 ± 0.07
Rx: Refraction; D: Diopters; VA: Visual acuity			0.14 ± 0.14 *	0.25 ± 0.08 *	OK (29)	Atropine, OK: Orthokeratology; NR: Not reported.			
* Statistically significant difference $p < 0.05$; † and two atropine concentrations, 0.125% and			−0.05 ± 0.05 *	−0.02 ± 0.03 *	OK (35)	0.025% and 0.05%, under 6 diopters and above 6 diopters,			

Summary & Conclusions

- I. Many specialty indications – often at referral centers
- II. Myopia control has drastically increased CL wear in kids
- III. Contact lens wear is safe, but like any treatment can have complications
- IV. Compliance (care and wear) is ESSENTIAL to avoid complications

5/31/2023

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University of Houston College of Optometry
Cedar Springs Eye Clinic - Adjunct Faculty

Ocular Manifestations of Herpes Virus from Cornea to Retina

Viviana Gonzalez, OD


Financial Disclosures

None

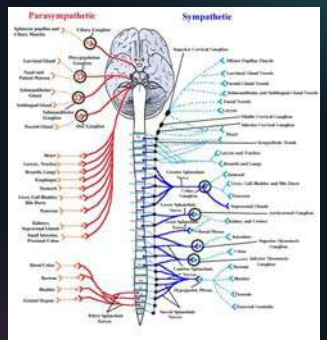
Objectives

1. Understand the systemic and ocular effects of human herpesvirus
2. Understand the treatment and management of Herpes simplex vs. Varicella zoster virus
3. Become familiarized with oral antivirals

The Herpes Virus Family



- **Herpes Simplex Type 1 (HSV 1)**
 - Transmission: saliva
 - An estimated 3.7 billion people under age 50 (67%) have HSV-1 infection globally
 - Asymptomatic, cold sores
- **Herpes Simplex Type 2 (HSV 2)**
 - Transmission: sexual contact
 - An estimated 417 million people aged 15-49 (11%) worldwide have HSV-2 infection.
- **Varicella Zoster Virus (VZV)**
 - Transmission: airborne, skin-to-skin contact
 - Chicken pox/ VZV vaccine -> Shingles
 - By adulthood, as many as 90-95% of individuals have serologic evidence of infection
- **Epstein Bar Virus (EBV) (aka Mono)**
 - Transmission: saliva
 - Approximately 90% of the US population is infected with Epstein-Barr virus by age 25 years
 - Asymptomatic/mild in children
- **Cytomegalovirus (CMV)**
 - Transmission: saliva, breast milk, sexual contact
 - Over half of adults by age 40 have been infected with CMV.
 - Usually asymptomatic



Parasympathetic

Sympathetic

Herpes Simplex Virus (HSV)

Varicella-Zoster Virus (VZV)

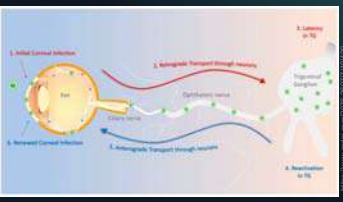
HSV 1: Trigeminal ganglion, Ophthalmic division, Cornea, Conjunctiva, Salivary glands, Genital area.

HSV 2: Sacral ganglia, Genital area.

VZV: Dorsal root ganglia, Spinal nerves, Skin, Ophthalmic division, Trigeminal ganglion, Sacral ganglia.

Herpes can affect every part of the eye!

Conjunctivitis
Keratitis
Uveitis
Episcleritis
Scleritis
Retinitis
Optic Neuritis
Ophthalmoplegia



1. Initial Corneal Infection

2. Anterograde Transport through neurons

3. Latency in TG

4. Reactivation to TG

5. Anterograde Transport through neurons

6. Retinal Infection

7. Optic Nerve Infection

8. Optic Neuritis

Case History

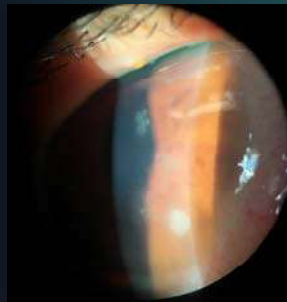
46-year-old Asian female
CC: Swollen, red, painful left eye worsening for 2 weeks.
 First occurrence.
Ocular Medications: Erythromycin ung qid x 5 days
PMH/POH: Unremarkable
Systemic Medications: None

Examination: Visit 1

Visual Acuity: 20/20 OD, OS
Goldmann tonometry: 15 mmHg OD / 15mmHg OS
Prelims: Unremarkable
Anterior Assessment:
 • OD: unremarkable
 • OS: 2+ diffuse injection, (+) 3 epithelial dendrites, (+) NaFl pooling, (+) Focal stromal opacity, (-) Cells/flare, Mild UL edema
Posterior Assessment: Unremarkable

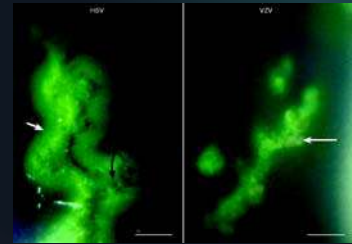
Examination: Visit 1

Visual Acuity: 20/20 OD, OS
Goldmann tonometry: 15 mmHg OD / 15mmHg OS
Prelims: Unremarkable
Anterior Assessment:
 • OD: unremarkable
 • OS: 2+ diffuse injection, (+) 3 epithelial dendrites, (+) NaFl pooling, (+) Focal stromal opacity, (-) Cells/flare, Mild UL edema
Posterior Assessment: Unremarkable



True dendrite vs Pseudodendrite

- True dendrite**
- HSV
 - Excavation, Terminal end bulbs
 - ACTIVE viral replication = Antivirals
- Pseudodendrite**
- VZV
 - Stuck on, elevated, lack end-bulbs and branching
 - Steroids will not worsen condition

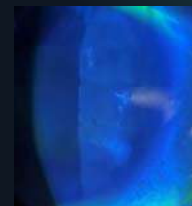


MM ID 2000

- **Assessment:** Herpes Simplex Epithelial and Stromal Keratitis
- **Plan:**
 - Initiate valacyclovir 1,000mg PO TID x 7 days
 - Initiate preservative free artificial tears every 2 hours
 - Defer topical steroid until epithelial ulceration heals
 - RTC 2 days



Initial Presentation



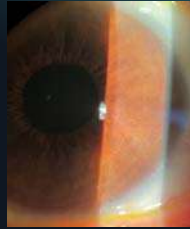
Day 3
 (+) Staining
 Continue valacyclovir 1,000mg TID
 Continue PFAT q2h



Day 6
 (-) Staining, (+) ghost dendrite,
 (+) new stromal infiltrate
 Continue valacyclovir 1,000mg TID
 Start Prednisolone acetate 1% BID
 Continue PFAT q2h



Day 7
Resolution of ghost dendrites,
(-) staining
Reduce valacyclovir to 500mg QD
Increase pred acetate 1% QID
Continue PFAT q2h



Seen 3x over 4-week period
Pred was tapered and d/c
valacyclovir d/c

HSV Keratitis Treatment

	Antiviral	Topical Steroid
Epithelial Dendritic	Therapeutic dose of topical OR oral antiviral agent	Not indicated
Epithelial Geographic	Therapeutic dose of oral (x2) OR topical antiviral agent	Not indicated
Stromal	Prophylactic dose of oral antiviral agent	Therapeutic dose of topical corticosteroid
Stromal + Epithelial	Therapeutic dose of oral (x2) antiviral agent	Limited dose of topical corticosteroid <small>once epithelial ulceration heals</small>
Endothelial	Therapeutic dose of oral antiviral agent	Therapeutic dose of topical corticosteroid

(x2) indicates double standard HSV oral antiviral dosage

HSV Keratitis Treatment

ORAL ANTIVIRAL			
Agent	Therapeutic dosage	Therapeutic dosage (x2) (Epi Geographic & Stromal+Epi)	Prophylactic Dosage
Acyclovir	400 mg 3-5x daily	800 mg 5x daily	400 mg BID
Valacyclovir	500 mg TID	1,000 mg TID	500 mg QD
Famciclovir	250 mg TID	500 mg TID	250 mg BID

HSV Epithelial Keratitis Treatment

ORAL ANTIVIRAL		
Agent	Dendritic Dosage (7-10 days)	Geographic Dosage (14-21 days)
Acyclovir	400 mg 3-5x daily	800 mg 5x daily
Valacyclovir	500 mg TID	1,000 mg TID
Famciclovir	250 mg TID	500 mg TID
-OR- TOPICAL ANTIVIRAL		
Agent	Dosage	
Trifluridine ophth. soln. 1% (Viroptic)	1 drop into affected eye 9x daily for 7 days Then may decrease to 5x daily if ulcer healed. (Tx not to extend 21 days)	
Ganciclovir ophth. gel 0.15% (Zirgan)	1 drop into affected eye 5x daily until healing of corneal ulcer, followed by 1 drop 3x daily for 7 days.	

American Academy of Ophthalmology Guidelines: <https://www.aao.org/education/clinical-statement/herpes-simplex-virus-keratitis-treatment-guideline>

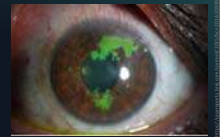
HSV Epithelial Keratitis Treatment

ORAL ANTIVIRAL		
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Acyclovir	400 mg 3-5x daily	800 mg 5x daily
Valacyclovir	500 mg TID	1,000 mg TID
Famciclovir	250 mg TID	500 mg TID
-OR- TOPICAL ANTIVIRAL		
Agent	Dosage	
Trifluridine ophth. soln. 1% (Viroptic)	1 drop into affected eye 9x daily for 7 days Then may decrease to 5x daily if ulcer healed. <i>*Tx not to extend 21 days</i>	
Ganciclovir ophth. gel 0.15% (Zirgan)	1 drop into affected eye 5x daily until healing of corneal ulcer, followed by 1 drop 3x daily for 7 days.	

American Academy of Ophthalmology Guidelines: <https://www.aao.org/education/clinical-statement/herpes-simplex-virus-keratitis-treatment-guideline>

HSV Epithelial Keratitis Treatment

ORAL ANTIVIRAL		
Agent	Dendritic Dosage (7-10 days)	Geographic Dosage (14-21 days)
Acyclovir	400 mg 3-5x daily	800 mg 5x daily
Valacyclovir	500 mg TID	1,000 mg TID
Famciclovir	250 mg TID	500 mg TID



- Consider oral antiviral over topical antiviral in HSV geographic epithelial keratitis

HSV Epithelial Keratitis Treatment

-OR- TOPICAL ANTIVIRAL

Agent	Dosage
Trifluridine oph. soln. 1% (Viroptic)	1 drop into affected eye 9x daily for 7 days Then may decrease to 5x daily if ulcer healed
Ganciclovir oph. gel 0.15% (Zirgan)	1 drop into affected eye 5x daily until healing of corneal ulcer, followed by 1 drop 3x daily for 7 days.



- Trifluridine usage not to extend 21 days due to corneal toxicity
- Consider topical antiviral for elderly patients
- Consider topical antiviral for patients with renal impairment
- Poor penetration into stroma with topical antiviral

HSV Stromal Keratitis Treatment

Oral Antiviral Agent	WITHOUT Epithelial Ulceration	WITH Epithelial Ulceration
Acyclovir	400 mg BID	800 mg 3-5x daily
Valacyclovir	500 mg QD	500 mg TID
Famciclovir	250 mg BID	500 mg BID
Duration of Oral Antiviral	Prophylactic dose maintained during corticosteroid therapy	Therapeutic dose 7-10 days reduced to prophylactic dose once epithelial ulceration healed
Topical Steroid		
Prednisolone Acetate 1%	6-8x daily tapered over 10+ weeks	BID *once epithelial ulceration heals

HSV Stromal Keratitis WITHOUT Epithelial Ulceration

Oral Antiviral Agent WITHOUT Epithelial Ulceration

Acyclovir	400 mg BID
Valacyclovir	500 mg QD
Famciclovir	250 mg BID

Topical Steroid

Prednisolone Acetate 1%	6-8x daily tapered over 10+ weeks
-------------------------	-----------------------------------



- AKA Non-necrotizing stromal keratitis, interstitial keratitis or immune keratitis.
- Prophylactic oral antiviral dose maintained during corticosteroid therapy.

STROMAL KERATITIS DIFFERENTIALS

Bacterial:

Syphilis
Lyme disease
Tuberculosis

Parasitic:

Acanthamoeba

Immune:

- Cogan's syndrome
- Sarcoidosis
- Contact lens
- Rheumatoid Arthritis

Viral:

- Herpes Simplex
- Varicella Zoster
- Cytomegalovirus
- Epstein-Barr
- Measles

HSV Stromal Keratitis WITH Epithelial Ulceration

Oral Antiviral Agent WITH Epithelial Ulceration

Acyclovir	800 mg 3-5x daily
Valacyclovir	1,000 mg TID
Famciclovir	500 mg TID

Topical Steroid

Prednisolone Acetate 1%	BID *once epithelial ulceration heals
-------------------------	--



- Wait to initiate topical corticosteroid until epithelial ulceration has healed
- Therapeutic dose 7-10 days reduced to prophylactic dose once epithelial ulceration healed
- Oral antiviral prophylactic dose maintained during topical corticosteroid use
- Topical corticosteroid can be increased once epithelial ulceration is healed then tapered

HSV Stromal Keratitis WITH Epithelial Ulceration

Oral Antiviral Agent WITH Epithelial Ulceration

Acyclovir	800 mg 3-5x daily
Valacyclovir	1,000 mg TID
Famciclovir	500 mg TID

Topical Steroid

Prednisolone Acetate 1%	BID *once epithelial ulceration heals
-------------------------	--



- AKA necrotizing keratitis
- Differential Dx: Acanthamoeba, Fungal keratitis, Bacterial keratitis
- Consider corneal specialist referral

HSV Endothelial Keratitis Treatment

Oral Antiviral Agent

Acyclovir	400 mg 3-5x daily
Valacyclovir	500 mg TID
Famciclovir	250 mg TID

Topical Steroid

Prednisolone Acetate 1%	6-8x daily
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- AKA disciform keratitis
- Therapeutic dose 7-10 days reduced to prophylactic dose while topical corticosteroids in use.
- Topical steroid tapered after condition is stable

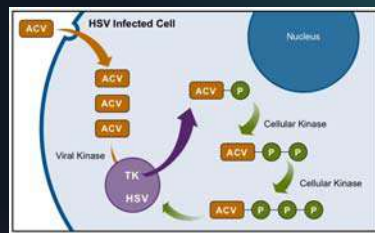
HSV Keratitis Treatment

	Antiviral	Topical Steroid
Epithelial Dendritic	Therapeutic dose of topical OR oral antiviral agent	Not indicated
Epithelial Geographic	Therapeutic dose of oral (x2) OR topical antiviral agent	Not indicated
Stromal	Prophylactic dose of oral antiviral agent	Therapeutic dose of topical corticosteroid
Stromal + Epithelial	Therapeutic dose of oral (x2) antiviral agent	Limited dose of topical corticosteroid (once epithelial ulceration heals)
Endothelial	Therapeutic dose of oral antiviral agent	Therapeutic dose of topical corticosteroid

(x2) indicates double standard HSV oral antiviral dosage

Oral Antiviral Mechanism

1. Acyclovir phosphorylated by viral thymidine kinase
2. The body then converts that to acyclovir triphosphate
3. Which gets incorporated into the growing viral DNA strand by viral DNA polymerase
4. Terminates viral replication



Prodrugs = Greater Bioavailability
Valacyclovir → Acyclovir
Famciclovir → Penciclovir

Antiviral Considerations

Oral antiviral side effects:

- **More common:** Headache (~10%); nausea (~6%); tiredness; dizziness; GI upset
- **CNS effects:** Agitation, hallucinations, confusion, and encephalopathy
 - More likely with higher dosage

Elderly

- Consider Famciclovir: Less CNS side effects reported
- Consider topical antiviral if HSV epithelial keratitis

Concomitant medications

- **Famciclovir + Probenecid:** May increase penciclovir levels. Monitor for evidence of penciclovir toxicity.
- Caution with nephrotoxic and diuretic medications

Kidney Impairment

- Dosage reduction if renal function is impaired
- Adequate hydration should be maintained

Antiviral Considerations

Stages of Chronic Kidney Disease

Stage 1 90% Kidney Function Possible symptoms None
Stage 2 60-89% Kidney Function Some symptoms may appear
Stage 3 40-59% Kidney Function Changes in diet, swelling of extremities, kidney pain, etc.
Stage 4 15-29% Kidney Function High blood pressure, anemia, bone disease, heart disease possible
Stage 5 ≤15% Kidney Function End-stage renal disease Symptoms as Transplant needed

Renal Dosing: HSV Stromal Keratitis w/ Epithelial Ulceration

Oral Antiviral	Creatinine Clearance (mL/min)	Dose	Frequency
Valacyclovir	Normal Dosage	1 g	3 times daily
	30-49	1 g	Every 12 hours
	10-29	1 g	Every 24 hours
	<10	500 mg	Every 24 hours

Stage of chronic kidney disease	Creatinine clearance (mL/min)
Stage 1 Normal	≥90
Stage 2 Mild	60-89
Stage 3 Moderate	30-59
Stage 4 Severe	15-29
Stage 5 Terminal	<15

Recurrence & Prevention

1. Multiple recurrences of any type of HSV keratitis
2. More than one episode of HSV keratitis with ulceration:
 - Strong stimulus for corneal vascularization and lipid deposition.
3. Post-keratoplasty performed for HSV-related scarring
4. Patients with a history of HSV ocular disease undergoing any type of ocular surgery or laser procedure
5. Patients with a history of ocular HSV during immunosuppressive treatment

Recurrence & Prevention

ORAL ANTIVIRAL

Agent	Prophylactic Dosage
Acyclovir	400 mg BID
Valacyclovir	500 mg QD
Famciclovir	250 mg BID

- The duration of prophylaxis is not fully established.
- At least 1 year is recommended.
- Absence of any prolonged protective action once the medication is stopped.

Case #2

Case History

61-year-old Hispanic female
 CC: 7/10 pain, photophobia, mild blur OD for 2 months
 PMH: (+) Shingles, (+) Lymphocytic leukemia, remission 1 year
 Systemic Medications: Gabapentin, previous course of Acyclovir 800mg 5x a day x 10 days

Case History

Ocular Medications: Polytrim tid and Artificial tears, Mild improvement initially
 POH: Stable choroidal nevus OD

Examination: Visit 1

Visual Acuity:

- 20/25 OD, 20/20 OS

Goldmann tonometry:

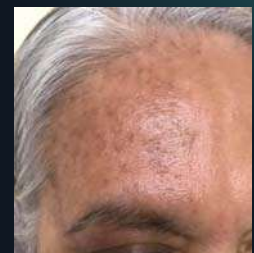
- OD/OS: 34 mmHg/ 18mmHg

Prelims:

- Unremarkable

Posterior Assessment:

- C/D: 0.35/0.35 OD, OS
- Vasculature: Normal
- Maculae: flat, even pigmentation
- Vitreous: No cells
- Retina: Temporal Nevus OD



Examination: Visit 1

Anterior Segment:

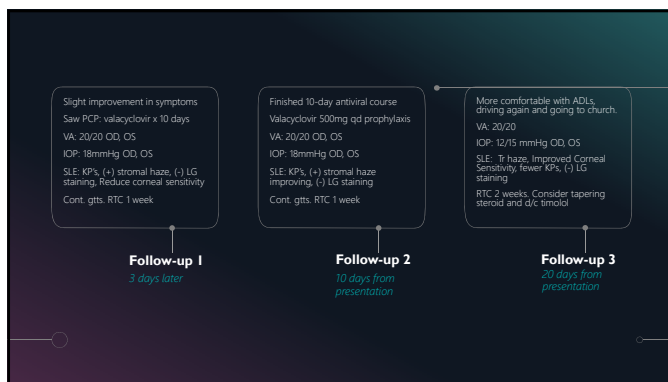
- **Adnexa:** Right-side pigmented scarring respecting midline
- **Cornea:** small pseudo-dendritic lesion (+) lissamine green staining, mild stromal haze, small non-granulomatous KPs, (-) cells/flare
- **AC:** Clear



- **Assessment:** Herpes epithelial and stromal keratitis with resolved anterior uveitis secondary to Varicella Zoster Virus

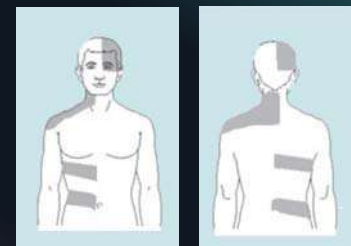
Plan:

- Initiate Prednisolone Acetate 1% OD qid, timolol maleate 0.5% OD bid, Cyclopentolate 1% TID
- Recommend visit PCP for oral antivirals
- RTC 3 days



Shingles

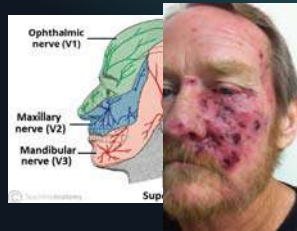
- Reactivation of VZV along a dermatome
- Most commonly, the rash occurs in a single stripe around either the left or the right side of the body.
- About 20% of people with shingles develop a rash that crosses multiple dermatomes.
- 20-25% of people the rash appears in or around the eye= Herpes Zoster Ophthalmicus



<https://www.cdc.gov/shingles/about/symptoms.html>

Herpes Zoster Ophthalmicus

- HZO is a reactivation along V1. Doesn't necessarily have to affect the eye itself
- Nasociliary nerve involvement (Hutchinson's sign) -> High risk for ocular involvement
- 1/3 w/o nasociliary involvement have ocular involvement
- Ocular zoster can affect any part of the eye from the conjunctiva to the optic nerve
- Most commonly around V1 but has also been noted along V2 and V3



<https://www.merckmanuals.com/eye/eye-conditions-and-injuries/herpes-zoster-ophthalmicus>

Anterior Ocular Involvement

Manifestations

- Conjunctivitis
- Epithelial Keratitis
- Stromal Keratitis
- Disciform Keratitis
- Neurotrophic Keratitis
- Anterior Uveitis
- Scleritis/episcleritis
- Sectoral Iris atrophy

Treatment

- Palliative
- None, Debridement
- Topical Steroids
- Topical Steroids
- Topical lubrication, BCL, antibiotics
- Topical Steroid
- Topical/Oral NSAID or Steroid
- None

Shingles Treatment

- Antivirals within 72 hours of symptom onset help reduce severity of the infection, how long **skin rash** lasts, and how painful it gets.
- Valacyclovir & famciclovir have led to pain resolution faster than acyclovir
- Systemic steroids have been shown to speed skin healing and to decrease initial pain

Oral Antiviral Agent	Dosage
Acyclovir	800 mg 3-5x daily x 7-10 days
Valacyclovir	1,000 mg TID x 7-10 days
Famciclovir	500 mg BID x 7-10 days

Zoster Eye Disease Study (ZEDS)

Brief Summary:
This is a multi-center, randomized, double-masked, placebo-controlled clinical trial of suppressive valacyclovir for one year in immunocompetent study participants with an episode of dendritic epithelial keratitis, stromal keratitis, and/or iris due to Herpes Zoster Ophthalmicus (HZO) in the year prior to enrollment.

Condition or disease	Intervention/treatment	Phase
Herpes Zoster Ophthalmicus	Drug: Masked Placebo Drug: Masked Oral Valacyclovir	Phase 4

Detailed Description:
The objective of the Zoster Eye Disease Study (ZEDS) is to determine whether prolonged suppressive oral antiviral treatment with valacyclovir reduces complications of Herpes Zoster Ophthalmicus (HZO), thereby improving clinical outcomes in this common and potentially vision- and life-threatening disease. There are 1,000,000 new cases of Herpes Zoster (HZ) per year in the USA, with 10-20% being HZO.

Specific Aims:
Primary Aim: The primary aim of this double-masked, placebo-controlled multicenter randomized clinical trial will test the hypothesis that suppressive antiviral treatment for 12 months with oral valacyclovir 1000 mg daily reduces the rate of new or worsening dendritic epithelial keratitis, stromal keratitis, endothelial events or iris compared to placebo, at 12 months as the primary endpoint, and at 18 months including 6 months of follow-up after treatment, as a secondary endpoint, in patients with HZO who have had an episode of one of these disease manifestations during the year prior to enrollment.

Secondary Aim: The second aim is to test the hypothesis that suppressive treatment for 12 months with oral valacyclovir 1000 mg daily reduces the severity and duration of postherpetic neuralgia (PHN), compared to placebo, at 12 months and at 18 months as secondary endpoints, in similar patients with HZO. PHN is a

<https://clinicaltrials.gov/ct2/show/study/NCT03415155>

Case #3

Case History

50-year-old Hispanic female

CC: Loss of vision in the right eye began 8 days prior
Medications: Prednisolone acetate 1% q2h OD, cyclopentolate 1% qam OD. Diagnosed 4 days prior by an outside doctor. No improvement reported.

POH: Unremarkable

PMH: Unremarkable

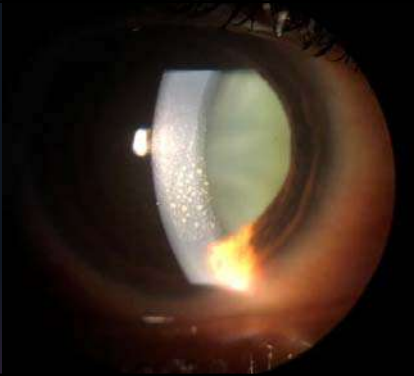
Initial Presentation

Pinhole Acuity :

- LP OD, 20/20 OS

Goldmann tonometry:

- OD/OS: 8, 10 mmHg



Initial Presentation

Pinhole Acuity :

- LP OD, 20/20 OS

Goldmann tonometry:

- OD/OS: 8, 10 mmHg



Initial Presentation

Pinhole Acuity :

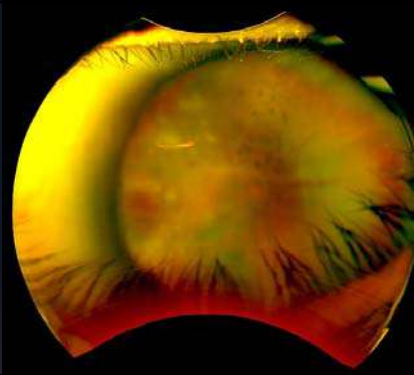
- LP OD, 20/20 OS

Goldmann tonometry:

- OD/OS: 8, 10 mmHg

B-Scan:

- Unremarkable.
- No detachments OD/OS



- **Assessment:** Granulomatous panuveitis OD. Unknown etiology.

• Plan:

- Cyclopentolate qid and difluprednate q2h OD.
- Immediate referral to community clinic for the following testing:
 - CBC with differentials, PPD skin test, FTA-ABS and RPR, ACE blood testing, ELISA titer for toxoplasmosis
- Leading differential diagnoses: toxoplasmosis, syphilis, tuberculosis and sarcoidosis.
- RTC 1 week

Week 1:

- **Slit lamp:** 2+ cells and flare, mutton-fat KP, PS, pigment on endothelium OD.
- **Posterior segment:** 3+ vitritis, clusters of retinal whitening in the periphery temporally and inferiorly OD.
- **Plan:**
 - Add Bactrim DS bid for presumed toxoplasmosis-related uveitis
 - RTC 1 week

Initial serology/ancillary lab findings:

Normal CBC with differentials
 (-) RPR/(-) FTA-ABS
 (-) Toxoplasmosis ELISA titers
 Normal ACE
 (+) PPD, (-) Chest x-ray

Week 2:

Slit lamp: 2+ cells and flare, mutton-fat KP, PS, pigment on endothelium OD.

Posterior segment: 2+ vitritis, clusters of retinal whitening in the periphery temporally and inferiorly OD.

Plan:

- o Further tuberculosis testing was ordered with QuantiFERON gold.
- o Titers for herpes simplex and varicella zoster viruses were ordered for suspicion of a viral etiology.
- o Bactrim DS was discontinued
- o Referral to a retinal specialist for consult

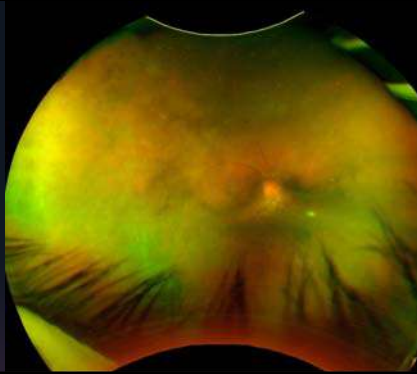
Week 3:

Had not yet seen retinal specialist.

Goldmann tonometry: 3 mmHg OD, 10 mmHg OS

Slit lamp: 1+ cells and flare, mutton-fat KP, PS, pigment on endothelium OD.

Posterior segment: 2+ vitritis

**Week 3:**

Had not yet seen retinal specialist.

Goldmann tonometry: 3 mmHg OD, 10 mmHg OS

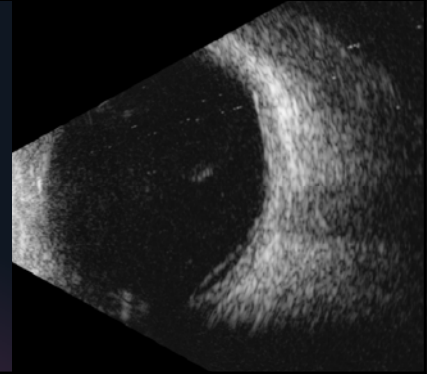
Slit lamp: 1+ cells and flare, mutton-fat KP, PS, pigment on endothelium OD.

Posterior segment: 2+ vitritis

B-Scan: Subretinal fluid OD

Plan:

Emergent referral to a retinal specialist

**Retina Specialist**

- Pars plana vitrectomy with silicone oil and vitreal biopsy (+) for varicella zoster virus (VZV)
- Diagnosis: VZV-related panuveitis and confirming the suspected manifestation of ARN
- Plan:
 - Initiated oral valacyclovir 1000mg tid, Durezol qid, cyclopentolate qhs

6 months:

- 90% silicone oil
- Dense cataract formed
- Vision in the right was 20/1250, and the left eye remained unaffected.
- Medications were reduced to 1,000mg valacyclovir qd and prednisolone acetate 1% bid.
- Removal of silicone oil is scheduled.

Acute Retinal Necrosis

Rare inflammatory condition

Caused by reactivation of latent herpes-virus in the retina

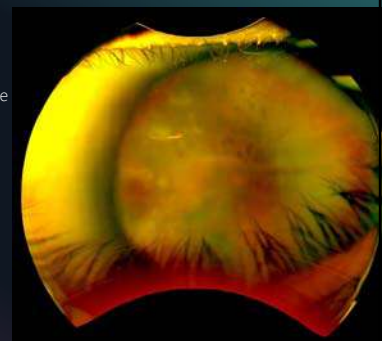
Typically Immunocompetent

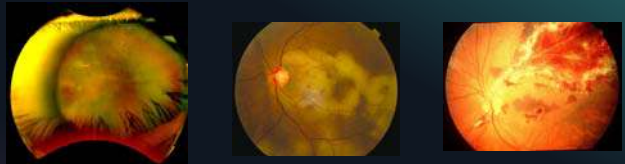
SIGNS

- Necrotizing retinitis and occlusive vasculopathy
- Panuveitis

SYMPTOMS

- Blurred vision
- Flashes/floaters
- Photophobia





ARN

- Immunocompetent
- Pan-uveitis
- Retinal necrosis/occlusive vasculitis
- Peripheral
- VZV

PORN

- Immunocompromised
- 1+ to no cell reaction
- Retinal necrosis
- Posterior pole
- VZV


CMV Retinitis

- Immunocompromised
- No cell reaction
- Prominent hemorrhage
- Posterior pole
- CMV


Retinal Differentials

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844444/>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844444/>

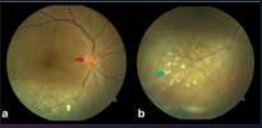
Systemic Differentials



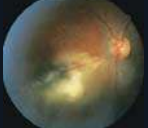
Tuberculosis



Sarcoidosis



Syphilis



Toxoplasmosis

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844444/>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844444/>

Treatment

Prompt treatment with oral antivirals can stop the progression of retinitis within 2-4 weeks.

Acyclovir

- 13 mg/kg/dose divided every 8 h IV for 7 days, followed by 800 mg five times daily

Famciclovir

- 500 mg orally q8h

Valacyclovir

- 1000-2000 mg orally TID

Ganciclovir

- 500 mg IV q12h

Valganciclovir

- 900 mg twice daily orally for 3 weeks induction, then 450 mg twice daily po for maintenance

Prognosis

- Poor prognosis due to retinal detachment and vascular occlusion
- Retinal detachments occur in ¾ of eyes
- Affect the fellow eye in 6 weeks

Panuveitis Pearls

- ARN is a fast progressing, visually devastating condition
- Antivirals can stop the progression of retinitis within 2-4 weeks
- Oral antivirals are typically well tolerated
- Panuveitis -> Oral antiviral?

Herpes Virus Pearls

- HSV keratitis is the most common corneal infection in the US and the #1 cause of corneal and infectious blindness.
- Rule out herpes when you see a unilateral red eye.
- Know that herpes can affect every part of the eye.
- Get comfortable with oral antivirals to help your patients.

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Thank You!

vivianag9392@gmail.com

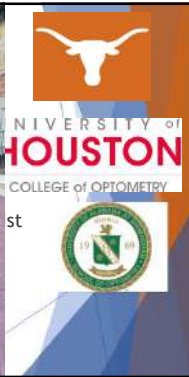
Basics of strabismus surgery

Becky Luu, OD, FAAO

No financial interest

Background

- ▶ Graduated from
- ▶ Graduated UHC
- ▶ Finished 1 year
- ▶ 5+ years working in Plano
- ▶ My daughter, Evelyn



Strabismus is a growing problem...

- ▶ Increase in life expectancy / ageing population
- ▶ Increase in pathology
- ▶ Advances in medicine
- ▶ Social media

Adult strabismus vs Pediatric Strabismus

- ▶ Increasingly more adult strabismus cases
 - ▶ Cosmetic vs pathology
 - ▶ Surgery is covered by insurance
 - ▶ Rising demand in adult strabismus surgeons

Adult strabismus vs Pediatric Strabismus

Pediatrics

- ▶ 2-5% prevalence
- ▶ Rarely have diplopia
 - ▶ Will have amblyopia
- ▶ Rarely associated with pathology
- ▶ Abnormal stereopsis

Adults

- ▶ 4-5% prevalence
- ▶ Diplopia common
 - ▶ No amblyopia
- ▶ Have normal stereopsis

Why should you care about adult strabismus?

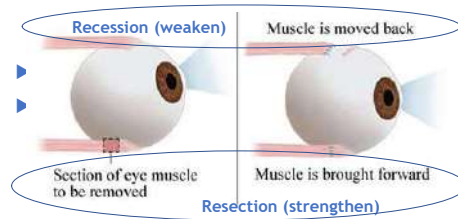
- ▶ Ischemic neuropathies
 - ▶ Hypertension - 108M adults (CDC-2017)¹
 - ▶ Diabetes - 34.1M diabetics in the US (ADA-2018)²
 - ▶ 1.5M new cases each year
- ▶ Traumatic neuropathies
 - ▶ Elderly patients - baby boomers (currently 56-75 yrs old)

1. <https://www.cdc.gov/bloodpressure/facts.htm>
2. <https://www.diabetes.org/resources/statistics/statistics-about-diabetes>

Examples of surgery:

- ▶ XT
 - ▶ Recess (**weaken**) LR and/or Resect (**strengthen**) MR
- ▶ ET
 - ▶ Recess (**weaken**) MR and/or Resect (**strengthen**) LR
- ▶ Hyper*
 - ▶ Weaken IO / SR or strengthen IR / SO

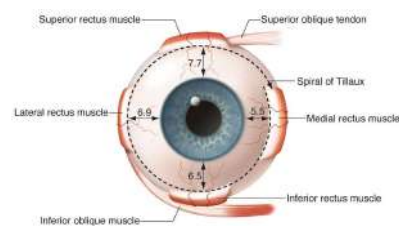
Basics of Surgery



Muscle function

Muscle	Primary	Secondary	Tertiary
Lateral Rectus	ABduction		
Medial Rectus	ADDuction		
Inferior Rectus	Depression	Excyclotorsion	ADDuction
Superior Rectus	Elevation	Incyclotorsion	ADDuction
Inferior Oblique	Excyclotorsion	Elevation	ABduction
Superior Oblique	Incyclotorsion	Depression	ABduction

Muscles anatomy



https://images.squarespace-cdn.com/content/v1/547b4b512abd9562d8a2a63/1562581603001-0K238UK9AUHF3KCE55/E/Spiral+of+Tillaux+128AA0_54747529.jpg

Case example:

PEDIG studies: R&R vs Bilateral surgery

Other procedures

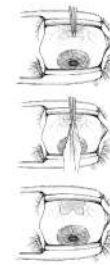
Weakening

- ▶ Recession*
- ▶ Tenotomy
- ▶ Tenectomy
- ▶ Silicone expander (SO)

Strengthening

- ▶ Resection*
- ▶ Plication
- ▶ Transposition

Weakening: Tenotomy / Tenectomy



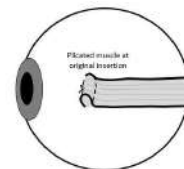
<https://d3i7xaburh42.cloudfront.net/291c27339e459a81b8cf0a224ce3a2cd81ea45/2-Figure1-1.png>

Weakening: Silicone Expander



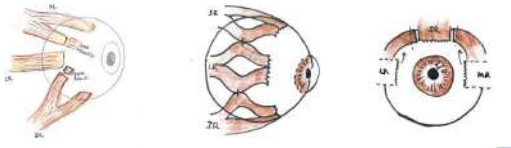
<https://d45j3w9libvn.cloudfront.net/jaypee/static/books/9789380704241/Chapters/Images/183-3.jpg>

Strengthening: Plication



https://higherlogidownload.s3.amazonaws.com/AAP05/UploadedImages/UHaC0EncQBWUJYn2aA_Fig1202-L.jpg

Strengthening: Transposition



<https://eyewiki.aao.org/w/images/1/thumb/8/86/Nishida527s.jpg/300px-Nishida527s.jpg>

Documenting strabismus: OMD vs OD

Strabismus	OD	OMD
Constant right esotropia	CRET	RET
Intermittent right esotropia	IRET	RE(T)
Constant alternating exotropia	CAXT	XT
Intermittent alternating exotropia	IAXT	IX(T)

Documenting strabismus: OMD vs OD

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Constant right esotropia	CRET	RET
Intermittent right esotropia	IRET	RE(T)
Constant alternating exotropia	CAXT	XT
Intermittent alternating exotropia	IAXT	IX(T)

Post-Op f/u schedule:

- ▶ 1 week - on combo steroid/AB drop
 - ▶ Subconj heme, maybe initial diplopia
- ▶ 1 month
 - ▶ No more diplopia, stitch has dissolved, maybe mild redness
- ▶ 3 months
 - ▶ No more redness, stable alignment

Complications from surgery¹

- ▶ Conjunctival cyst - common - steroid or drain in office
- ▶ Dellen - AT's
- ▶ RD - <1% - highest risk in thinned scleras: high myopes, older patients, multiple strab sx's
- ▶ Infection - endophthalmitis - immediate referral to retina
- ▶ Anterior segment ischemic - uveitis, reduced blood flow due severing of ant ciliary arteries on multiple recti muscles

1. Olitsky, Scott E., and David K Coats. "Complications of Strabismus Surgery." *Middle East African journal of ophthalmology* vol. 22, 3 (2015): 271-8. doi:10.4103/0974-9231.159692

FAQs with strabismus surgery

- ▶ Covered by insurance?
 - ▶ Yes, even if for cosmesis
- ▶ Patient's too old or strabismus is too chronic
 - ▶ We've operated on 90+ yr olds! Studies have shown adults regain binocular vision if strabismus not from childhood
- ▶ Intractable diplopia in adults¹
 - ▶ Very rare, <1%
- ▶ Scarring?
 - ▶ Sort of
- ▶ Can surgery be repeated?
 - ▶ Absolutely



1. Kushner, Burton J. "The benefits, risks, and efficacy of strabismus surgery in adults." *Optometry and Vision Science* 91, 5 (2014): e102-e109.

Common questions from patients/ODs

- ▶ Refraction?
 - ▶ After 1 month
- ▶ Contacts?
 - ▶ If cleared after 1 week post op
- ▶ Incomitant deviations?
 - ▶ Surgery can correct - adjustments to recessions/resections
- ▶ Swimming/flying?
 - ▶ No swimming for 1 week, flying okay

Who ISN'T a candidate for surgery

- ▶ Patients with variable alignment
 - ▶ Recovering nerve palsies
 - ▶ MG patients
 - ▶ Active thyroid patients

Cosmesis and psychosocial impact on adults



1. Beauchamp GR et al 2005, Liebermann et al 2014, Dickmann et al 2013

Common Types of Adult Strabismus

With Diplopia - goal: fusion

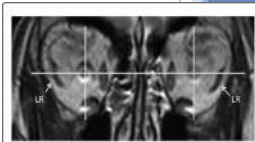
- ▶ Divergence Insufficiency
- ▶ Nerve Palsies
- ▶ Thyroid Eye Disease
- ▶ Post-Cataract surgery
- ▶ Myasthenia Gravis
- ▶ Consecutive deviations
- ▶ Decompensated phorias

Without Diplopia—goal: cosmesis

- ▶ Sensory deviations (non-seeing eye)
- ▶ Consecutive deviations (previous strabismus surgery)
- ▶ Recurrent deviations from childhood strabismus

Divergence Insufficiency or Age Related Distance Esotropia (ARDE)

- ▶ Small ET ≤ 15 pd at distance, ortho at near
- ▶ 70+ yrs, slightly more females
- ▶ Mechanism: LR starts 'sagging' inferiorly with age
- ▶ Work up?
 - ▶ Not needed, benign, not neurological
- ▶ Treatment:
 - ▶ Prism (2 pairs of glasses)
 - ▶ Surgery



Post-Op CAT

- ▶ As much as 3% of patients post-cataract surgery¹
- ▶ 2 proposed mechanisms:
 - ▶ 1. Decompensated phoria secondary to monovision
 - ▶ Unable to suppress
 - ▶ 2. Toxic myopathy from retrobulbar anesthesia
 - ▶ Usually IR muscle affected, so will get Hyper deviation
- ▶ Treatment:
 - ▶ Prism
 - ▶ Strabismus surgery



1. Nayak H, Kersey JP, Oystreck DT, Cline RA, Lyons CJ. Diplopia following cataract surgery: a review of 150 patients. *Eye (Lond)*. 2008;22(8):1057-1064. doi:10.1038/sj.eye.6702847

Nerve Palsies

- ▶ 3rd Nerve:
 - ▶ Down and Out
 - ▶ Pupil involving
 - ▶ Pathology: Ischemic, traumatic
- ▶ 4th Nerve:

35RET	20pd RET	15RET
-------	----------	-------

 - ▶ Hypertr
 - ▶ SO unde
 - ▶ Positive Park's step test
 - ▶ After 6 months - surgery
- ▶ 6th Nerve:
 - ▶ Esotropia - limited abduction
 - ▶ Compensatory ipsi head turn
 - ▶ ex: RET, right head turn to fuse



Treatment for patients with diplopia

- ▶ Prism
- ▶ Vision Therapy (best for intermittent XT's)
- ▶ Surgery
- ▶ ~~Occlusion~~
- ▶ ~~Monovision~~

Goal: binocular fusion

double vision can look like this:

double vision
double vision
double vision
double vision

Prescribing prism for diplopic adult patients

- ▶ Lowest amount needed to fuse the patient
 - ▶ Trial and error
 - ▶ BO for esos, BI for exos, BD for hyper
 - ▶ Split the prism
- ▶ Fresnel for unstable deviations
 - ▶ Recovering traumatic/ischemic nerve palsies
 - ▶ Only over one eye (usually non dominate eye)



Adult Strabismus w/o diplopia

- ▶ Consecutive deviations
 - ▶ Prev childhood alignment issue, corrected with surgery, now opposite direction
- ▶ Recurring deviations
 - ▶ Prev childhood alignment issue, returning
- ▶ Sensory deviations
 - ▶ Acquired or childhood monocular blindness
- ▶ Goal: Cosmesis
- ▶ Treatment:
 - ▶ Surgery
 - ▶ Reverse prism

Questions?

- ▶ Thank you!

Remember, "There's no business like strabismus"

- ▶ luu.becky@gmail.com



2024 Texas Professional Responsibility Course

UNIVERSITY OF HOUSTON COLLEGE OF OPTOMETRY

ANDREW KEMP, OD, FAAO

PRESENTER

Welcome to the 2024 Professional Responsibility Course sponsored by the University of Houston College of Optometry. As you know, this course is a requirement for Texas license holders. What you may not know is that ***all*** fees associated with this course are devoted to permanent projects that are important for ***the future of the profession***.

Thank you for choosing UHCO for your continuing education.

The development and production of the 2024 Professional Responsibility Course is underwritten by the Harris Lee Nussenblatt Lecture Series Endowment. This endowment was established in 1992 by the Nussenblatt Family in memory of former Associate Professor Harris Nussenblatt, OD. The Lecture Series focuses on issues related to professional ethics, public health and practice administration

The following activity planners and speaker have no relevant financial interests in this lecture:

Dr. Andrew Kemp, UHCO Speaker

Amanda Johnson, UHCO

Carlos Cole, UHCO

Cristian Loayza, UHCO

Lorellye Macomber, UHCO

Preface

The content of the Professional Responsibility Course is at the discretion of the Texas Optometry Board. This year, the Board set an aggressive agenda. **Some of the items are presented based on our knowledge of the subject matter as of January 1, 2024 and may change over the course of the year.**

Pay attention to any updates from TOB and TOA.

AGENDA – TEXAS OPTOMETRY BOARD

- Statutory address requirement
- CE Broker update
- CPR/BLS CE requirement
- Professional identification requirements (again...)
- Initial examination of a patient – in detail
- Remote care and initial examination of the patient – where are we?
- Review of HB1696 – Vision Plan Bill

Statutory Address Requirement

Tex.Occ.Code 351.351 – License Holder Information

(a) A license holder shall file with the board:

- (1) the license holder's mailing address;
 - THIS WOULD BE YOUR PREFERRED MAILING ADDRESS
 - **USED FOR COMMUNICATIONS FROM THE BOARD**
- (2) the address of the license holder's residence;
 - WHERE YOU LIVE
- (3) the mailing address of each office of the license holder; and
 - MAYBE LESS CLEAR – THIS REFERS TO THE MAILING ADDRESS OF THE OFFICE WHERE YOU PROVIDE PATIENT CARE TO TEXAS PATIENTS
- (4) the address for the location of each office of the license holder that has an address different from the office's mailing address.
 - PHYSICAL ADDRESS OF THE OFFICE WHERE YOU PROVIDE PATIENT CARE TO TEXAS PATIENTS IF THAT ADDRESS IS DIFFERENT FROM THE MAILING ADDRESS
- **#3 AND #4 USED BY THE BOARD FOR INSPECTION PURPOSES**

This information would be included in your initial application for licensure. We are focusing on **CHANGE** to that information.

Statutory Address Requirement

Tex.Occ.Code 351.351

LICENSE HOLDER INFORMATION

THIS IS THE BIG ONE....because change happens!

(b) Not later than the 10th day after the date of a change in the information required to be filed with the board under Subsection (a), the license holder shall file with the board a written notice of the change

Some Specifics

- This includes **ALL** the information in the previous slide
- Special instructions related to short-term fill-in work (see next slide)
- Primary updates can be made directly at <https://tob.texas.gov/optometrists/update-contact-information/>
- To report secondary addresses, email to info@tob.Texas.gov

OK...what about the temporary thing

For licensees who are in an office routinely and provide ONLY fillin (temporary) services

If you are in a particular office routinely, report that office as your primary business location

If you see patients at multiple locations in a given year, provide the location where **you see the MOST patients** as your primary location (update online) and supply other locations to the Board (by email) as described in the previous slide

If you are not in any office on a routine basis and see a minimal number of patients, report "No primary address – fill-in work only" in the business address field

NOTE FOR EVERYONE: The Board is actively reviewing all aspects of the inspection process they are mandated to make by Texas law. Look for notices in 2024 from the Board for any changes applicable to this information.

Statutory Address Requirement

Tex.Occ.Code 351.351

While this may seem like a minor issue, it is imperative that the Board be able to contact every license holder and know where they provide patient care.

Any failure to receive essential / legal information from the Board based on you not keeping contact information up to date is **TOTALLY on you** and there is no allowed excuse.

CE Broker – Deeper Dive

Key Points

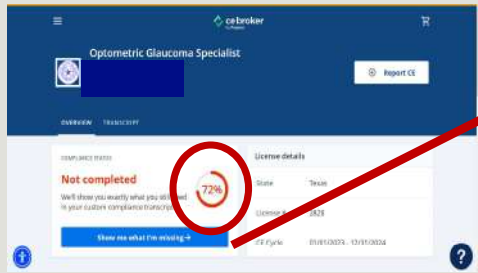
- CE Broker is the official / only CE tracking system for the Board
- CE Broker Basic Account is FREE – you can sign up for an upgraded account (\$39 a year) that provides more information, if you wish
- CE hours can ONLY be reported through CE Broker – **NOT the Board**

NOTE: **EVERYTHING** CE happens through CE Broker – do not call the Board asking about your hours, asking if a course is approved, asking to approve a course, etc. etc. etc.

CE Broker

- Everyone should already have a CE Broker account. For new grads or anyone who has never gone through renewal process, simply go to <https://cebroker.com> and create an account – VERY easy
- Knowing your CE is recorded with CE Broker is **YOUR** responsibility
 - Make sure any CE you expect credit for is going to be recorded with CE Broker **BY THE ENTITY PRESENTING THE CE**
 - You CAN upload CE to your account yourself – a somewhat painful process
 - There is **NO** retro-active approval – **CE must be approved BEFORE you attend**

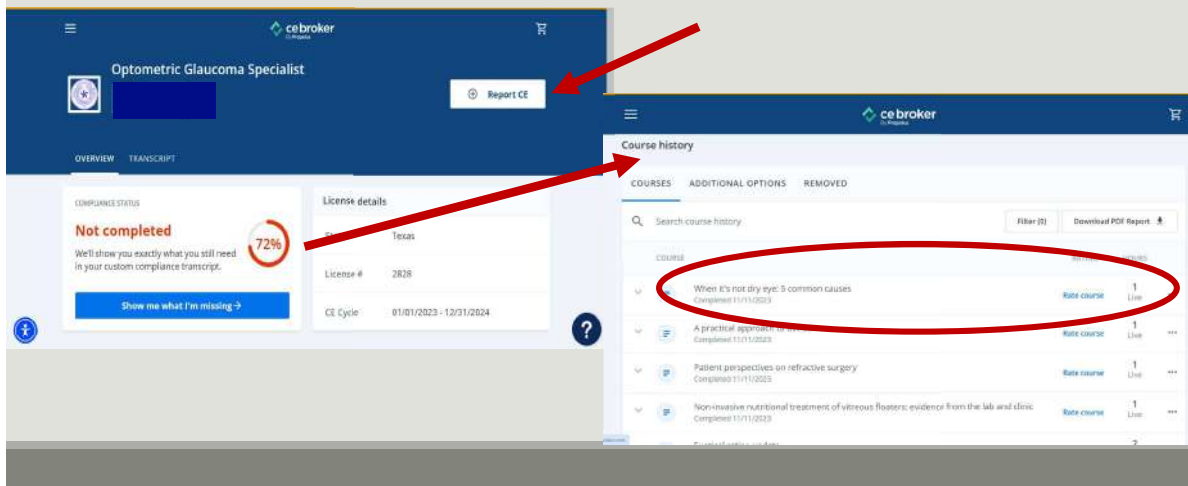
Very helpful...



Hour based requirements

Opioids	Hours required: 2	We found 13 courses that will fulfill this requirement.																								
No hours applied	Hours needed: 2	View courses + Report CE																								
Human Trafficking	Hours required: 1	We found 8 courses that will fulfill this requirement.																								
No hours applied	Hours needed: 1	View courses + Report CE																								
Diagnostic / Therapeutic	Hours required: 22	We found 265 courses that will fulfill this requirement.																								
<table><thead><tr><th>Course history</th><th>Type</th><th>Hrs. applied</th></tr></thead><tbody><tr><td>Feb 18 2023 - Live presentation: Self-Medication and Opioid Use from the Opioid, Pain and...</td><td>LIVE</td><td>2</td></tr><tr><td>Feb 18 2023 - The Ocular Glaucoma: Optometry's Next Frontier</td><td>LIVE</td><td>1</td></tr><tr><td>Jul 26 2023 - OPI AND ADDICTION WORKSHOP</td><td>LIVE</td><td>2</td></tr><tr><td>Jul 26 2023 - BAY STATE HEALTHCARE WHAT REALLY WORKS</td><td>LIVE</td><td>1</td></tr><tr><td>Jul 26 2023 - ADDICTION: NEUROBIOLOGY, WHAT WORKS, WHAT'S LEGAL AND WH...</td><td>LIVE</td><td>1</td></tr><tr><td>Show more ></td><td></td><td></td></tr><tr><td>Total</td><td></td><td>7</td></tr></tbody></table>	Course history	Type	Hrs. applied	Feb 18 2023 - Live presentation: Self-Medication and Opioid Use from the Opioid, Pain and...	LIVE	2	Feb 18 2023 - The Ocular Glaucoma: Optometry's Next Frontier	LIVE	1	Jul 26 2023 - OPI AND ADDICTION WORKSHOP	LIVE	2	Jul 26 2023 - BAY STATE HEALTHCARE WHAT REALLY WORKS	LIVE	1	Jul 26 2023 - ADDICTION: NEUROBIOLOGY, WHAT WORKS, WHAT'S LEGAL AND WH...	LIVE	1	Show more >			Total		7	Hours needed: 5	View courses + Report CE
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Show more >																										
Total		7																								

Once you get it, it's pretty cool...



More help...

CE Broker provides a “Course Search” feature (also free) to find courses needed to help with license renewal. Access at <https://courses.cebroker.com/search/tx> – select profession and search away! Or look on your account page

NOTE: These are all online courses – remember you are limited to 16 online credit hours per renewal cycle

Hour based requirements

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Show more >																										
Total		7																								

Some of the features I showed are not available with the basic plan...here is a breakdown

BASIC PLAN – FREE

- ✓ Connect with TOB
- ✓ Complete course history
- ✓ Can report hours manually
- ✓ Check your status any time
- ✓ Take recommended courses

PROFESSIONAL PLAN - \$39/YR

- ✓ Everything in Basic Plan
- ✓ Detailed view of missing compliance
- ✓ Details of when each requirement was met
- ✓ Can track multiple licenses
- ✓ Personalized compliance transcript
- ✓ Onsite storage of training certificates

CONCIERGE PLAN ALSO AVAILABLE...PRETTY PRICEY

CPR Requirements

Board Rule 273.17

Everyone who applied or renewed in 2023 had to have this...everyone applying or renewing in 2024 will have to provide this!

(a) Definitions.

(1) Cardiopulmonary resuscitation (CPR) is an emergency lifesaving procedure performed when the heart stops beating. A certification in CPR includes training and successful course completion in cardiopulmonary resuscitation, AED and obstructed airway procedures for all age groups according to recognized national standards.

(2) Basic Life Support (BLS) is a basic level of pre-hospital and inter-hospital emergency care and non-emergency medical services care. A certification in BLS includes training and successful course completion in airway management, cardiopulmonary resuscitation (CPR), control of shock and bleeding and splinting of fractures, according to recognized national standards.

(b) Requirement for **Initial License**. Commencing effective January 1, 2023, all applicants for initial licensure shall provide proof of successful completion of a CPR or BLS certification prior to receiving a license.

(c) Requirement for **Renewal of License**. Effective January 1, 2023, all active licensees shall provide proof of successful completion of a CPR or BLS certification for renewal of a license each renewal cycle. Licensees may be credited two general hours of continuing education for CPR certification and four general hours of continuing education for BLS certification.

CPR Requirements

Board Rule 273.17

Break it down....

- This requirement was established by Board Rule 2022 – required for all licensee renewals after January 1, 2023
- **CPR** is the basics and entry-level training – **BLS** offers more areas of training for emergency preparedness. Both are allowed for certification – BLS is more applicable to healthcare settings (opinion)
- Courses may be taken live or online – online courses can take less than an hour...advanced live courses can take 2-4 hours
- Courses are readily available – online, certified trainers, fire department, put a group together, extended staff meeting. NOT expensive!!!

Making sure
it counts....

Report CE

BLS CERTIFICATION/RECERTIFICATION
Learn More ▾ How to Report ▾

CPR CERTIFICATION/RECERTIFICATION
Learn More ▾ How to Report ▾

Course Detail
BLS CERTIFICATION/RECERTIFICATION (BLS)

Date Completed *
12/13/2023

Course Type *

☐ Live (includes live interaction with presenter(s))

☒ Asynchronous (on-line class, video or recorded lecture, etc.)

Computer Based Training (or online course) ▾

SUBJECT AREA

Back CONTINUE

Attachments
BLS CERTIFICATION/RECERTIFICATION (BLS)

Please be prepared to attach your BLS card

ATTACH DOCUMENT
File size up to 10 MB

Back CONTINUE

You must upload your
certificate of training to the
CE Broker website – **trainers
and online presenters will
typically NOT do this for you**

Log in to your CE broker
account – select “Report CE”.
Follow the instructions –
have your certificate ready
to upload

Check the attestation on the next page....

Professional Identification

Same as seven other PR courses...

Section 351.362 NAME OF PRACTICE

- (a) An optometrist or therapeutic optometrist may practice under a trade name, an assumed name, or the name of a professional corporation or association.
- (b) An optometrist or therapeutic optometrist practicing in this state shall display the **actual name** under which the optometrist or therapeutic optometrist **is licensed by the board**, so that the name is **visible to the public** before entry into the optometrist's or therapeutic optometrist's office reception area.

Professional Identification

Same as seven other PR courses...

Rule 279.10

- (a) To **protect the public health and provide a means for the patient to identify a licensee in a complaint filed with the Board**, §351.362 of the Act requires an optometrist or therapeutic optometrist to display the doctor's name so that the name is visible to the public before entry into the office reception area. This requirement does not apply to an optometrist or therapeutic optometrist practicing at a location on a **temporary basis**, as defined in subsection (b) of this section.
- (b) Temporary basis is defined as the practice of optometry or therapeutic optometry at an office for no more than two consecutive months. For example, an optometrist or therapeutic optometrist practicing at a location one day per week during a three month period is not at that location on a temporary basis, and the doctor's name must be displayed as required in §351.362 of the Act.
- (c) Section 351.458 of the Act prohibits the display of an optometrist or therapeutic optometrist's professional designation if **the intent of the display is to mislead the public that the named optometrist or therapeutic optometrist owner regularly practices at that location**. Therefore an optometrist or therapeutic optometrist practicing at an office in which the doctor has no ownership interest, must display the doctor's name as licensed by the Board, regardless of the percentage of time spent at that office, unless the doctor's practice meets the definition of temporary basis in subsection (b) of this section.

Professional Identification

Break it down...

This is a **STATE law** – Occupations Code 104. In effect since 1999.

Optometrists (me as an example) may identify as:

- ✓ Joe DeLoach, Optometrist
- ✓ Joe DeLoach, Therapeutic Optometrist
- ✓ Doctor Joe DeLoach, Optometrist
- ✓ Joe DeLoach, Doctor of Optometry
- ✓ Joe DeLoach, OD

Key Points

Intent of the law:

- Individuals cannot mislead the public regarding the licensure/credentials of a healthcare provider
- Doctors cannot mislead the public into thinking they **do or do not** practice at a particular location (cannot put name on door unless you practice there – including owners). **WORKS BOTH WAYS!**

Professional Identification

Key point..often misunderstood. “Temporary basis”

Does not apply to practice at a location on a temporary basis – defined as the “practice of optometry or therapeutic optometry at an office for no more than two consecutive months”. KEY WORD IS **CONSECUTIVE**

EXAMPLES

1. Doctor works at practice full or part-time for two or more consecutive months – NAME ON DOOR
2. Doctor works only one day every week for two or more consecutive months – NAME ON DOOR
3. Doctor fills in full or part-time for six weeks – NO requirement for name on door

Minimum Competency and Remote Eye Examinations

This information is current as of January 1, 2024. Various parties are involved in challenging the law and rules related to Section 351.353.

Information presented **IS** in effect at the time the course was written. It could change at any time.

If this directly applies to you, it is very important you stay aware of any potential changes in the information that will be forthcoming from the TOB, should/when they occur.

Section 351.353 – Initial Examination of Patient

Back to the beginning – 1956!

(formally adopted as law in 1969 after being upheld by the SCOTUS and only a few changes since then)

INITIAL EXAMINATION OF PATIENT.

To ensure adequate examination of a patient for whom an optometrist or therapeutic optometrist signs or **causes to be signed an ophthalmic lens prescription**, in the **initial examination of the patient** the optometrist or therapeutic optometrist shall make and record, **if possible**, the following findings concerning the patient's condition:

First three issues – #1

Causes to be signed an ophthalmic lens prescription

Minimum competency only applies if the examination results in issuing a glasses or contact lens prescription.

In many cases – how would you know beforehand?

Another thought....apply logic

Patient presents with medical emergency - new patient with a corneal ulcer from CL overwear and no glasses. Would this be a logical exemption from 351.353? Law is law and usually rigidly interpreted. You can only trust, and having been there I do, that your colleagues on the Board can understand when it doesn't apply (wouldn't recommend playing games here!).

First three issues – #2

Initial examination of a patient

Current interpretation is initial means the first complete eye examination you conduct on that patient (no specific time limitation like Medicare)

First three issues - #3

If possible

Intent IS - a **unique situation** results in not being able to perform the service.

- patient refuses autorefractor (or **any** element of the care)
- cannot perform tonometry because of uncontrollable nystagmus
- cannot adequately perform internal examination due to mature cataracts
- cannot perform biomicroscopy examination because patient is obese

Intent is NOT – the patient and the doctor just don't happen to be in the same place at the same time

KEY TO "NOT POSSIBLE" IS DOCUMENTING WHY!

And what is required? 1-5

With the addition of points from Rule 279.3

- (1) case history - ocular, physical, occupational, and other pertinent information;
KEY POINT: "Pertinent" – left to the discretion of the provider
- (2) visual acuity;
KEY POINT: Left to the discretion of the provider
- (3) results of biomicroscopy examination, including lids, cornea, and sclera;
KEY POINT: Rules add "using a binocular microscope"
- (4) the results of an internal ophthalmoscopic examination, including an examination of media and fundus;
KEY POINT: Rules add "using an ophthalmoscope or biomicroscope with fundus condensing lenses"
- (5) the results of a static retinoscopy, O.D., O.S., or autorefractor;
KEY POINT: None – left to discretion of provider

And what is required? 6-10

With the addition of points from Rule 279.3

- (6) subjective findings, far point and near point;
KEY POINT: None – left to the discretion of the provider
- (7) assessment of binocular function;
KEY POINT: None – left to the discretion of the provider
- (8) amplitude or range of accommodation;
KEY POINT: None – left to the discretion of the provider
- (9) tonometry; and
KEY POINT: None – left to the discretion of the provider
- (10) angle of vision, to right and to left.
KEY POINT: None – left to the discretion of the provider

Other “Key Points” – Rule 279.3

- The optometrist must “**personally make and record**”
 - Biomicroscopy (external) exam
 - Ophthalmoscopic (internal) exam
 - Subjective findings, far point and near point (refraction)
- The optometrist may either personally make and record or authorize an assistant present **in the same office with the optometrist** to make and record the remaining seven required findings
- **Videos and photographs** do not fulfill the internal ophthalmoscopic examination requirement – **YOU MUST LOOK IN THE EYE WITH YOUR OWN TWO EYES!**

“personally make and record”

The current TOB interpretation of “*personally*” means the doctor performed the test. This rule IS currently in effect.

The board has submitted a rule change changing the language to “***in person***” – NOT in effect at the time this course was published. This would make it clear that the doctor is **IN THE ROOM WITH THE PATIENT**.

The terms “personally” or “in person” do not apply to telehealth services outside of the requirements of Section 351.353. The Board has an entire section on Rules related to telehealth services (Rule 279.16) – those rules do state that telehealth services must provide the **same level of care as an in-person visit**.

Few other points...

Section 351.359. Prescription. (a) *An ophthalmic prescription must include:*
(1) *the signature of the optometrist or therapeutic optometrist...*

UNLESS PRACTICING UNDER DELEGATION, THE DOCTOR WHO PERFORMED THE EXAMINATION MUST SIGN ANY PRESCRIPTION THAT IS THE RESULT OF THE EXAMINATION. THE BOARD POSITION IS THE DOCTOR THAT SIGNED THE PRESCRIPTION PROVIDED THE SERVICE AND IS RESPONSIBLE FOR COMPLIANCE WITH ALL ASPECTS OF 351.353.

Rule 279.2

(o) *an optometrist or therapeutic optometrist may not sign, or cause to be signed, an ophthalmic lens prescription without first personally examining the eyes for whom the prescription is made*

SELF-EXPLANATORY

The Penalty – Rule 279.3

*The willful or repeated failure or refusal of an optometrist or therapeutic optometrist to comply with any of the requirements in the Act, §351.353 and §351.359, shall be considered by the board to constitute **prima facie evidence that the licensee is unfit or incompetent by reason of negligence within the meaning of the Act, §351.501(a)(2), and shall be sufficient ground for the filing of charges to cancel, revoke, or suspend the license.** The charges shall state the specific instances in which it is alleged that the rule was not complied with. After the board has produced evidence of the omission of a finding required by §351.353, the **burden shifts to the licensee to establish that the making and recording of the findings was not possible.***

Are some optometrists exempt from all this?
Back to the Act – Section 351.005(a)(2) & (b)

(a) This chapter does not:

(2) prevent or **interfere with the right of a physician** licensed by the Texas Medical Board to:

(A) treat or prescribe for a patient; or

(B) direct or instruct a person **under the physician's control, supervision, or direction to aid or attend to the needs of a patient according to the physician's specific direction, instruction, or prescription;**

(b) A direction, instruction, or prescription described in Subsection (a)(2)(B) **must be in writing if it is to be followed, performed, or fulfilled outside the physician's office**

WOW...that is a bunch of words. Is it even possible to break this one down?

What is FACT.

A physician licensed to practice medicine in Texas under the Physicians Medical Practices Act has broad authority to “*delegate to a qualified and properly trained person acting under the physician's supervision any medical act that a reasonable and prudent physician would find within the scope of sound medical judgment to delegate...*” (TOTALLY open ended!)

When an optometrist is under delegation of a physician per the terms of Section 157.001 of the Medical Practices Act which means the physician signs the medical record and the prescription, the optometrist is operating under the PHYSICIAN'S license and IS NOT bound by the Texas Optometry Act. Refer back to Slide 32 – if you sign it, the service was provided by you and you are under the Texas Optometry Law and Board rules.

WOW...that is a bunch of words. Is it even possible to break this one down?

More FACT

Delegation is NOT the same as direction, instruction or prescription.

Optometrists simply employed by, contracted with (legally or illegally), under the direction of, or who receive a paycheck signed by a physician are NOT operating under delegation unless they have a written delegation order from the physician.

NOTE: Texas optometrists have NO legal delegation authority.

WOW...that is a bunch of words. Is it even possible to break this one down?

Sure...we can look to precedent issued in 2023 by a Texas Administrative Law Judge (ALJ) and resultant rulings adopted by the Texas Optometry Board.

Texas Optometry Board Conclusions

The Board has affirmed that licensees must comply with the Act even if acting under the direction of a medical doctor unless that direction is sufficiently specific, addressed to the optometrist, and aids the needs of the patient. If the optometrist signs the prescription, that licensee must comply with the required 10 findings under Section 351.353 during an initial examination when a prescription will be written **even if the examination is conducted in a remote setting.**

NOTE: The Judge ruling in the case concluded *“the optometrist and employer created the ‘impossibility’ of making the required 10 findings under Section 351.353 when they decided to operate remotely.”*

What now?

What NOW is what the last two slides said!

What will happen going forward is in the hands of the courts, as the actions of the State and TOB are being challenged as not legal. The outcome of said challenge will likely take time. In the meantime, **the conclusions of the State ALJ and the TOB are IN FORCE.**

Stay tuned!

And last....

A review of HB1696 – the Vision Plan Bill. What it did, where it is and where it's going.

Let's Start With What It Did



- ✓ Prohibits plans from the **identifying and tiering of in-network ODs** based on discounts on non-covered services, amounts spent on products, or brands or sources of products utilized by the OD.
- ✓ Prohibits plans from **steering patients towards any particular in-network OD**, any retail location owned by or affiliated with the plan, or any internet site or virtual provider owned by or affiliated with the plan.
- ✓ Requires plans to provide direct, immediate, electronic **access to complete in-network and out-of-network plan benefits** to the patient and OD.
- ✓ Requires plans to accept **standardized claim submission forms and processes**, and reimburse doctors via electronic funds.

Let's Start With What It Did



- ✓ Prohibits **improper chargebacks** to reimbursements when the plan is not supplying the materials (cost of goods) for a patient.
- ✓ Prohibits plans from **calling services and products "covered" when the reimbursement amount to the OD is considered "de minimus"** in nature. De minimis means of nominal or very small value.
- ✓ Prohibits plans from **calling services and products as "covered" when zero reimbursement** of the service or product comes from the plan to the OD.
- ✓ Prohibits plans from using or offering **reimbursement rates that are different** from another OD based on the OD's particular practice and business decisions, such as what lab they choose to use or what products they choose for a patient.
- ✓ Requires plans to give **90-day notice to any provider contract changes**.

Let's Start With What It Did



- ✓ Prohibits plans from requiring an OD provide a **covered product or service at a loss**.
- ✓ Prohibits plans from requiring that an OD receive **reimbursement by a virtual credit card**.
- ✓ Prohibits plans from requiring an OD to use **any particular EHR**.
- ✓ Prohibits plans from requiring an OD to use **any particular clearinghouse or claim filing service**.
- ✓ Prohibits plans from requiring **unneeded and unrelated patient information to file a claim** or receive reimbursement for a wellness eye exam, including glasses/contact lens prescriptions, unique anatomical measurements like PD, or facial photographs.
- ✓ Prohibits vision plans from **using extrapolation** as a method to complete an audit. This provision does not apply to medical plans.
- ✓ Requires that the provisions of the bill are to be **enforced by the Texas Insurance Commissioner**.

WOW!



So, what's going on now...

Several entities are doing everything in their power to stop this law from making changes in the system

- ☹ Restraining orders
- ☹ Injunctions
- ☹ Law suits
- ☹ Forcing contract renewals



THEY DO NOT LIKE WHAT THE STATE OF TEXAS DID!

When does this law change things? Some specifics

1. If you are under operating under a contract you signed or renewed prior to January 1, 2024, that contract is in force under the terms as written. **WATCH FOR #2!!!**
2. Any contract signed after January 1, 2024, renewed after January 1, 2024 **or CHANGED after January 1, 2024** – the conditions and terms of the new law are in **FULL FORCE**

WATCH FOR ANY NEW CONTRACT OR CHANGE IN YOUR CONTRACT – this will trigger all the stipulations under HB1696

So what should I do?

This law, in whatever form emerges from the legal war, is just like other practice enhancements – therapeutics, managed care plan access, telehealth. They are all resources / choices.

The TOB nor the TOA can tell you what decision to make or how conduct your practice inside the legal aspects of the law.

Each licensee ultimately has to decide how they interact and cooperate with vision plans, or all managed health plans for that matter.

TOA Has Stepped Up As A Significant Resource for Texas Optometrists

TOA managed care general resource webpage

<https://texas.aoa.org/advocacy/managed-care-plan-laws-resources-for-texas-optometrists?sso=y>

TOA partner law firm for managed care contract review:

<https://texas.aoa.org/Affiliates/TX/Documents/Advocacy/2023/2023-24%20Enoch-Announcement-v4.pdf>

TOA complaint submission form:

<https://texas.aoa.org/advocacy/managed-care-plan-laws-resources-for-texas-optometrists/manage-care-plan-concerns-form?sso=y>

TDI complaint webpage:

<https://www.tdi.texas.gov/hprovider/providercompl.html>



Thank you for your attention
and have a great 2024 _____

joe@pcscomply.com

apjohns7@central.uh.edu

Janice.McCoy@tob.texas.gov

www.tob.state.tx.us

Pediatric Red Eyes and the Amblyopia that Follows

Becky Luu, OD, FAAO

No financial disclosures

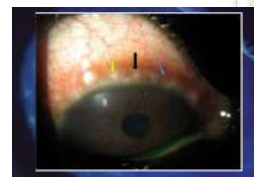
Case

- ▶ 4yr old Hispanic female
- ▶ CC: Recurring redness x 3 years, photophobia, tearing, pain OU
- ▶ Medical hx: unremarkable
- ▶ Ocular hx: See above. Never worn GLs
- ▶ VAs(sc): 20/50 OD and 20/400 OS

Differentials?

▶ Chronic or recurrent anterior seg conditions:

- ▶ Ocular hypertension
- ▶ Chronic / Recurrent uveitis - JIA
- ▶ Recurrent herpetic infection
- ▶ Marginal keratitis
- ▶ Thygeson's
- ▶ Neurotrophic keratitis
- ▶ VKC
- ▶ AKC



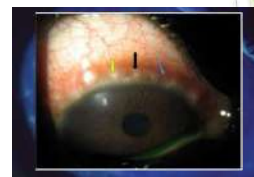
Case

- ▶ 4yr old female
- ▶ CC: Recurring redness x 3 years, photophobia, tearing, pain OU
- ▶ VAs(sc): 20/50+ OD and 20/400 OS
- ▶ Anterior segment:
 - ▶ OD: Scattered SPK.
 - ▶ OS: Significant corneal scarring with stromal haze. Neo almost 360 into central cornea. Trc Bleph. Scattered SPK
 - ▶ IOPs: 13mmhg OD / 11 mmhg OS
 - ▶ No A/C reaction

Differentials?

▶ Chronic or recurrent anterior seg conditions:

- ▶ Ocular hypertension
- ▶ Chronic / Recurrent uveitis - JIA
- ▶ Recurrent herpetic infection
- ▶ Marginal keratitis
- ▶ Thygeson's
- ▶ Neurotrophic keratitis
- ▶ VKC
- ▶ AKC



https://www.mdpi.com/pharmaceuticals/pharmaceuticals-14-00658/article_deploy/html/images/pharmaceuticals-14-00658-g003.png

https://www.reviewofoptometry.com/CMSImagesContent/2018/04/083_r00418_CLQA-1.jpg

Case

- ▶ 4yr old Hispanic female
- ▶ CC: Recurring redness x 3 years, photophobia, tearing, pain OU
- ▶ VAs(sc): 20/50+ OD and 20/400 OS
- ▶ Anterior segment:
 - ▶ OD: Scattered SPK.
 - ▶ OS: Significant corneal scarring with stromal haze. Neo almost 360 into central cornea. Trc Bleph. Scattered SPK. Intact cornea. No ulcer
- ▶ Cyclo retinoscopy: +1.50+1.50x090 OD / unable to due to scarring OS
- ▶ Fundus exam: normal OD / Hazy view OS but roughly normal

My treatment:

- ▶ MY treatment for the patient:
 - ▶ Aggressive lid hygiene
 - ▶ Referred to cornea specialist* same week

Cornea Specialist's treatment:

- ▶ Dx: Staph related keratitis (aka marginal keratitis)
- ▶ Treatment:
 - ▶ Zylet (0.5% loteprednol / 0.3% tobramycin)
 - ▶ J&J baby shampoo, ocusoft lidwipes
 - ▶ Bacitracin ointment

Staph-hypersensitivity keratitis or marginal keratitis

- ▶ The true culprit is the eyelids
- ▶ The problem is the inflammation, not infectious
 - ▶ "Autoimmune" condition
- ▶ Strong association to MGD



https://eyewiki.aao.org/Marginal_Keratitis

Treatment:

- ▶ Short term:
 - ▶ Aggressive steroid. Pred forte 1% QID
 - ▶ Aggressive lid hygiene
 - ▶ AB ointment
 - ▶ Artificial tears and warm compresses
- ▶ Long-term:
 - ▶ May need 0.1% cyclosporin (at least 50% of my pts on this)
 - ▶ Compounded vs Verkazia
 - ▶ Lid hygiene
 - ▶ Artificial tears / warm compresses
 - ▶ Amblyopia?

Three types of Amblyopia

- ▶ Strabismic
- ▶ Refractive
- ▶ Deprivation: ptosis, cataract, corneal scarring, abnormal pupil...
- ▶ Combo of any of the 3*
- ▶ Amblyopia can be bilateral (mostly refractive) or unilateral
 - ▶ 2 lines of difference between OD and OS

Overdue 9 month f/u from initial exam

- ▶ VAs (sc)
 - ▶ 20/40 OD
 - ▶ 20/300-1 OS
- ▶ Cyclo ret:
 - ▶ OD: +1.50+1.50x090
 - ▶ OS: +1.50+4.50x120
- ▶ **Dx:** Combo deprivation and refractive amblyopia, OS
- ▶ **Tx:** Rx GLs, patch OD 1-2 hrs / day

Refractive amblyopia risk factors

Table 2
Potential Amblyopia Risk Factors

Refractive Error	Risk Factor
Isometropia	None
Anisometropia	>1.50 D
Hypertropia	>1.00 D
Myopia	>4.00 D

Table 2
Refractive amblyopia risk factors

Age, months	Anisometropia	Hypertropia	Anisometropia	Myopia
12-30	>2.0 D	>4.5 D	>2.5 D	>3.5 D
31-48	>2.0 D	>4.0 D	>2.0 D	>3.0 D
>48	>1.5 D	>3.5 D	>1.5 D	>1.5 D

Nonrefractive amblyopia risk factors:
All ages Manifest strabismus >8PD in primary position.
Media opacity >1 mm.
One diagnosis, PDH: patch diaper; ¹ Additional reporting of sensitivity to detect greater-magnitude refractive errors is encouraged; ² For all ages.
Amblyopia risk factors: 2013 American Association of Pediatric Ophthalmology and Strabismus guidelines

1. AOA Clinical Guide, 2004
2. AAPOS guidelines, 2013

Unilateral amblyopia Treatment:

- ▶ Penalization:
 - ▶ 1% atropine twice a week
- ▶ Patching
 - ▶ Severe (20/100 or worse): 4-6 hrs / day
 - ▶ Moderate (20/80): 2-4 hrs / day
 - ▶ Mild (20/40): 1-2hrs / day
- ▶ Dichoptic treatment
 - ▶ Stimulating both eyes together, but weakening contrast on the good eye

Amblyopia is frustrating, rewarding, and the outcome is not a guarantee

Case 1- 6 yrs old

- ▶ 1st visit: 1st time wearing GLs, outside rx early 2023, never patched
 - ▶ +0.50-1.00x005 VA(cc) 20/20
 - ▶ +2.50-4.25x171 VA(cc) 20/60
 - ▶ **Dx:** refractive amblyopia,
 - ▶ **Tx:** patch OD 2-3hrs/day
- ▶ 2-3 mo f/u: VAs (cc)
 - ▶ OD: 20/25+2 and OS: 20/30+2
 - ▶ **Tx:** cont patching
- ▶ 2-3mo f/u: VAs (cc)
 - ▶ OD: 20/20 and OS: 20/20
 - ▶ **Tx:** Patch 1 more mo. F/u in 3 mos for regression

Case 2 - 1.5 yrs old

- ▶ Cyclo ret:
 - ▶ OD: +3.00-1.00x060 VA(sc) CSM
 - ▶ OS: +1.50-1.00x090 VA(sc) CSM
 - ▶ **Dx:** refractive amblyopia secondary to NLDO
 - ▶ **Tx:** 1% atropine or patch 1hr/day prophylactically
- ▶ 6 mo f/u VAs (sc)
 - ▶ Noncompliant with tx
 - ▶ OD: 20/80 and OS: 20/40
- ▶ 3 mo f/u VAs(sc)
 - ▶ OD: 20/50 and OS: 20/50

Case 2 continues...

Case 2 - 1.5 yrs old

- ▶ Cyclo ret:
 - ▶ OD: +3.00-1.00x060 VA(sc) CSM
 - ▶ OS: +1.50-1.00x090 VA(sc) CSM
 - ▶ **Dx:** refractive amblyopia secondary to NLDO
 - ▶ **Tx:** 1% atropine or patch 1hr/day prophylactically
- ▶ 5 mo f/u VAs (sc)
 - ▶ Noncompliant with tx
 - ▶ OD: 20/80 and OS: 20/40
- ▶ 3 mo f/u VAs(sc)
 - ▶ OD: 20/50 and OS: 20/50
- ▶ 3 mo f/u VAs (sc)
 - ▶ 20/30 OD and 20/20 OS
 - ▶ Cyclo ret:
 - ▶ OD: +3.25-0.75x180
 - ▶ OS: +1.00x05
 - ▶ 3 mo f/u VAs (sc)
 - ▶ 20/30 OD and 20/20 OS
 - ▶ Not compliant with patching
 - ▶ Rx GLs:
 - ▶ OD: +2.25-0.75x180
 - ▶ OS: Pano
 - ▶ 3 mo f/u VAs (cc)
 - ▶ 20/30 OD and 20/20 OS
 - ▶ 3 mo f/u VAs (cc)
 - ▶ 20/30 OD and 20/20 OS
 - ▶ Refer for dichoptic treatment at RFSW

Moral of the story....

- ▶ Every individual is different and will respond differently to the same treatment even if the problem is the same
- ▶ 6 yr old got to 20/20 in 4-6 months
- ▶ 4 yr old BCVA 20/30 after on/off treatment for almost 2 yrs

Emerging amblyopia treatment options...

- ▶ Dichoptic
 - ▶ Amblyoplay
 - ▶ VR head sets
- ▶ *Not gold standard
- ▶ Research institutions:
 - ▶ RFSW w/ Eileen Birch, PhD
 - ▶ PEDIG on ATS-20



Take aways...

- ▶ Recurrent red eye in pediatrics...don't forget about marginal keratitis
- ▶ Reduced vision isn't always just amblyopia or pathology...could be both
- ▶ Amblyopia refractive risk thresholds are lower than you think...please f/u with your pediatric pts

Questions? Thank you!

luu.becky@gmail.com

Identification and Response to Human Trafficking In Healthcare

Jason Spees MSN APRN FNP-C

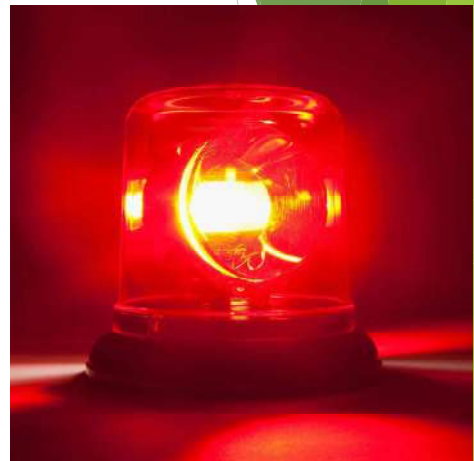
► No Disclosures

Take care of yourself

TRIGGER WARNING:

This lecture discusses sensitive matters such as physical sexual and psychological abuse of adults and children

Feel free to mute or walk away from the lecture if you need



Objectives

- ▶ Provide an overview of human trafficking including definitions, types of trafficking, dynamics, and vulnerabilities
- ▶ Describe the health impact of human trafficking on persons experiencing trafficking
- ▶ Describe identification assessment and documentation techniques for persons experiencing trafficking
- ▶ Describe appropriate response and follow up for a suspected or confirmed person being trafficked

Human Trafficking Healthcare Competencies



- Core Competency 1: Understand the nature and epidemiology of trafficking
- Core Competency 2: Evaluate and identify the risk of trafficking
- Core Competency 3: Evaluate the needs of individuals who have experienced trafficking or individuals who are at risk of trafficking
- Core Competency 4: Provide patient-centered care
- Core Competency 5: Use legal and ethical standards
- Core Competency 6: Integrate trafficking prevention strategies into clinical practice and systems of care
- Universal Competency: Use a trauma- and survivor-informed, culturally responsive approach

Overview



The Public's Idea of Human Trafficking



Myths

- ▶ Human trafficking is the same as human smuggling and involves border crossing
- ▶ Human trafficking is the same as kidnapping
- ▶ Only foreign-born persons are trafficked
- ▶ Sex work and sex trafficking are the same
- ▶ Only women and girls are trafficked
- ▶ ***Everyone who is being trafficked wants to be rescued***

Facts

- ▶ Smuggling is illegally transporting a person over a border - trafficking does not require the crossing of a border
- ▶ Kidnapping is abducting someone and controlling their movements and is not required for trafficking
- ▶ Both foreign born and domestic persons can be trafficked
- ▶ Sex work and sex trafficking are different
- ▶ All genders can be trafficked
- ▶ Many persons who are trafficked are not seeking rescue

Terminology for People Experiencing Trafficking

- ▶ Victim - infers lack of agency
- ▶ Person experiencing trafficking
- ▶ Person surviving trafficking
- ▶ Trafficked person
- ▶ Survivor
- ▶ Thriver

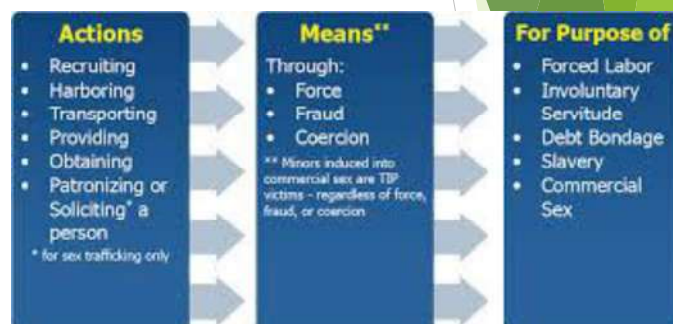
Trafficking Victims Protection Act (TVPA) 2000

- ▶ Bipartisan legislation designed to create a legal definition for trafficking
- ▶ Addressed deficiencies in the legal framework by solidifying definitions of trafficking and establishing protection and restitution for victims
- ▶ Prior to the TVPA traffickers were prosecuted according to slave laws according to the 2020 federal report from the Human Trafficking Institute.



Action Means Purpose Model

- ▶ This is the legal model used to establish the phenomenon of trafficking in prosecution
- ▶ Action - induces, recruits, harbors, transports, patronizes, solicits, provides or obtains
- ▶ Means - force, fraud, coercion
- ▶ Purpose - commercial sex or labor act



Healthcare and Human Trafficking in Texas

- ▶ Healthcare providers are required by state law to participate continuing education each year in Texas along with other state requirements for licensure
- ▶ This course only satisfies the human trafficking requirement for licensure
- ▶ Mandatory human trafficking awareness flyers must be present in certain clinical environments
- ▶ Healthcare is concerned with upstream factors that create the conditions for human trafficking and identification in order to stop it from occurring

TVPA Human Trafficking Definition

- ▶ **Sex trafficking**
The recruitment, harboring, transportation, provision, obtaining, patronizing and soliciting of a person for the purpose of a commercial sex act, in which a commercial sex act is induced by force, fraud, or coercion, **or in which the person forced to perform such an act is under the age of 18 years.**
- ▶ **Labor trafficking**
The recruitment, harboring, transportation, provision, obtaining, patronizing and soliciting of a person for labor or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage or slavery.

Human Trafficking Definition

Two main types*:

- ▶ Labor trafficking
- ▶ Sex trafficking

Both require the use of force, fraud, or coercion

*Other subtypes exist such as debt bondage and involuntary servitude. Internationally, child soldiering, organ trafficking, and forced marriage exist

Two populations:

- ▶ Adults
- ▶ Minors

- ▶ ***Minors being commercially exploited for sex acts do not have to prove force fraud or coercion***

Force Fraud and Coercion

- ▶ Force - physical beating, rape, controlling movements
- ▶ Fraud - tricking someone with false promises or hope i.e. “I can give you a great job that pays well”, “I promise we will get married and you can get citizenship”
- ▶ Coercion - psychological manipulation - shaming, threatening the person or their family, withholding identification or immigration documents

Difference Between Sex Work and Sex Trafficking

- ▶ “Sex work” is exchanging money for sex in places where it is legal and includes agency of the person
- ▶ Where it is a crime it is called prostitution
- ▶ People who do sex work get to decide:
 - ▶ To use a condom
 - ▶ To say no to the solicitor
 - ▶ Where they go, what they do
 - ▶ How to use the money they make
- ▶ People who are sex trafficked don’t get to decide

Difference Between Sexual Abuse and Sex Trafficking

- ▶ Force fraud or coercion can be involved in both sex trafficking and sexual abuse
- ▶ Commercial exchange is involved in sex trafficking
 - ▶ Money
 - ▶ Housing
 - ▶ Food
 - ▶ Gifts
 - ▶ Labor
 - ▶ Anything of value

Statistics of Human Trafficking

- ▶ The human trafficking field is in its infancy in terms of research
- ▶ There are not universally accepted standards for how to statistically verify the prevalence of a hidden crime like trafficking
- ▶ Many statistics in the human trafficking field cannot be proven, only estimated
- ▶ The presence of sensationalism harms the anti-trafficking movement by taking extreme examples of real but less common occurrences and presenting them as typical - *this can cloud our ability to identify less obvious forms of trafficking*
- ▶ Presenting human trafficking as only sex trafficking makes labor trafficked persons invisible

Sensationalism in Human Trafficking



Which image is sensational?

Statistics in Human Trafficking

- ▶ Ask yourself:
 - ▶ Are they referring to sex trafficking or labor trafficking or both?
 - ▶ Children or adults or both?
 - ▶ Are they referring to the United States or worldwide?
 - ▶ Are they using sensational images or language?
 - ▶ What is their source? How dated?

Estimations of Prevalence

- ▶ 49.6 million estimated persons trafficked worldwide (International Labor Organization)
- ▶ 150 billion dollars potentially made in criminal profit worldwide (whitehouse.gov)
- ▶ 313,000 estimated total human trafficked persons in Texas
- ▶ 234,000 estimated labor trafficking persons in Texas
- ▶ 79,000 estimated sex trafficking persons who are minors and youth in Texas
- ▶ (<https://sites.utexas.edu/idvsa/research/human-trafficking/>)

Risk Factors/Vulnerabilities for Labor and Sex Trafficking

- ▶ Poverty
- ▶ Substance use
- ▶ Foster care involvement
- ▶ LGBTQIA+ identification
- ▶ Previous history of psych/sexual/physical violence
- ▶ Family rejection, runaway/homeless
- ▶ Low self-esteem
- ▶ Gang involvement
- ▶ Immigration status or undocumented
- ▶ Low levels of education
- ▶ Learning or developmental disabilities

Who is a Trafficker?

- ▶ A trafficker can be anyone
- ▶ They control the exploitation and profit from it
- ▶ Romantic partner/“friend”
- ▶ Family member - father, mother, aunt, uncle, brother, sister
- ▶ Boss of a company
- ▶ Pastor, teacher, coach
- ▶ Can use violence or finesse/grooming

Violent Tactics of Traffickers

- ▶ Alienation
- ▶ Isolation
- ▶ Cementing a codependent intimate relationship - “*trauma bond*”
- ▶ Violence/abuse/threats
- ▶ Normalizing the abuse
- ▶ Give drugs or alcohol to cause dependency
- ▶ Withholding basic necessities

Finesse Tactics of Traffickers

- ▶ Exploit vulnerabilities in the patient through meeting basic needs
- ▶ Making pleasing offers that are too good to be true
- ▶ Offering cash, expensive items
- ▶ Giving love, romantic relationship
- ▶ Making promises, flattery
- ▶ Using an older friend already in the life of trafficking to help recruit

Who is a Solicitor?

- ▶ Also known as a “John,” “Customer,” or “Client”
- ▶ The one purchasing the sex or labor act
- ▶ In sex trafficking, mostly men
- ▶ Customers who use the services of the person being trafficked
- ▶ Person in charge, boss/manager
- ▶ Downstream customers

Biderman's Chart of Coercion and Control

- ▶ Isolation
- ▶ Controlling/Distorting perceptions
- ▶ Humiliation/Degradation
- ▶ Threats
- ▶ Demonstrating Omnipotence/Superiority/Power
- ▶ Enforcing Trivial Demands
- ▶ Exhaustion
- ▶ Occasional Indulgences

The Trauma Bond

- ▶ Type of relationship formed under the conditions of danger, anger, shame, exploitation and other unhealthy states
- ▶ Reinforced by perpetuating the violence and fear through controlling tactics
- ▶ The trafficker may use isolation and abuse to terrify the person into compliance
- ▶ May use reward and punishment to strengthen the relationship and control
- ▶ Overlaps with Stockholm Syndrome type state
- ▶ Fawning phenomena may occur

Health Impact



Common Acute Medical Conditions

- ▶ Injury from abuse or unsafe working conditions
- ▶ Sexually transmitted infections (GC/CL, syphilis, HIV)
- ▶ Unplanned pregnancy (lack of reproductive health access)
- ▶ Anxiety/depression/panic attacks
- ▶ Somatic symptoms from emotional distress
- ▶ Behavioral issues (adult and pediatric)
- ▶ Toxic exposure

Chronic Medical Conditions

- ▶ Malnourishment/Dehydration
- ▶ Untreated chronic diseases - DM, HTN, thyroid
- ▶ Substance use
- ▶ Dental problems
- ▶ Fatigue
- ▶ Musculoskeletal pain, especially in the neck, throat and face from strangulation or beating
- ▶ Dizziness, tinnitus, hearing or visual problems
- ▶ Headaches
- ▶ Cognitive disorders

Mental Health Impact

- ▶ Panic attacks
- ▶ Anxiety/Depression
- ▶ Hallucinations
- ▶ Suicidality
- ▶ Trauma bonding
- ▶ PTSD
- ▶ Hypervigilance
- ▶ Addiction

Life of a Trafficked Person

- ▶ Little to no personal agency/autonomy
- ▶ Unable to perform some life skills
- ▶ Mental health issues - afraid/anxious/angry
- ▶ Suicidality
- ▶ Lack of access to resources - reproductive, medical, dental, food access, transportation, communication
- ▶ Physical health issues
- ▶ Stigma from public, police, fear of immigration
- ▶ May not identify self as being trafficked

Living Conditions of Trafficked Persons

- ▶ May not have a bed
- ▶ May live with several people
- ▶ Unable to see family
- ▶ Poor sanitation
- ▶ Poor safety equipment
- ▶ Poor medical care, uncontrolled chronic diseases
- ▶ Dehydration/Malnutrition
- ▶ Environmental toxins
- ▶ Not enough shelter from heat/cold

Identification and Assessment



How Do We Recognize Someone Who is Trafficked in Healthcare?

- ▶ As high as 88% of trafficked persons pass through the medical system undetected (polarisproject.org)
- ▶ Review medical history for risk factors
- ▶ Listen to patient, allow them to describe their experience in their own words
- ▶ Have enough knowledge about trafficking to recognize red flags
- ▶ Put the picture together and ask the right questions

Environments Where Trafficking Occurs

- ▶ Labor trafficking: agriculture, sweatshop/factory, cleaning services, housemaid services, babysitting or nanny services, nail salons, restaurants
- ▶ Sex trafficking: pornography production companies, massage parlors, escort services, strip clubs, online sex venues, hotels
- ▶ *These are not comprehensive lists*

The Clinical Environment Where a Trafficked Person May Present

- ▶ Emergency Rooms
- ▶ Primary Care Clinics
- ▶ OBGYN Clinics
- ▶ Reproductive Health Clinics
- ▶ Surgery Centers
- ▶ Homeless shelters with medical services

Barriers to Identification in the Provider

- ▶ Providers may be biased toward the patient due to their race or status as a “problem child”, “gang person”, or “prostitute”
- ▶ Providers may not have training or understanding of a trafficking situation
- ▶ Providers can be tricked by the trafficker who is family or friend
- ▶ The window of opportunity to help the person being trafficked is very small
- ▶ Provider may be hesitant to investigate further

Barriers to Disclosure in the Patient

- ▶ Fear of the trafficker
- ▶ Fear of the police
- ▶ Fear for their family (threats)
- ▶ Fear of deportation
- ▶ Strong trauma bond
- ▶ Stigma
- ▶ Shame
- ▶ Disoriented
- ▶ Not be ready to change
- ▶ Lack of insight into their trafficking situation

Initial Assessment

- ▶ Review the medical record (including across regional records if possible) for history of or current status of:
 - ▶ Previous violence
 - ▶ STIs (sex trafficking)
 - ▶ Multiple pregnancies and/or abortions
 - ▶ Multiple sex partners
 - ▶ Substance addiction/mental health issues
 - ▶ Work history
 - ▶ Reliance on street economy
 - ▶ Workplace accidents

Interview

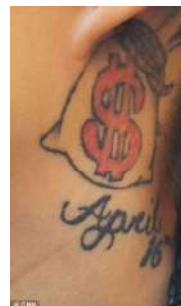
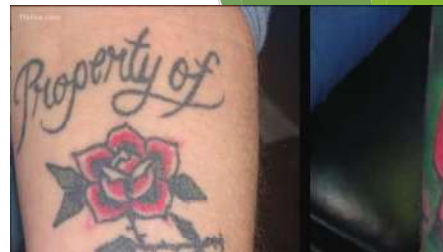
- ▶ Attempt to separate the patient from their companion if possible
- ▶ Very important to use a translator when possible if needed
- ▶ Assess the patient's immediate medical needs through history
- ▶ Perform relevant review of systems questions (may ask general questions that could point to trafficking indicators) "Have you ever had any problems in your private area/penis/vagina/anus?"
- ▶ When complete ask if there is anything else you can help them with
- ▶ "Do you feel safe where you are living?" - read the room
- ▶ Consider employing a screening tool

Other Trafficking Related Questions

- ▶ What are your work hours like?
- ▶ How do you make your money?
- ▶ Where do you sleep? What are your living conditions like?
- ▶ How many people do you live with?
- ▶ Could you get another job if you wanted to?
- ▶ Do you get breaks?
- ▶ Are you in control of your money?
- ▶ Has anyone ever hurt you?
- ▶ Has anyone ever made you do something you didn't want to do?

Identification of Sex Trafficking Physical Exam

- ▶ Relationship between patient and the person with them seems discordant or has an unusual quality; patient may be scared or deferent, however everyone presents differently
- ▶ Dressed inappropriately for weather
- ▶ Patient's account of illness seems scripted
- ▶ Tattoos indicating branding
- ▶ Patterned injuries/bruises/scars
- ▶ PE findings of STIs (PID, dysuria, proctitis)
- ▶ Genital trauma
- ▶ Foreign object in vagina or anus



Identification of Labor Trafficking

- ▶ Relationship between patient and the person with them seems discordant or has an unusual quality; patient may be scared or deferent, however everyone presents differently
- ▶ Acute or post-acute injuries related to work accidents due to poor safety conditions
- ▶ Malnourished
- ▶ Language barrier, person with them gives account
- ▶ Owes a debt
- ▶ Does not have control over money or documents
- ▶ Long work hours, minimal or no breaks
- ▶ Is in poor contact with family

Survivor Voice

- ▶ Presenter may speak about their advice/account if there is a survivor speaker

Testing and Screening

- ▶ Consider labs for malnutrition - CBC, CMP, Magnesium, vitamin A, E, D, B12, folate, iron etc.
- ▶ STI screening: chlamydia, gonorrhea, syphilis trichomoniasis, mycoplasma - swabbing any of the body parts they have sex with including throat and anus, follow up testing
- ▶ Other infectious disease such as hepatitis B and C and HIV with retesting 6 weeks and 3 months after last sexual contact
- ▶ Testing for parasitic infections, tuberculosis, lead, diseases endemic to country of origin
- ▶ X-Rays of injured body parts
- ▶ Head, neck, abdomen CT/MRI/US for trauma related injuries
- ▶ Pelvic exam, pregnancy test

Screening Tools

- ▶ RAFT by Chisolm-Straker (2019):
- ▶ Have you ever worked, or done things in a place that made you feel unsafe?
- ▶ Have you ever been tricked into doing any kind of work you didn't want to do?
- ▶ Have you ever had to leave or quit a work situation due to fears of violence or threats of harm to yourself and family?
- ▶ Have you ever received anything in exchange for sex such as a place to stay, gifts or food?

Screening Tools

- ▶ Six-Item Screening Questionnaire from Greenbaum (2018) for high-risk adolescent populations:
- ▶ Is there a previous history of drug and/or alcohol abuse?
- ▶ Has the youth ever run away from home?
- ▶ Has the youth ever been involved with law enforcement?
- ▶ Has the youth ever broken a bone, had traumatic loss of consciousness, or sustained a significant wound?
- ▶ Has the youth ever had a sexually transmitted infection?
- ▶ Does the youth have a history or sexual activity with more than 5 partners?

Safety and Assessment

- ▶ If possible, try to separate the trafficker from the patient - this can be done by "taking a patient for an x-ray" or "obtaining a urine sample"
- ▶ Be aware that traffickers have been known to monitor those they traffic through electronic devices so separating devices from the patient should be considered
- ▶ A professional interpreter should be utilized for interviewing if needed after the patient is alone
- ▶ There should be a protocol at your institution for signaling that there is a suspected trafficker in the clinic
- ▶ Personnel at all stations should have some training in human trafficking including security and front desk staff

Patient Centered Trauma Informed Care

- ▶ The provider should be alert for signs of physical and/or mental trauma in the patient
- ▶ Create a sense of safety, privacy and collaboration
- ▶ Demonstrate calmness, care, and curiosity about the patient's experience
- ▶ Build trust by showing empathy and support by using the same words the patient uses, i.e personal pronoun preference, respect for gender identity and sexual preferences

Patient Centered Trauma Informed Care

- ▶ Identify and reinforce strengths the patient has and encourage their thoughts and opinions
- ▶ Do not re-traumatize the patient by asking for unnecessary details of their experience
- ▶ Be honest, transparent and sensitive to diverse populations
- ▶ Use the same language the patient uses
- ▶ Ask the patient their preferred name and pronouns
- ▶ If possible have a provider of the same race and gender involved

Documentation of Human Trafficking

- ▶ Documentation principles are similar to those of domestic violence with HT nuances - should be legible, factual, non-biased, medical language
- ▶ Be careful if you use ICD-10 codes as these may print out on the discharge sheet or online portal and alert the trafficker
- ▶ Do not use legal language "perpetrator", "victim", etc.
- ▶ Do not use language which implies doubt on the part of the provider, "pt claims...", "pt allegedly was trapped in her house..."
- ▶ Do not draw conclusions, just state the facts
- ▶ Use universal abbreviations
- ▶ Be aware your chart is a legal document, inform the patient of this

Documentation of Human Trafficking

- ▶ Describe physical injuries, site, color, shape, size, etc.
- ▶ Take photos if possible with the patient's permission and fill out body maps of injuries, ***"no consent" must be respected***
- ▶ Be aware of injuries that are consistent with abuse patterns and document them appropriately, "lateral left forearm, upper arm and left face bruised"
- ▶ Note mood, affect, demeanor and any sudden unprovoked comments the patient may make, i.e. pt suddenly stated "I think he wants to kill me"
- ▶ Identify the person who hurt them in the patient's words with quotation marks, "My boyfriend hit me"

ICD-10 Codes for Human Trafficking



ICD-10 Human Trafficking Codes

- "LIVE" on October 1, 2018
- Allows for differentiation of human trafficking from other forms of abuse
- Supports appropriate treatment of victims
- Retrieved from:
<https://www.aha.org/system/files/2018-09/icd-10-code-human-trafficking.pdf>

ICD-10-CM Code/ Subcategory	Title
T74.51*	Adult forced sexual exploitation, confirmed
T74.52*	Child sexual exploitation, confirmed
T74.61*	Adult forced labor exploitation, confirmed
T74.62*	Child forced labor exploitation, confirmed
T76.51*	Adult forced sexual exploitation, suspected
T76.52*	Child sexual exploitation, suspected
T76.61*	Adult forced labor exploitation, suspected
T76.62*	Child forced labor exploitation, suspected
Y026	Multiple perpetrators of maltreatment and neglect
Z04.81	Encounter for examination and observation of victim following forced sexual exploitation
Z04.82	Encounter for examination and observation of victim following forced labor exploitation
Z62.813	Personal history of forced labor or sexual exploitation in childhood
Z91.42	Personal history of forced labor or sexual exploitation

*Subcategories require additional characters for specific codes. Please refer to ICD-10-CM for complete codes

Response to Trafficking



What Do Healthcare Providers Do About Trafficking?

- ▶ Listen and respond with *trauma informed care*
- ▶ Be culturally responsive and respectful
- ▶ Protect privacy
- ▶ Use interpreters
- ▶ Report to authorities if necessary
- ▶ Refer to appropriate multidisciplinary services like social work, safe house or a SANE nurse
- ▶ Treat the patient medically
- ▶ Offer messages of hope
- ▶ *Be a safe place to come back to*

The PEARR Tool

- ▶ Provide Privacy
- ▶ Educate
- ▶ Ask
- ▶ Respect
- ▶ Respond



Reporting in Texas -Title 5 Chapter 261 Texas family Code

- ▶ Healthcare providers are mandated reporters in Texas
- ▶ Any suspected or confirmed abuse of children, the elderly, or adults with disabilities must be reported the Department of Family And Protected Services
- ▶ Types of abuse include exploitation, neglect and physical, sexual and psychological abuse of children, the elderly and people with disabilities
- ▶ May report by telephone or internet, use telephone if urgent: 1-800-252-5400, or website: <https://www.txabusehotline.org/Login/Default.aspx>.
- ▶ A healthcare provider can be criminally charged if they do not report, and may not delegate an abuse report

What to Report in Texas

- ▶ Demographics of the patient and people in contact with the patient
- ▶ Findings that confirm or cause suspicion of abuse including the intersection of risk factors and suspicious findings
- ▶ What the parent is doing and who the abuser may be
- ▶ Access to the patient an abuser may have
- ▶ Supervision of the child or disabled/impaired/older adult
- ▶ Record name of operator and case number in the medical record
- ▶ If a case is opened record name of the investigator
- ▶ Report of child abuse must be made ***within 48 hours***
- ▶ Abuse neglect or exploitation of an elderly person, a person with a disability, or an individual receiving services from a provider must be reported ***immediately***.

Law Enforcement

- ▶ It is important to be in collaboration with law enforcement while advocating for the patient's needs
- ▶ Be familiar with federal, state and local law
- ▶ Build relationships with law enforcement
- ▶ Law enforcement is not necessarily entitled to HIPAA protected information

If a Patient Discloses

- ▶ Let them know this is not their fault
- ▶ Let them know they have rights
- ▶ Affirm their agency and choice as much as possible
- ▶ Treat their medical conditions and establish medical trust
- ▶ Affirm a safe clinical environment for the patient
- ▶ Offer support in terms of referrals to community organizations, social workers SANE nurse and counseling
- ▶ Contact Department of Family and Protective Services if any type of child, disabled person, or person over 65 abuse is suspected or confirmed

If a Patient Does Not Disclose or Refuses Resources

- ▶ Prioritize the decision of the patient, support agency
- ▶ *Do not try to get the patient to disclose - it is not the goal*
- ▶ *Do not try to convince the patient to accept resources*
- ▶ Employ harm reduction measures if possible, offer PrEP, condoms, birth control, crisis phone numbers etc.
- ▶ Reaffirm that your clinical environment is there for them and resources will always be available to them
- ▶ If patient is a minor and you suspect trafficking **REPORT**

You Have a Patient Who Is Recovering From Being Trafficked


- ▶ Consider a free or income-based payment process
- ▶ Flexibility with scheduling
- ▶ Preserve their autonomy
- ▶ They may be processing with a social worker or counselor
- ▶ Consider other referrals that may be of help
- ▶ They may continue to do sex work on their own to survive
- ▶ Evaluate for access to medications
- ▶ Needs may change quickly - re-evaluate medical conditions and social determinants of health (food, neighborhood, work, family, healthcare access etc.) on a regular basis
- ▶ They may return to the trafficking life

Institutional and Systemic Actions

- ▶ Advocate for survivor informed training on human trafficking
- ▶ Advocate for protocols for the clinic to be put in place
- ▶ Establish relationships with organizations who help trafficked persons
- ▶ Be aware of vicarious trauma within staff and offer debriefing if detected
- ▶ Participate in research
- ▶ Become an ACT Advocate through NAPNAP


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 If you or a family member is hurt or in danger, call 911.

 If you need to report child abuse, please call 1.800.252.5400.



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CHAT IS AVAILABLE MONDAY-THURSDAY FROM 12:00 TO 4:00 PM, FRIDAY FROM 8:00 AM TO 12:00 PM AND MONDAY - FRIDAY FROM 5:00 PM TO





Resources

- ▶ Office of Trafficking in Persons
- ▶ SOAR to Health and Wellness Training
- ▶ HEAL Trafficking
- ▶ National Association of Pediatric Nurse Practitioners
- ▶ Polaris
- ▶ PEARR Tool

Reminders

- ▶ ***DO NOT TRY TO RESCUE THE PATIENT***
- ▶ *The patient must make their own choice given the resources available to them*
- ▶ Stay within your scope
- ▶ Don't make promises you can't keep
- ▶ The window of opportunity is very small, you will maximize your ability to respond if you are prepared
- ▶ Use the same words as the patient
- ▶ Practice good self-care



Last Final Thoughts

- ▶ Properly inform yourself on the nature of trafficking
- ▶ Include labor and sex trafficking in your toolkit of knowledge
- ▶ Always check your statistics
- ▶ Build a trusted network of community support services
- ▶ ***Contact the authorities if the suspected or confirmed trafficked person is a minor***
- ▶ ***Do not try to rescue***
- ▶ Call the police or Human Trafficking Hotline or text 233733 for help

National Human Trafficking Hotline:

888 3737 888

Thank You!



Jason Spees MSN, MaOM APRN L.Ac FNP-C
jspees@utexas.edu

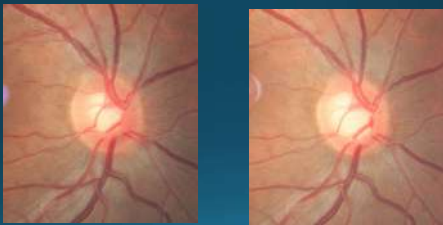
Beyond the C/D Ratio

Marcus Gonzales, OD, FAAO

Financial Disclosures

- No financial disclosures.
- Marcus Gonzales OD, FAAO
- Clinical Associate Professor at the University of Houston College of Optometry
- Clinic Director of the Cedar Springs Eye Clinic

What's the C/D Ratio?



Points to Remember

- Glaucoma affects the ONH in characteristic patterns
- Typically affects the eyes and rims asymmetrically
- Monitoring for change is the key

What Can You Do?

- More comprehensive documentation of the optic nerve at baseline helps better determine this over time
- OCTs and disc photography can be a huge aid
- Be more consistent in C/D estimation

C/D Estimation

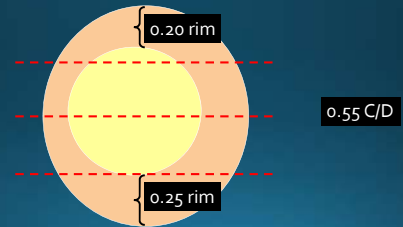


Cup-to-Disc vs Rim-to-Disc

- Judge the smaller structure
- Judge the rims and calculate the C/D ratio
- Judge based on contour vs color

STEREO is key!!!

C/D Estimation



Why is a C/D ratio not enough?

- High degree of inter and intra-observer repeatability
 - Poor indication for progression
- Doesn't take into account nerve size
- Doesn't take into account rim configuration
- Vessel changes and/or NFL defects more apparent

Glaucomatous ONH Evaluation

- Optic nerve size
- Rim evaluation
- Vessel/cup changes
- Retinal nerve fiber layer
- Disc hemorrhage

Nerve Size Affects C/D Ratio

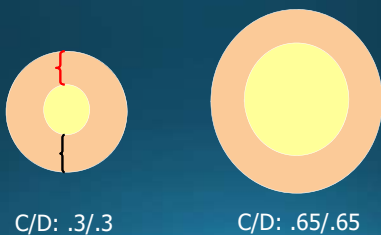


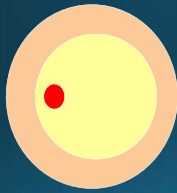
TABLE 5-2. Suspicion of Glaucoma Based on Cup and Disc Size

Cup size	Small disc	Medium disc	Large disc
Small	Expected	Normal	Normal
Medium	Abnormal	Expected	Normal
Large	Abnormal	Abnormal	Expected*

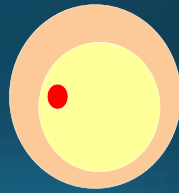
*Although a large cup should be expected in a patient with a large disc, glaucoma can be present in a large disc.

- Per Litwak (Glaucoma Handbook)

Rim Configuration



C/D: .7/.7
Rims: I=S=N>T



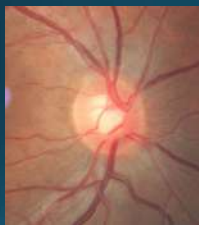
C/D: .7/.7
Rims: S>N>T>I

Rim Evaluation

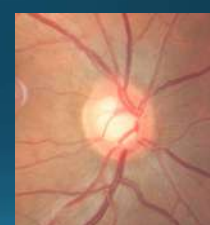
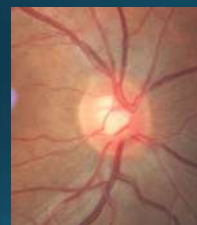
- Rim Configuration
 - Estimate relative size (not number)
 - Document thickest to thinnest
 - ISNT rule for normal
 - I & S should be thicker than T
- Focal Notch
 - 3x more common inferior-temporal



What's the C/D Ratio?



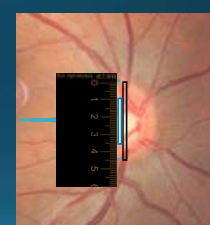
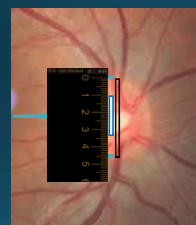
What's the Rim Configuration?



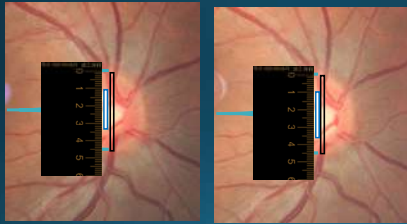
Change Over Time



C/D Ratios

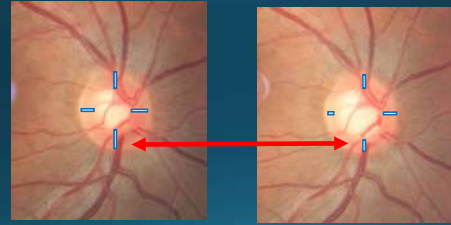


C/D Ratios



Optic Nerve: 4.6mm
 C/D #1: $2.35/4.6 = .511$
 C/D #2: $2.7/4.6 = .587$
 Difference = .076

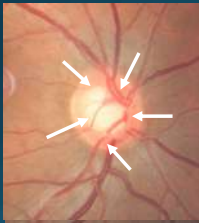
Rim Configuration



Rims: I>S>N>T

Rims: S>N>I>T

Changes?

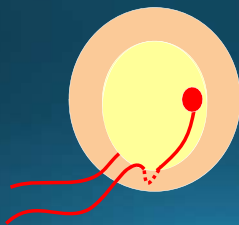


Bayoneting Nasalization Bean Potting

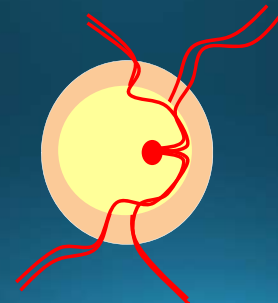
Bayoneting



Bayoneting



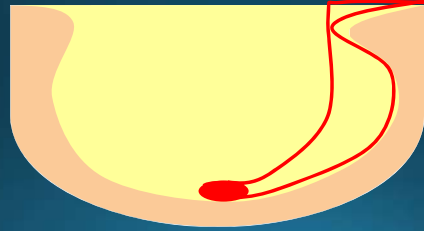
Nasalization



Bean potting

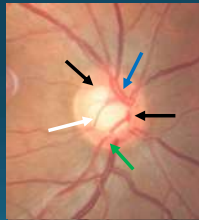


Bean potting



Changes?

Bayoneting

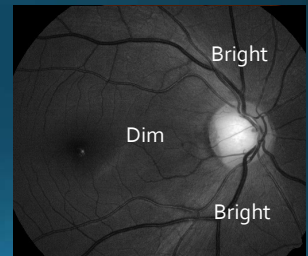


Nasalization

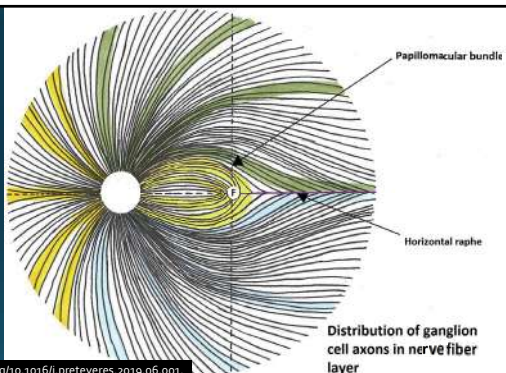
Bean Potting

Nerve Fiber Layer

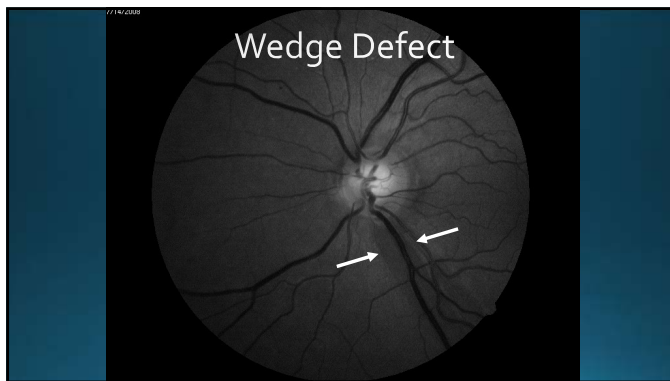
- Best visualized with red-free (green) filter
- Don't overlook photography as an aid



Wedge Defect



<https://doi.org/10.1016/j.preteyeres.2019.06.001>



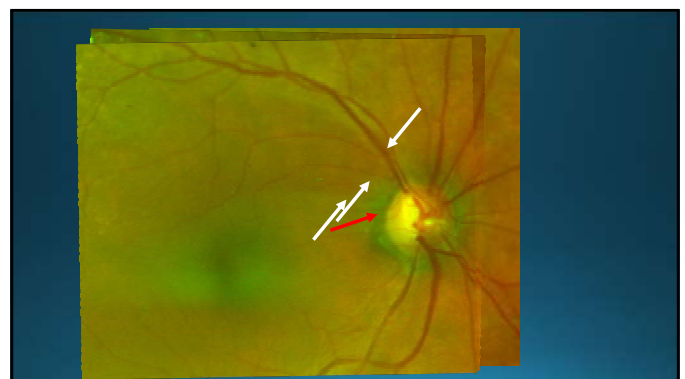
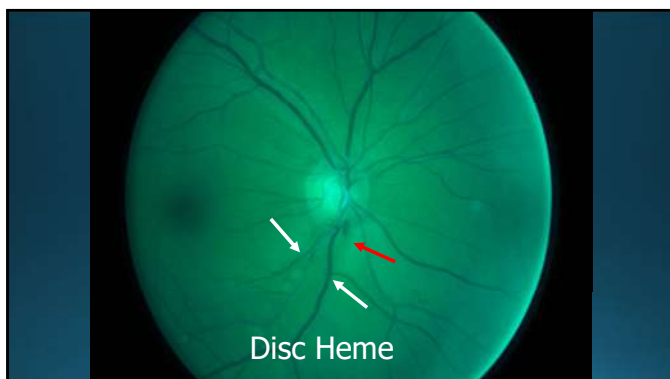
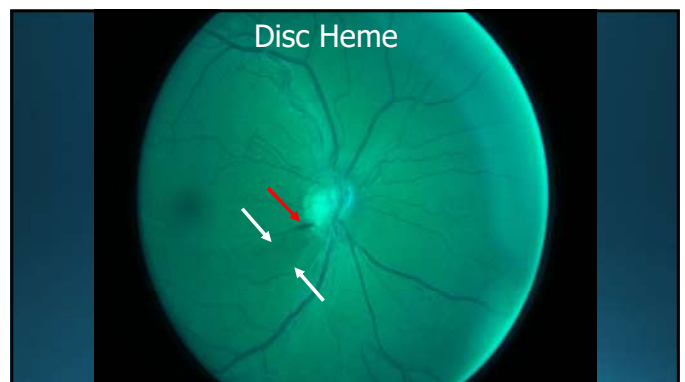
Disc Hemorrhage

- Flame-shaped hemes at/near disc or round hemes in the disc at the level of the lamina cribrosa
- WGA: Disc hemorrhage is one of the most important findings in the diagnosis of glaucoma
- More common in NTG
- In ocular hypertensives, **2X** risk to develop POAG

Disc Hemorrhage

- Most commonly inferior/temporal
- 95% are within 2 clock hours of existing NFL defect
- Can be a sign of progressing glaucoma
- OHTS data showed 84% of disc hemorrhages were missed on physical exam alone
 - Later found via disc photography

Bedenz D, Beiser Huecker J, et al. Thirteen-Year Follow-up of Optic Disc Hemorrhages in the Ocular Hypertension Treatment Study. Am J Ophthalmol. 2017



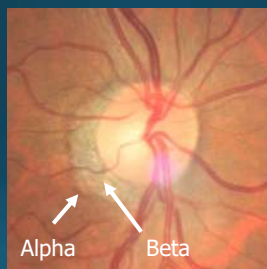
Peripapillary Atrophy

- Atrophy of tissue surrounding ONH
- Pathogenesis: Ischemia of peripapillary choroidal circulation and/or vascular deficiency in the ONH
- Correlation of size and location of PPA to the extent of damage to ONH
- Correlation to changes in PPA associated with progression of VF loss

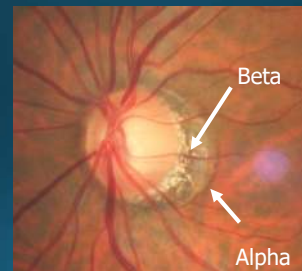
Peripapillary Atrophy

- Alpha (α) zone changes
 - Irregular hyper/hypopigmentation of the RPE
 - Normal variation with age
- Beta (β) zone changes
 - Atrophy of the RPE and choriocapillaris making large choroidal vessels and sclera apparent
 - More common and extensive in glaucomatous nerves
 - May precede notch, disc heme, NFL defect
 - If both changes are present, alpha changes occur outside the beta zone changes

Peripapillary Atrophy



Peripapillary Atrophy



Case Example



Case Example



ONH-NFL/GCC Interpretation (Optovue)

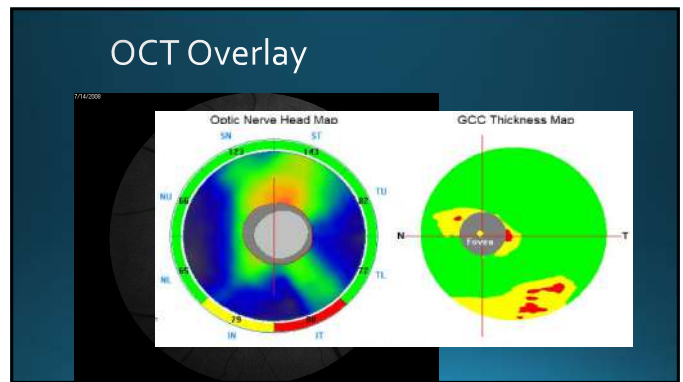
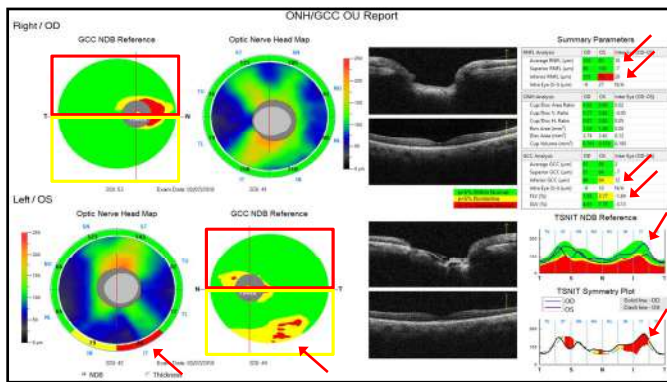
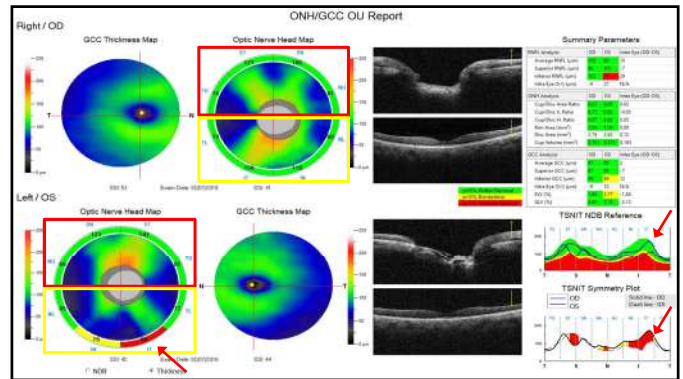
Reliability

General Overview:

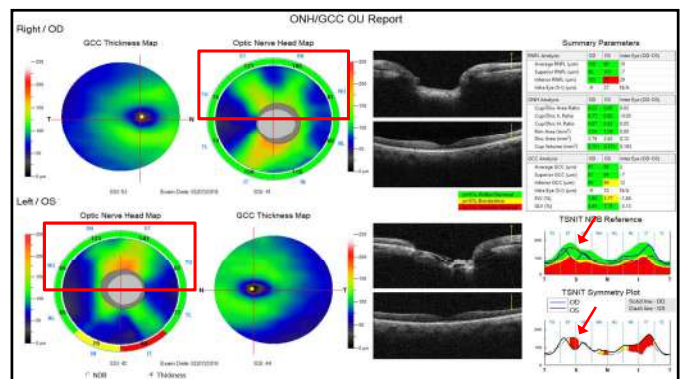
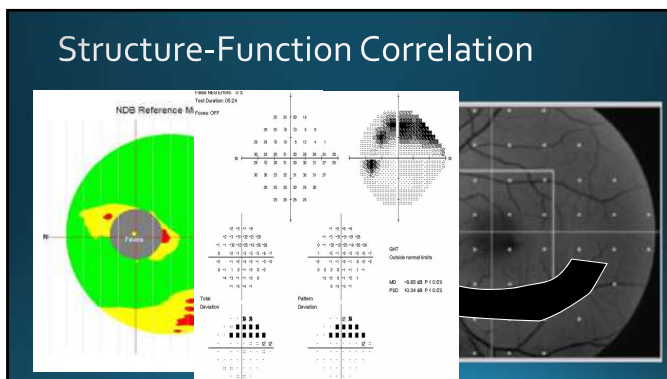
- TS/NIT & Symmetry Plot
 - NFL Cube Thickness Maps
 - GCC Thickness & Deviation Maps
- Comparison to Normative Database
 - Inter-eye Symmetry
 - NFL-GCC Correlation

Specific Numbers:

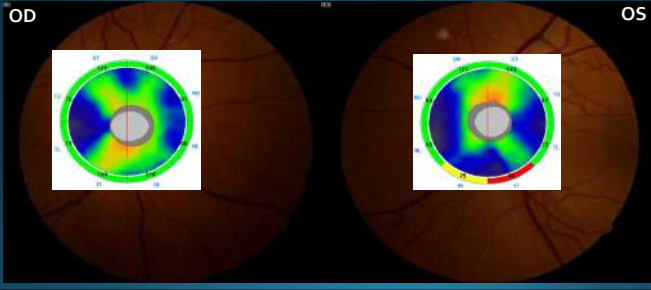
- Avg, Superior & Inferior Thicknesses
 - Focal (FLV) & Global Loss Volumes (GLV)
 - ONH Calculations
- Comparison to Normative Database
 - Inter-eye Symmetry



Structure-Function Correlation



Normal Anatomical Variance



Questions?

mbgonzal@central.uh.edu