

Slide 1

2025
AFOS/SECO
**EDUCATION
DESTINATION**
San Antonio

Course # 120

To Remove or Not to Remove:
That is the Question

Lily Arendt, OD

Please Silence All Mobile Devices.
attendseco.com

AFIS SECO
INTERNATIONAL

Slide 2

2025
AFOS/SECO
**EDUCATION
DESTINATION**
San Antonio

Lily Arendt, OD

Disclosure statements:
RxSight: Consulting Fees

All relevant relationships have been mitigated.

attendseco.com

AFIS SECO
INTERNATIONAL

Slide 3

To Remove or Not to
Remove...
That is the Question!

Lily Arendt, OD, FAAO
Rosenberg School of Optometry
San Antonio, TX



Slide 4

Today's Game Plan

Review FOUR different cases of anterior
segment pathologies that often warrant
removal so that you can better diagnose,
manage, and treat your patients



Case 1

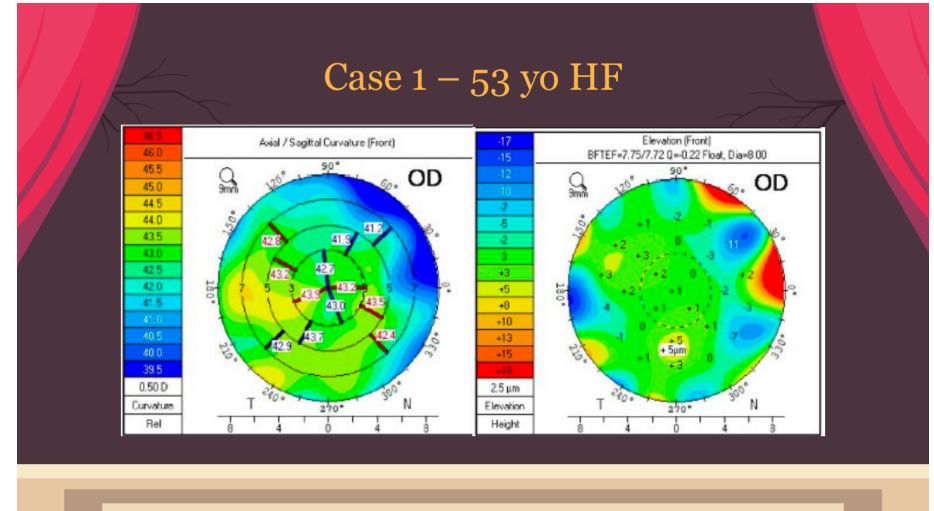
“My left eye is blurry with my glasses”

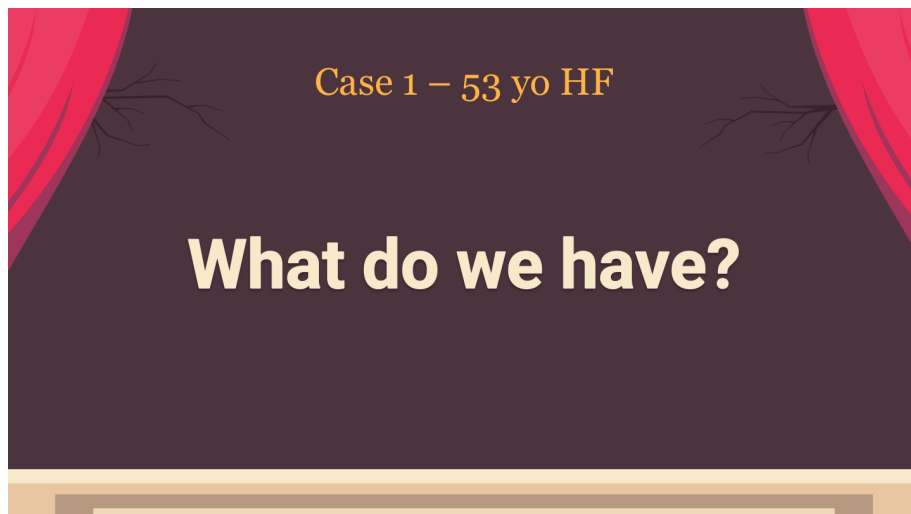
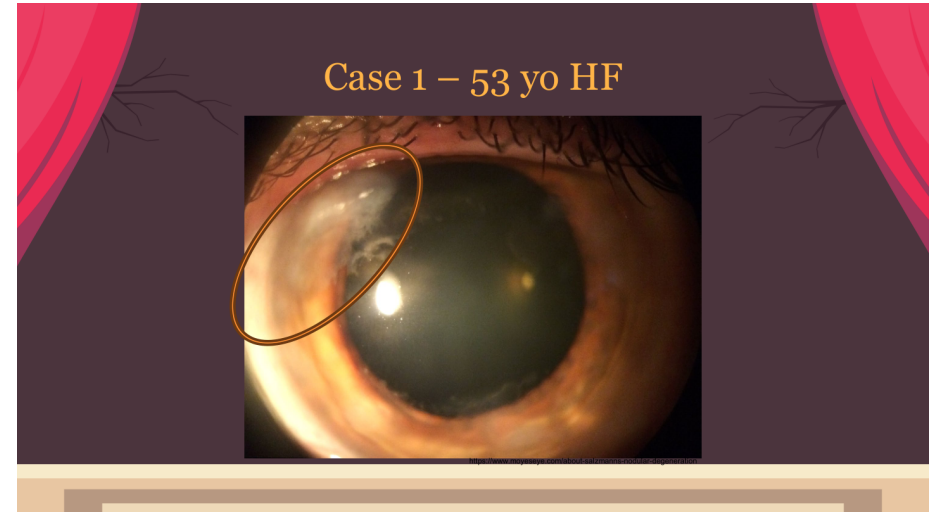
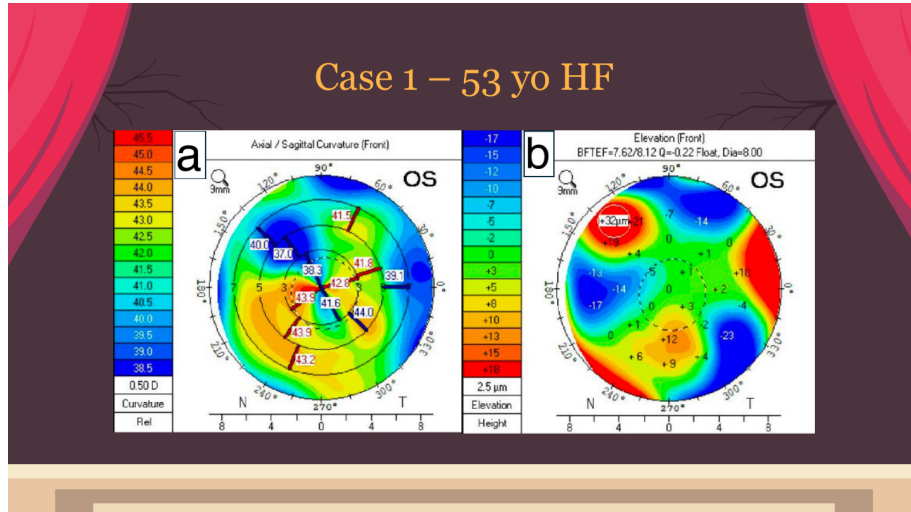
Case 1 – 53 yo HF

- Complains of blurred vision and occasional light sensitivity, redness, irritation OS
- KCS OU treated with cyclosporine 0.05% BID x 3 years, PFATs
- (-) CLs
- (-) eye surgeries
- (-) systemic meds

Case 1 – 53 yo HF

<u>Habital Spec Rx (2 yrs)</u>	<u>MRx</u>
OD: +0.75-1.00x100 20/25	+0.75-1.25x105 20/20
OS: +0.50-1.25x086 20/60	+1.25-3.00x107 20/20
+2.00 ADD J3	





Case 1

Salzmann Nodular Degeneration

- Noninflammatory, progressive corneal condition affecting Bowmans membrane
- First discovered by Maximillian Salzmann in 1925¹
- Affects 1 in 2400 vs 1 in 60?
 - 2018: 1 in 60 pts with OSD had nodule before cataract surgery²

Figure 12 shows a clinical photograph of the eye of Case 1, showing a white, nodular lesion on the cornea.

Case 1 Salzmann Nodular Degeneration

- The classic SND patient
- Of 108 eyes...¹
 - 66% bilateral
 - 76% Caucasian
 - 72% female
- Bimodal: 50s-60s vs 80s-90s
- Lack of androgens

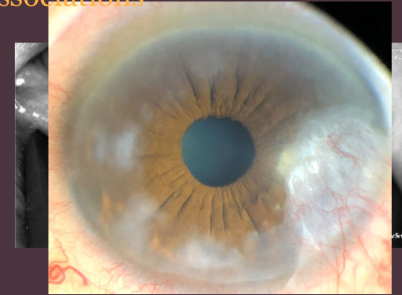


1922-2021 (99 years old!)

© 2010 American Academy of Ophthalmology. All rights reserved. This document is intended for educational purposes only. It is not to be used for clinical or legal advice. For more information, please visit www.aao.org.

Case 1 Salzmann Nodular Degeneration Ocular/Systemic Associations¹

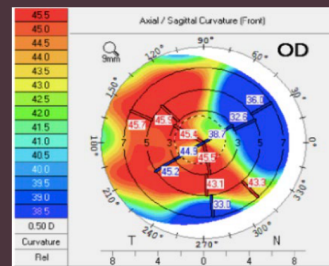
- Meibomian gland dysfunction
- OSD
- CL wear
- Pterygium
- Previous inflammation
- Trauma/Surgery
- Crohn's disease
- Ehlers-Danlos syndrome
- Thyroid eye disease



© 2010 American Academy of Ophthalmology. All rights reserved. This document is intended for educational purposes only. It is not to be used for clinical or legal advice. For more information, please visit www.aao.org.

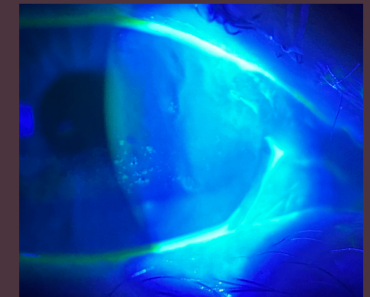
Case 1 Salzmann Nodular Degeneration Symptoms

- Blurred vision
 - Central nodule
 - Irregular astigmatism
 - Corneal flattening due to epithelial hyperplasia adjacent to nodules → hyperopic shift
- Foreign body sensation
 - Ocular lubrication
 - Topical steroids, cyclosporine 0.05%
 - Surgery



Case 1 Salzmann Nodular Degeneration Signs

- Best seen at the slit lamp
- Round, blue-ish grey nodules
 - May be vascularized
- 1-2mm+
- Often midperiphery
 - Along incisions¹
- Negative NaFl staining/pooling



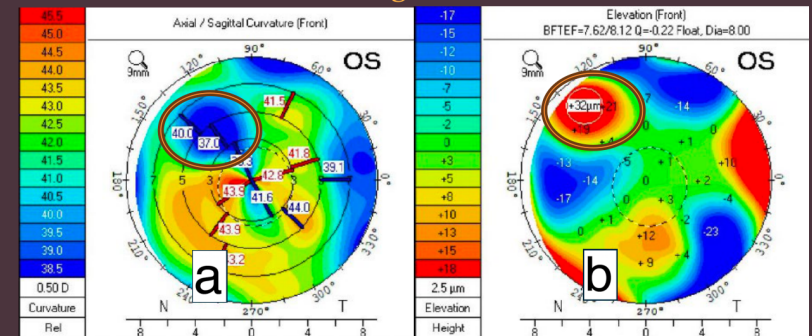
© 2010 American Academy of Ophthalmology. All rights reserved. This document is intended for educational purposes only. It is not to be used for clinical or legal advice. For more information, please visit www.aao.org.

Case 1 Salzmann Nodular Degeneration Diagnosis

- Slit lamp biomicroscopy
- Corneal topography
 - Area of flattening on the curvature map corresponding to an area of elevation
 - Determine amount of astigmatism

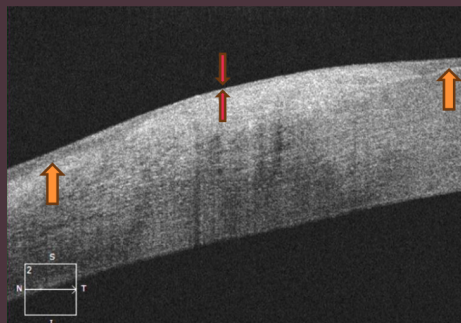


Case 1 Salzmann Nodular Degeneration Diagnosis

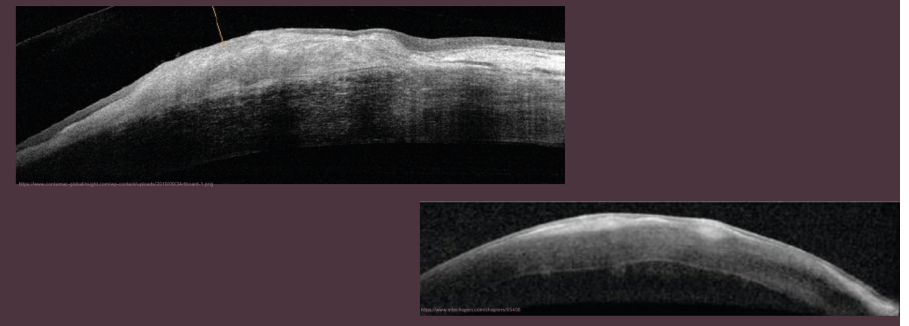


Case 1 Salzmann Nodular Degeneration Diagnosis

- Slit lamp biomicroscopy
- Corneal topography
- Anterior segment-OCT
 - Hyperreflective lesion
 - Irregular/missing basement membrane
 - Attenuated epi above lesion

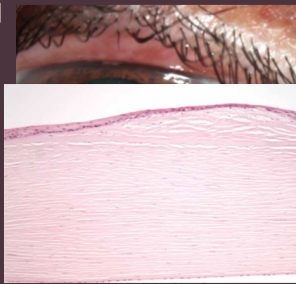


Case 1 Salzmann Nodular Degeneration Diagnosis



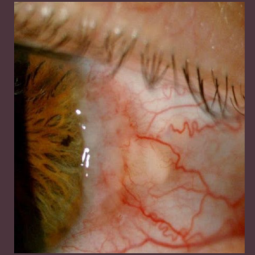
Case 1 Salzmann Nodular Degeneration Diagnosis

- Often difficult to distinguish from corneal scarring or other lesions
- Biopsy if suspicious
 - Histopathology confirmation
 - Mounds of extracellular matrix¹
 - Irregular collagen fibrils, fibroblasts, basal lamina



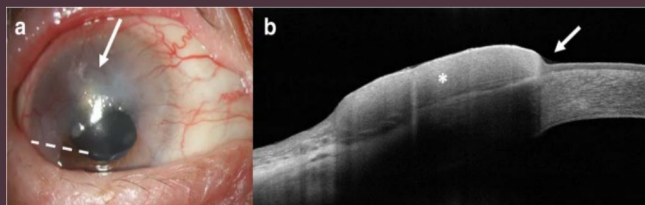
Case 1 Salzmann Nodular Degeneration Differential

- Ocular surface squamous neoplasia
 - Any growth of neoplasms derived from squamous cells from conjunctiva or cornea¹
 - Epi dysplasia
 - Conjunctival intraepithelial neoplasia
 - Squamous cell carcinoma (SCC)
 - Mucoepidermoid carcinoma
- Caucasian male in 60s
- UV-B radiation and cigarette smoking
- Located interpalpebral near limbus
- Can be elevated with abnormal vasculature

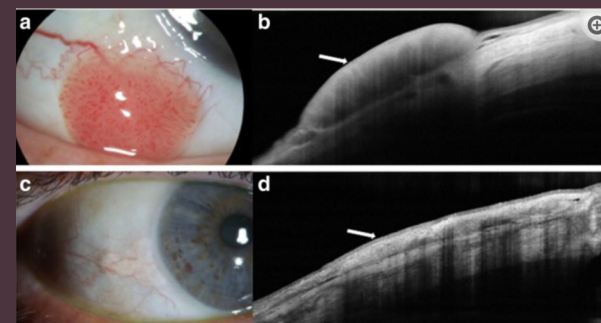


Case 1 Salzmann Nodular Degeneration Differential

- Ocular surface squamous neoplasia
 - Nodular form found to be of higher severity than flatter forms¹
 - AS-OCT shows thickened, hyperreflective epithelial layer
 - Distinct zone between normal and abnormal epi



Case 1 Salzmann Nodular Degeneration Differential

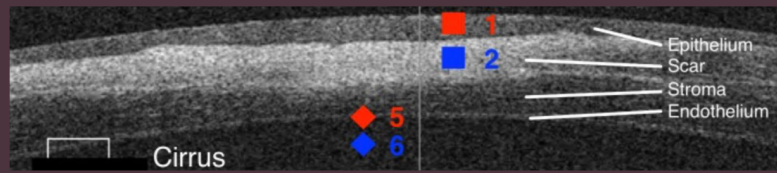


Papillomatous
OSSN

After 2 rounds
of topical
5-fluorouracil

Case 1 Salzmann Nodular Degeneration Differential

Corneal Scarring

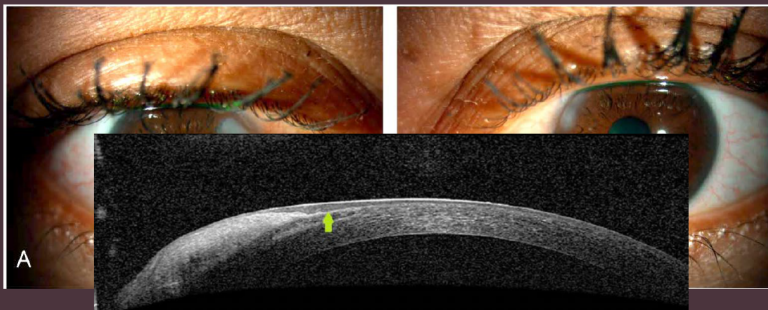


Case 1 Salzmann Nodular Degeneration Differential

Peripheral Hypertrophic Subepithelial Corneal Degeneration¹

- Peripheral circumferential, elevated, white, subepithelial opacities at the limbus
- Discovered in 2003, etiology unknown, inflammation?
- Middle aged, female
- Cover more than one quadrant, most often superior nasal (93%),
- If bilateral, always symmetric
 - If 8 to 10 o'clock OD, 2 to 4 o'clock OS

Case 1 Salzmann Nodular Degeneration Differential



Case 1 Salzmann Nodular Degeneration Differential

Peripheral Hypertrophic Subepithelial Corneal Degeneration¹

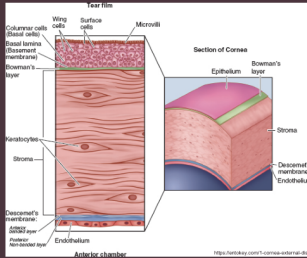
- Lesions are larger than SND
- Located near limbus, not mid peripheral
- Fine, superficial vessels with PHSCD
- Suspect less of an inflammatory cause with PHSCD
- Can still remove with SK

Case 1

Salzmann Nodular Degeneration

Pathophysiology

- Epithelium is continuously regenerating w/ growth factors
- Epithelial basement membrane and Bowman's layer act as barrier



Case 1

Salzmann Nodular Degeneration

Pathophysiology

- Epithelium is continuously regenerating w/ growth factors
- Epithelial basement membrane and Bowman's layer act as barrier
- A break occurs between these two layers
 - Growth factors travel from epithelium to stroma and activate fibroblasts
 - Fibroblast formation → deposition of unorganized ECM beneath epithelium

Case 1

Salzmann Nodular Degeneration

Pathophysiology

- Mechanical break caused by surgery or trauma
 - Pterygium removal
 - LASIK flap interface
 - Cataract surgery main incision
 - Along RK incisions
- OSD
 - Chronic friction
 - Induces overactive epi cell repair and remodeling



Case 1

Salzmann Nodular Degeneration

To remove or not to remove...

- Asymptomatic? Mild?
 - Ocular surface management
 - Scleral lens fitting for improved vision and comfort¹
- Reasons for surgery
 - FBS and failed medical therapy
 - Blurred vision/irregular astigmatism
 - Nodules in/near visual axis
 - Preparing for cataract surgery

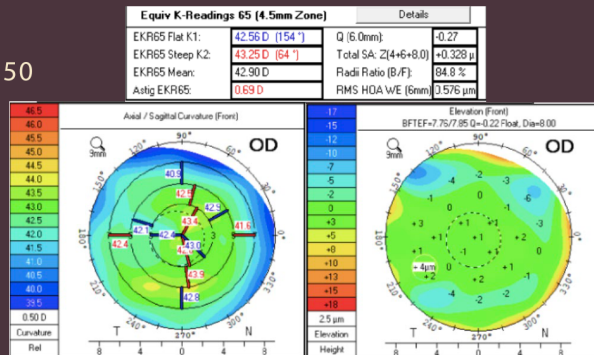


Case 1

Salzmann Nodular Degeneration

To remove or not to remove...

85yo Female
OD +2.00 -1.00 x150

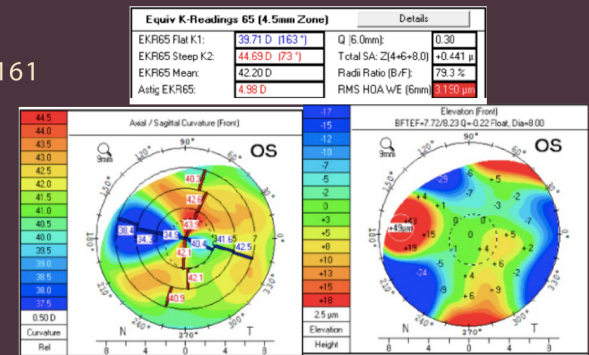


Case 1

Salzmann Nodular Degeneration

To remove or not to remove...

85yo Female
OS +6.00 -6.75 x161



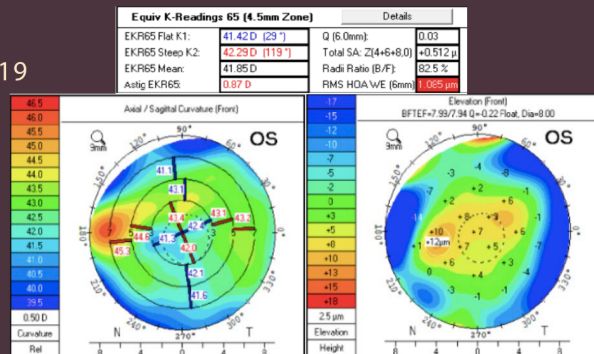
Case 1

Salzmann Nodular Degeneration

To remove or not to remove...

85yo Female
OS +0.75 -0.75 x019

Large myopic shift
and
reduced corneal
astigmatism!



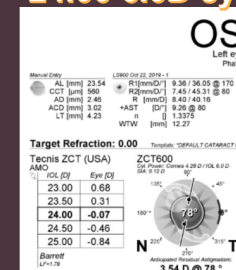
Case 1

Salzmann Nodular Degeneration

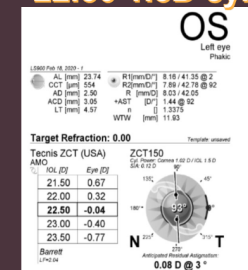
To remove or not to remove...

24.00 6.0D cyl

22.50 1.5D cyl



3.5D cyl remaining!



0.08D cyl remaining!

Case 1

Salzmann Nodular Degeneration

To remove or not to remove...

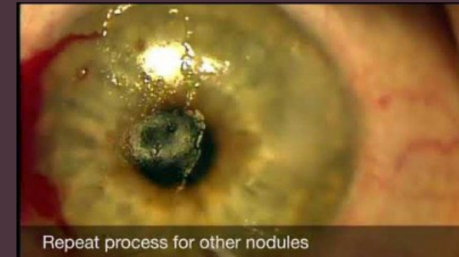
Nodule removal is recommended prior to cataract surgery if it appears to be affecting the corneal topography, if it is inducing irregular/high astigmatism, or if the patient desires spectacle independence

Case 1

Salzmann Nodular Degeneration

HOW to remove?

- Superficial Keratectomy (SK) aka Epi-peel
 - Remove the nodule and allow epithelium to grow back more regular



Case 1

Salzmann Nodular Degeneration

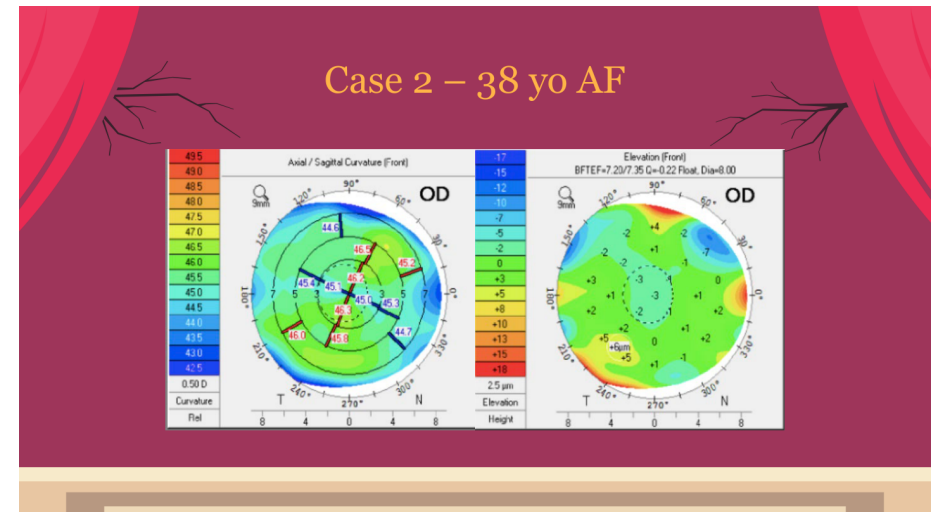
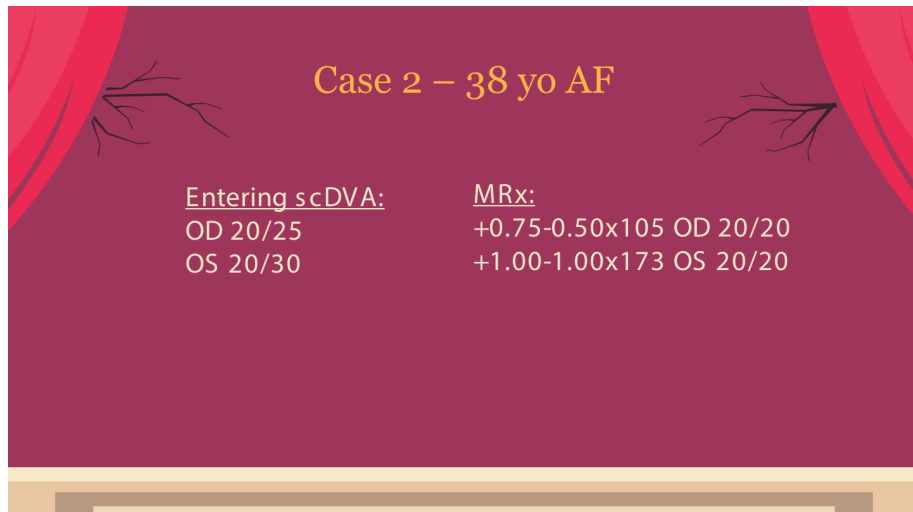
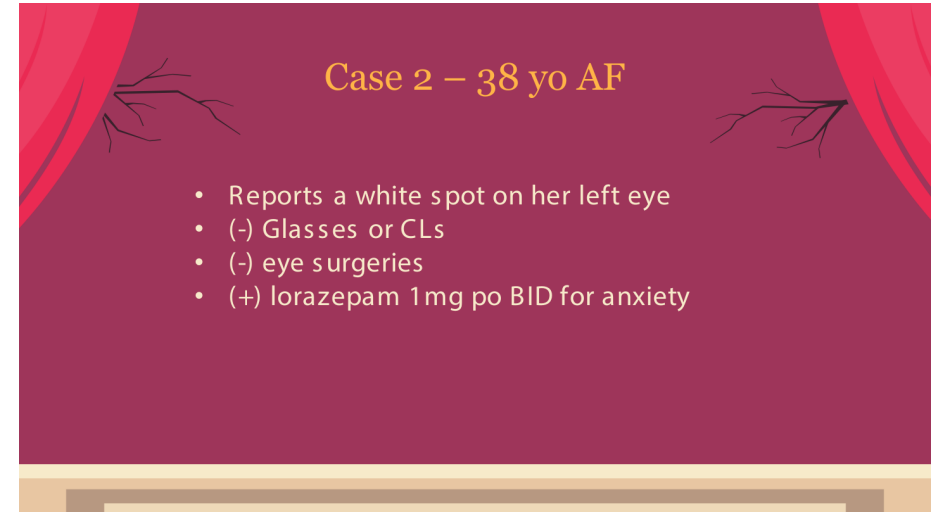
HOW to remove?

- Superficial Keratectomy (SK) aka Epi-peel
- Reoccurrence rate ~22%¹
- Follow-up management
 - Cryopreserved amniotic membrane (CAM) placed immediately following procedure
 - Start polytrim QID and pred-moxi QID while CAM is on
 - Patient returns for CAM removal 5-7 days later
 - Switch from Abx drops to pred acetate 6-week taper
 - 4/3/2/2/1/1
 - Patient seen for 1-month follow-up
 - If getting ready for cataract surgery, obtain new baseline corneal tomography biometry measurements

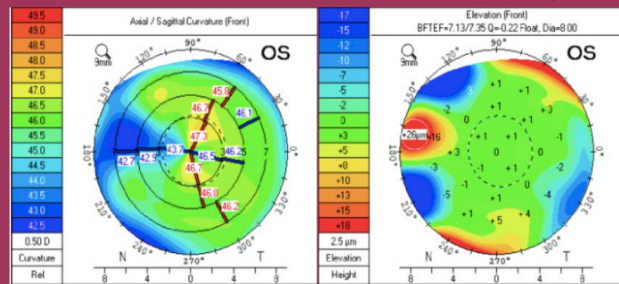
Case 1

Salzmann Nodular Degeneration

Questions?



Case 2 – 38 yo AF



Case 2 – 38 yo AF

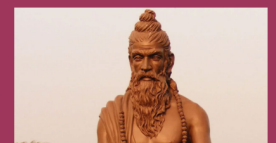


Case 2 – 38 yo AF

What do we have?

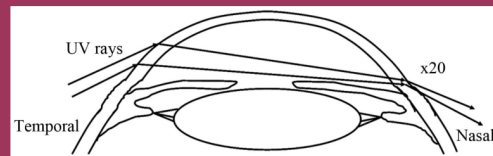
Case 2 Pterygium

- Triangular, fibrovascular, sup-epithelial growth from bulbar conjunctiva over the limbus
- Discovered by Susruta as early as 1000 BC¹
- 5-15% prevalence worldwide
 - Up to 22% in "Pterygium Belt"



Case 2 Pterygium Signs

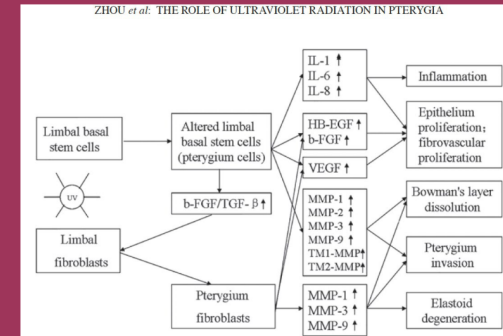
- More often occur nasally > temporally
 - Temporal light focuses on the nasal limbus at 20x intensity compared to incident light intensity temporally¹
 - UV light reflecting off the nose



1. ZHOU W, F, JIAO Y, F, JIANG B, QIN M, Y, & TAN Y, F. (2008) The role of ultraviolet radiation in the pathogenesis of Pterygia (review). Molecular Medicine Reports, 10(1), 1-15. http://dx.doi.org/10.3892/mmr.1001.0001

Case 2 Pterygium Pathophysiology

Altered limbal basal stem cells increase inflammation



Breaking the barrier between conjunctiva and cornea

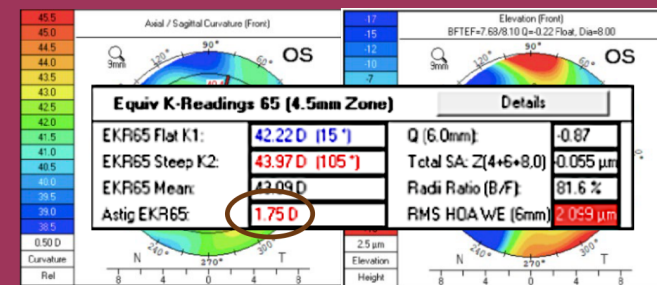
Case 2 Pterygium To remove or not to remove...

- Conservative measures
 - Ocular surface lubricants
 - UV protection
- PTY removal with auto graft or amniograft



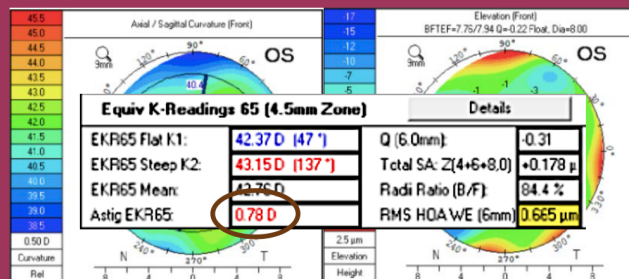
Case 2 Pterygium To remove or not to remove...

OS: +3.00 -1.00 x017



Case 2 Pterygium To remove or not to remove...

OS: +2.00 -0.50 x057



Case 2 Pterygium To remove or not to remove...

Analysis of Pterygium Size and Induced Corneal Astigmatism

Pazman A-K, Mohammad-Salih, MsOphth (UM), and Ahmad Fauzi M. D. Sharif, MsOphth (UM)† 2007*

- How big does a PTY have to get before it makes a significant visual impact?
 - 77 eyes of 77 patients
 - PTY induced 2D of corneal astigmatism if:
 - Its length ≥ 2.2 mm onto cornea
 - Width was ≥ 5 mm
 - Total area ≥ 6.25 mm²
 - Length and total area $\gg$ width

Case 2 Pterygium To remove or not to remove...

Pterygium removal is recommended prior to cataract surgery if it appears to be affecting the corneal topography, if it is inducing irregular/high astigmatism, or if the patient desires spectacle independence

Case 2 Pterygium HOW to remove? Amniograft



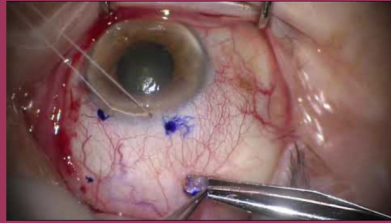
Case 2

Pterygium

HOW to remove?

Conjunctival Autograft

- Tissue is collected from the superior bulbar conjunctiva and used to cover the bare sclera
- Less expensive for the patient¹
- Recurrence rates range from 2.33%-23.2%¹
 - Compared to recurrence rates of up to 40.9% for amniografts²
- Risk of post-op ptosis



1. Gnanapavan, S. et al. "The Safety of Office-Based Pterygium Surgery." American Journal of Ophthalmology, 2013. American journal of ophthalmology. 155:101-107.

Case 2

Pterygium

Mitomycin C

- Derived from bacteria *Streptomyces caespitosus*¹
- Selectively inhibits DNA synthesis preventing cellular division
 - Chemotherapy drug
- Inhibits fibrovascular growth
- Typically saved for recurrent PTY since it can lead to scleral thinning/melt

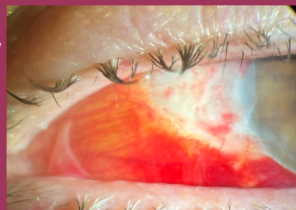
1. Roberts, A. C., & Hawk, L. W. (2000). Pterygia: How benign are they? Annals of Eye Diseases, 3(1), 21-31. [https://doi.org/10.1016/S0002-9378\(00\)00001-0](https://doi.org/10.1016/S0002-9378(00)00001-0)

Case 2

Pterygium

To remove or not to remove...

- Setting post-op expectations
 - Out-patient surgery ~30 mins
 - Eye will look very red and angry for ~1 month
 - 6 weeks of gtts
 - Tobradex q2h x 2 weeks, then 4/3/2/1
 - May still see scarring on cornea
 - If scarring, can still have impact on vision quality
 - They can come back!
 - Recurrence rate of amniograft ~3.8-40.9%¹



1. Davis, R. A. et al. "Mitomycin C in Pterygium Recurrence." Cornea, 2010. 29:1011-1013.

Case 2

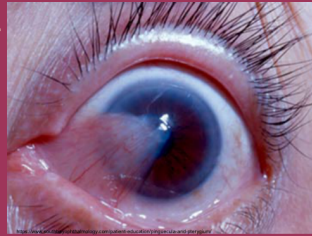
Pterygium

To remove or not to remove...

- Setting post-op expectations
 - Risk of binocular diplopia
 - A rare complication if the medial rectus muscle is affected during PTY removal due to adhesion of fibrotic tissue
 - Important to assess binocular function
 - May need additional surgery postoperatively

Case 2 Pterygium To remove or not to remove...

- Risk of recurrence of primary PTY
 - Post-op recurrence rates vary from 0% to 67% based on surgical technique, PTY sizes, follow-up periods¹
 - Many factors have been linked to reoccurrence
 - Fleshiness of PTY
 - Exposure to UV
 - Younger age
 - Surgical technique
 - Race
 - Surgeon experience



1. Berman, J., Chen, L., Thompson, C., Robinson, J., Chan, W. & Pinsky, J. (2008). Risk Factors for Recurrence in the Treatment of Recurrent Pterygia. Ocular, 15(6), 390-395. doi: 10.1007/s12043-008-0000-0

Case 2 Pterygium To remove or not to remove...

- Recurrent pterygium
 - Similar histological features to primary PTY, but proliferation of fibrovascular tissue is more severe and prominent making dissection more challenging
 - 2024: Recurrence rate in recurrent PTY surgery was 12.6%¹
 - Increased risk with more corneal involvement and a higher number of previous PTY surgeries
 - 80% had recurrence within 12 months

1. Berman, J., Chen, L., Thompson, C., Robinson, J., Chan, W. & Pinsky, J. (2024). Risk Factors for Recurrence in the Treatment of Recurrent Pterygia. Ocular, 31(6), 390-395. doi: 10.1007/s12043-024-00000-0

Case 2 Pterygium To remove or not to remove...

- Topical Cyclosporine A 0.05%
 - An immunosuppressor that controls interleukin synthesis, inhibits VEGF and fibroblast proliferation, and reduces intensity of an inflammatory response
 - Studies suggest use BID for 3-6 months postoperatively¹
 - Decreased recurrence rate from 43% to 7.5%, but extended healing time by 1 week²
 - No additional benefit found between 0.05% and 0.1%³

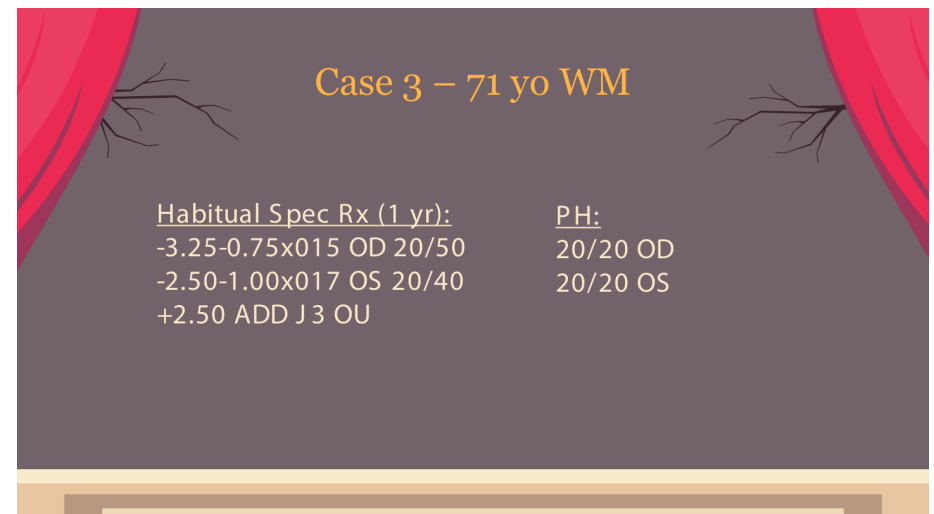
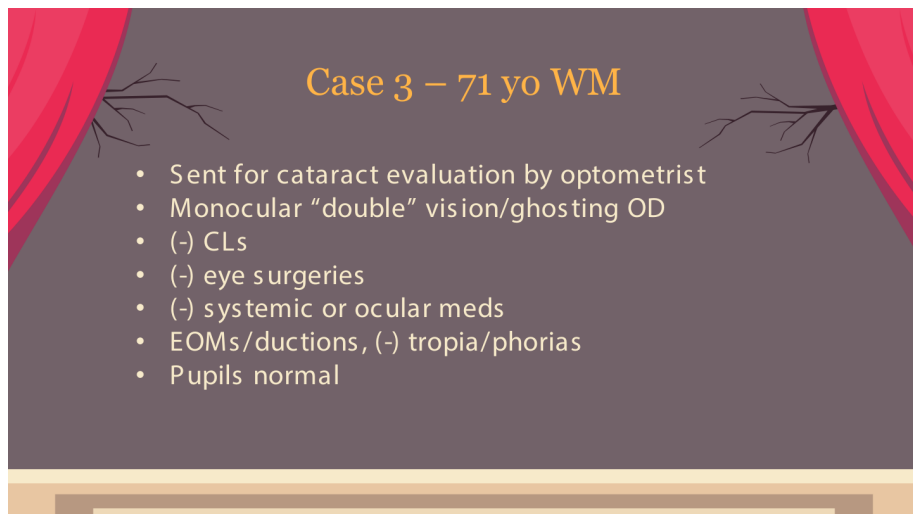
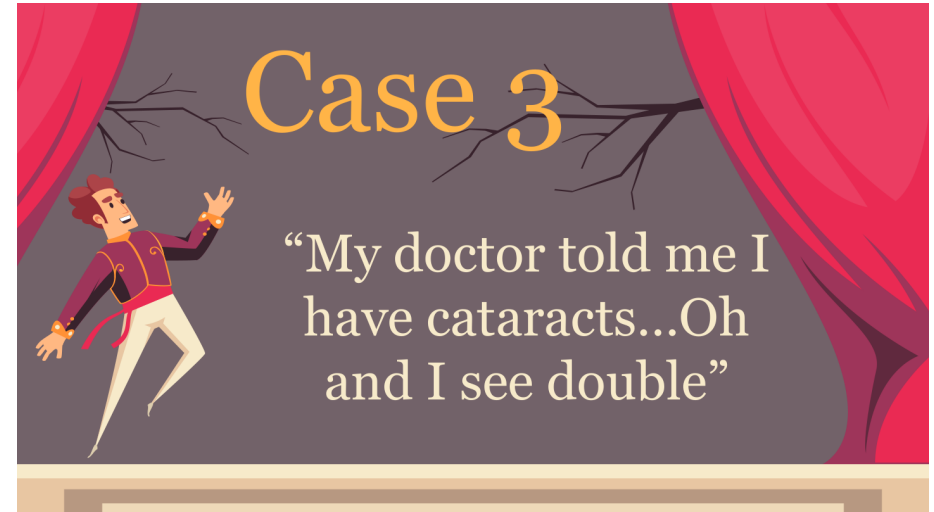
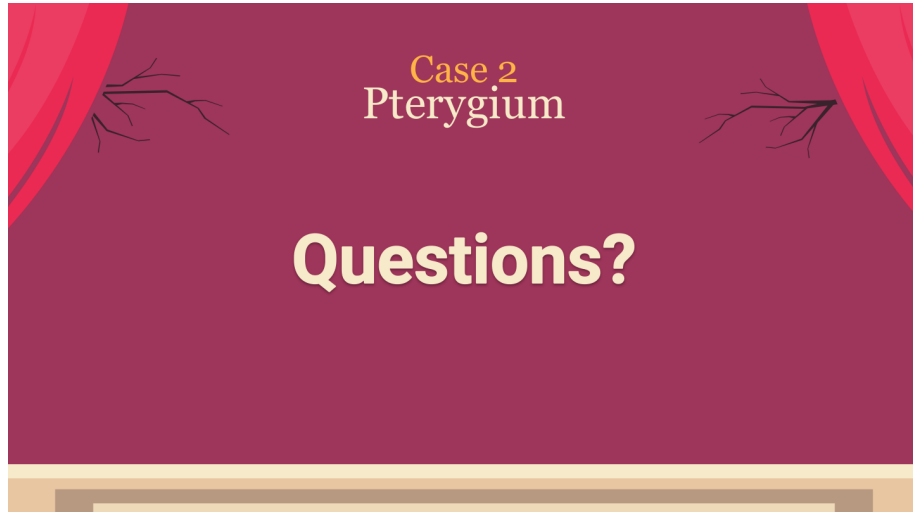
1. Berman, J., Chen, L., Thompson, C., Robinson, J., Chan, W. & Pinsky, J. (2008). Risk Factors for Recurrence in the Treatment of Recurrent Pterygia. Ocular, 15(6), 390-395. doi: 10.1007/s12043-008-0000-0

Case 2 Pterygium To remove or not to remove...

- Rho kinase inhibitors for recurrent pterygium??
 - A potential, post-surgical treatment to minimize PTY recurrence¹
 - Current data based on cell cultures (not yet in vivo)
 - By inhibiting the Rho-ROCK signaling pathway, can decrease cell proliferation and migration
 - Shown to reduce TGFβ1-induced fibrosis in human pterygium cells



1. Berman, J., Chen, L., Thompson, C., Robinson, J., Chan, W. & Pinsky, J. (2024). Risk Factors for Recurrence in the Treatment of Recurrent Pterygia. Ocular, 31(6), 390-395. doi: 10.1007/s12043-024-00000-0



Case 3 – 71 yo WM

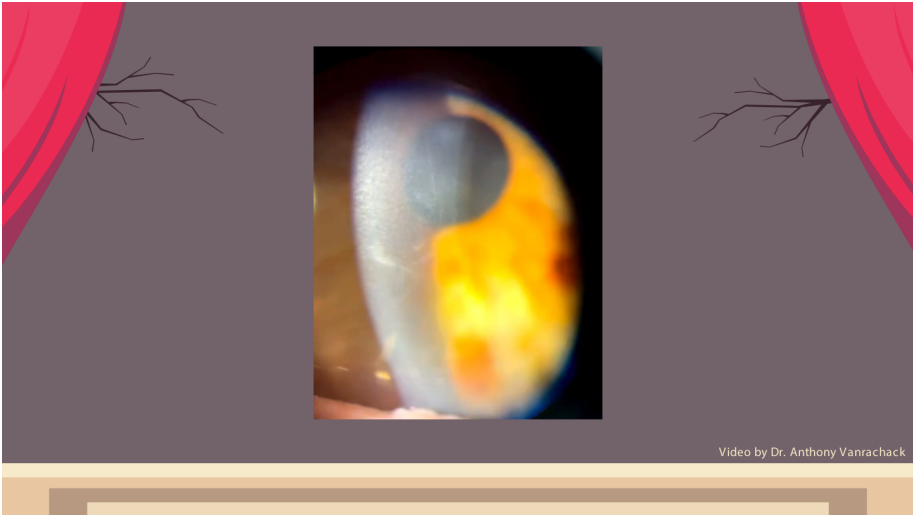
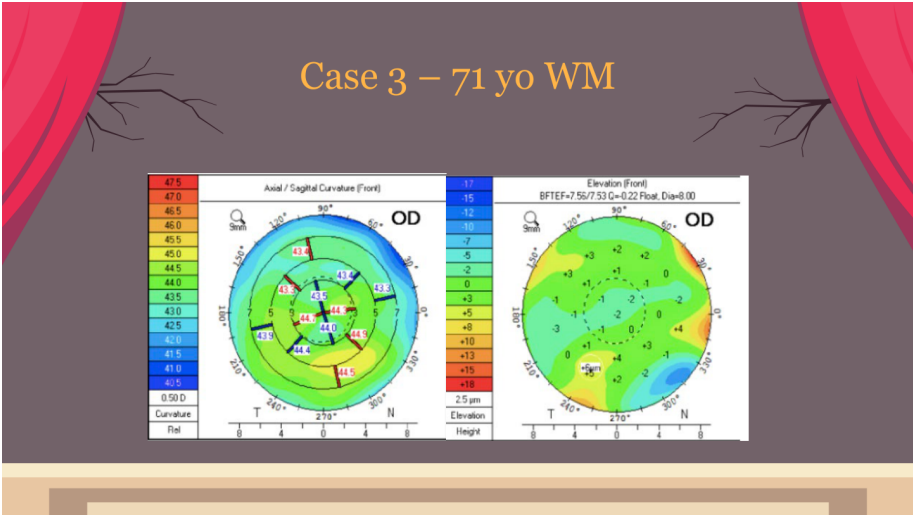
Lens:
OD: 2+ NS, tr PSC
OS: 1+ NS, 2+ cortical

ONH:
OD: 0.6 round
OS: 0.5 round

Macula:
Normal OD,OS confirmed with OCT

Vitreous
(+) PVD OD,OS

Periphery:
(+) cobbles tone degeneration OU



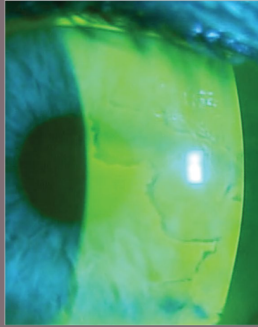
Case 3 – 71 yo WM

What do we have?

Slide 77

Case 3 EBMD

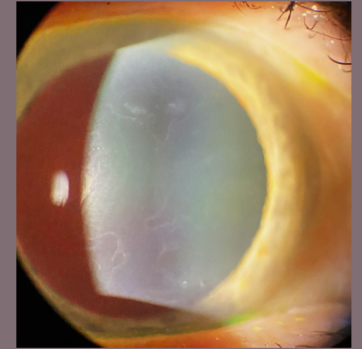
- Epithelial Basement Membrane Dystrophy
 - AKA:
 - ABMD
 - Map-dot-fingerprint
 - Cogan's Dystrophy
- First described by Cogan in 1964¹
- Most common anterior corneal dystrophy
- Affects 2-6% of general population²
- Redundant epithelial basement membrane extends into corneal epithelium



Slide 78

Case 3 EBMD

- Bilateral, asymmetric
- 3rd to 5th decade¹
- Women>Men
- Associations
 - OSD
 - Recurrent corneal erosions
 - ~10% develop RCEs¹



1. Brown N, Brice A. Recurrent excision of the cornea. *Br J Ophthalmol*. 1976; 60: 84-96. <https://doi.org/10.1136/bjo.60.2.84> PMID: 1001

Slide 79

Case 3

EBMD

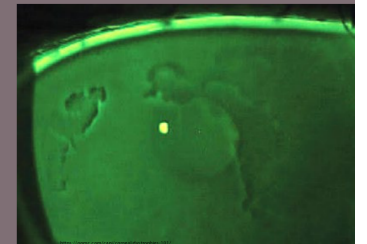
Symptoms

- Blurred vision
 - Irregular astigmatism/HOA¹
- Ghosting/shadowing
- Photophobia/Starbursts/Halos
- FBS
- Occasional pain immediately upon waking

Slide 80

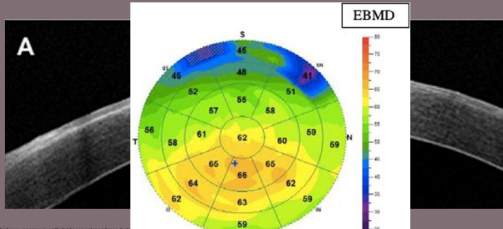
Case 3 EBMD Signs

- Pinpoint spots, irregular shaped greyish/white opacities, fingerprint-like curved parallel lines
 - Rows of thickened basement membrane
 - Negative NaFl staining/pooling
 - Less is more!
 - Scarring from past RCEs
 - Don't forget to lift the patient's eyelid!
- 



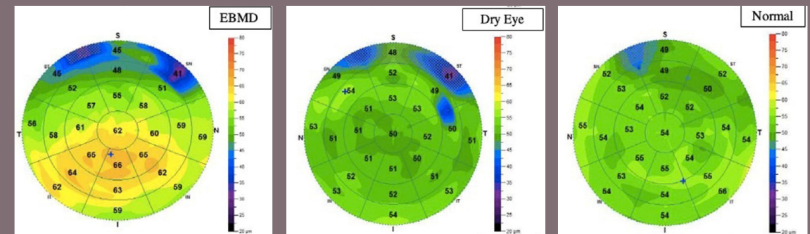
Case 3 EBMD Diagnosis

- Slit lamp biomicroscopy
- AS-OCT
- OCT epithelial thickness mapping
 - 2020 study comparing EBMD vs DED vs normal patients¹



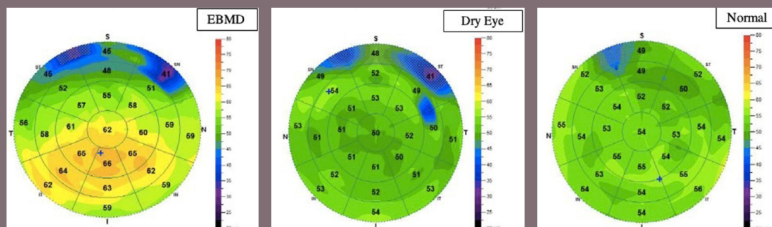
Case 3 EBMD Diagnosis

- Evaluated for:
 - Epithelial thickness irregularity
 - Difference between superior and inferior epithelium



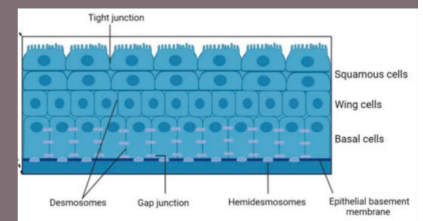
Case 3 EBMD Diagnosis

- Concluded:
 - Epithelial thickness irregularity EBMD > DES > normal corneas
 - Superior/inferior difference EBMD >> DED
 - Superior lid possibly pushing loosely adhered epithelium downwards
 - No epithelial difference between DED and normal corneas



Case 3 EBMD Pathophysiology

- Normal basal epithelial cells secrete continuous basement membrane (BM)
 - Aka Basal Lamina
- Hemidesmosomes form between basal cells and BM
- Basal cells turn into wing cells turn into squamous cells



Case 3 EBMD Pathophysiology

- Normal basal epithelial cells secrete continuous basement membrane (BM)
- Abnormal BM protrudes up into epithelium and prevents deeper epi cells from moving upwards, trapping the new epithelial cells beneath
 - Creates microcysts of cellular/nuclear debris
- Lack of adhesion of epi cells to BM with hemidesmosomes



Case 3 EBMD To remove or not to remove...

- How much of an impact is the EBMD making on vision quality?
 - Air/tear/cornea interface contributes 2/3 of eye's total refractive power



Case 3 EBMD To remove or not to remove...

- How much of an impact is the EBMD making on vision quality?
 - Is it the EBMD or the cataracts?
- RGP or Scleral CLORx
 - Tear film between CL and cornea simulates a smooth corneal surface
 - Manifest over hard CL
 - Soft CL won't work!
 - If image becomes clearer with CLORx vision disturbance is likely due to corneal surface



Case 3 EBMD To remove or not to remove...



- 2023: Retrospective study evaluating patients diagnosed with EBMD after cataract surgery
 - 25 EBMD eyes, 25 control eyes
 - Each group had both monofocal and trifocal patients
- All EBMD pts requested unscheduled post-op visits complaining of blurred/fluctuating vision and ocular discomfort

Case 3 EBMD

To remove or not to remove...

- The EBMD patients were Rx'd PFATs and ointment Rx'd for 3 months
 - All monofocal EBMD pts had subjective improvement
 - None of the trifocal EBMD pts had subjective improvement

Case 3 EBMD

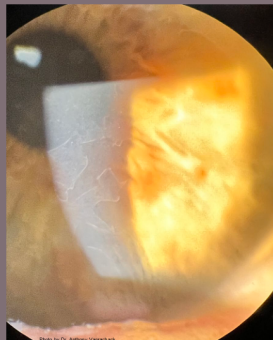
To remove or not to remove...

- Avg post-op scDVA:
 - EBMD group: 20/30
 - Control group: 20/25
 - ($p = 0.016$)
 - Avg post-op ccDVA:
 - EBMD group: 20/30
 - Control group: 20/22
 - ($p = 0.001$)
- Takeaways:
- EBMD group saw significantly worse both uncorrected and corrected
 - EBMD can affect vision in both monofocal and trifocal patients

Case 3 EBMD

To remove or not to remove...

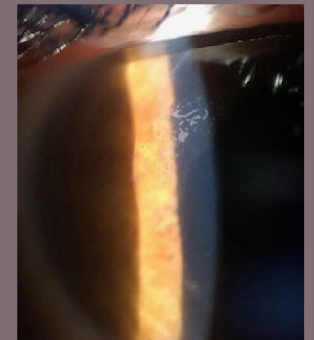
Removal of EBMD is recommended prior to cataract surgery if it appears to be affecting the corneal topography, is within the visual axis or is easily detected with SLE in the mid periphery



Case 3 EBMD

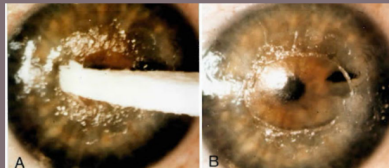
To remove or not to remove...

- What about LASIK?
 - Considered a relative contraindication
 - Can result in epithelial sloughing during surgery → epi defects
 - Epithelial ingrowth
 - PRK >> LASIK



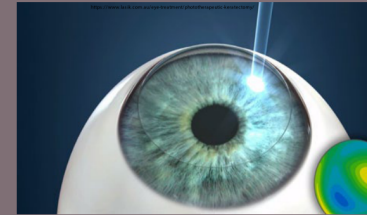
Case 3 EBMD HOW to remove?

- Superficial Keratectomy (SK) aka Epi-Peel
 - Remove EBMD and allow epithelium to grow back more regular while preserving Bowmans membrane
 - Same post-op management as Salzmann nodules
 - Less expensive for both patient and surgeon than PTK
- Followed by the placement of a cryopreserved amniotic membrane



Case 3 EBMD HOW to remove?

- Phototherapeutic Keratectomy (PTK)
 - Excimer laser used to remove part of Bowman's layer to create a new, smooth surface
 - Allows newly generated epi to migrate and form attachments
 - 13-46% recurrence rate^{1,2}
 - More costly for surgeon and patient
 - Can lead to refractive error changes
 - Hyperopic shift with central flattening



1. Clinical Response and Recurrence of Epithelial Basement Membrane Dystrophy after Phototherapeutic Keratectomy. JAMA Ophthalmol. 2004;122(10):1511-1512.
2. Pappas E, Langenhove A, Kriegl R, Kral B. (2005). Long-Term Results of Phototherapeutic Keratectomy for Corneal Map-Dystrophy. Ophthalmology. 2005;112(12):2174-2177. doi:10.1053/j.ophtha.2005.01.001

Case 3 EBMD Vitamin C

- Supplemental Vitamin C for corneal healing
 - A strong antioxidant for the cornea, reducing reactive oxygen species (ROS)
 - Proposed to have a therapeutic impact on corneal wound healing
 - Helps generate healthy keratocyte tissue
 - Enhance collagen synthesis and ECM production
 - Often advising patients to take 1-2g/day following epithelial surgery



1. Clinical Response and Recurrence of Epithelial Basement Membrane Dystrophy after Phototherapeutic Keratectomy. JAMA Ophthalmol. 2004;122(10):1511-1512.
2. Pappas E, Langenhove A, Kriegl R, Kral B. (2005). Long-Term Results of Phototherapeutic Keratectomy for Corneal Map-Dystrophy. Ophthalmology. 2005;112(12):2174-2177. doi:10.1053/j.ophtha.2005.01.001

Case 3 EBMD HOW to remove?

- Counsel the patient
 - It CAN come back!
 - It may take months before cornea is stable enough for cataract surgery
 - Repeat corneal tomography and biometry scans every 3-4 weeks to determine corneal stability

Case 3 – 71 yo WM

Questions?

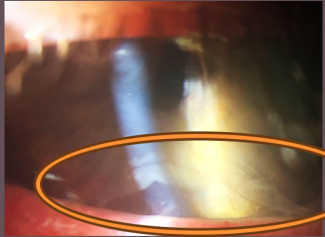
Case 4

“Extremely painful
eye after waking this
AM”

A cartoon illustration of a man with a beard, wearing a black tuxedo with a white shirt and a black cape. He is holding a white skull in his right hand and a black top hat in his left. He is standing on a small stage with a red curtain in the background.

Case 4 – 45 yo AM

- Extreme pain, photophobia OS
- Started right when he woke up - has happened before

A small, square, ophthalmoscopic image showing the interior of an eye. A bright, yellowish-white light is visible in the center, surrounded by a dark, reddish-brown area. A yellow oval is drawn around the central light.

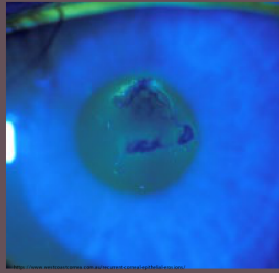
Case 4 – 45 yo AM

What do we have?

Slide 101

Case 4 RCEs

- A faulty, loose adherence of the epithelium to the underlying stroma
- Trauma most common cause
 - Inflammation from initial trauma disrupts proper hemidesmosome formation
- EBMD/other corneal dystrophies make up 19-29% of all RCE cases
 - 2000: 46% of all RCE patients had EBMD¹

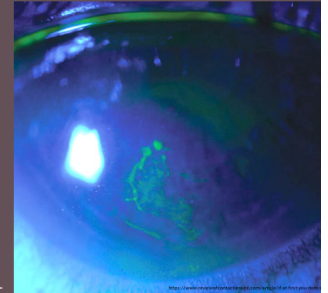


1. Bello J, Pinsky MP. Case 1: Recurrent erosion of the cornea: epidemiology and treatment. Cornea. 2000 May;19(5):557-61.

Slide 102

Case 4 RCEs

- Micro erosions
 - Milder in symptoms, shorter duration, more frequent
 - Often present to you with an intact epithelium
 - Likely due to EBMD
- Macro erosions
 - Persist for days at a time
 - Extreme pain, photophobia, eyelid edema
 - Often due to previous trauma
 - I.e. fingernail scratch, tree branch, paper cut



Slide 103

Case 4 RCEs

- Why do erosions happen first thing in the morning or while sleeping?
 - Normal cornea swells ~4% nightly¹
 - Epithelial edema can disrupt adhesion to BM

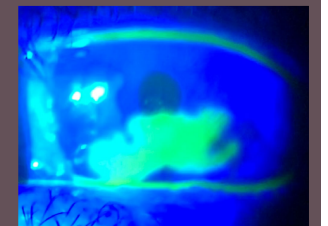


1. Bello J, Pinsky MP. Case 1: Recurrent erosion of the cornea: epidemiology and treatment. Cornea. 2000 May;19(5):557-61.

Slide 104

Case 4 RCEs

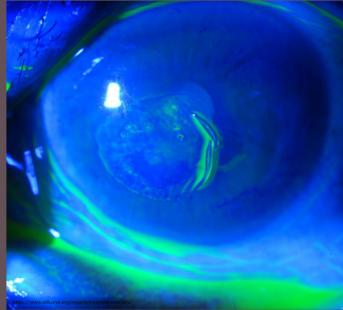
- Traumatic corneal abrasion is most common form of ocular injury presenting to ER¹
- Accounts for 37.8% of all eye injuries²
- Followed by foreign body, 29.8%



1. Bello J, Pinsky MP. Case 1: Recurrent erosion of the cornea: epidemiology and treatment. Cornea. 2000 May;19(5):557-61.

Case 4 RCEs

- Treatment goals:
 - Relieve pain
 - Facilitate rapid re-epithelialization
 - Allow hemidesmosomes to form to prevent reoccurrences



Case 4 RCEs The Initial Trauma

- Corneal epi that heals over an initial abrasion often adheres poorly to the underlying stroma
- If BM still present and regular, firm adhesion in as early as 1 week¹
- If not, firm epi adhesion can take 8 weeks to form!

Case 4 RCEs Treatments

- Topical antibiotics + BCL if epi defect
 - Risk of microbial keratitis
- Autologous serum tears
 - Isolating the blood serum from the WBCs and RBCs
 - Mimics the biochemical properties of the basal tears
 - Typically diluted to 20-50% concentration
 - Requires refrigeration

Use of Autologous Serum Eye Drops with Contact Lenses in the Treatment of Chemical Burn-Induced Bilateral Corneal Persistent Epithelial Defects

Yan-Ming Chen ^{1 2 3}, Wei-Yu Wang ¹, Yen-Chun Lin ¹, Shih-Hao Tsai ¹, Yun-Ting Lou ¹

Case 4 RCEs Treatments

Long-term follow up of autologous serum treatment for recurrent corneal erosions

Nikolaos G Ziakas MD PhD, Konstantinos G Boboridis MD, Chryssa Terzidou MD, Tatiana L Naoumidi MD, Dimitris Mikropoulos MD, Eirini N Georgiadou MD and Nick S Georgiadis MD PhD
1st Department of Ophthalmology, Aristotle University of Thessaloniki, Thessaloniki, Greece

- 33 eyes who failed previous treatments
- Serum gtts 6x/day for 3 months; then QID for 3 months
- 85% had no relapses over 2.5 years
- 15% had single recurrence 3-12 months and end of treatment

6-month treatment was sufficient for keeping patients symptom-free for 2.5 years

Case 4 RCEs Treatments

- Topical antibiotics + BCL if epi defect
- Serum Tears
- Topical Steroids
 - Reduce MMP-9
 - Dissolve the BM and adhesion fibrils of hemidesmosomes
- Oral doxycycline
 - 50mg BID
 - Reduce MMP-9

MMP = Matrix metalloproteinase

Case 4 RCEs Treatments

- MMP-2 and MMP-9 are upregulated in corneas with RCEs
 - Dissolve the BM and adhesion fibrils of hemidesmosomes
- Chronic activation may be a result of/cause of poor epi adherence → RCEs

Can take 8 weeks for hemidesmosomes to form between basal epithelial cells and basement membrane!

Case 4 RCEs Treatments

- Topical antibiotics + BCL if epi defect
- Serum Tears
- Topical Steroids
- Oral doxycycline
- Topical ointments for lubrication
 - Hypertonic vs erythromycin
 - Theoretical advantage of osmotically drawing fluid from epithelium and promoting adherence to BM¹

Case 4 RCEs Treatments

- Topical ointments for lubrication
 - 2010: Ointment makes symptoms worse?!¹
 - 72 patients with traumatic corneal injury found actual worsening of symptoms when treated with bland ointment
 - Hypertonic ung can help decrease edema and reduce friction and patient RCE symptoms
 - Often using ung qhs x 3-6 months

Case 4 RCEs Treatments

- Topical antibiotics + BCL if epi defect
- Serum Tears
- Topical Steroids
- Oral doxycycline
- Topical ointments for lubrication
- Topical insulin?
 - Known for its effectiveness for treating persistent corneal epithelial defects¹

1. Choudhury S, et al. Topical insulin for persistent corneal epithelial defects. A systematic review and meta-analysis. JAMA Ophthalmol. 2015;133(11):1211-1217. doi:10.1001/jamaophth.133.11.1211

Case 4 RCEs Treatments

- Topical insulin
 - Insulin is a peptide like insulin-like growth factor (IGF) and stimulates cell migration and is involved in wound healing
 - Insulin receptors are present on cornea and in tear film¹
 - Not yet commercially available, need to be compounded
 - No guidelines on most effective dose or standardized preparation
 - 2023: 25 IU/mL concentration used QID in patients with RCE²
 - Recurrence rate with topical insulin (0%) vs gel tears (21.4%) over 3 months

1. Choudhury S, et al. Topical insulin for persistent corneal epithelial defects. A systematic review and meta-analysis. JAMA Ophthalmol. 2015;133(11):1211-1217. doi:10.1001/jamaophth.133.11.1211
2. Bhatia A, et al. Topical insulin for persistent corneal epithelial defects. A systematic review and meta-analysis. JAMA Ophthalmol. 2023;141(11):1211-1217. doi:10.1001/jamaophth.141.11.1211

Case 4 RCEs Treatments



- Patient comes in with macro erosion
 - If loose epi, not going to adhere well → debride!
 - Can use Weck-cel and proparacaine at the slit lamp
 - Debride loose epi until point of tight adherence
 - Avoid limbus (leave at least 1-2mm of protective epi)
- Cryopreserved amniotic membrane + Abx or BCL + Abx
- Oral doxycycline
- Once epi has healed, start topical steroid gtts

Case 4 RCEs Treatments

Taking the Recurrence out of Recurrent Corneal Erosions: A Case Series

Scott G Hauswirth; Milton M Horn

+ Author Affiliations & Notes

Investigative Ophthalmology & Visual Science June 2017, Vol.58, 2612. doi:

- Recurrence rates of RCE over 6 months in patients treated with:
 - BCL alone – 66.7%
 - Epi debridement + BCL – 50%
 - Epi debridement + CAM – 14.3%

Case 4 RCEs Surgical Treatments

- Goal of surgery:
 - To induce a healing response in the stroma that results in firmer epithelial adherence
 - Fibroblast proliferation in anterior stroma during wound healing may stimulate formation of new anchoring fibrils¹
- Typically saved for recalcitrant cases

Case 4 RCEs Surgical Treatments

- Superficial keratectomy with or w/o diamond burr polishing
 - Remove irregularities of the epi and allow to grow back more regular
 - 50-60% effective¹
 - Diamond burr polishing after the procedure has been found to be more effective than debridement alone¹
 - Less expensive for surgeon than PTK



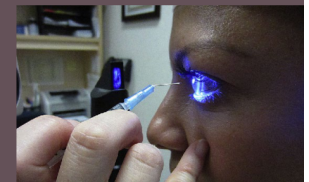
Case 4 RCEs Surgical Treatments

- Phototherapeutic Keratectomy (PTK)
 - Excimer laser used to remove part of Bowman's layer to create a new, smooth surface
 - Allows newly generated epi to migrate and form attachments
 - ~70% effective¹
 - Higher rate of success for RCEs from trauma than dystrophy²
 - More costly for surgeon and patient
 - Can lead to refractive error changes
 - Hyperopic shift with central flattening



Case 4 RCEs Surgical Treatments

- Anterior stromal puncture if outside visual axis
 - 23 to 25 gage needle used to penetrate anterior stroma
 - Goal is to make pinpoint scars
 - Rational: RCEs occur less frequently when traumatic abrasion penetrates anterior stroma vs just epithelial abrasions
 - Can cause glare, scarring, blurred vision
 - ~60% efficacy¹



Case 4
RCEs
Surgical Treatments

Efficacy and Safety of Secondary Surgical Treatment for Refractory Recurrent Corneal Erosion

Hyunmin Ahn, MD, Young Jun Kim, MD,* Kyoung Yul Seo, MD, PhD,† and Jae Lim Chung, MD, PhD**

- 2025 in Cornea: Combined PTK + ASP
 - 115 eyes with refractory RCE treated with either combo surgery or conservative therapy of PFATs and ointment
 - After 1 year:
 - 27.2% recurrence rate with combo sx
 - 69.6% with conservative therapy
 - All recurrences within the combo group happened within 6 months

Case 4
RCEs
How to check for future RCE?

ARTICLE

Implementation of the Corneal Sweep Test in the Diagnosis of Recurrent Corneal Erosion: A 2-Year Retrospective Study

Kim, Madeleine Eun-Ji ; Kim, Doocho Brian

Cornea, 2022-10, Vol.41 (10), p.1248-1254

- Retrospective chart review on 58 eyes of 51 patients
- To help diagnose corneal erosions in the absence of visible corneal findings in patients with persistent ocular pain

Case 4
RCEs
How to check for future RCE?

ARTICLE

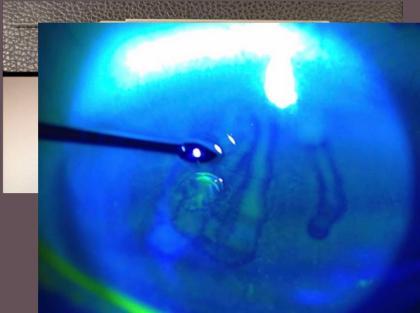
Implementation of the Corneal Sweep Test in the Diagnosis of Recurrent Corneal Erosion: A 2-Year Retrospective Study

Kim, Madeleine Eun-Ji ; Kim, Doocho Brian

Cornea, 2022-10, Vol.41 (10), p.1248-1254

- Performed CST on 49/58 eyes to confirm erosion diagnosis
- 34/49 had “occult corneal erosion”
 - Normal appearing cornea on slit lamp but found to have loose epi with CST

Case 4
RCEs
How to check for future RCE?

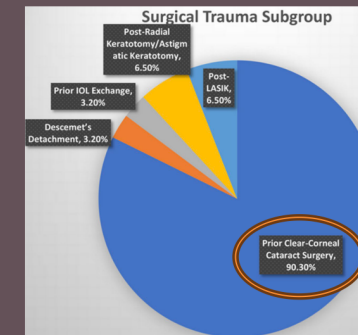


Case 4 RCEs How to check for future RCE?

- Results:
 - 9/58 eyes were diagnosed with RCE at slit lamp based on obvious signs
 - 49/58 eyes underwent CST to locate area of loose epi
 - 34/49 had "occult corneal erosion" found by CST
- All occult erosion patients had a presumed mechanism of injury

© 2004, R. & B. & D. (2004). Implementation of the Clinical Trauma Test in the Diagnosis of Postoperative Corneal Erosion. A Pilot Retrospective Study. Cornea, 21(10), 1044-1046. doi: 10.1097/01.COR.0b013e3180100000

Case 4 RCEs How to check for future RCE?



© 2004, R. & B. & D. (2004). Implementation of the Clinical Trauma Test in the Diagnosis of Postoperative Corneal Erosion. A Pilot Retrospective Study. Cornea, 21(10), 1044-1046. doi: 10.1097/01.COR.0b013e3180100000

Case 4 RCEs How to check for future RCE?

- "Occult Corneal Erosion" Subgroup: (34/58 eyes)
- 8 categories of symptoms
 - FB sensation
 - Blurred vision
 - Photophobia
 - Tearing
 - Pain
 - Itching
 - Redness
 - Non-specific, vague symptoms
 - "The eye feels bigger"
 - "The eye just does n't feel right"

© 2004, R. & B. & D. (2004). Implementation of the Clinical Trauma Test in the Diagnosis of Postoperative Corneal Erosion. A Pilot Retrospective Study. Cornea, 21(10), 1044-1046. doi: 10.1097/01.COR.0b013e3180100000

Case 4 RCEs How to check for future RCE?

- Once erosion was identified, all patients received ocular surface treatment with lubrication, ointments, hypertonic saline drops/ung
- Secondary tx with BCLs, SK, ASM
- 85% of eyes responded to treatment with improvement or resolution of symptoms
 - Suggests that identifying loose epi with the CST does correlate and confirm diagnosis of RCE

© 2004, R. & B. & D. (2004). Implementation of the Clinical Trauma Test in the Diagnosis of Postoperative Corneal Erosion. A Pilot Retrospective Study. Cornea, 21(10), 1044-1046. doi: 10.1097/01.COR.0b013e3180100000

Case 4 RCEs

How to check for future RCE?

- Once erosion of ocular surface, ointments, and systemic antibiotics
- Secondary RCEs
- 85% of eyes improved with treatment
- Suggestive of RCE



Case 4 – 45 yo AM

- Extreme pain, photophobia OS
- Started when he woke up - has happened before



It has happened many times before!

Case 4 – 45 yo AM RCEs

Visit 1:

- Put in 1 gtt of cyclopentolate and proparacaine for pain
- Debrided OS at slit lamp
- Put on a CAM
- Start moxifloxacin QID OS
- Start oral doxycycline (50mg BID)
- Start oral vitamin C (1000mg/day)
- RTC 1 week



Case 4 – 45 yo AM RCEs

Visit 2: 1 week later

- Remove CAM as epi defect closed
- Put on BCL – decreased Abx to BID for prophylaxis
- Start Pred Acetate gtt QID (with plans of weekly taper)
- Start hypertonic ung qhs
- Continue oral doxycycline
- Continue vitamin C
- RTC 2 weeks for BCL removal



Case 4 – 45 yo AM RCEs

Visit 3: 2 weeks later

- Remove BCL with forceps
- Cornea looked PRISTINE!
- Continue pred taper (now on BID OS)
- Continue hypertonic ung qhs
- D/c Abx
- Continue oral doxy
- Continue vitamin C
- RTC 2 weeks to reassess



Case 4 – 45 yo AM RCEs

Visit 4: 5 days later

Woke up with PAIN OS! Pt comes in with
macro erosion AGAIN! ☹

- Debrided OS at slit lamp
- Put on another CAM
- Restarted moxifloxacin back to QID OS
- Continue oral doxy (50mg BID)
- Continue oral vitamin C (1000mg/day)
- RTC 1 week for CAM removal



Case 4 – 45 yo AM RCEs

Visit 5: 1 week later

- Remove CAM as epi defect closed
- Put back on BCL – decreased Abx to BID for prophylaxis
- Increased Pred Acetate gtts back to QID (with plans of biweekly taper)
- Continue oral doxycycline
- Continue oral vitamin C
- Continue hypertonic ung qhs
- RTC 2 weeks for BCL exchange



Case 4 – 45 yo AM RCEs

Visit 6: 2 weeks later

Visit 7: 2 weeks after that

- Removed BCL with forceps
- Cornea looked PRISTINE, but not stopping here!
- Put on another BCL
- Continued biweekly pred taper
- Continue prophylactic Abx
- Continue hypertonic ung qhs
- Continue oral doxycycline
- Continue oral vitamin C
- RTC 2 weeks for BCL exchange



Case 4 – 45 yo AM RCEs

Visit 8: 2 weeks later
(6 weeks with a BCL)

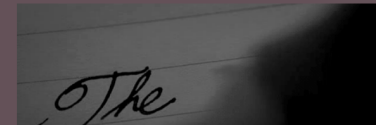
- Remove BCL with forceps
- Cornea still looked good – but should we do one more?
 - It can take 8 weeks for hemidesmosomes to form!
- Put on another BCL
- Continued pred taper (pt to start QD OS x 2 weeks)
- Continue prophylactic Abx
- Continue hypertonic ung qhs
- Continue oral doxycycline
- Continue oral vitamin C
- RTC 2 weeks for BCL REMOVAL?!?



Case 4 – 45 yo AM RCEs

Visit 9: 2 weeks later
(8 weeks with BCL)

- Remove BCL with forceps
- Cornea still looked goooooood 😊
- D/c pred taper
- D/c prophylactic Abx
- Continue hypertonic ung qhs for 6 more weeks
- Continue oral doxycycline for 6 more weeks, then d/c
- Continue oral vitamin C
- RTC...??



Take aways

- You will see patients with Salzmann Nodular Degeneration, Pterygium, and EBMD (and likely RCEs)
- They CAN impact vision quality and may require removal for best vision results

Questions?

Thank you!



Lily Arendt, OD, FAAO
lilyarendt1@gmail.com