"2020 and Beyond: Surgical Innovations and Updates"

Derek Cunningham, OD, FAAO
Josh Johnston, OD, FAAO

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Financial Disclosures: Derek Cunningham, OD, FAAO

- Consultant
  - Alcon
  - Valeant
  - J&J
  - RVL
  - Kala
  - Santen
  - Sun
  - Lumenis
  - Nike
  - Smith

2

Disclosures for Josh Johnston, O.D., F.A.A.O.

- Allergan- Consultant, speaker, research
- Aldeyra- consultant
- Avellino- consultant
- Azura- consultant, speaker
- Alcon- consultant
- BioTissue- consultant
- Bruder- consultant
- Dompe- consultant
- Glaukos- consultant, speaker
- Horizon Therapeutics- consultant
- Johnson & Johnson- consultant
- Kala- consultant
- LacriSciences- share holder
- Sight Sciences- consultant, speaker
- Maxi Vision- consultant
- Novartis
- Novaliq- consultant
- Sun- consultant, speaker
- Tarsus- consultant, researcher
- Trukera- consultant
- Thea – consultant
- Visus- consultant
- Quidel- consultant, speaker
- Zeiss- consultant
- Oyster Point – consultant

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Optometric Co-Management

- High quality eye care
- Benefits to patient care
  - Patient comfort
  - Patient convenience
  - Efficiency
  - Cost effective
- Utilize skills and expertise of each practitioner

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2.0 B

People with Presbyopia around the globe in 2019 – growing to

2.3 B

by 2023

PRESBYOPIA Worldwide

Presbyopes	2019	2024
US	128.7 M	136.5 M
OUS	1.93 Billion	2.17 Billion

Source: 2019 Market Scope Estimates

~ 1.8 million new presbyopes a year in U.S.

Contributing Factors:

- **Aging population**
- **Longer life expectancies**
- **Longer Working Careers**
- **Near Vision needs**
- **Growing Middle Class in emerging markets**

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Why Is This Important For Optometry?

- 4 out of 5 patients diagnosed with a cataract are done so by an optometrist
- Optometrists are the "gatekeepers" to cataract referrals and ATIOLs
- Referring O.D.'s must discuss all IOL options and educate patients about cataract and treatment options

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Expect (Avoid) the Unexpected!

- Pre-op for Lifestyle IOLs
  - Topography, ocular surface testing
  - Macular OCT
  - Reliable biometry, reproducible astigmatism measurements
- Under promise and over deliver for ATIOLs
  - Emphasize need for +1.00 readers for near tasks ***
  - Discuss starbursts around lights at night

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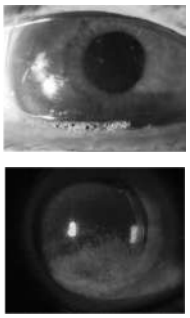
Preparation for Ocular Surgery

- Optimize the Ocular Surface
- Normalize the Lids
- Prepare the Cornea
- Eliminate Intra-ocular Inflammation
- Control Glaucoma
- Satisfy the Macula
- Evaluate the Retinal Periphery
- ***Patient Education***



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Today's Presbyopia-Correcting IOL Options

- Enhanced Monofocal IOL
- Wavefront-Shaping EDOF IOL
- Hybrid Multifocal/EDOF IOL
- Small Aperture IOL
- Light Adjustable Lens

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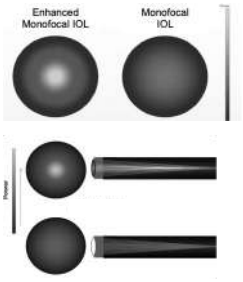
Enhanced Monofocal IOL

- Refractive technology (no rings)
- Same material, spherical aberration and A-constant as monofocal IOL
- Pupil independent behavior
- Power increases continuously from periphery to the center of the lens, resulting in slightly extended range of vision
- Provides a bigger landing zone than a standard aspheric monofocal lens



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J&J Vision – Tecnis Eyhance

- First lens[1] in the monofocal IOL category in Europe to deliver improved intermediate vision and 20/20* distance vision
- TECNIS Eyhance IOL offers the same well-established low incidence of halo, glare, or starburst as TECNIS® 1-piece IOLs
- FDA approved 2/2/21

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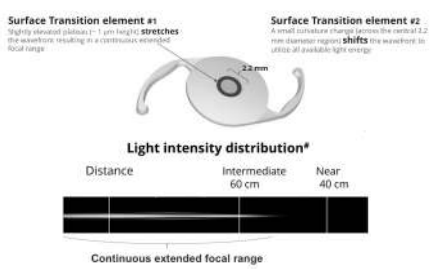
Wavefront-Shaping EDOF IOL



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EDOF - Vivity IOL

- Non-diffractive IOL
- Novel X-Wave shaping technology creates an extended focal range by stretching and shifting the wavefront
- Low incidence of visual disturbances
- Possible for AMD?? Glaucoma??

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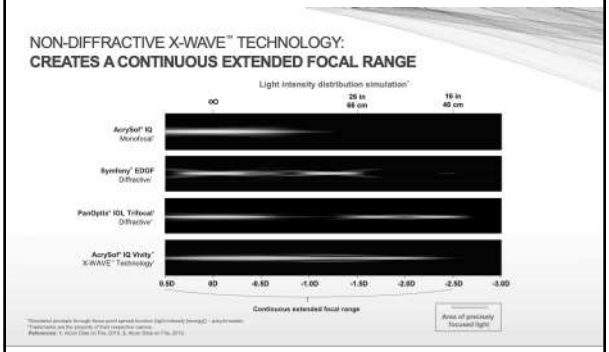

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Proprietary Technology

TECNIS Symfony® IOL Merges Two Complementary Enabling Technologies

Proprietary Echelette Design Extends the depth of focus

Proprietary Achromatic Technology Corrects chromatic aberration for enhanced image contrast[1]

1. TECNIS® Symfony® IOL DFU

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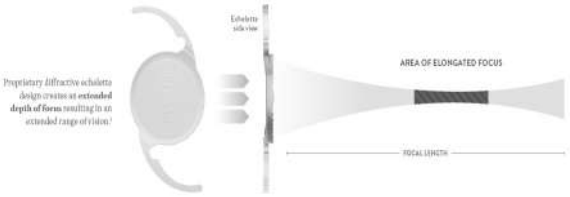
The TECNIS Symfony® IOL has unique optics, creating a different visual experience

Extended Depth of Focus



- The proprietary echelette design introduces a novel pattern of light diffraction that elongates the focus of the eye
- The echelette is the relief or profile of the lens (height differential) within each ring
- The height, spacing, and profile of the echelettes to create a diffractive pattern for an elongated focus

1. TECNIS® Symfony® IOL DFU

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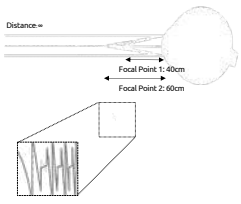
PANOPTIX TRIFOCAL IOL

- **SUPERPOSITION OF FOCAL POINTS**
- **LIGHT REDIRECTION** - 120 cm intermediate focal point redirected to distance
- **3 FOCI** – Trifocal with 40cm, 60 cm and distance
- **88% LIGHT UTILIZATION** - at 3.0 mm pupil
- **LIGHT ALLOCATION** - 50% of available light to distance, 25% to intermediate and 25% to near



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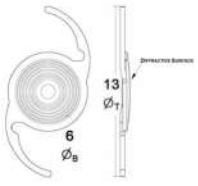
Hybrid Multifocal/EDOF IOL

- Combines diffractive multifocal and EDOF technologies (echelette surface to improve light scatter and halo intensity)
- Achromatic technology for image contrast
- Violet filter to reduce halo, glare, starburst



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J&J Vision – Tecnis Synergy

- Gives broad range of continuous vision[3] covering from distance to 33 cm**[4-6]
- Eliminates the visual gaps present in trifocal and other multifocal technology
- Continues to deliver superior performance in low-light conditions***[2]
- Violet-filtering technology demonstrates reduction in halo intensity for tasks like night driving,[7]

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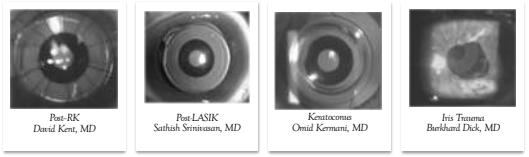
Presbyopia Correction No Longer Only for the Perfect Cornea!



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"Pinhole" IOL Design

- IOL Material
  - Single-piece hydrophobic acrylic
- Mask
  - PVDF & nano-particles of carbon
  - 1.36mm aperture
  - 3.23mm total diameter
  - 3200 microperforations
  - 5 microns thick

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Premium IOLs: 5 Pearls ("P's") for Success

1. **P**lano Outcome
2. **P**roactive Tx of Ocular Surface Disease
3. **P**re Op Counseling – Setting Realistic Expectations
4. **P**roperly Screen Candidates
5. **P**ick the Right IOL

Other:
6. **P**ick the Right Surgeon
7. **P**osterior Capsular Opacification
8. **P**oor IOL Centration

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Dry Eye Disease

- Chair time: blurred vision from cataracts versus DED
- Cataract sx can worsen DED for months after surgery
- Quality of vision may require chronic DED therapies

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ARTICLE

Prevalence of ocular surface dysfunction in patients presenting for cataract surgery evaluation

Preeya K. Gupta, MD, Owen J. Drinkwater, BS, BA, Keith W. VanDusen, BS,

Results: There were 120 patients (69% women), mean age 69.5 years ± 8.4 (SD). Abnormal osmolarity was found in 68 patients (56.7%), and abnormal MMP-9 in 76 patients (63.3%). Clinical findings showed that 47 patients (39.2%) had positive corneal staining on presentation, 9 patients (7.5%) had epithelial basement membrane dystrophy, and 2 patients (1.6%) had Salzmann nodules. Questionnaire data showed 54 (54.0%) of 100 patients reported symptoms suggestive of ocular surface dysfunction. In the asymptomatic group of 46 patients, 39 (85%) had at least 1 abnormal tear test (osmolarity or MMP-9) and 22 (48%) had both tests abnormal. Overall, 96 (80%) of 120 patients had at least 1 abnormal tear test result suggestive of ocular surface dysfunction and 48 patients (40%) had 2 abnormal results.

J Cataract and Refractive Surgery 2018

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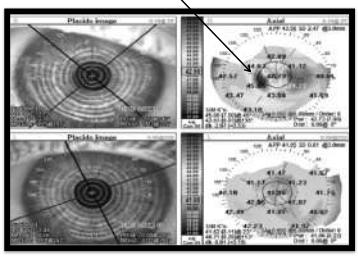
"Hot spots" and "Flat spots" are abnormal



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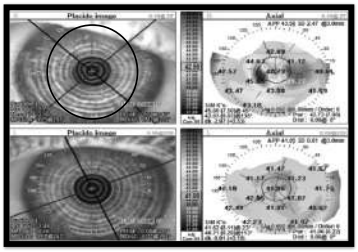
Irregularly shaped or smudgy placido disk is abnormal!



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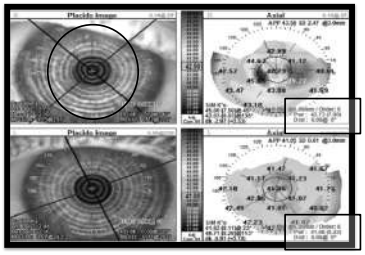
Take a closer look if <u>average</u> K values are different



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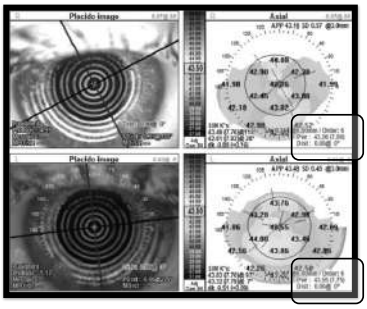

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REVIEW/UPDATE

An algorithm for the preoperative diagnosis and treatment of ocular surface disorders

Christopher E. Starr, MD, Preeya K. Gupta, MD, Marjan Farid, MD, Kenneth A. Beckman, MD, Clara C. Chan, MD, FRCSC, Elizabeth Yeu, MD, José A.P. Gomes, MD, PhD, Brandon D. Ayers, MD, John P. Berdahl, MD, Edward J. Holland, MD, Terry Kim, MD, Francis S. Mah, MD, the ASCRS Cornea Clinical Committee

An algorithm for the preoperative diagnosis and treatment of ocular surface disorders
Starr, Christopher E. et al.
Journal of Cataract & Refractive Surgery, Volume 45, Issue 5, 669 – 684 2019

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Light Adjustable Lens

- Only FDA approved IOL that can be adjusted postoperatively
- Polymerization of a photosensitive silicone macromer
- Customized blended vision

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Light Adjustable Lens (LAL)

- FDA Approved 11/17 for pts with pre-existing astigmatism of ≥0.75D undergoing cat sx
  - Spherical and cylindrical errors up to 2D
- First and only lens designed to be ***adjusted*** after implantation by UV light
- 3 piece IOL design
- 6.0mm biconvex optic; 13.0mm overall length
- UV absorbing back layer: 50-100 µm

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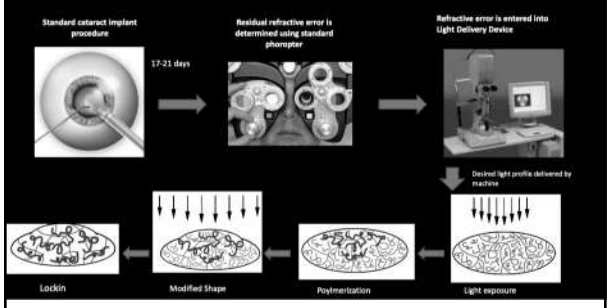
Prediction to Prescription



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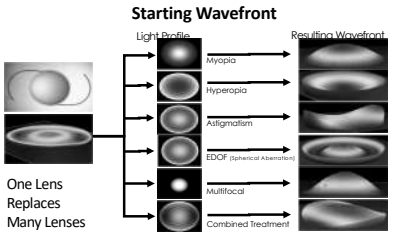
Flexible Treatment Profiles



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RxLAL Will Expand Monovision Use

- **Monovision used 3-4x more than PC-IOLs**[1]
  - Usual target: 0.75D-1.00D anisometropia
  - W/ average 0.5D SD[1], hard to hit target
  - If miss first eye, acuity degradation/ binocular fusion
- **RxLAL will dramatically increases binocular accuracy**
  - Standard deviation reduced to 0.2D[1]
  - Patient ability to test-drive/adjust final outcome
  - LASIK-like outcomes
- **Creates new premium channel opportunity**

IOL Type	Refractive Error (Standard Deviation)
Non-Adjustable	0.5D
RxLAL	0.2D

1. 2015/2016 AEOS Survey 2. Average over all ECPs 3. Data on File FDA Study

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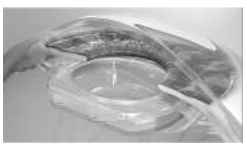
What's Next in IOL Technology?

- Modular IOL Systems
- Accommodating
- Multifocal / trifocal
- Extended Depth of Focus



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Accommodating IOL – LensGen Juvene

- Modular, curvature-changing, fluid-optic IOL
- Two-part IOL - Base and Modular
- Advantages
  - Doesn't split light
  - Up to 3D of continuous range vision
  - No change in ELP
  - No PCO up to 4 years
- Astigmatism?? Drug Delivery?? Exchangeable 2nd implant??

**Not FDA Approved

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Accommodating IOL – Alcon FluidVision Lens

- Entire lens is hollow and filled with liquid silicone
- Fluid changes changes in optic
- Avg. accommodation range 2D
- Dr. Nichamin ESCRS 2018
  - 29 eyes
  - Distance 20/20
  - Intermediate 20/20-20/25
  - Near 20/22-20/27

**Not FDA Approved

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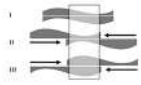
Accommodative IOL – Akkolens Lumina



- Two piece sulcus IOL
  - Fixed and variable
  - Hydrophilic acrylate
- Shifting optics
  - Can provide 3-4 D focal range when shifted
- Dr. Alio -59 eyes of 43 pts
  - Accommodative range of 3.1D

**Not FDA Approved

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Postoperative Complications

- 1 day – High or low IOP
- 3-7 days – Endophthalmitis
- 2-3 weeks – Steroid Responder
- 3-4 weeks – Iritis/Uveitis
- 3-6 weeks – CME
- 1-3 months – Posterior capsule opacification

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20/Unhappy

Causes of unhappiness

Woodward MA, Randleman JB, Stulting RD. Dissatisfaction after multifocal intraocular lens implantation. *Journal of cataract and refractive surgery*. 2009;35(6):992-997. doi:10.1016/j.jcrs.2009.01.031.

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Neuroadaptation of Multifocal IOLS

- Patients' expectations of time frame needed to adapt needs to be managed
  - These patients require more counseling post-op
  - Neuroadaptation can take as long as 6-12 months
  - About 10% never neuroadapt (will need IOL exchange)
  - No way of testing before surgery which patients will be able to adapt vs not
- Multifocal IOLs will induce more aberrations than monofocal IOLs

Take away: no YLC to be performed until rule out that IOL exchange is necessary

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Refractive Enhancement: Laser Vision Correction (LVC)

- **Timing is everything!**
- Wait at least 2-3 months after cataract surgery for wounds and LRIs to settle
- Nd:YAG posterior capsulotomy BEFORE LVC
  - **No YAG in multifocal IOL that was never happy**

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Managing the Unexpected Outcome: Have an Algorithm to Identify the Issue

- Develop communication with your staff regarding dissatisfied patients
  - Encourage clinic techs to communicate patient satisfaction to you
  - Have work-up done before you see the patient
    - **MRx BCVA/Topo/OCT/Ocular surface testing**
  - Have a plan to fix the problem before you enter the room!

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Avedro's Approach: Non-invasively Stabilizing and Reshaping the Cornea

Corneal Remodeling Technology

The Mosaic System, Boost Goggles, and transepithelial drug formulations are not sold in the United States

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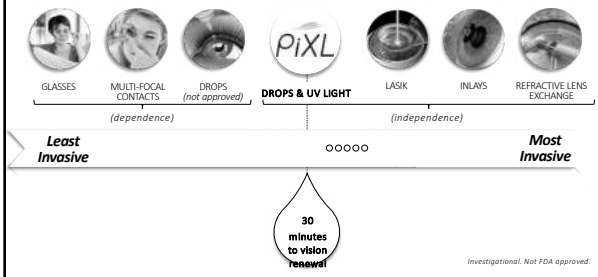
Corneal remodeling for non-invasive reshaping the cornea without ablation or incision



Investigational. Not FDA approved.

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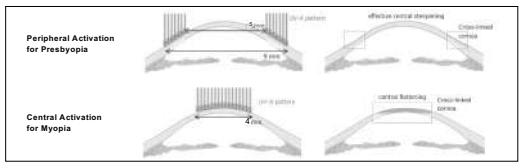
PiXL for Vision Improvement

Non-invasive corneal remodeling

Treatment Concept	Visual Target	Patient Experience
One time, non-invasive corneal remodeling treatment	Spectacle independence Binocular UNVA of J2 or better No halo or loss of CDVA	Non-invasive, simple procedure 1-2 day recovery Long-term stability of CXL



Investigational. Not FDA approved.

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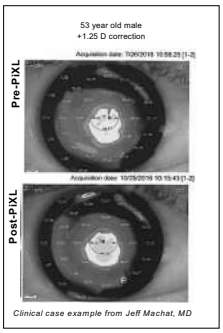
PiXL for Presbyopia

Spatially targeted, epithelium-on, accelerated cross-linking

More than 200 eyes treated internationally with PiXL to date

- Midperipheral cross-linking, no UVA applied to central cornea
- Image above: High resolution OCT image showing mid peripheral corneal stromal demarcation line after epi-ON PiXL with oxygen

Investigational. Not FDA approved.



Clinical case example from Jeff Machat, MD

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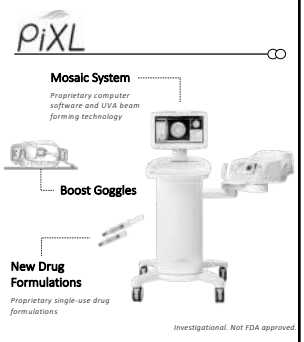
- A potential non-invasive solution for presbyopia
- Filling a gap in refractive treatment options
- Drops, UV light and O_2
- Targeted corneal reshaping with long-term durability of cross-linking
- Likely advantageous for post operative cornea adjustability
- Early clinical results are promising
- **Multicenter Phase II Study in 2019**



Investigational. Not FDA approved.

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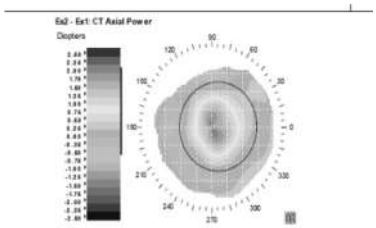
Allogenic Corneal Inlay (Allotex)
PEARL: PrEsbyopic Allogenic Refractive Lenticule

- Increasing central corneal power to improve near vision



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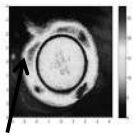
Excimer laser shaped corneal inlays

Early Development: Laminar Sheets

Scaling

Valuable use of gifted human tissue!

Predictability



Human tissue shaped with excimer laser precision.

www.allotex.com

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Surgical Procedure (Aylin Kylic, MD)

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European Multicenter Study: Interim data analysis (20 eyes)

	Preoperative	Post-op (last visit)
UCNVA of 20/40 or better (monocular)	0%	95%
Near Vision (binocular)	Gain: +17 letters (mean)	
Intermediate Vision (binocular)	Unchanged: +2 letters (mean)	
Distance Vision (binocular)	Unchanged: -2 letters (mean)	

*** last visit was 1 or 3 months after surgery

c/o Aylin Kylic, MD

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The LIRIC Platform: Laser Induced Refractive Index Change for Refractive Error Correction

LIRIC: *a disruptive technology*

Poised to revolutionize:
- **refractive surgery**
- **cataract surgery**
- **contact lenses**

A revolutionary way to refine the optics of the eye

Cornea
- Minimally invasive
- No flap, epi on, no doping
- No nerve damage

IOL
- Post-implantation optical touch-up
- Monofocal to multifocal & vice-versa
- Correct residual refractive error

Contacts
- Enables diffractive multifocals for better presbyopia correction
- Thin lenses for all prescriptions
- Better oxygen transmissibility

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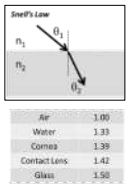
The LIRIC Platform

Low-Pulse Energy Femtosecond Laser

- **Refractive Index Modification**
  - Refractive error correction[1,2,3]
  - Presbyopia correction[4,5]

Refractive Index Bends Light



Air	1.00
Water	1.33
Cornea	1.39
Contact Lens	1.42
Glass	1.50

1. Gandara-Montano et al., Optical Materials Express, 2017
2. Gandara-Montano et al., Optical Materials Express, 2018
3. Zheleznyak et al., ARVO 2018
4. Zheleznyak et al., ARVO 2019
5. Butler et al., ARVO 2019

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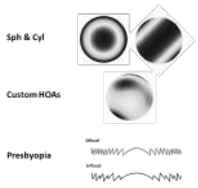
The LIRIC Platform

Low-Pulse Energy Femtosecond Laser

- **Refractive Index Modification**
  - Refractive error correction[1,2,3]
  - Presbyopia correction[4,5]



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4. Zheleznyak et al., ARVO 2019
5. Butler et al., ARVO 2019

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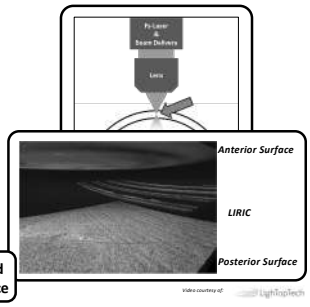
The LIRIC Platform

Low-Pulse Energy Femtosecond Laser

- **Refractive Index Modification**
  - Refractive error correction
  - Presbyopia correction
- **High Resolution Wavefronts**
  - Multiphoton process
  - Scanning µm-size laser focus
  - Repeat treatments: thin LIRIC layer, ~10 µm



LIRIC is embedded beneath the surface

Video courtesy of: LightTopTech

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Updates on Modern Day Corneal Surgery

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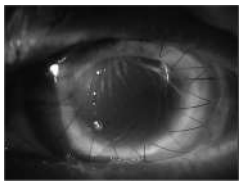
Common Corneal Procedures

- Corneal crosslinking
- Penetrating keratoplasty
- Descemet's stripping endothelial keratoplasty
- Pterygium surgery
- Superficial keratectomy



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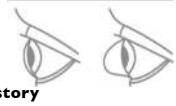
Watch Out for Keratoconus!



8 Potential Signs & Symptoms

Typically onset occurs in teenage years or early twenties

- **Look out for warning signs in medical history**
  - History of eye rubbing
  - Family & genetic predispositions
- **Look out for visual complaints**
  - Blurred vision
  - Distortion of images
- **Look out for refractive anomalies**
  - Distortion of mires on keratometry
  - Error messages on autorefractors
  - Unsatisfactory attempts at vision correction & progressive loss of UCVA & BCVA
  - Increasing astigmatism

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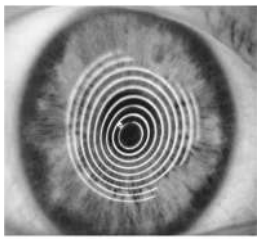
Diagnostic Imaging

- Irregular Placido (egg-shaped) Topography



Early signs of keratoconus may include

- *Skewed radial axis of astigmatism*
- *Asymmetric or truncated bow-tie*

[1] Y.S. Rabinowitz. Keratoconus. Survey of Ophthalmology Vol 42. Num 4. Jan-Feb 1998.

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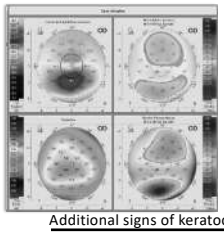
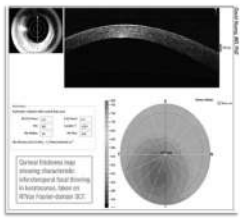
Diagnostic Imaging

Irregular Topography/Tomography



Focal thinning on OCTs[1]



Additional signs of keratoconus may include

- Astigmatism variance between eyes
- Stromal and epithelial thickness changes
- Posterior elevation changes
- Wavefront aberrations
- Topographic changes
  - Inferior steepening
  - Irregularity indices

[1] https://www.reviewofophthalmology.com/article/making-the-most-of-anterior-segment-oct.

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Corneal Crosslinking

- UV light and photosensitizer to strengthen chemical bonds in the cornea
  - Oxidative deamination reaction with ends chains of collagen
- FDA Approved in the US 2016
  - Epi-off
- Indicated to help slow progression of:
  - Keratoconus
  - PMD
  - Terrien Marginal Degeneration
  - Post-refractive surgery ectasia

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Contraindications (or we thought they were)

- Corneal thickness <400um (epi off)
- Prior herpetic infection
- Concurrent infection
- Severe corneal scarring or opacification
- History of poor epithelial wound healing
- Severe ocular surface disease
- Autoimmune disorders

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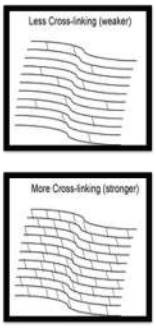
Mechanism of Action

- Corneal collagen cross-linking combines the use of **ultra-violet (UV) light** and **riboflavin (vitamin B2) drops**
- The absorption of UVA by riboflavin generates radical riboflavin and singlet oxygen to form cross-links[1]
- **Corneal Cross-Linking**:
  - Creates new corneal collagen cross-links
  - Results in a shortening and thickening of the collagen fibrils
  - Leads to the stiffening of the cornea[2]



[1] Kamaev P, Friedman MD, Sherr E, Muller D. Photochemical kinetics of corneal cross-linking with riboflavin. Invest Ophthalmol Vis Sci. 2012;53:2360–7.
[2] Bekhtaw IM, O'Donnell C, Radhakrishnan H. Biomechanical properties of corneal tissue after ultraviolet-A-riboflavin crosslinking. J Cataract Refract Surg. 2013;39(3):451–62.

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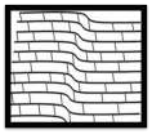
Keys to Patient Counseling: Discuss Treatment Goals



Aim of CXL is to halt or slow disease progression

Cross-Linking is <u>not</u> a refractive procedure

Post-op evaluation for visual correction will be necessary

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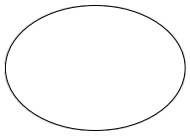
Follow-up Care Landmarks



Due to Zero Global period, those may be billable to insurance for follow up when medically indicated

VISIT	PLAN
Day 1 to 1 Week	• Topical antibiotic, steroid • Frequent lubricants • No eye rubbing • Remove BCL once epithelium heals
Month 1	• OCT Imaging • Tomography/Topography • Vision assessment • Contact lens refitting evaluation
Month 3, 6, 12 *(Follow ups potentially performed and billed by diagnosing physician depending on practice preference)*	• Continued evaluation utilizing tomography/topography • Vision assessment

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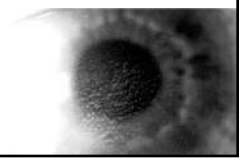
CXL Complications

- Endothelial cell damage
  - <400um thickness
- Persistent epithelial defects (epi off)
  - Mechanical, CL preservatives, topical medication
  - Haze
- Scarring
- Infectious keratitis
  - Fungi, bacteria, HSV,
  - Acanthamoeba
  - HSV vs UV light



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Long-term maintenance

- Close monitoring immediately after CXL
  - Every 3 months with pachymetry, MRX and corneal topography
  - Then decrease to yearly to monitor for any progression
- Counseling patient that mechanical rubbing of the eye can cause it to progress
  - Treat allergies
  - Treat DED
  - Treat Blepharitis/MGD

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29 year old black male

- Very poor bcva
- OS worse than OD
- Spectacles useless
- RGP BCVA 20/100

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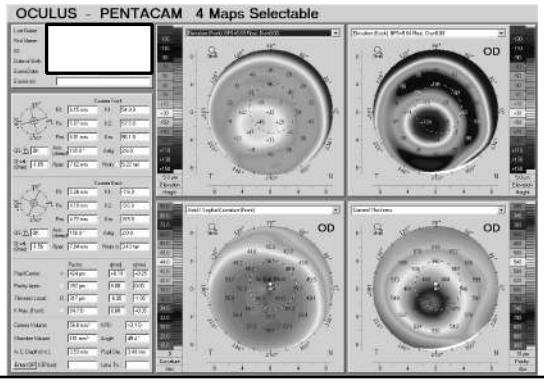
Initial presentation



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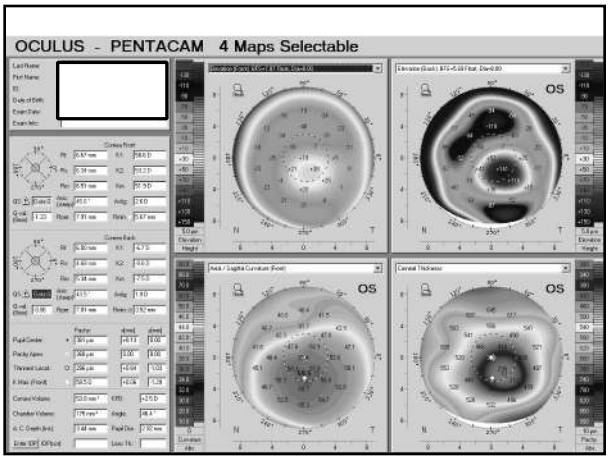

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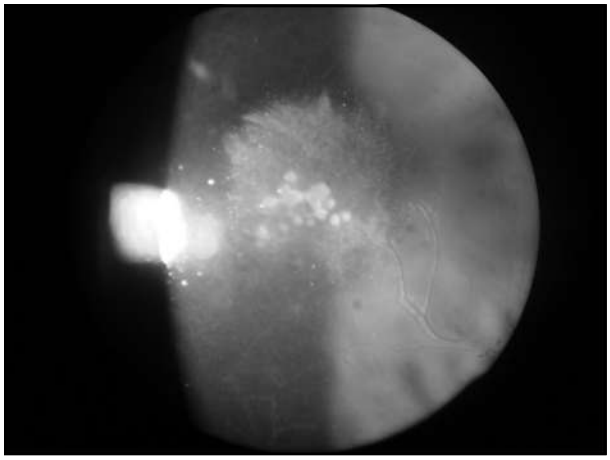

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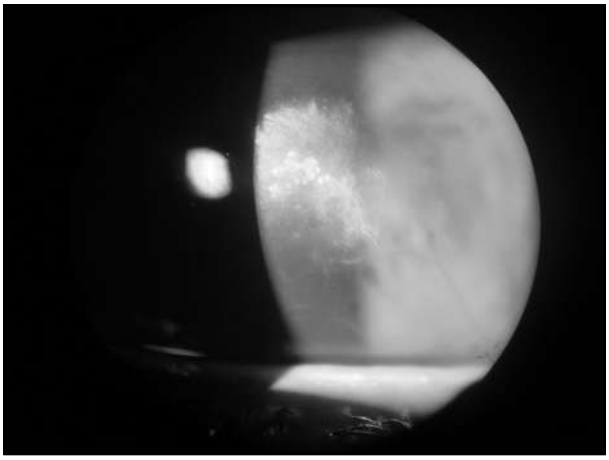

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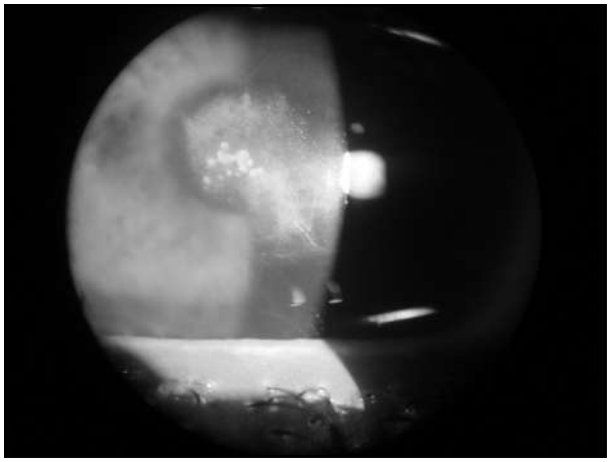

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Do We Dare?

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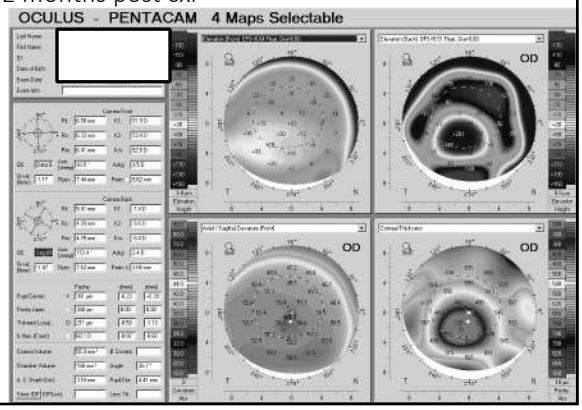
2 months post cxl



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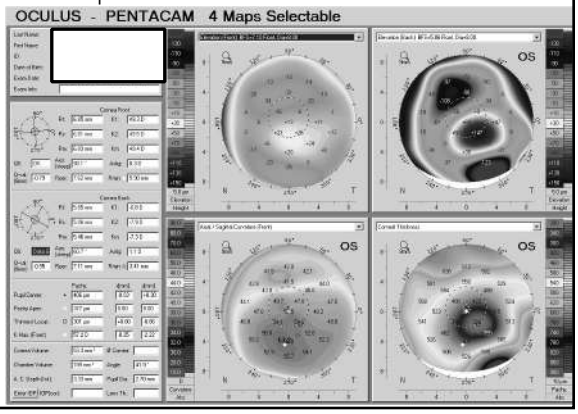
2 months post cxl



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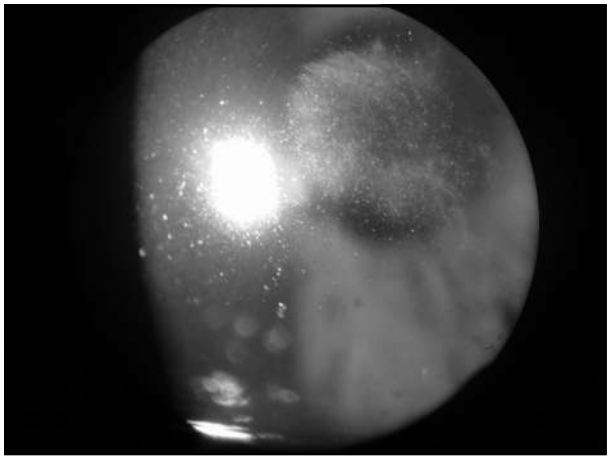

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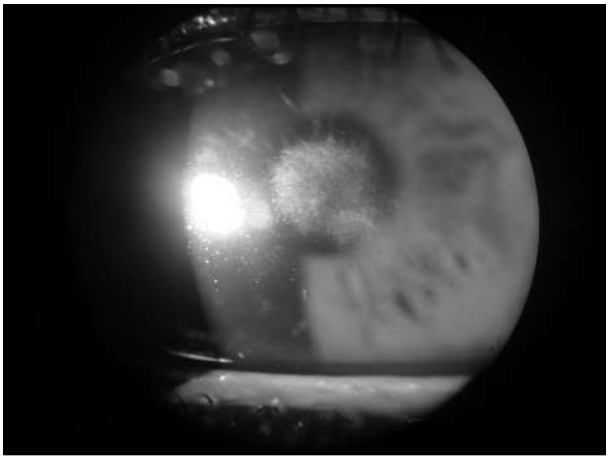

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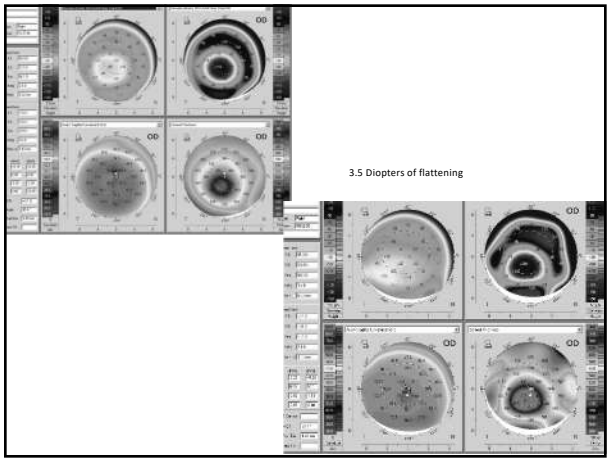

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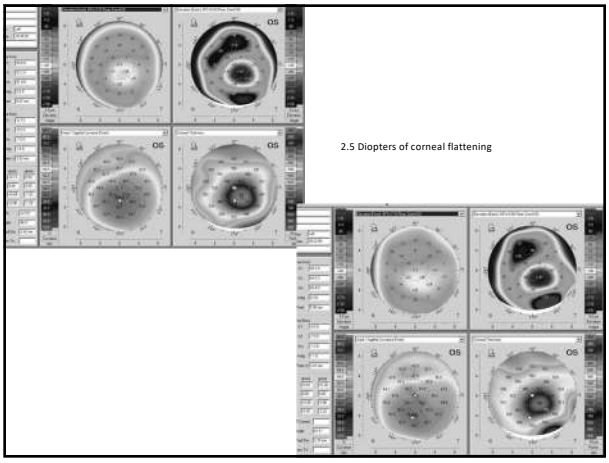

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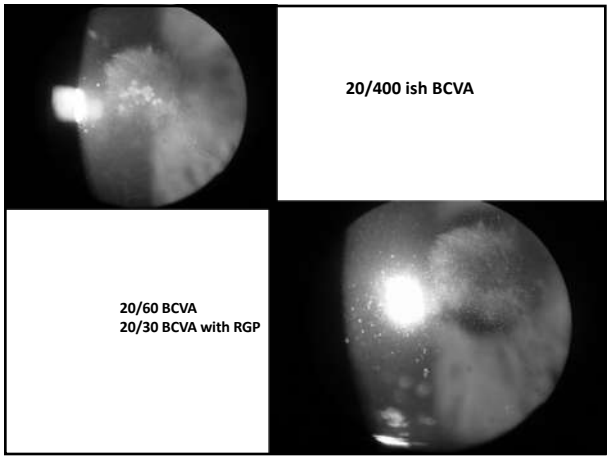

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GENETIC DATA CAN HELP US...

Perform the right refractive surgery procedure on the right patient.

Identify the risk of keratoconus and presence of corneal dystrophies.

Supplement diagnostic data and environmental factors with genetic information to diagnose suspected and asymptomatic patients early

Confidently make decisions about patient management and treatment

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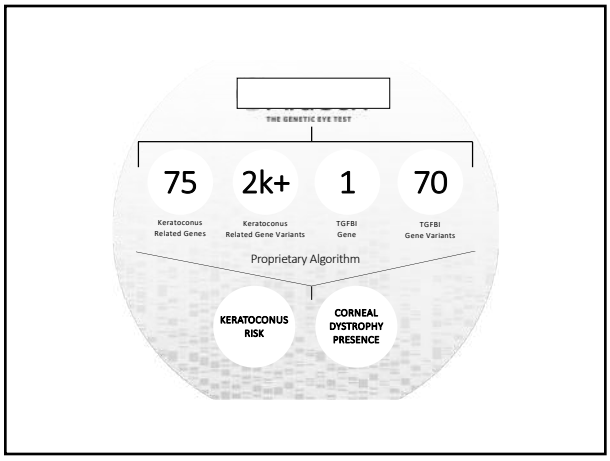

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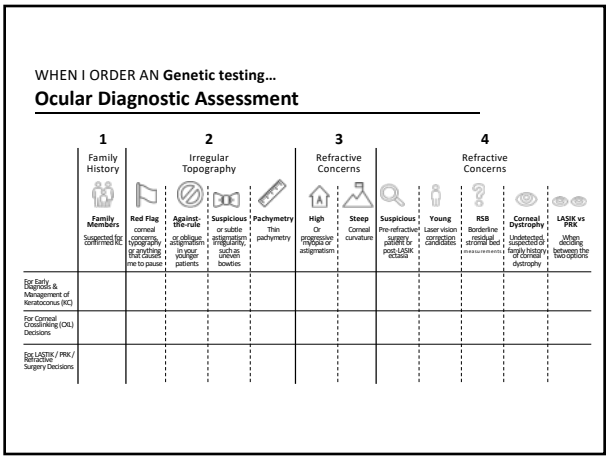

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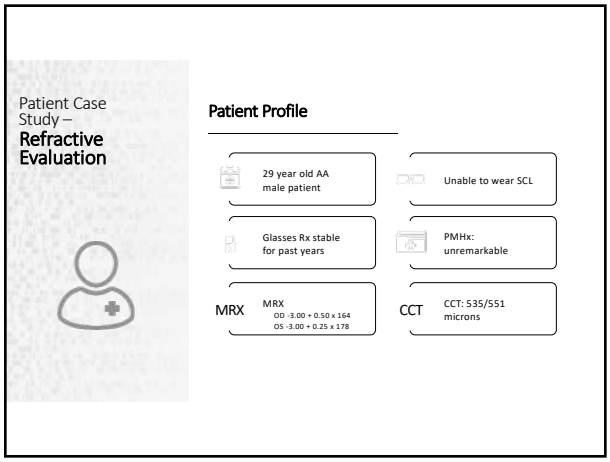

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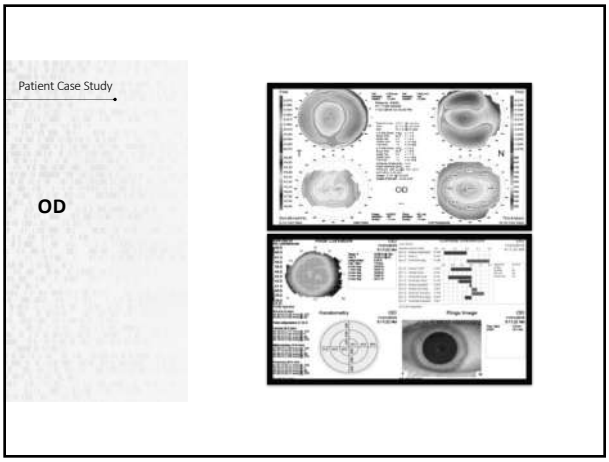

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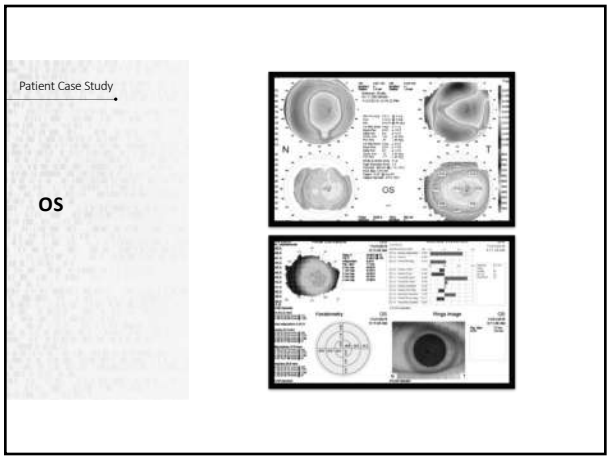

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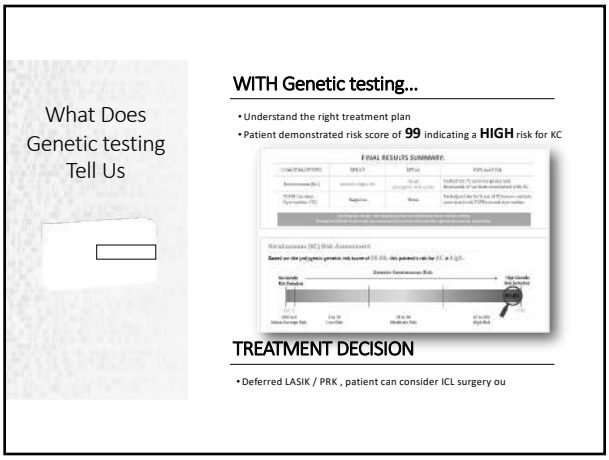

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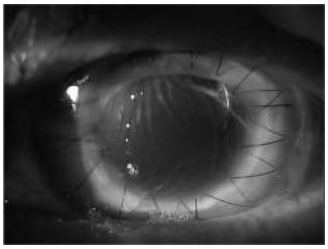
Corneal Transplant



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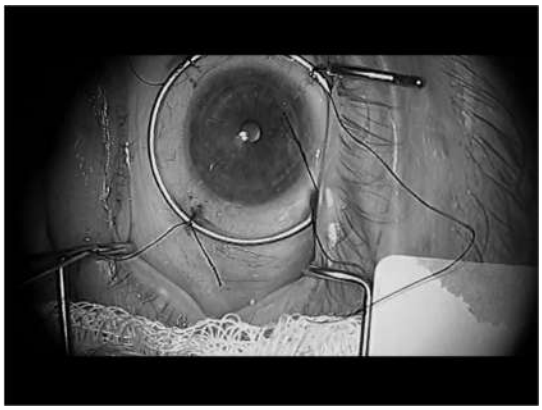

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What to expect PK

- Day 1
  - Moderate to severe stromal/corneal edema
  - AC 1-2+ cell and pigment
  - Poor vision and pain
- Week 1
  - Moderate corneal edema may still be present
  - Vision is improved but still moderately decreased
  - AC some inflammation present (tr-1+ cell)
- Month 1
  - Most corneal edema should be resolved at this time
  - Refraction/Pachymetry/Atlas to monitor
  - AC is quiet
- Month 6
  - Stabilization
  - Select suture removal to decrease induced astigmatism

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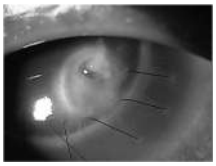
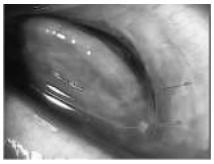
Complications of Penetrating Keratoplasty

- Long-term complications
  - Glaucoma
  - Microbial keratitis
  - Suture-related problems
  - Wound dehiscence
  - Immunologic graft rejection
  - Late endothelial failure
  - Graft failure
- Refractive error, astigmatism





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Long-term maintenance

- Long term topical steroid to decrease rejection rate
- Some patients may require oral antivirals if corneal transplant is related to scaring from prior HSV
- Repeat PK may be needed after approximately 20 years

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Descemet's Stripping Endothelial Keratoplasty (DSEK)

- Sutureless transplant of the posterior cornea
- Replaces diseased portion of cornea with donor graft
- Donor tissue obtained by
  - Manual dissection
  - Microkeratome dissection
  - Femtosecond laser

1. Photos accessed from http://www.moria-surgical.com/ on 8/26/11
2. Photos accessed from http://www.alcon.com/en/alcon-products/refractive-surgery.aspx

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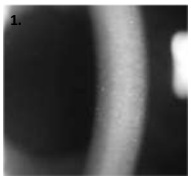
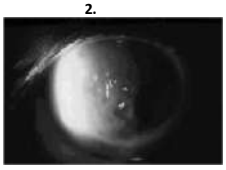
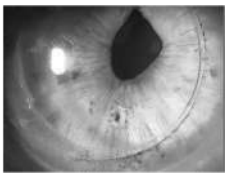
Indications







1. http://emedicine.medscape.com/article/1193218-overview
2. http://webeye.ophth.uiowa.edu/eyeforum/cases/case5.htm

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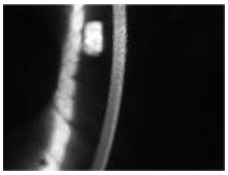
DSEK/DSAEK Exclusion Criteria

- Exclusion
  - Corneal scarring
  - Aphakic
  - Iris loss / atrophy



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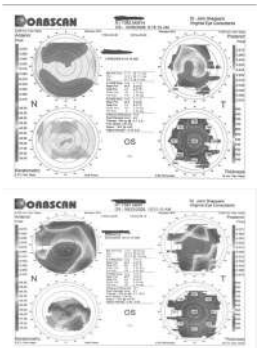
Advantages of DSEK/DMEK vs. PK

- Sutures
- Visual recovery
- Astigmatism / ametropia
- Epithelial complications
- Corneal allograft rejection
- Wound strength
- Globe stability
- Length of surgery
- Intraoperative complications
- Post op visits



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DSEK, PK Yield Similar Graft Survival

Price et al. Ophthalmology. 2011;118(4):725-729

- Retrospective, interventional case series
- DSEK graft survival rates
  - 95% for Fuchs
  - 76% for PBK/ABK
- PK graft survival rates
  - 93% for Fuchs
  - 73% for PBK/ABK
- Endothelial cell loss at 5 years
  - 53% in DSEK
  - 70% in PK

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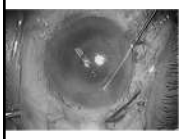
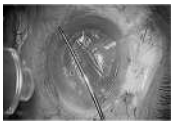
DSEK Procedure



Incision / Stripping / Removal

Donor Prep

Centration



Removal of Fluid

Closure of wound

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Postoperative Day One

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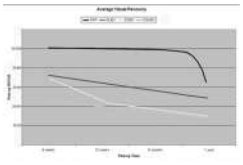
DSEK Average Visual Recovery

- 1 Day: 20/400
- 1 Week: 20/70
- 1 Month: 20/40
- 3 Months: 20/30
- 6 Months: 20/25
- 1 Year: 20/25-20/20



Dr. Gororvoy Study - Results presented during the AAO 2006 - Las Vegas

Terry and Shamie. Endothelial Keratoplasty. Retrieved from http://www.dlek-dsek.com/dsekprocedure.htm on 6/20/08.

133

DMEK

- Graft of Descemet's membrane and endothelium only
- Better optical outcome of 20/25 or 20/20
- Difficult to manipulate
- Early graft dislocation risk
- Decreased risk of rejection

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DMEK

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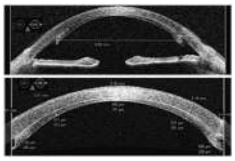
DSEK/DMEK Complications

- Caused by any of the following
  - Graft-recipient interface
  - Fragile graft tissue
  - Graft location
  - Glaucoma
  - Infection
  - CME
  - Retinal detachment



Miller, J. Accessed from http://www.revoptom.com/content/d/technology/c/16179/

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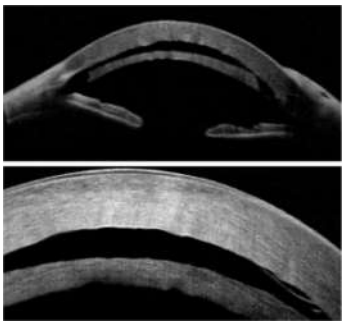
DSEK Gone Wrong



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Long-term Maintenance DMEK and DSEK

- Long term topical steroid
  - Helps decrease rejection rate
  - Steroid Loteprednol, prednisolone acetate, FML 1 gtt QD typically
- Unknown length of graft viability
  - No long term data since started approx 2003
  - In theory surpass PK ~20 years
- 5 year Graft survival similar at 93%[1]

1. Price DA, Kelley M, Price FW Jr, Price MO. Five-Year Graft Survival of Descemet Membrane Endothelial Keratoplasty (EK) versus Descemet Stripping EK and the Effec of Donor Sex Matching. Ophthalmology. 2018 Oct;125(10):1508-1514. doi: 10.1016/j.ophtha.2018.03.050. Epub 2018 May 3. PMID: 29731147.

138

Limbal Stem Cell Deficiency

- When limbal stem cells begin to struggle and poorly function, the epithelial cell layer and its reproduction becomes compromised
- Loss or deficiency of stem cells in the limbus which are vital for re-population of the corneal epithelium and to the barrier function of the limbus
- Once limbal stem cells are damaged the epithelium will be replaced by conjunctival goblet cells

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LSCD Causes

- Acquired
  - Trauma
  - Contact lenses
- Inflammatory
  - DED
  - Allergy
  - Neurotrophic keratopathy
- Autoimmune
  - Sjogrens Syndrome
  - Stevens Johnson syndrome
  - Mucous membrane pemphigoid
- Congenital
  - Aniridia
  - Autoimmune Polyglandular Syndrome
  - Keratitis, Icthyosis, and Deafness Syndrome

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Signs and Symptoms

- Varying degree of ocular signs depending on severity and level of corneal conjunctivalization
- Symptoms
  - Decreased vision
  - Photophobia
  - Tearing
  - Blepharospasm
  - Recurrent pain

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Severe LSCD

- Conjunctivalization
  - Corneal surface stains abnormally because the conjunctival epithelium is more permeable to the stain than true corneal epithelium
- More prone to recurrent or non-healing epithelial defects
- Stromal scarring or melting
  - Expect more pain and vision loss

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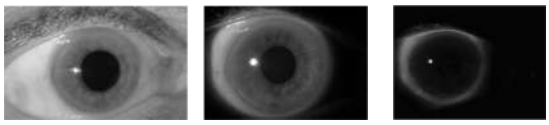
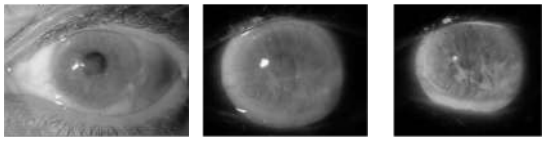
NORMAL EYE



TOTAL LSCD



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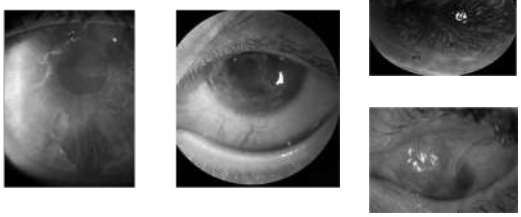
Conjunctivalization



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Non-Surgical Treatment

- Remove traumatic or toxic insults that may be the cause
- Discontinue contact lens wear
  - Possible refit in scleral
  - Bandage CL?
- Discontinue or switch topical medications
  - Glaucoma medications
  - Preservative sensitivity

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Non-Surgical Treatment

- Treating underlying systemic causes
  - Autoimmune control
- Improve tear film and control inflammation
  - Vitamin A ointment QHS
  - Topical steroids
    - Compounded Preservative Free option
  - Topical cyclosporine
  - Preservative free AT
  - Punctal Plugs

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Non-Surgical Treatment

- Amniotic membrane
  - Dehydrated vs cryopreserved
- Amniotic membrane drops
  - Can be costly and not covered by insurance currently
- Serum Tears
  - Can be costly and inconvenient
- Cenegermin
  - Neurotrophic keratitis

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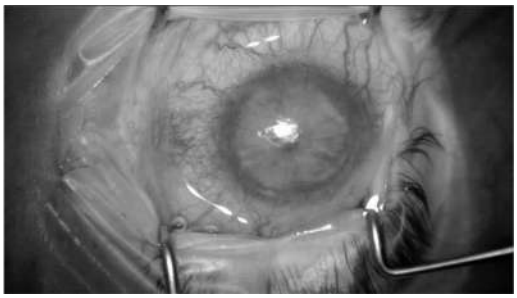

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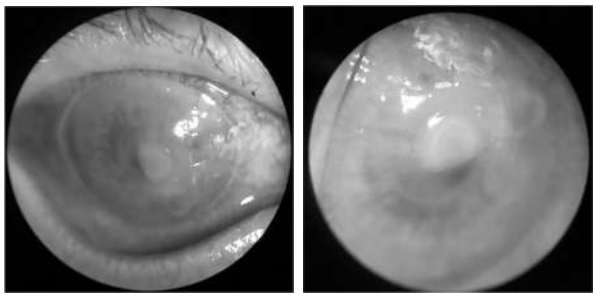

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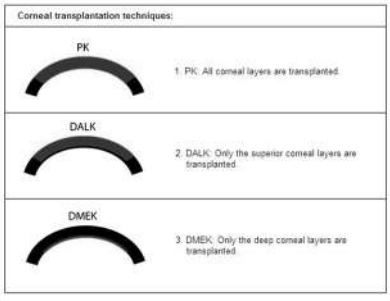
DALK (deep anterior lamellar keratoplasty)



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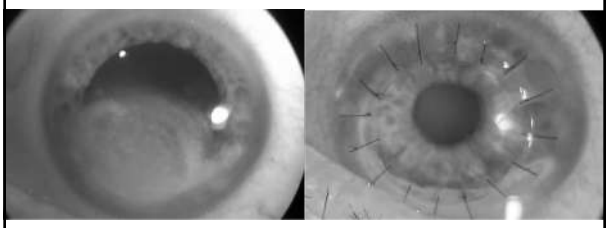
151



Pre/Post Example of DALK

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Post-Operative Care

- Moxifloxacin QID OD x 1 week and Difluprednate starting at QID OD and tapered down to Loteprednol QHS OD for maintenance
- Several corneal sutures removed after 6-9 months
- Cataract extraction OD
- Final BCVA 20/25 OD

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Pterygium

- "wing" like ocular surface lesion originating from limbal conjunctiva within the palpebral fissure progressing to the cornea
  - Nasal and temporal
- More common in people with history of increased UV exposure
  - Males>females
- Typically asymptomatic
  - Induced astigmatism

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Treatment

- Non Surgical
  - Treat the ocular inflammatory response
    - Cyclosporin
    - Lifitegrast
    - Topical steroids
    - Artificial tears
- Surgical
  - Encroaching on visual axis
  - Preparing for cataract surgery
  - Significant induced astigmatism

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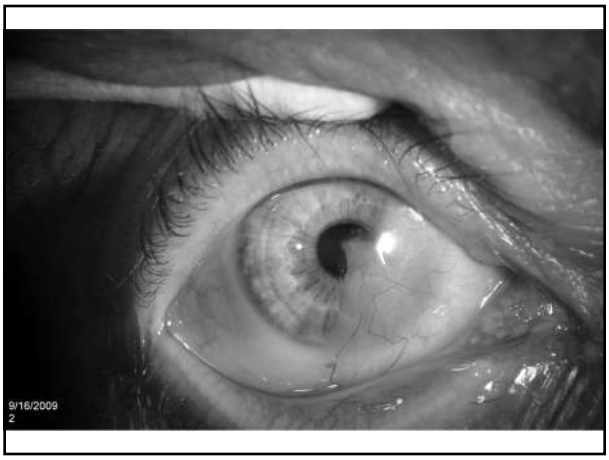

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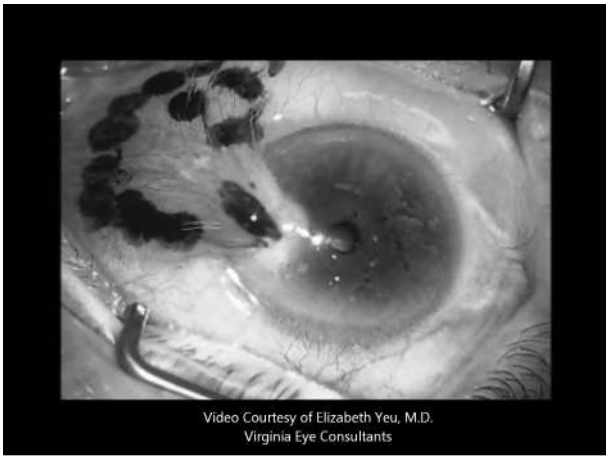

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What to expect after Sx

- Day 1
  - Epithelial defect
  - Conjunctival injection, check wound site
- Week 1
  - Epithelial defect healed with haze
  - Conjunctiva check for secure would site
    - Monitor for wound dehiscence
- Month 1
  - Haze resolution
  - Conjunctival stabilization

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Long term treatment

- Control UV exposure
- Control dryness and inflammation
  - Cyclosporine
  - Lifitigrast
  - Artificial tears
  - Topical steroids
  - Punctal plugs
- Will help to control reoccurrence

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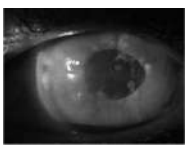
Lamellar keratoplasty

- Indications:
  - ABMD
  - Salzmanns
  - Band Keratopathy
  - RCE
  - Corneal scars



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Lamellar Keratoplasty

- Corneal epithelium is removed down to Bowman's layer
- Can be performed in slit lamp or operating room using Weck-cel sponge or scarifier blade, and cleaned up with diamond burr
  - After removal surface is polished with cellulose sponge, antibiotics, and THBL placed

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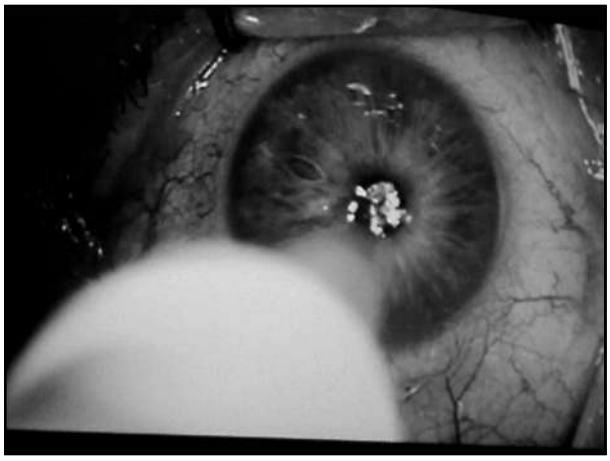

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Long Term Treatment

- After Iam K for RCE
  - Maintain THBL for 3 months
  - Oral Doxycycline
  - Topical Antibiotics
  - Topical Steroids
  - Vitamin C
- Control of ocular surface disease

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Comanagement Pearls

- Opportunity to provide cutting edge technology
- Importance of your recommendation
- Patient education is critical!

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Comanagement Pearls

- Identify potential causes of surgical complications
- Educate your patients your role within medical eye care
- *We are all judged by the visual outcomes our patients. Comfort and quality of vision is the key!*

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Thank you!!

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