

Managing Ocular Injuries: From Front to Back

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Ocular Trauma

- More common in males
- More likely to occur in left eye
- Higher risk of blindness:
 - Involving a rupture or perforation
 - Involvement of posterior segment: vitreous hemorrhage, retinal detachment, choroidal rupture and endophthalmitis
- Lower risk/better prognosis: young age, contusion, intraocular foreign body

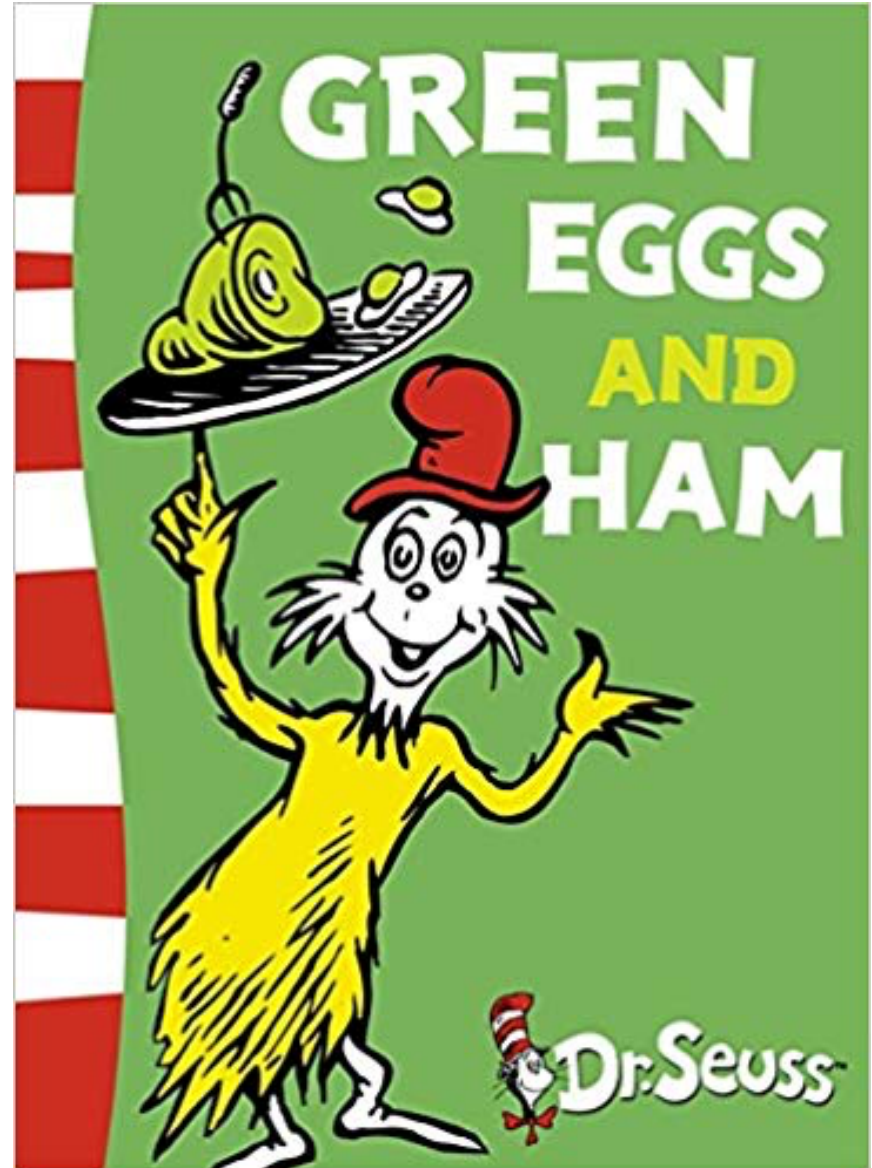
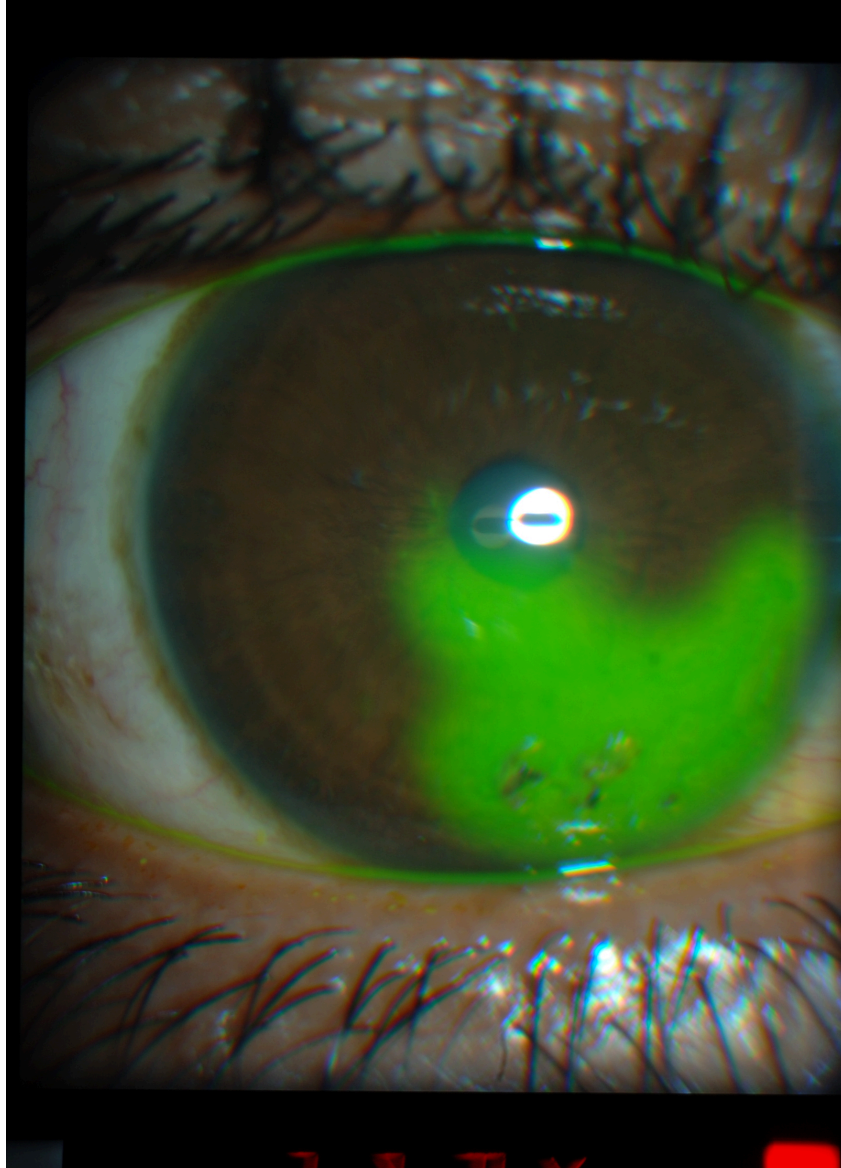
Ocular Trauma

- Closed Globe (Blunt Trauma)
 - More common and better visual outcome
- Open Globe
 - Majority caused by sharp penetrating injuries
 - Wound Length greater than 10mm in open globe worse prognosis
- Childhood injuries are common (30%)
 - 50% of unilateral blindness in children

Case

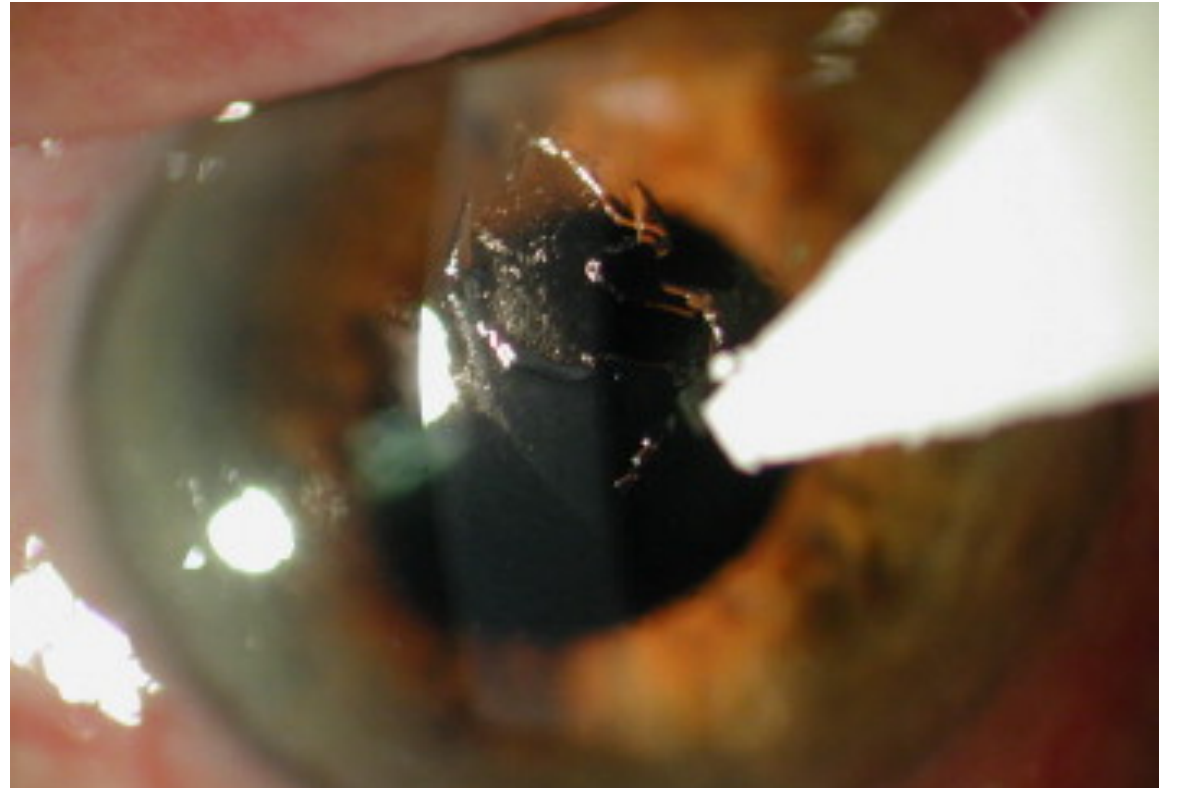
- 48 YO female
- C/O excruciating pain and blurry vision
- Claims she got something in her eye while cooking.





Corneal Abrasion Management

- Debride if necessary
- Prophylactic antibiotics
- Cycloplege in office
- Frequent artificial tears
- Topical steroids on F/U if re-epithelialized and necessary
- Oral analgesics
- Hyperosmotics after epithelium healed



Corneal Abrasion Management

- Smaller abrasion – topical AB QID (3-5 days), possibly cycloplege in office and artificial tears.
- Larger abrasions (50% or greater) – topical AB QID bandage CL, cycloplege in office, artificial tears
- Pressure patch anyone?

Be careful when removing bandage lenses on follow-up...
float with artificial tears before removal

Poor Healer



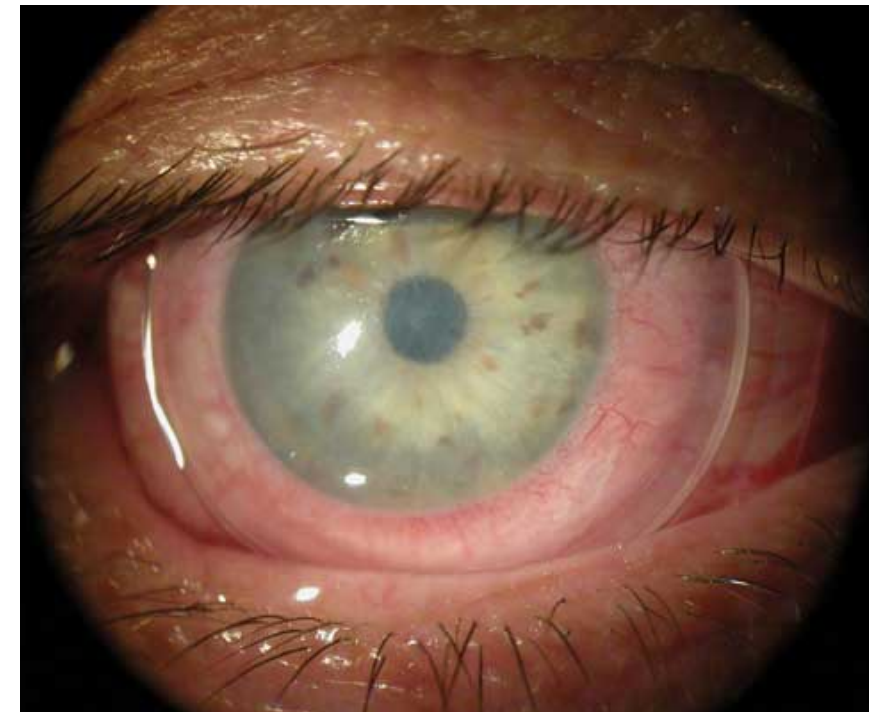
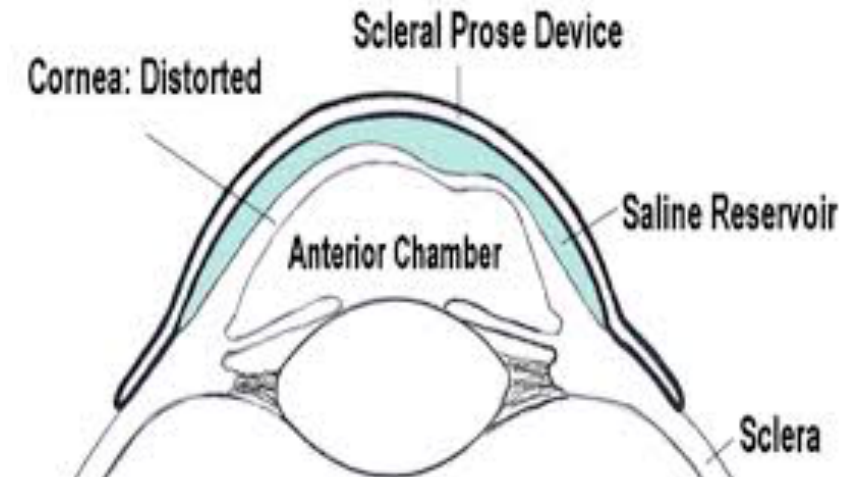
Poor Corneal Healing



- Epithelial/limbal stem cell deficiency: epithelial cells are shed but not adequately replaced.
- Inflammatory disease: K-sicca
- Neurotrophic disease: impaired corneal sensation (diabetes, herpetic infection, nerve damage from surgery).
- Mechanical factors: abnormal lid anatomy causing epithelial trauma, ocular surface disease.

Recalcitrant Defects

- Tetracycline/doxycycline: **anti-collagenolytic** properties that aid in corneal wound healing and prevent stromal lysis.
 - Oral tetracycline 250 mg QID or doxycycline 50-100 mg twice daily
- Amniotic membrane: (Prokera; Bio-Tissue)
- Tarsorrhaphy: Partial or complete closure of the eyelid
 - Botox?
- Scleral lenses: Prosthetic replacement of ocular surface ecosystem (PROSE) lens. Lens vaults over the cornea to protect the ocular surface and provide reservoir for hydration.



Recalcitrant Defects

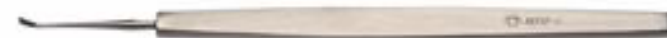
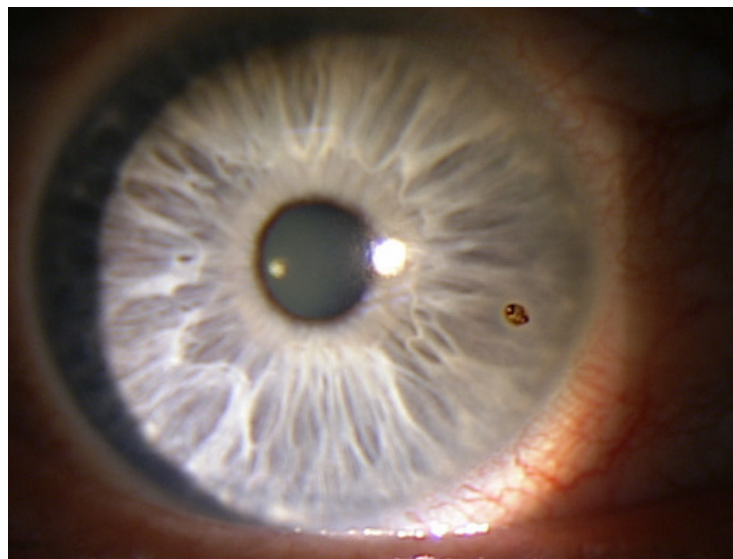
- Autologous serum: Patient's serum is diluted to concentration of 20% and the drops used 6-8 x day.
- Therapeutic effect promoted by growth factors contained in the serum, including vitamin A, substance P, immunoglobulins, and fibronectin.



Foreign Body Removal

- Removal: Inspection, assessing depth and development of the least invasive plan for removal.
- Instruments: Spud, scraping of adjacent tissue, blunt edge of a 25-gauge needle and/or jeweler's forceps.



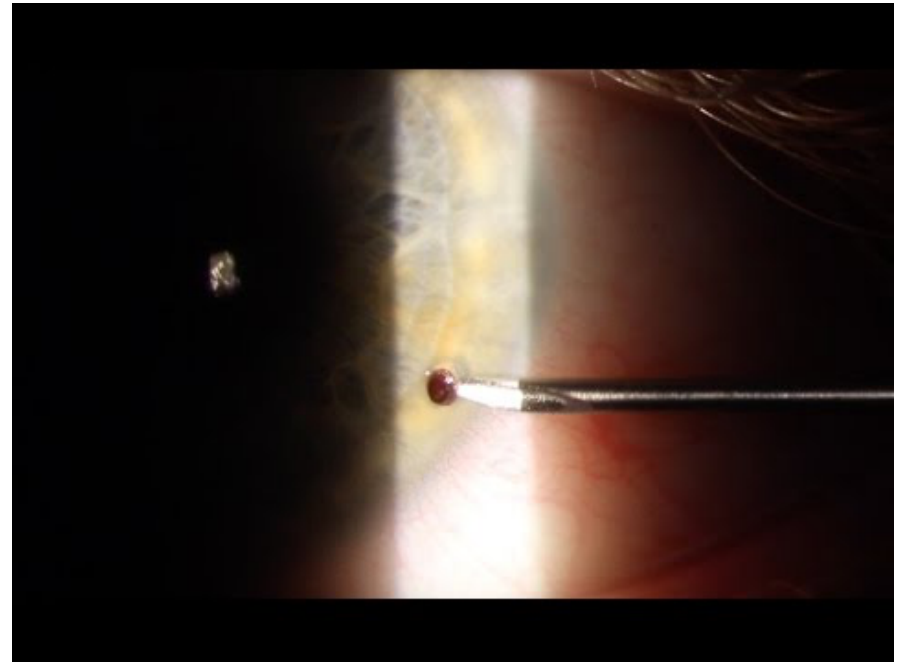
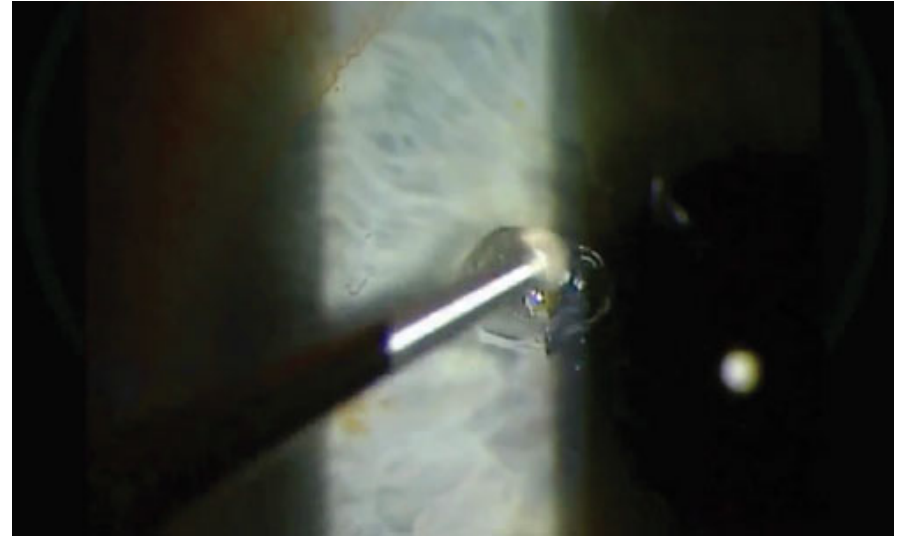


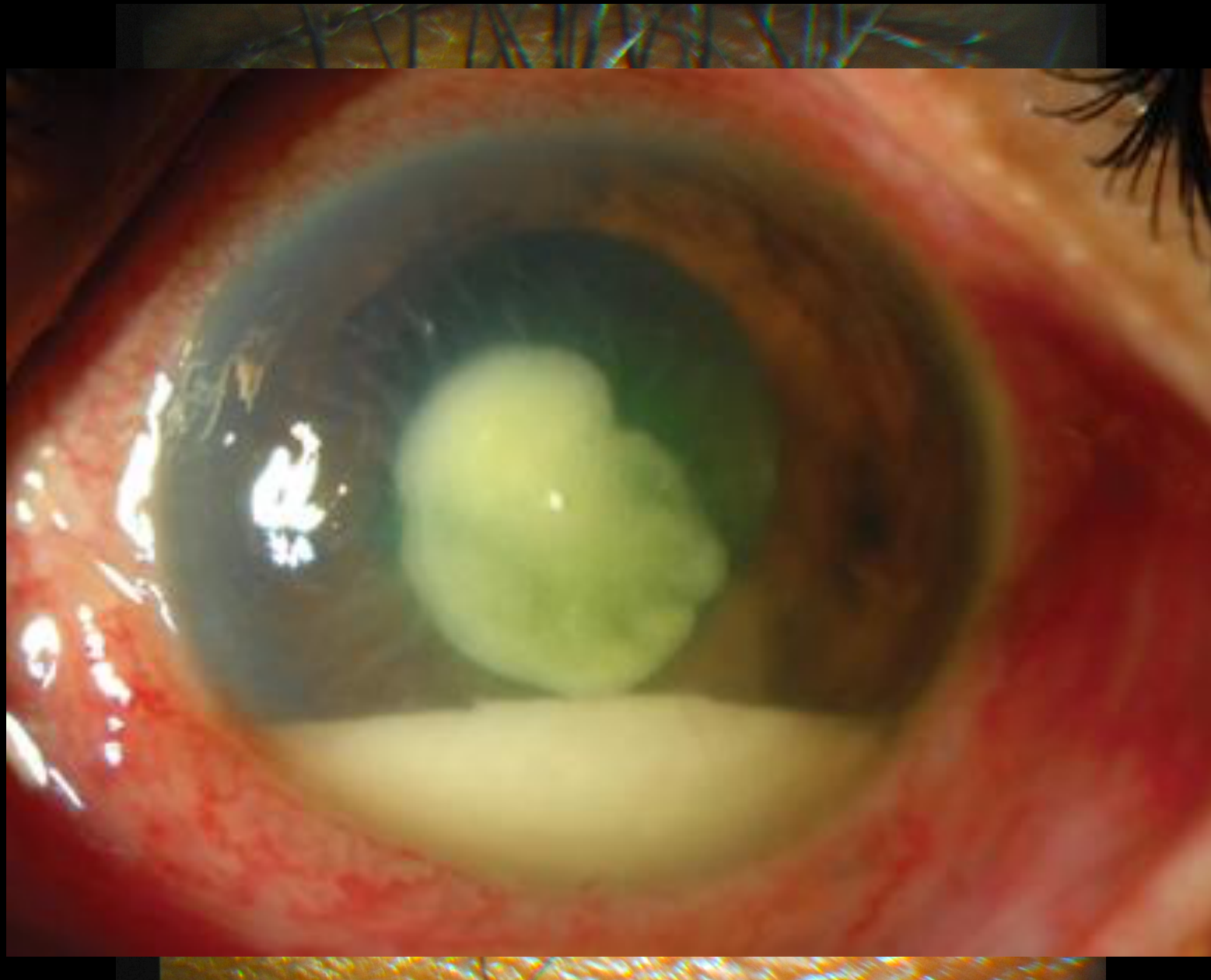
FB Removal

Metallic objects may form rust after approximately 6 hours
Removal of rust ring may be necessary with FB tools or Alger brush

Removal of Foreign Body

- Tangential approach recommended when removing FB to prevent accidental puncture, laceration or penetration.
- Following removal, patient will be left with varying sizes and depths of abrasions, which should then be managed accordingly.





Do you really need the prophylactic antibiotic?



Case

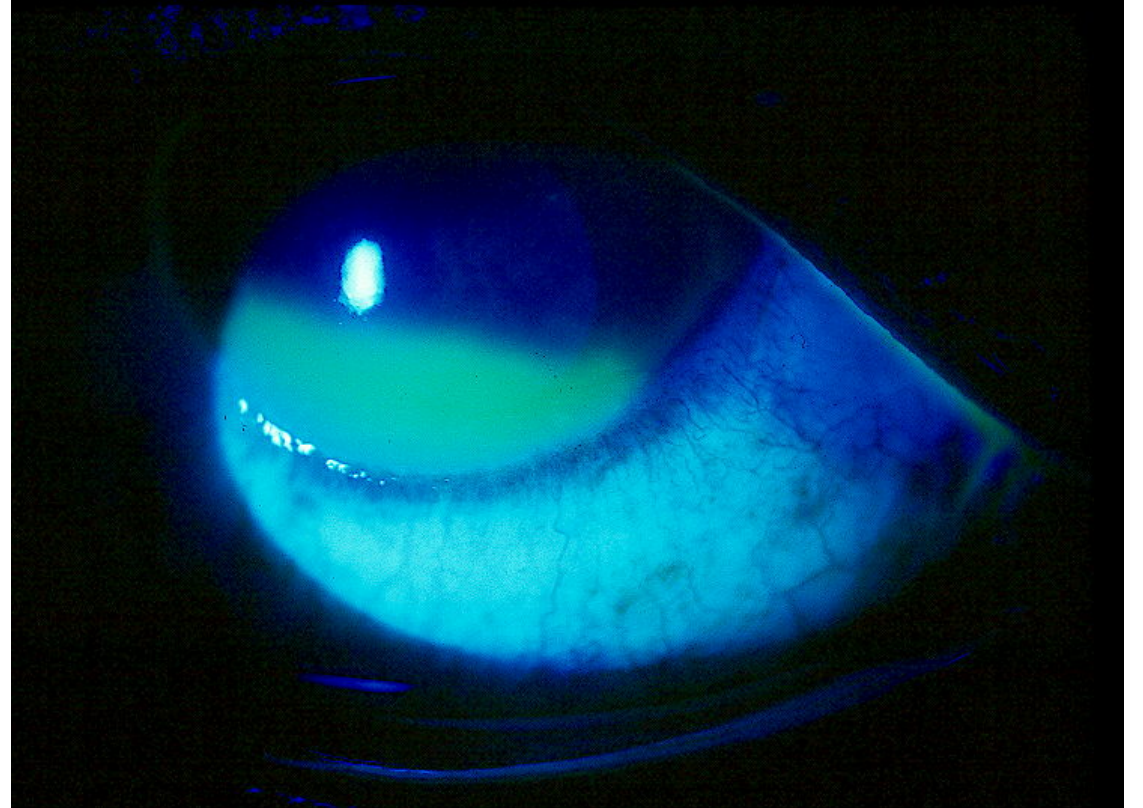
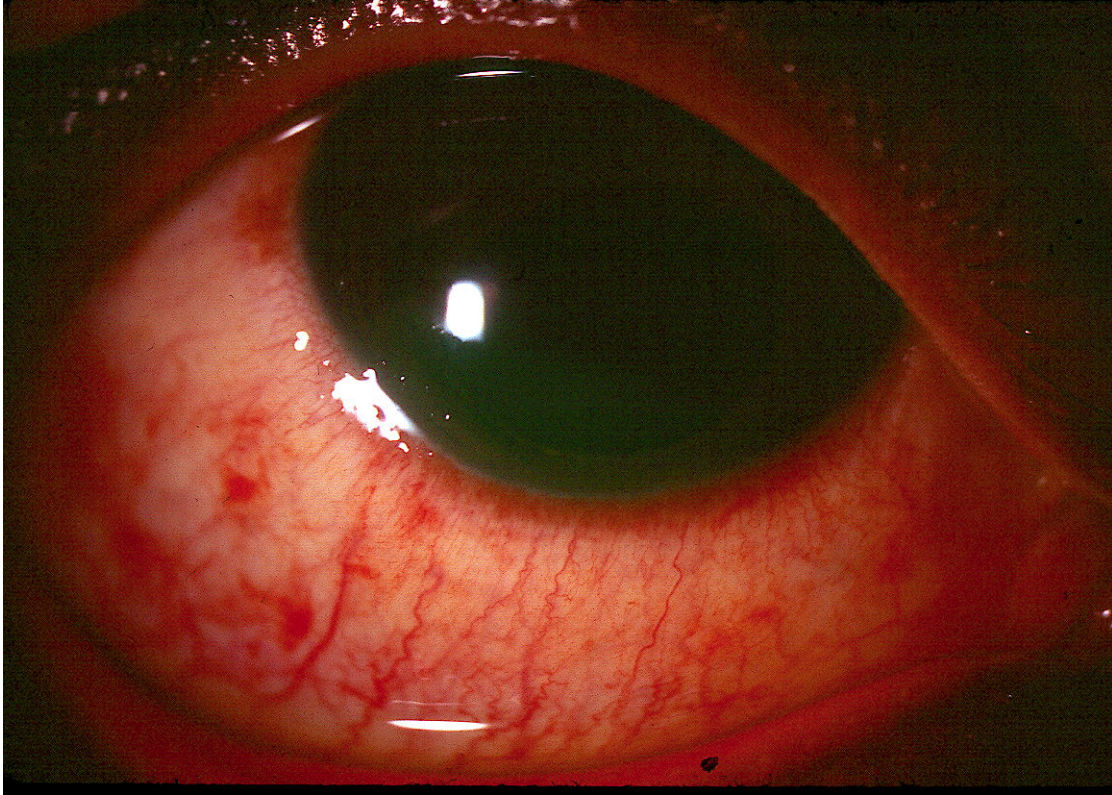
21 yo female with painful, red eyes OU x 24 hours

Father threw rubbing alcohol in her face

Epiphora

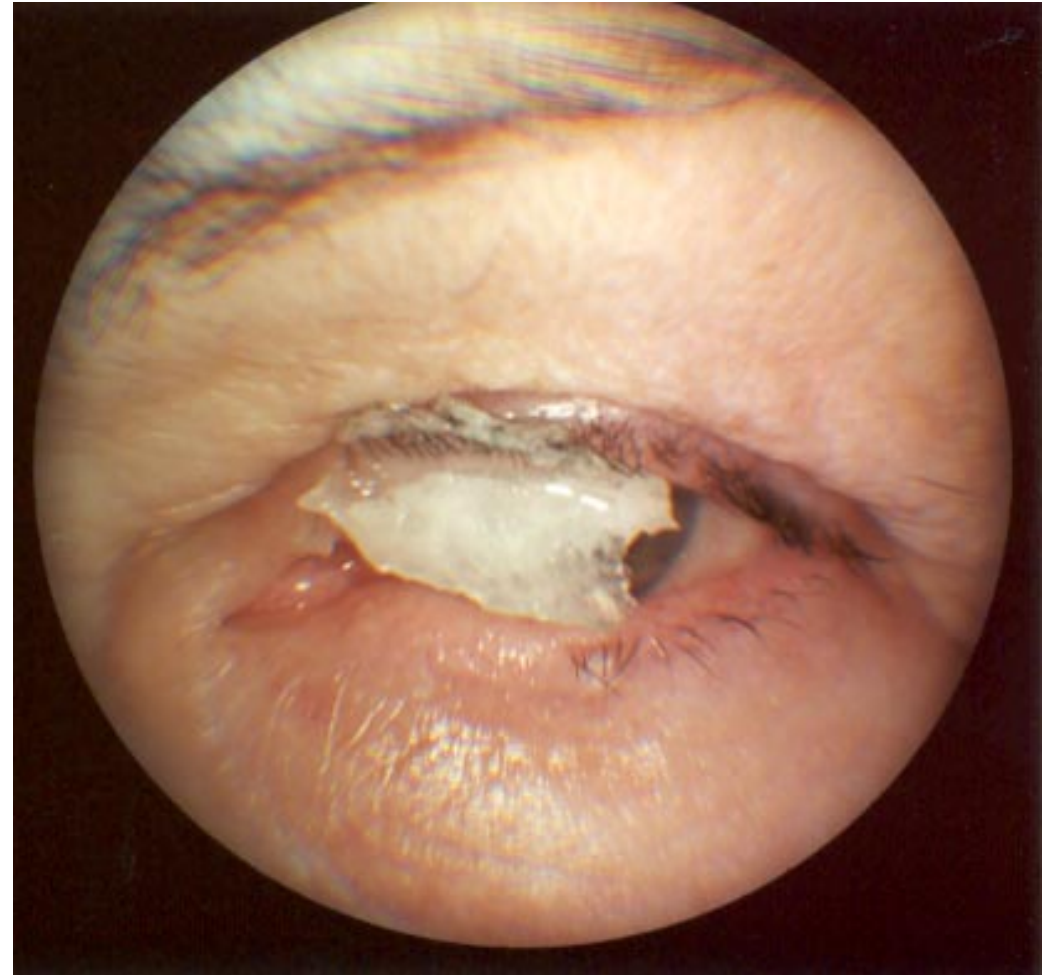
No discharge

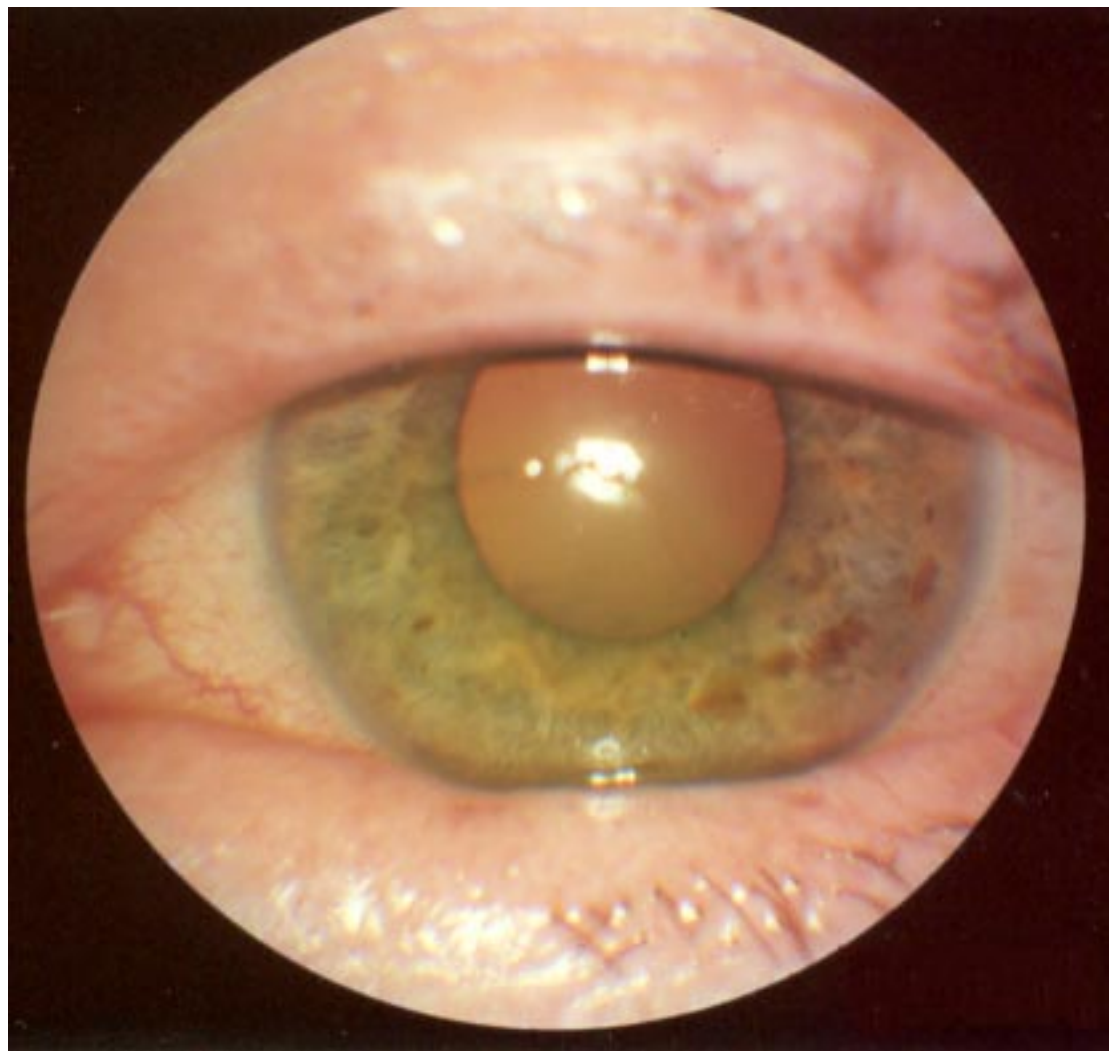
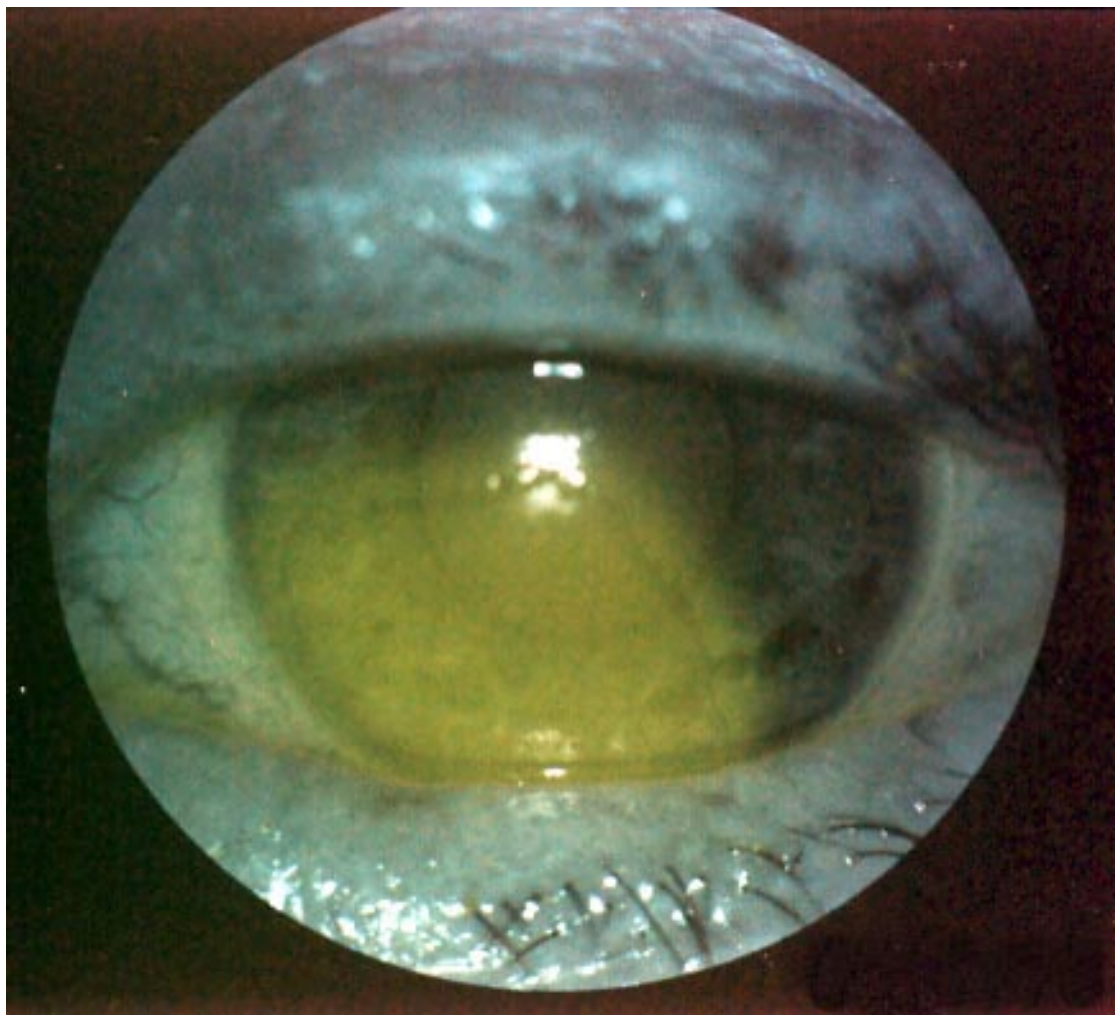
Photophobia OU and extremely uncomfortable



Alcohol is a chemical “irritant”

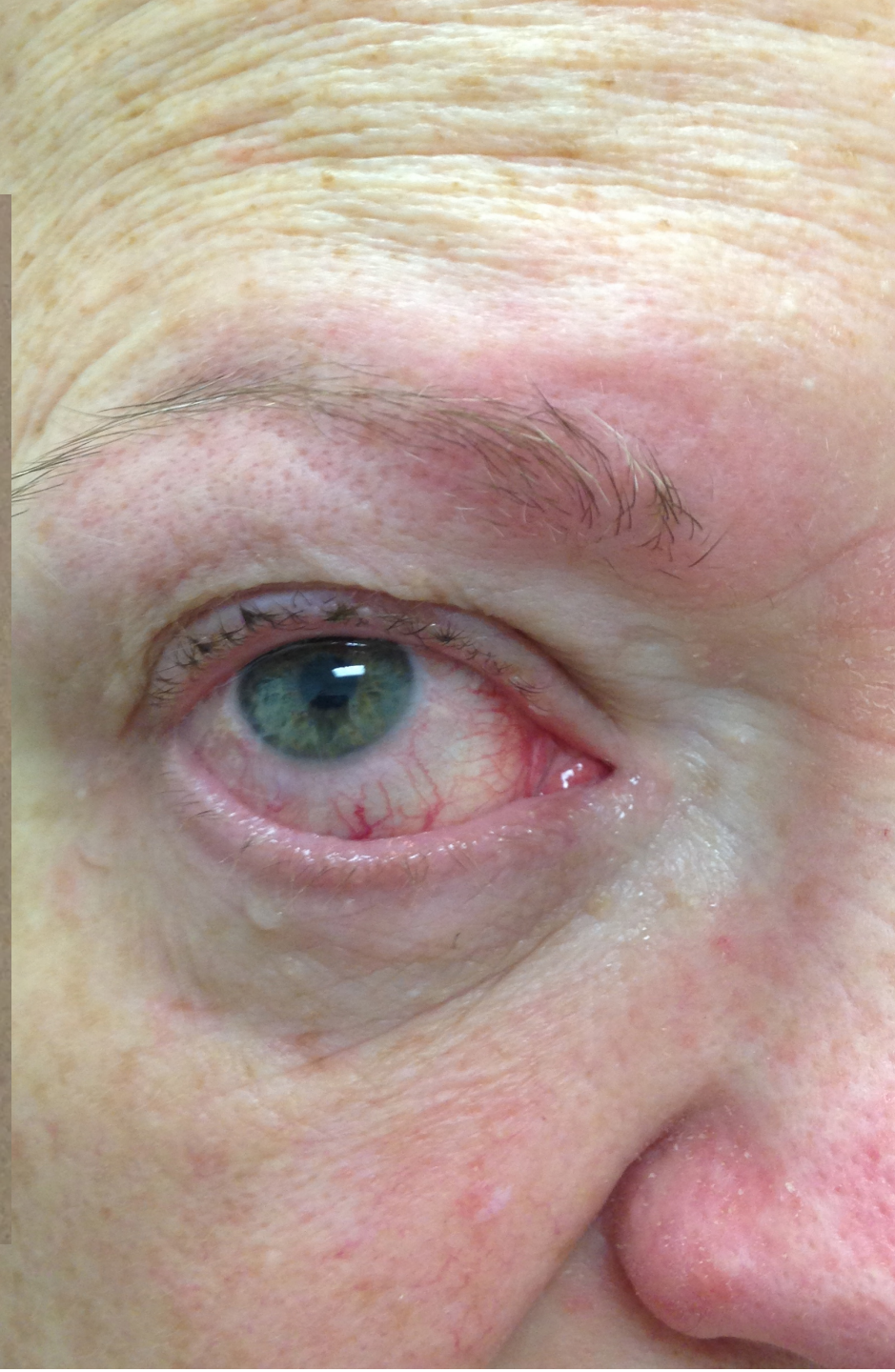
The “Look a Like” Boo Boo’s





TAP ONE OR TWO
DROPS ON TIP OF TONGUE.
USE ONLY AS DIRECTED.

INGREDIENTS: ALCOHOL DENAT.
SD ALCOHOL 38-B, AQUA (WATER),
GLYCERIN, POLYSORBATE 20,
SORBITOL, AROMA (FLAVOR), SODIUM
SACCHARIN, CI 42090 (BLUE 1),
CI 15985 (YELLOW 6),
ALCOHOL 65% V/V



Chemical Burn

- Acidic
 - $\text{pH} < 7$ ($\text{pH} < 4$ induces burns)
 - Bind with tissue proteins and create their own barrier to further penetration (what you see is what you get)
 - Sulfuric acid (battery acid)
 - Hydrochloric acid
 - Hydrofluoric acid
 - Acetic acid (vinegar)

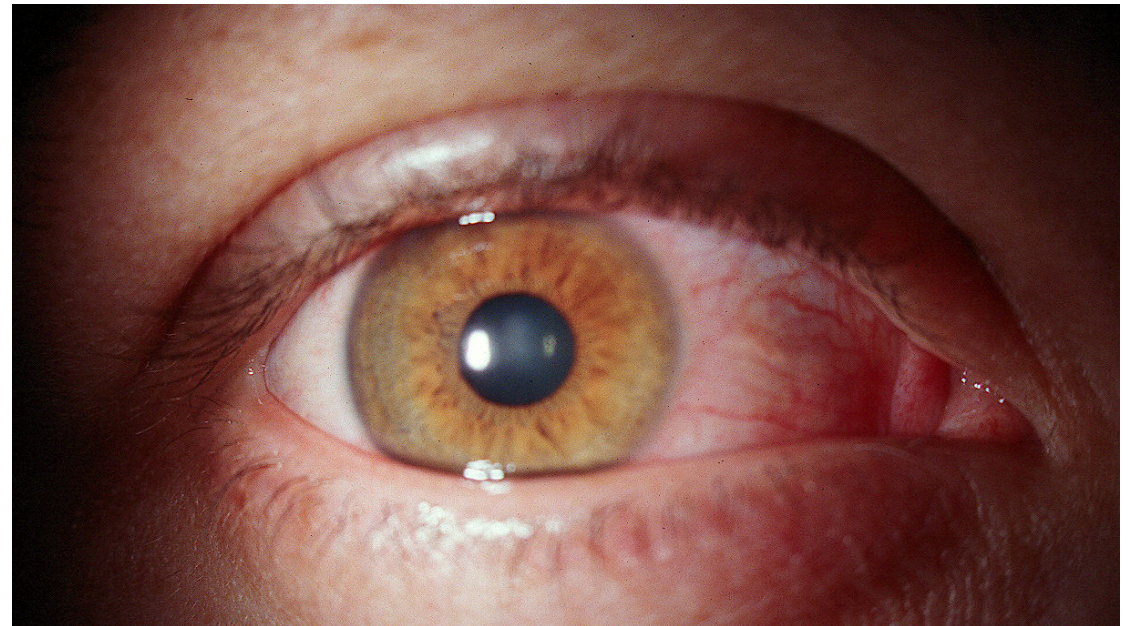
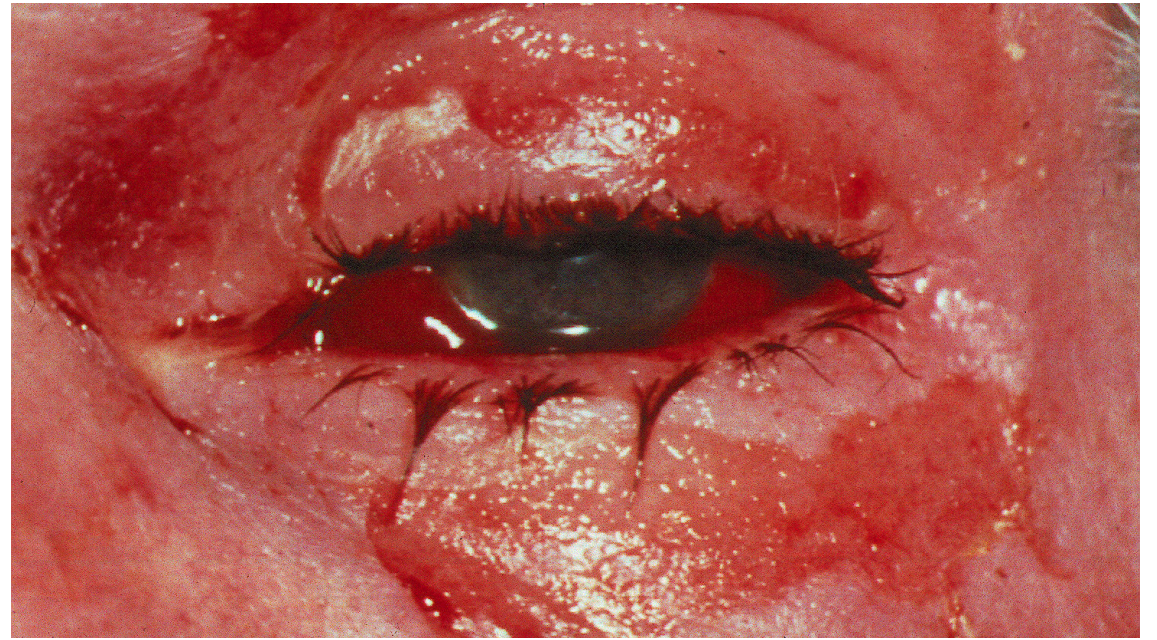
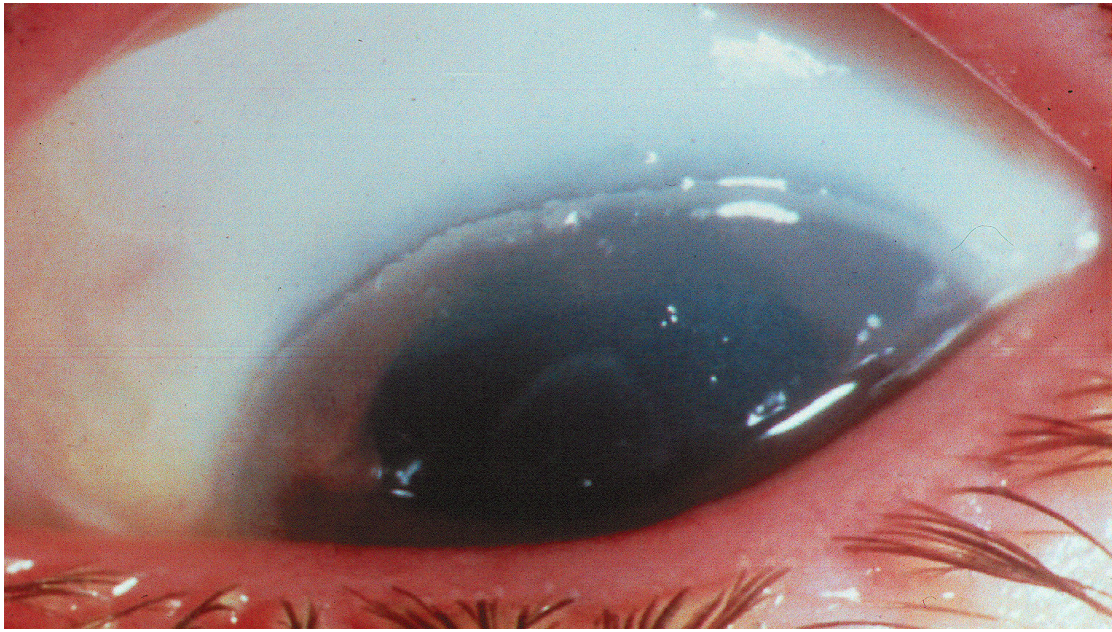
Chemical Burn

- Alkaline
 - $\text{pH} > 7$ ($\text{pH} > 10$ induce burns)
 - Saponify fatty components of tissues/cornea and “melt” the tissue causing deeper penetration of the chemical (can worsen after initial presentation)
 - Ammonia (household cleaning agents)
 - Lye (commercial cleaning agents)
 - Lime (cement)
 - Magnesium hydroxide (fireworks)

Chemical Burn

- Conjunctival redness
- Blanching of vessels (“fried egg”)
- Inflammatory reaction
- Lid edema or burn
- Corneal staining with NaFl
- Corneal edema or haze

**WHEN IT COMES TO CHEMICAL BURNS....
THE REDDER THE BETTER!**



Chemical Burn Management

- IRRIGATE!
- Litmus paper to determine acid vs. alkaline
- Irrigate again when they arrive
- Sweep fornices for particulate matter
- Debride necrotic conjunctival and corneal tissue



Chemical Burn Management

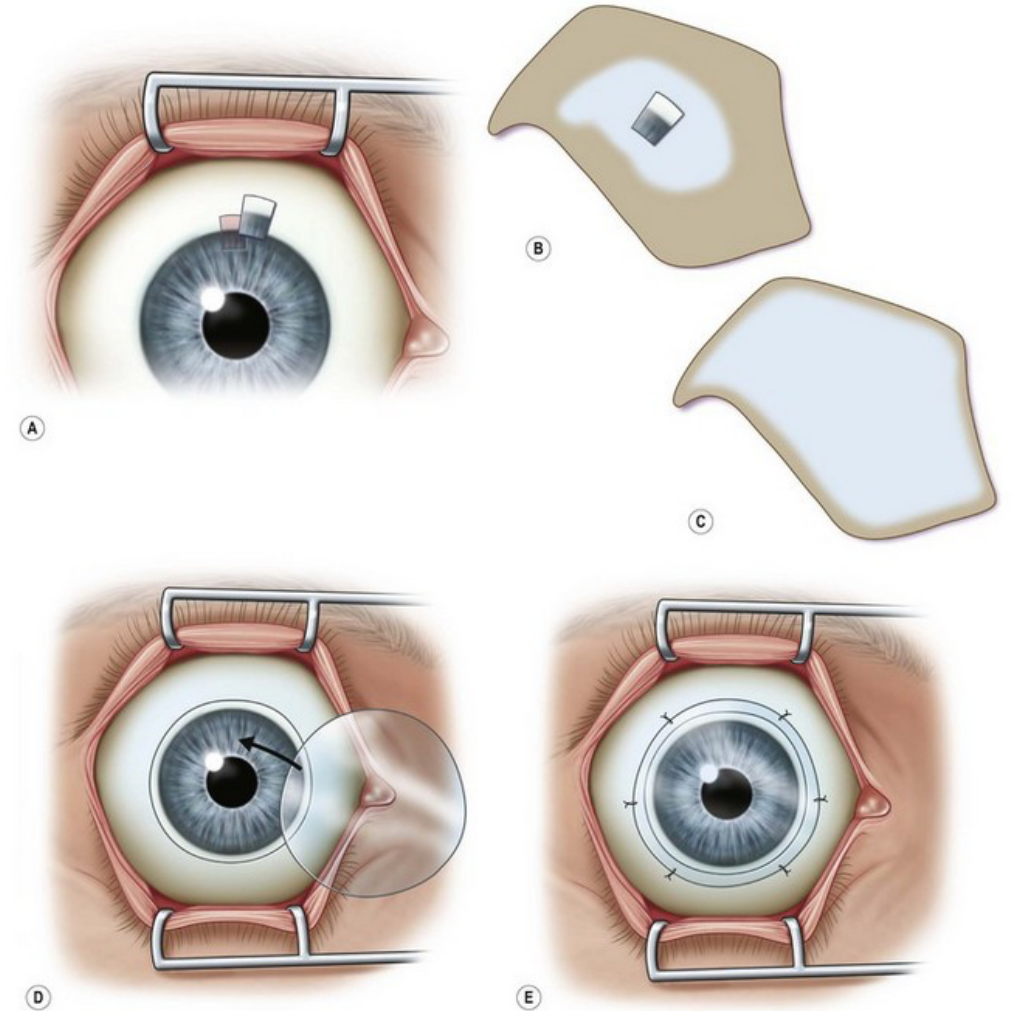
- Treat corneal abrasion
 - Prophylactic topical antibiotics (broad spectrum)
 - Cycloplegic (choice depends on severity)
 - Careful with bandage lenses
 - Pressure patch?
- Topical steroids (carefully)
- Lubricants
- Hyperosmotics (NaCl 2%, 5% solution) as necessary

Chemical Burn Management

- Ascorbate and citrate may be used to treat severe alkaline burns
- Vitamin C 1,000 mg BID
- Topical steroids
 - Manage the associated inflammation
 - Alkaline burns have a biphasic pattern: the initial burn, then the secondary endothelial breakdown.
 - Steroids are helpful in preventing the secondary breakdown and promoting endothelial repair.

Goal of Management

- Improve patient comfort
- Control inflammation of underlying corneal stroma
- Preserve the limbal vasculature
- Restore limbal stem cells
 - Amniotic membrane covers entire eye (chemical burn)
 - Prevent symblepheron, promote conjunctival regeneration, inhibit corneal melt by promoting epithelialization, protect ocular surface
 - Limbal stem cell transplant





Case

55 year-old male

Hit by whiffle ball “going 60 mph”

Pain, lid bruising, blurry vision

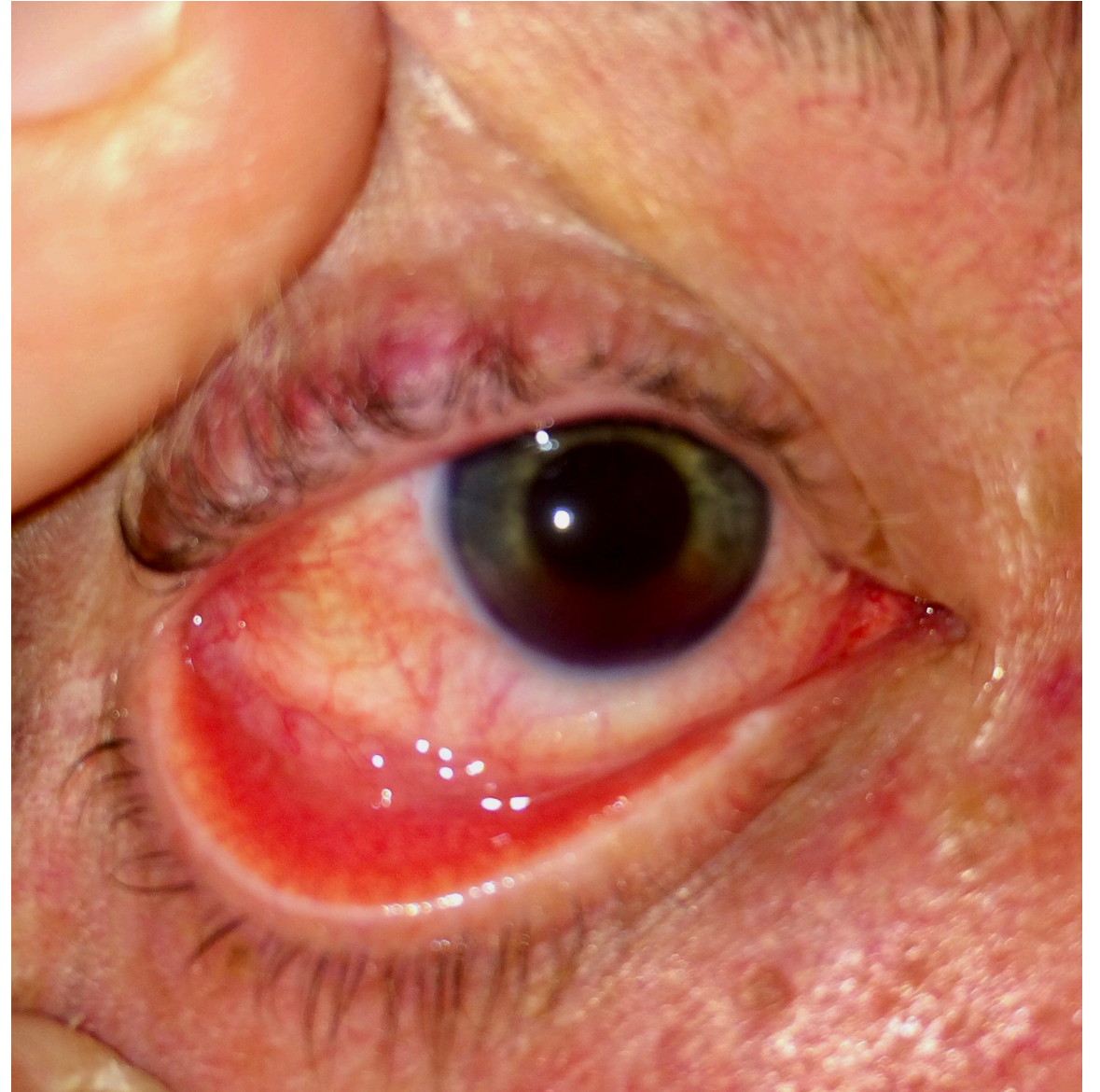
Parking lot consultation

Case

- VA 20/25 OD and OS
- Lids bruised with edema
- Pupil mid-dilated and minimally reactive
- EOM and CF full
- A/C 3+ cell/flare, + RBC, formed (no perforation)
- Lens in place (no subluxation)
- IOP 15 OD, 12 OS

Case...Whiffle Ball

- No pigment in vitreous
- Nerve pink and healthy C/D 0.5 OD/OS
- Macula flat OU
- No commotio retina
- Periphery flat, no holes/tears/detachments



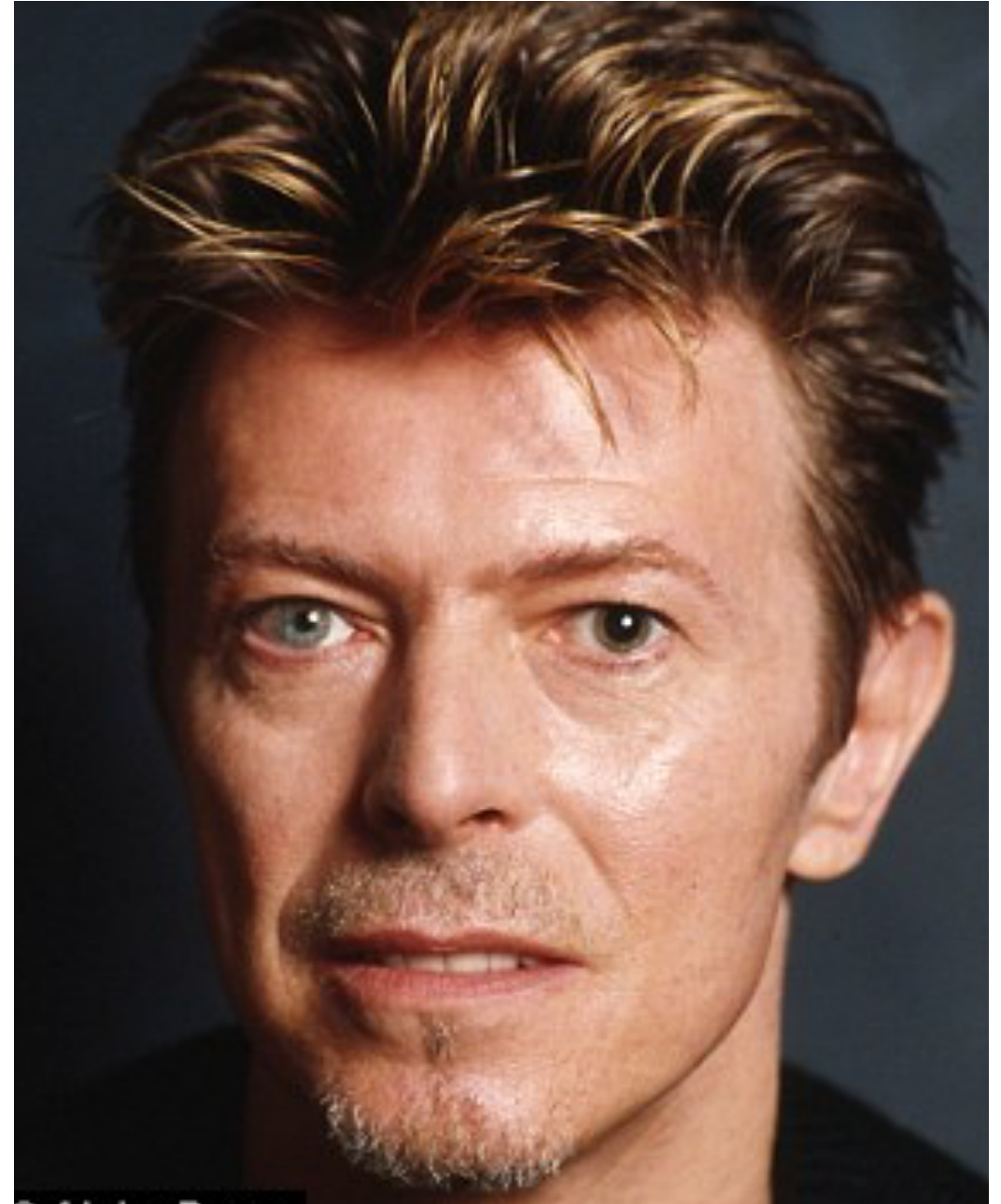
Traumatic Hyphema

- BED REST WITH BATHROOM PRIVILEGES
 - Re-bleed occurs 0-38% time and may occur 2 to 3 days after trauma
 - Associated with worse visual prognosis
- No aspirin or ibuprofen
- No reading
- No eye rubbing (Fox shield)
- Sleep with head elevated slightly
- Topical cycloplegic (strong cycloplegic)
- Topical steroid (Pred Forte 1%) every hour and taper
- B-scan if unable to view posterior segment



Traumatic Hyphema

- Long term complications:
 - Glaucoma
 - Accommodative impairment
 - Sphincter tears or dilation
 - Corneal staining
 - Lens dislocation, iridodonesis and/or phakodonesis
 - Traumatic optic atrophy



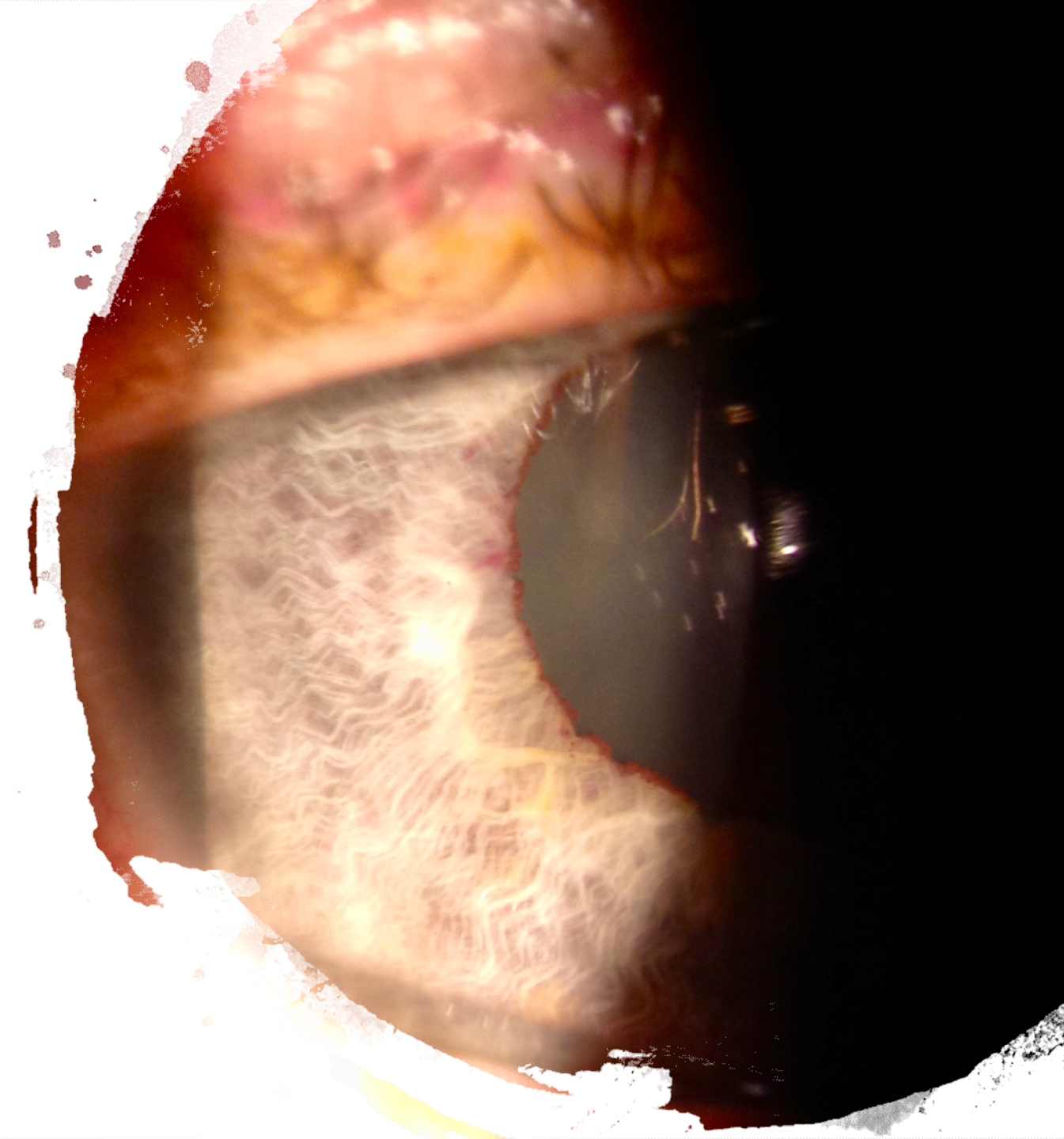
Traumatic Hyphema

ANYTHING THAT HIT THE EYE HARD ENOUGH TO
CAUSE A HYPHEMA, HIT IT HARD ENOUGH TO
CAUSE A RETINAL DETACHMENT

DILATED FUNDUS EXAM REQUIRED

Our Patient

- Treated with Durezol
 - Q2h and tapered
- Atropine 1% BID
- Bed rest, no ASA or ibuprofen
- Discussed possibility of permanent pupillary change and risk of angle recession



Case...Today

- BCVA 20/20 OD/OS
- Mid-dilated pupil OD
 - Glare – discussed tinted specs and or CL's
- Gonio – NO recession
- IOP 10 OD/OS

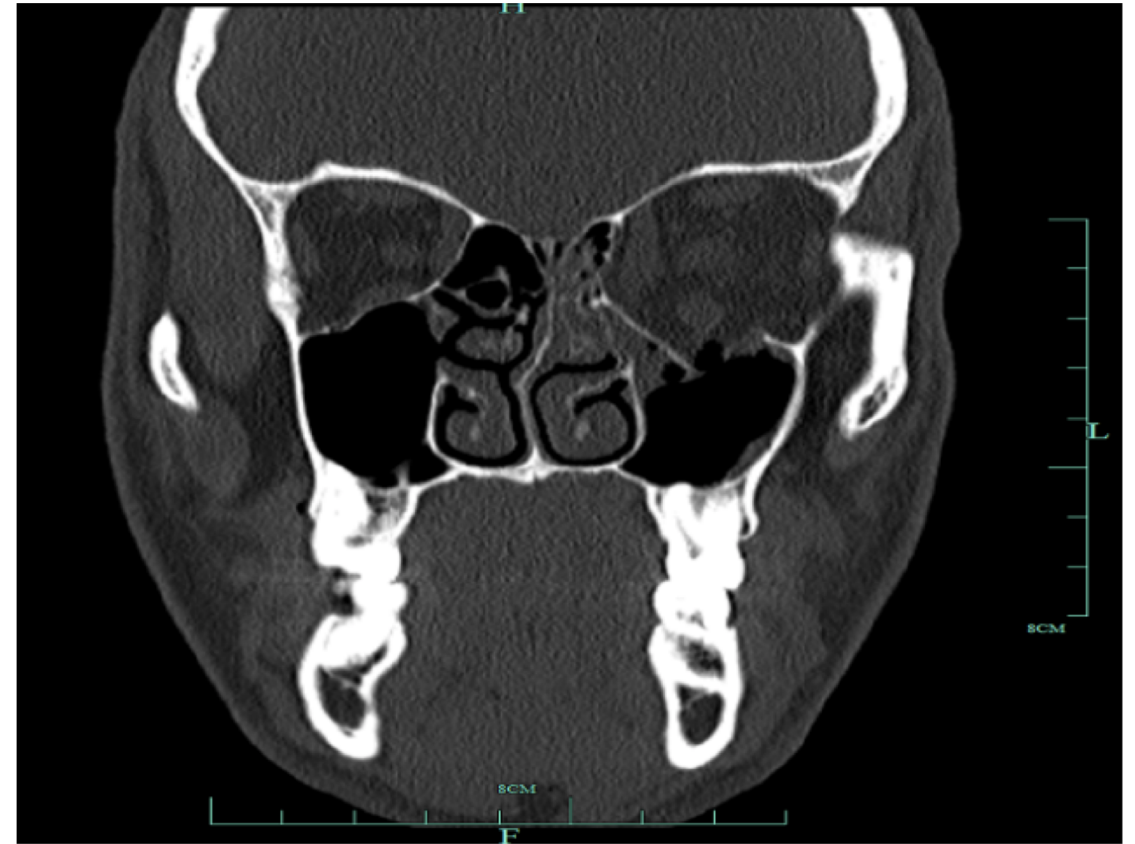
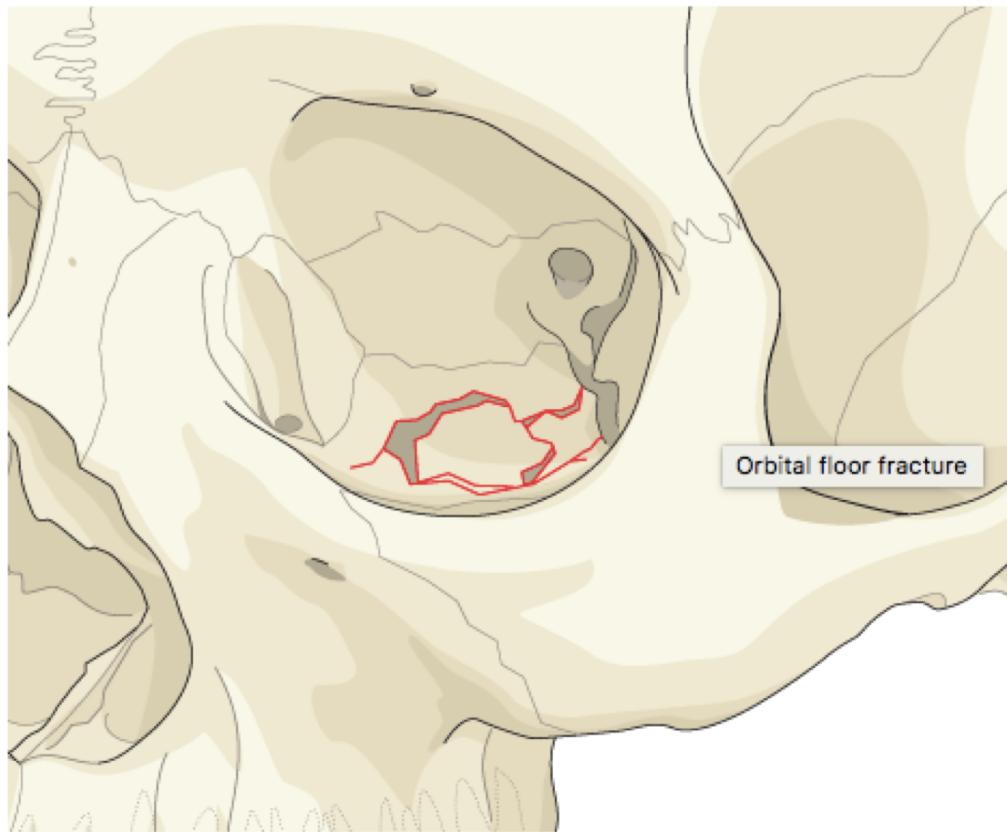


Case

- 23 YO HM – got into a fight and punched in the face
- C/O pain and redness OS
- His BCVA was 20/25
- Noted double vision on motility testing
- EOM demonstrated restriction in up-gaze



Orbital Floor Fracture



Clinical Signs

- Enophthalmos or globe ptosis
 - Obscured initially by surrounding tissue swelling
- Proptosis
 - Retrobulbar or peribulbar hemorrhage
- Diplopia
 - Muscle entrapment or tissue swelling
- Sensory disturbances along path of infra-orbital nerve
 - Hypoesthesia, Dysesthesia, or Hyperalgesia
- Lid edema or emphysema - connection of orbit to maxillary sinus
- Epistaxis and lid/orbital swelling when blowing nose

Orbital Floor Fracture...Exam

- Ocular adnexa (lacerations, edema)
 - Isolated floor fractures assoc. upper lid injury
- Visual acuity and pupils (r/o traumatic optic injury)
- EOM's (forced duction)
- Cover test in all positions of gaze
 - EOM entrapment – worse in up-gaze
- Exophthalmometry
- Infraorbital nerve evaluation – cotton wisp
- Anterior and posterior segment evaluation
 - 30% incidence ruptured globe with orbital fractures



Orbital Floor Fracture

- CT Scan to confirm (preferred over MRI for bony structures)
- INSTRUCT NOT TO BLOW NOSE
 - May use nasal decongestants
 - Head elevation
- Ice or cool compresses
- Photo-document
- May need oral steroids to reduce inflammation
- May need systemic antibiotics to prevent infection from sinuses (Keflex)

Surgical Indicators

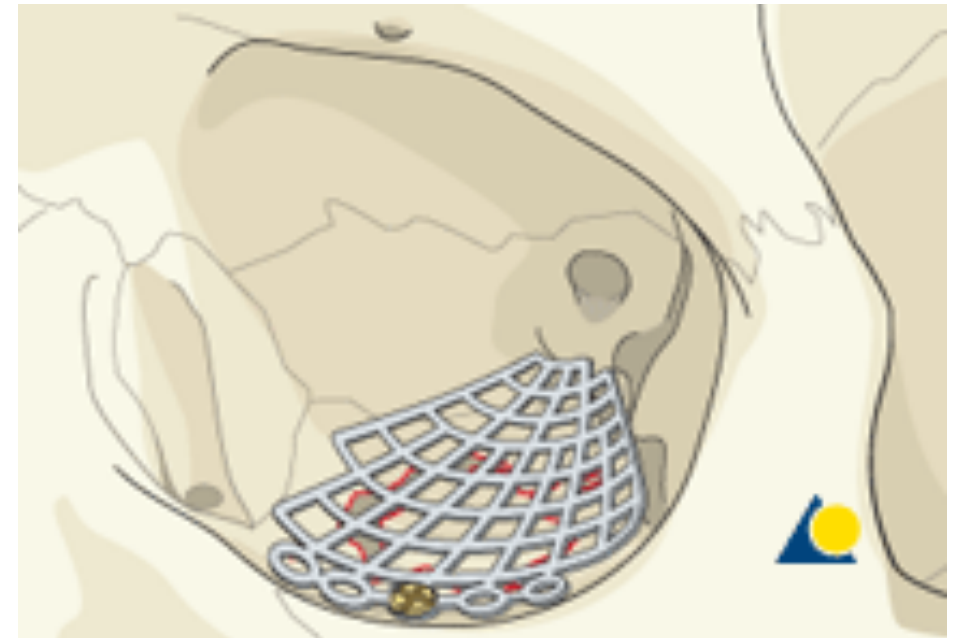


- Significant muscle entrapment confirmed on CT scan (and forced duction testing)
- Diplopia within 30 degrees of primary gaze
- Enophthalmos $> 2\text{mm}$ or cosmetically unacceptable beyond 2 week waiting period
- 50% or more of the orbital floor involved

Orbital Floor Fracture

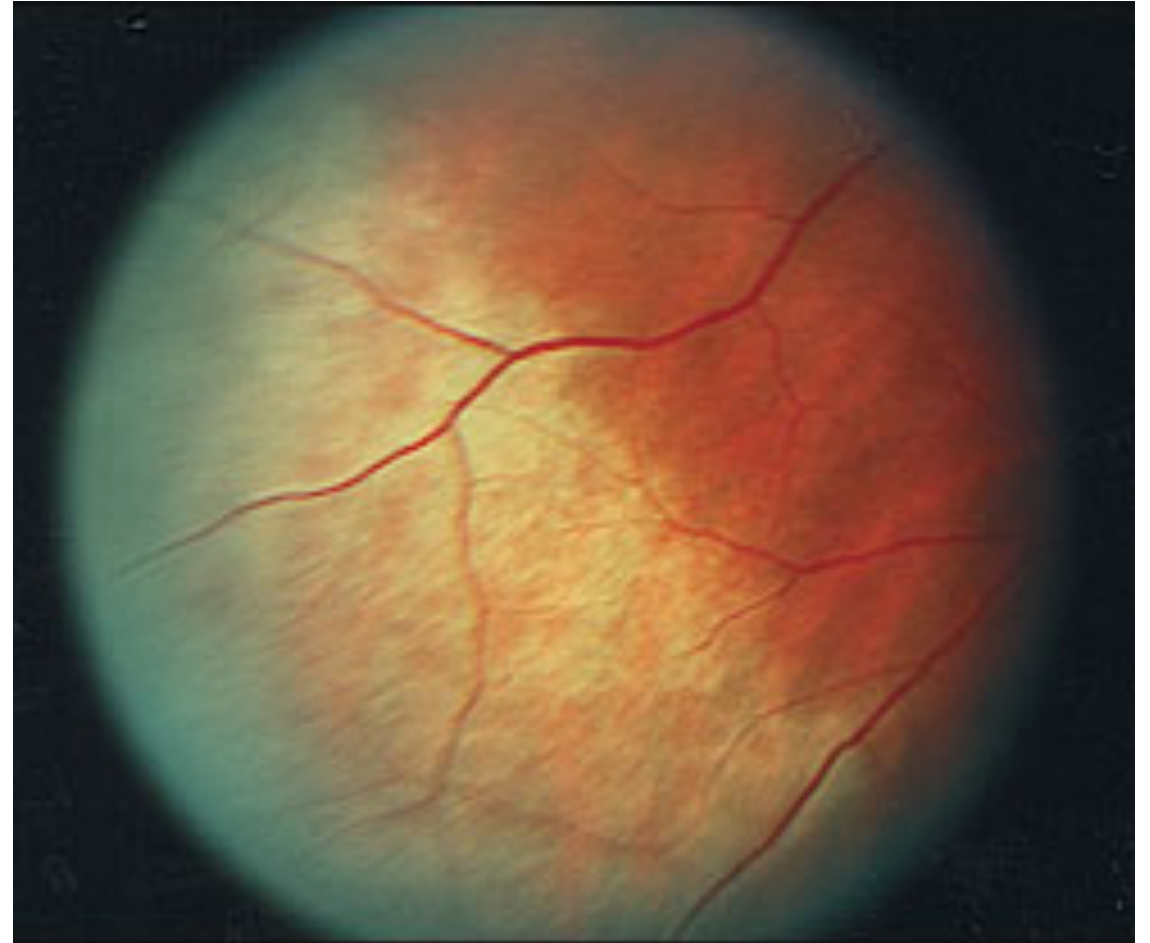
- Goal to maintain and restore best possible physiologic function and aesthetic appearance
- Consists of spanning floor defect with material to provide structural support and restore orbital volume
 - Rigid internal plates/clips
 - Synthetic biocompatible material
 - Autografts and cadaveric bone grafts
- Transconjunctival approach most common

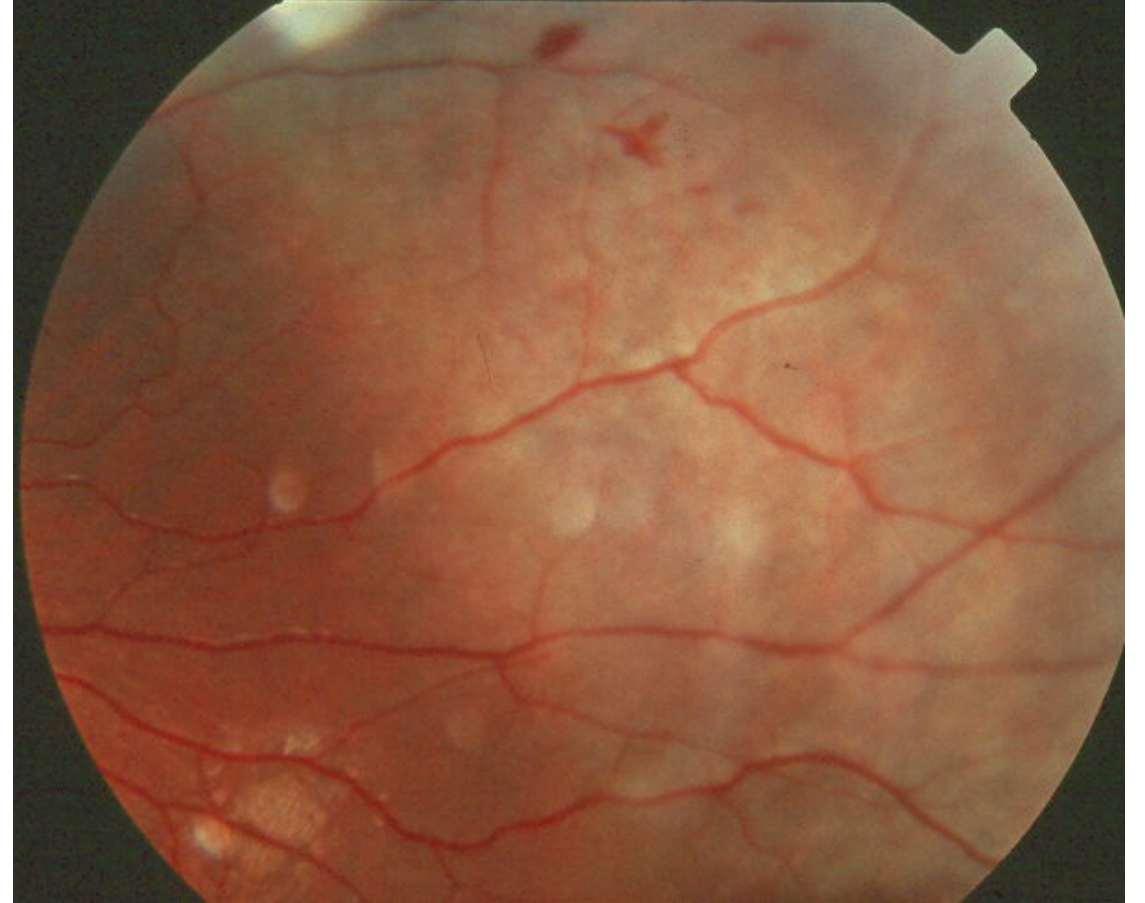
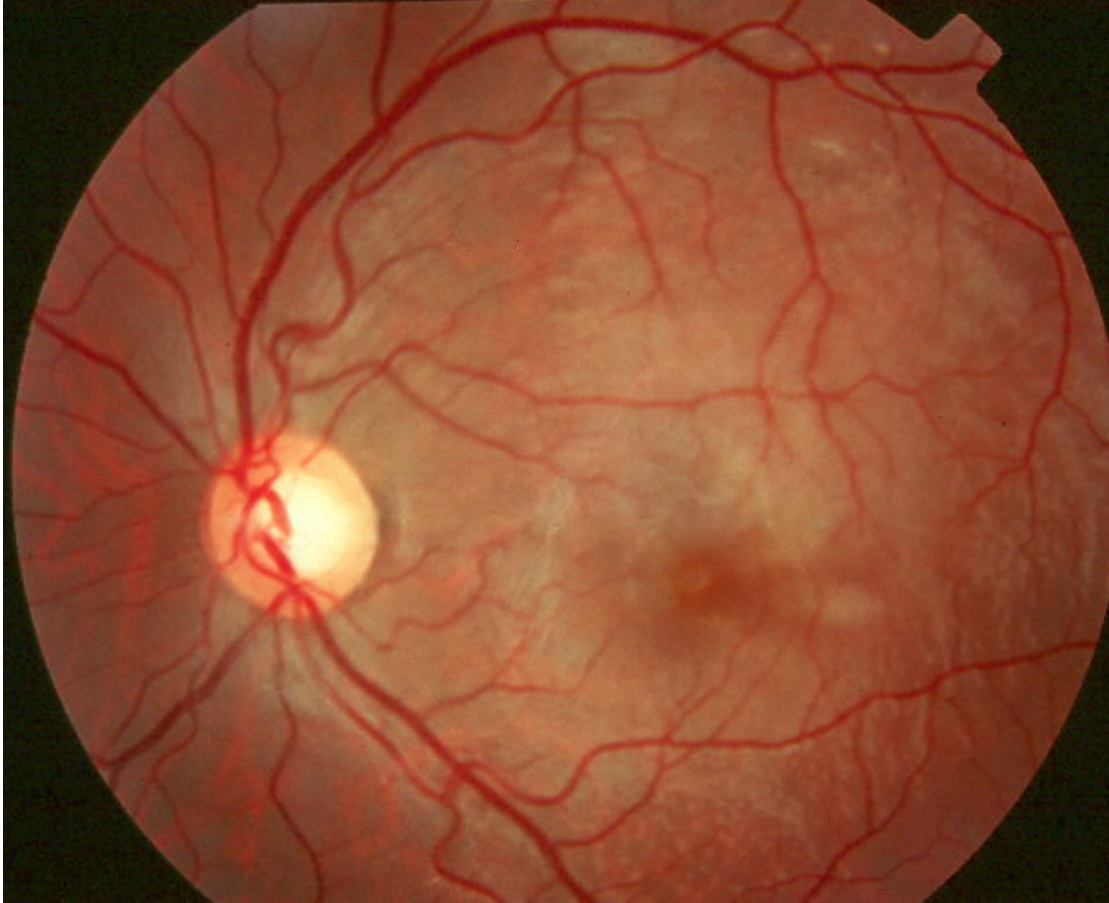
Warning sign of possible abuse



Commotio Retinae

- Berlin's edema
- Retina contusion injury
- Damage to the outer segment of the photoreceptors
- Concussive injury causes shearing and disorganization within photoreceptor layer
 - Extracellular edema?
 - Intracellular edema?
 - Photoreceptor outer segment disruption*
 - RPE damage*
 - Some reversible

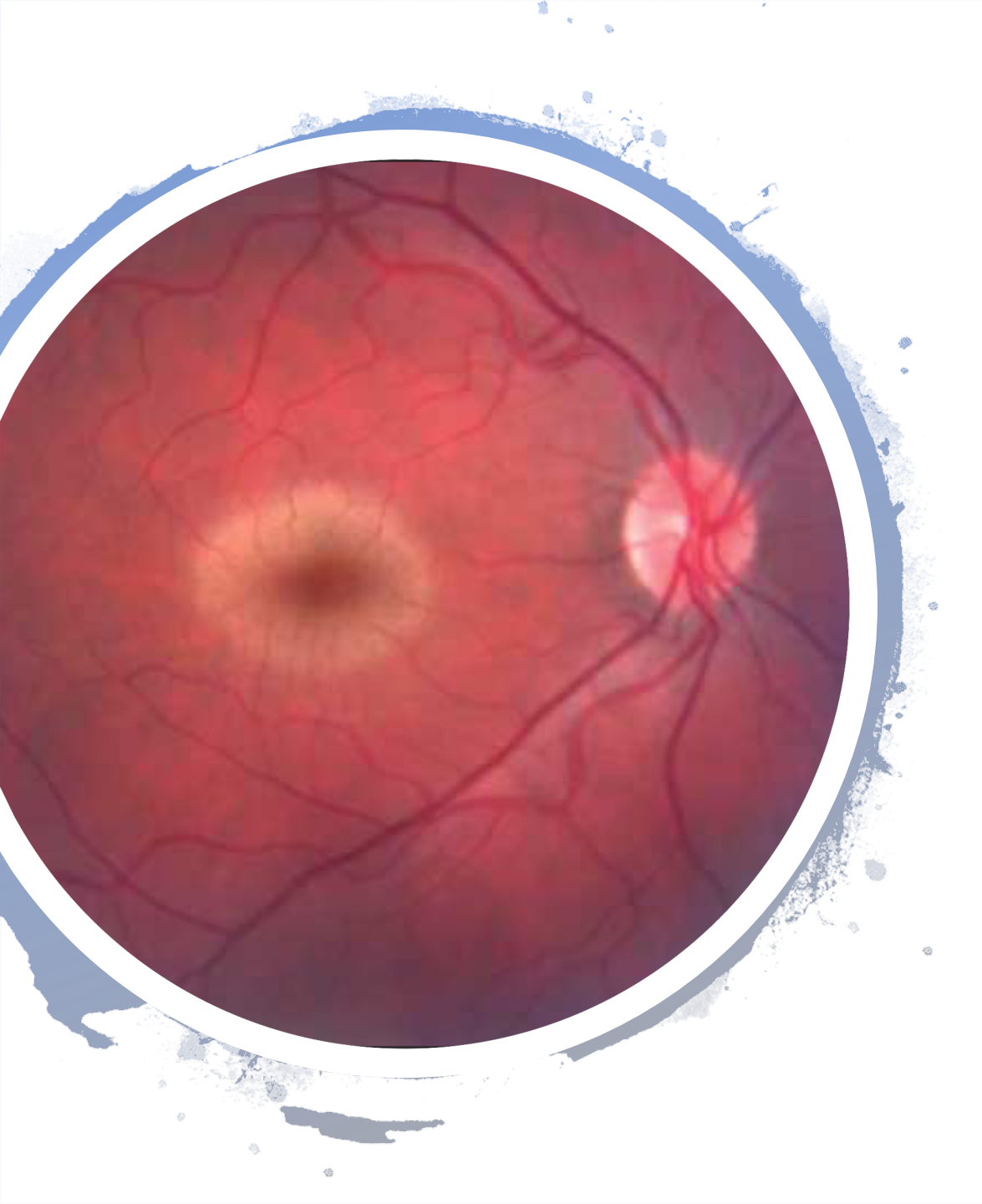






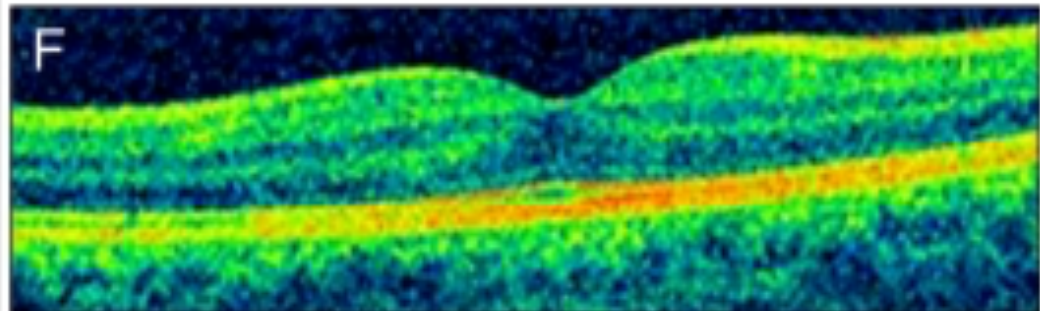
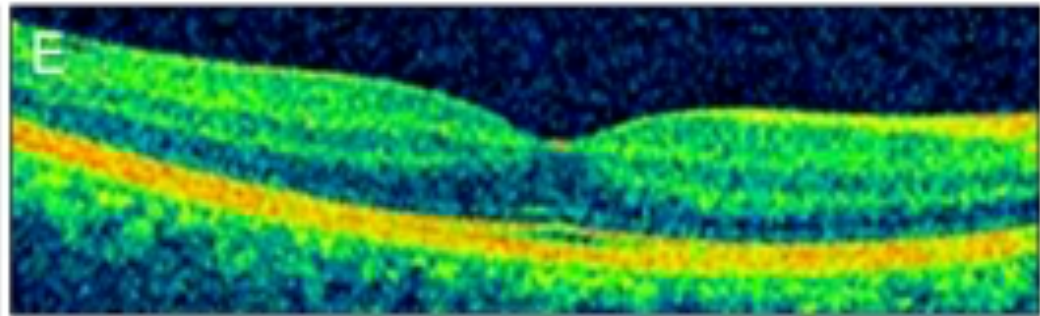
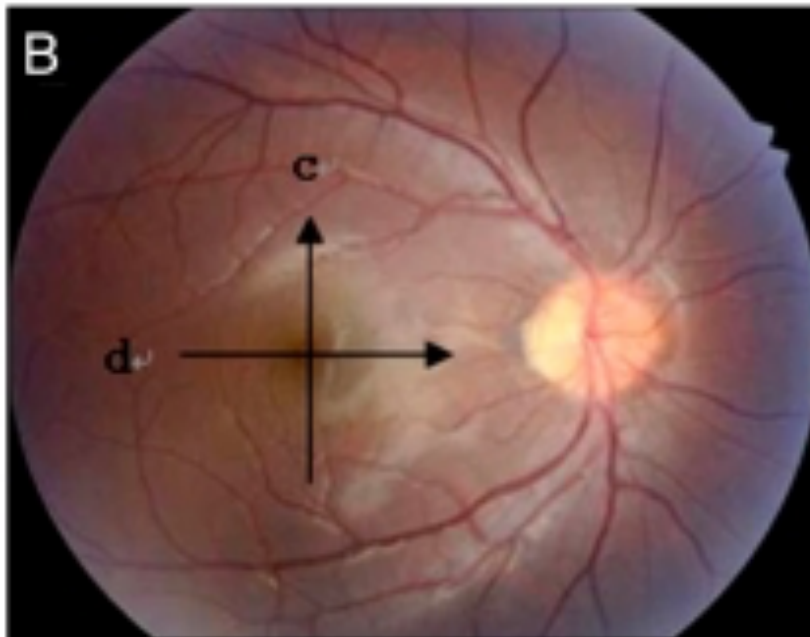
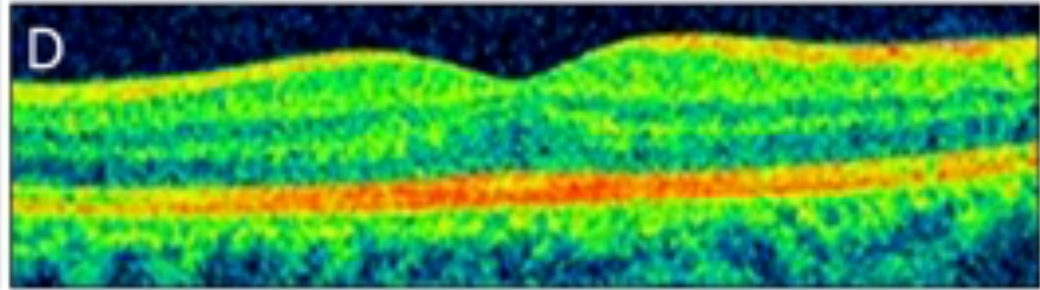
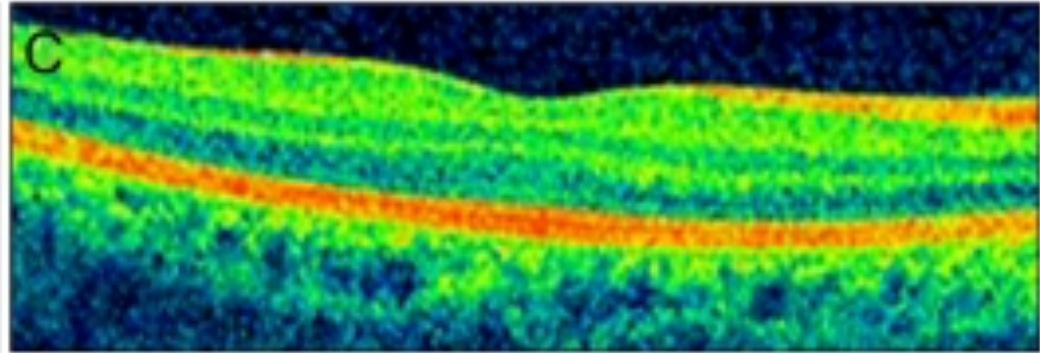
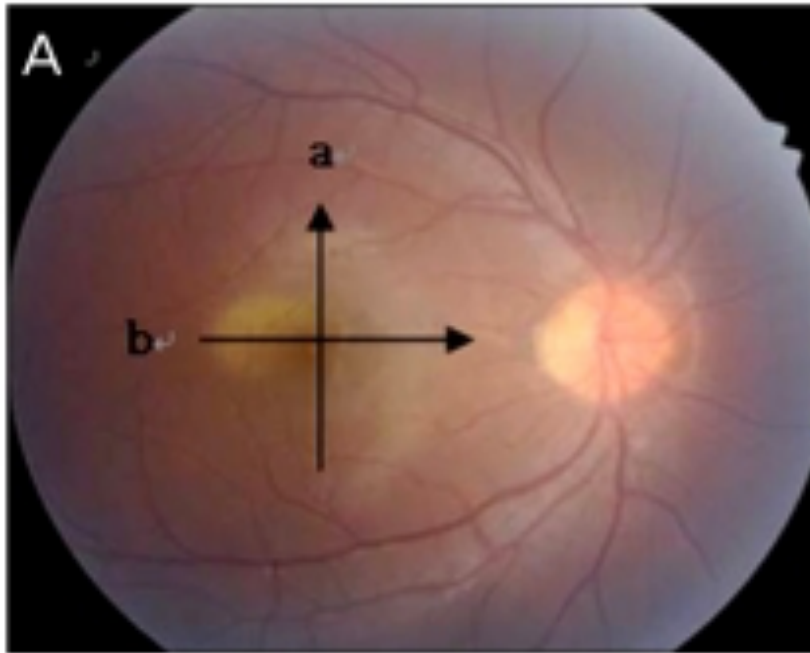
Commotio Retinae

- Peripherally - generally resolves quickly without treatment with excellent visual outcome
- Central Berlin's edema - rule out choroidal infarction or choroidal rupture
- Late complications: atrophy of fovea and RPE, macular hole



Commotio Retinae

- SD-OCT
 - Mild commotio hyper-reflectivity
 - May resolve completely or have residual atrophy
 - Later stage IS/OS layer disruption (ellipsoid portion)
- Centrally located commotio retinae
 - OCT
 - mfERG

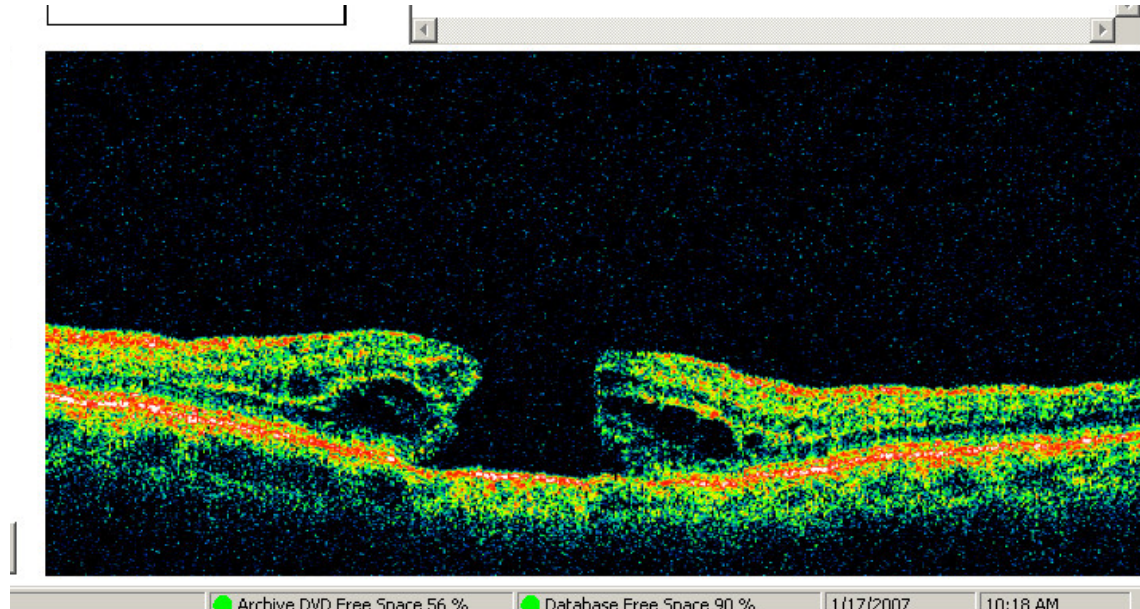


Traumatic Macular Hole

- Estimated incidence 1.4% closed globe injuries and 0.15% open globe injuries.
- Pathophysiology debated likely a contrecoup mechanism that occurs with acute axial compression of globe resulting in compensatory equatorial expansion, which increases vitreomacular traction forces.
- Children>Adults
- May occur in the absence of PVD
- May spontaneously resolve

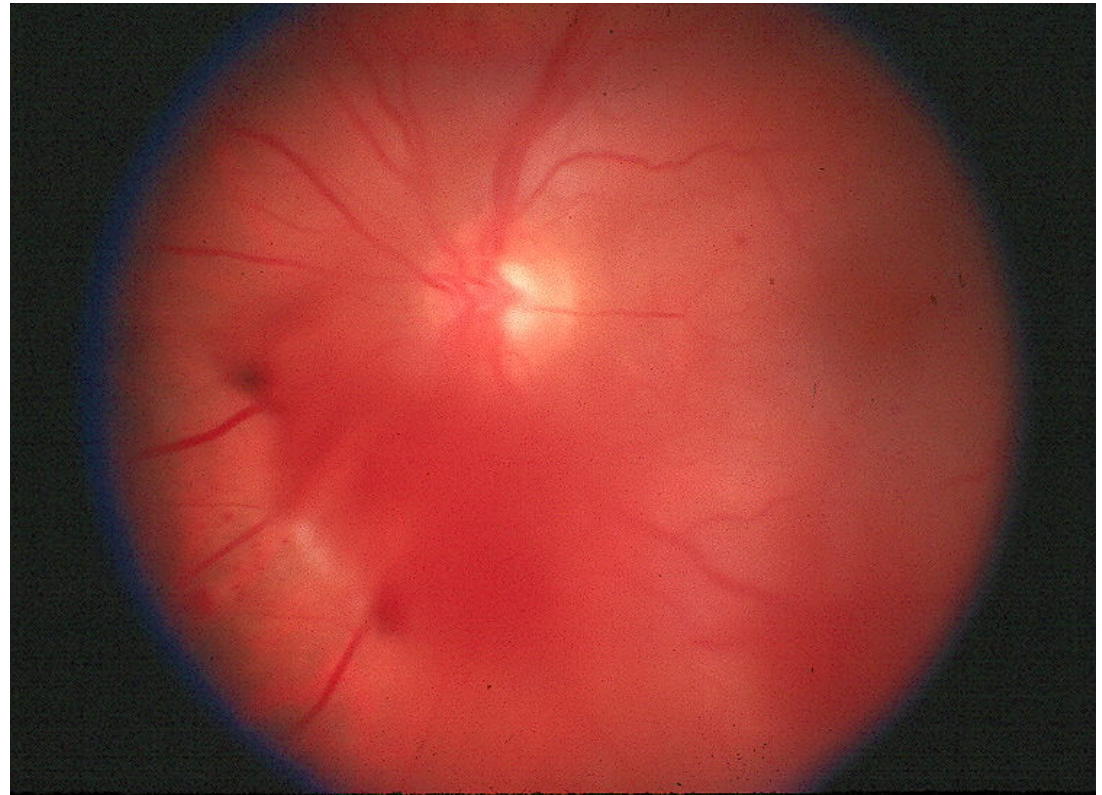
Traumatic Macular Hole

- Good success rates of closure following PPV
 - 70% closure rate in a single-center series of 23 eyes by (Amari et al)
 - 96% closure rate reported in a multicenter series of 25 eyes (Johnson et al)
- Composition of vitreous and adherence of vitreoretinal interface in pediatric/adolescent population may make the induction of PVD challenging, increasing the risk of complications
- Testing: OCT



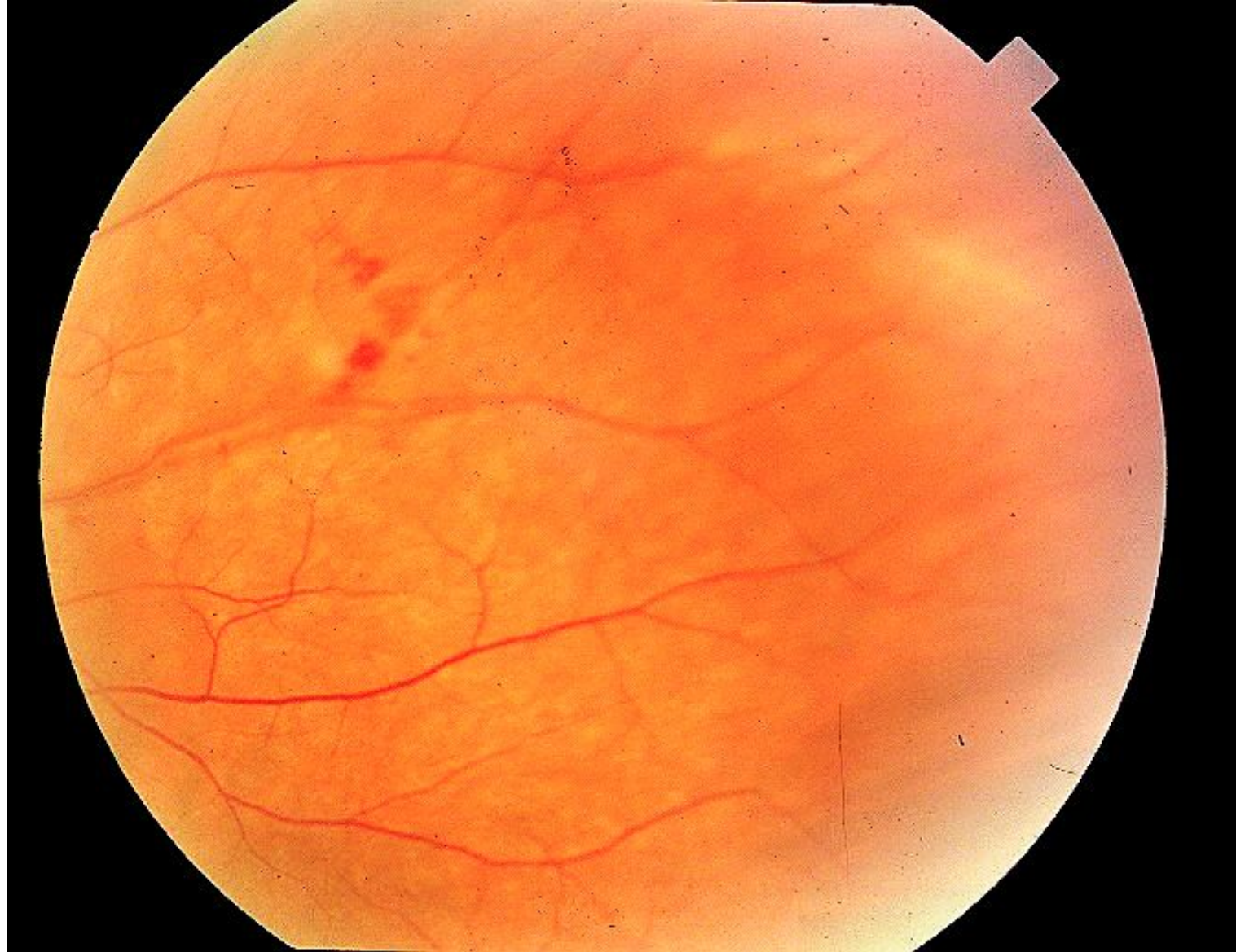
Case

- 62 YO female
- History of eye injury and complains of blurry vision following event
- BCVA CF OS
- No pain
- No APD
- No view of fundus



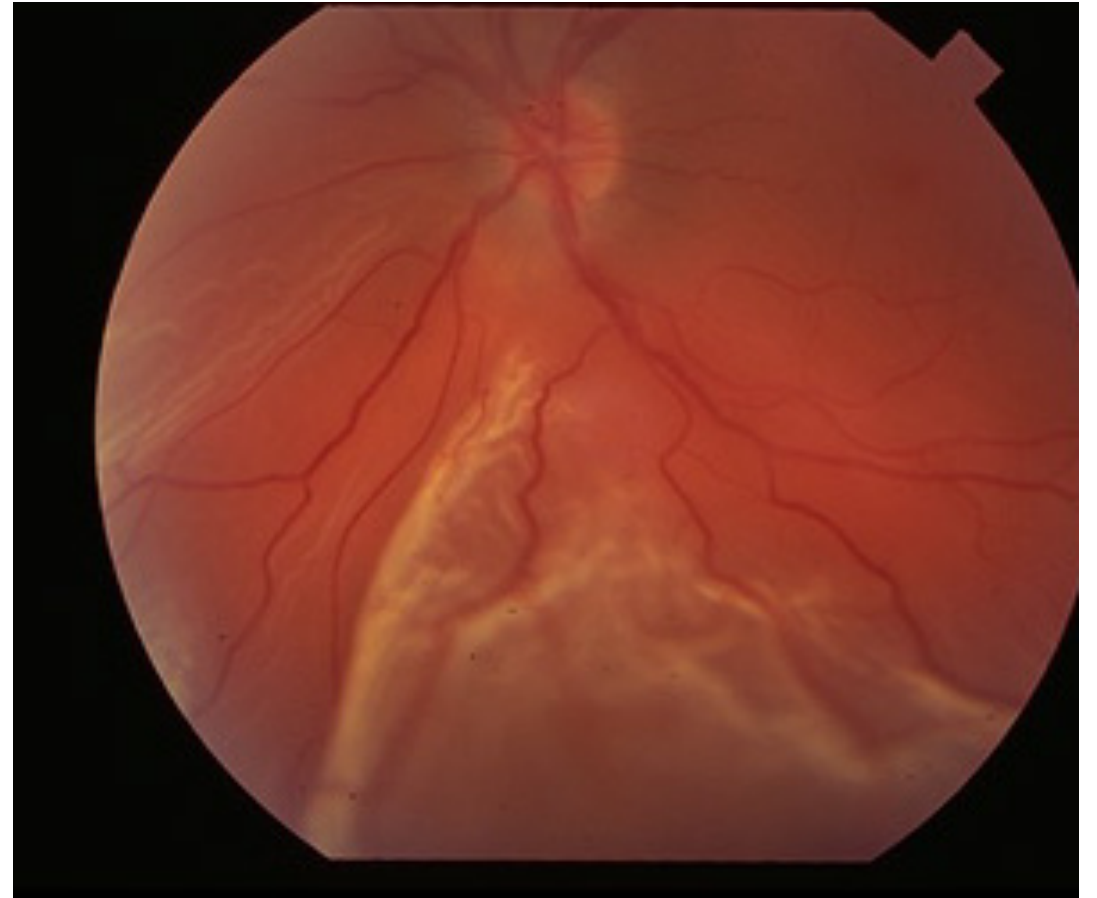
Vitreous Hemorrhage

- Poor visual outcome when associated with ocular trauma
- Retinal tear, PVD with tear of vessel
- Terson syndrome (rare): vitreous hemorrhage as a result of abrupt intracranial bleeding
- Leading cause of vitreous hemorrhage in young people is trauma
 - Shaken baby syndrome in infants
- B scan when fundus not visible
- Head elevation
- Avoid aspirin
- Surgical evacuation with vitrectomy and repair of associated retinal break or detachment



Rhegmatogenous Retinal Detachment

- Retinal break or tear which allows the vitreous to pass through the break and lift off the retina
- The most common type of detachment
- Type of RD associated with trauma
- Traumatic RD represents approximately 3% to 6% of all causes of RD in pediatric patients.
- Incidence of RD from trauma is approximately 2.5 per 100,000, and it is 4 times more common in males.





Trauma in Young Patient

- Presence of formed vitreous may result in slower development of the detachment, higher rates of proliferative vitreoretinopathy (PVR), a more challenging repair process, greater chance of macular involvement, and worse visual prognosis.

Traumatic RRD Repair

- Scleral buckle:
 - Breaks treated with cryotherapy or laser
 - Silicone band
 - Fluid may be drained or reabsorb on own
 - Vitrectomy: more often used for tractional RD
 - Vitreous removed and gas or oil replace
- Pneumatic retinopexy: superiorly located, requires head positioning, tears treated with laser or cryo before/after procedure.



RRD Repair

Silicone oil retention sutures and iridoplasty

Long-acting gas and silicone oil both viable tamponade agents.

Poor compliance with positioning in the pediatric patient population may influence surgeon choice toward silicone oil.