Ocular Trauma: Triage & Treatment

COPE ID # 21554-SD
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1

800-lb. Magnet Treats Eye Injury

AN EYE magnet so powerful that it will pull a flatiron across a room has recently been installed in a Minneapolis, Minn., hospital to remove steel cinders from patients' eyes. It is the largest eye magnet in the world and weighs over 800 pounds. One and one-half miles of copper wire are wound in the apparatus, which uses a 220-volt current.

This huge magnet contains 1½ miles of copper wire and is used to draw steel cinders out of the patient's eyes.

4

Why Should We Care?

U.S. Eye Injury Registry:

- 2.4 million eye injuries yearly in the U.S.
- Leading cause of monocular blindness
- Second leading cause of visual impairment (cataract 1st)
- One third of eye injuries in children → permanent visual deficit

USEIR, September, 2008

7

Speaker Disclosures

- Alcon Speakers Bureau
- InSpire Speakers Bureau
- Bausch & Lomb Speakers Bureau
- Clinical Investigator, Bausch & Lomb

2

Significance

- According to Gallup polls, eye injury is the most feared disability
- Approx. 75% of information from the outside world comes from our eyes
- Half of the human cortex is dedicated to vision
- Prevention is **much** more effective than treatment

5

Epidemiology of Ocular Trauma

- Socio-economic factors
  - Rural/Agricultural – 32% result in legal blindness
  - Alcohol abuse
- Age
  - Young > Old, (Av age 30); blindness greater in old
- Gender
  - Males 80% (4.6:1 males:females)
- Education
  - Inversely proportional

Kuhn & Pieramici, *Ocular Trauma*, 2002

8

"So much for his new glasses... he didn't see that coming!"

3

6

Epidemiology of Ocular Trauma

- 25% eye injuries occur in the workplace
  - cost over $450 billion annually
- 2001 workman's comp claims due to eye injury… $924,840,000
- 90+% result from *not wearing proper eye protection* at the time of injury

US Bureau of Labor Statistics, May 5, 2008

9

Cornea

- Small irregularities can result in significant loss of vision function
- Cornea is involved in >50% of all serious ocular trauma reported in the U.S.
- 83% corneal injuries involve males
- 52% corneal injuries involve full-thickness lacerations

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Telephone Triage

- Your front office staff MUST be able to "triage" complaints
- Documentation !

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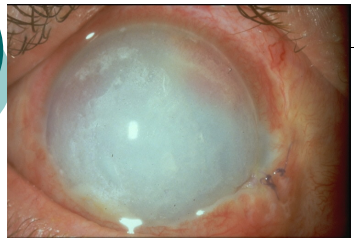

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11

CATAGORIES

- True Ocular Emergencies
  - Requires care in minutes to hours
- Acute Urgencies
  - Requires care within 6-12 hours same day
- Subacute Urgencies
  - Requires care within 12-24 hours
- ASAP
  - Care within 24 hours

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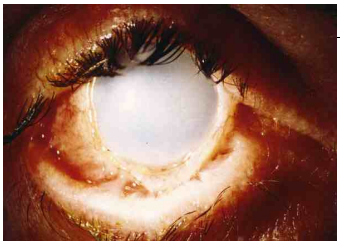

17

What's Our Job?

- Recognize full extent of the injury
- Triage appropriately
- Initiate appropriate care/counsel/referral
  - Correct and complete diagnosis
  - Patient education, prognosis
  - Timely referral

12

TRUE EMERGENCIES !

- Requiring care within minutes to hours to save the eye and/or vision
- Chemical/alkaline burns
- CRAO
- Sudden loss of vision with or w/o trauma
- Flashes and floaters
- Post-surgical red eye/VA loss/pain
- High velocity projectile injury
- Orbital cellulitis

15

URGENCIES

- Endophthalmitis
- Penetrating injuries
- AACG
- Pupillary block glaucoma
- Orbital cellulitis
- Cavernous sinus thrombosis
- Corneal ulcer
- K foreign body
- K abrasion
- Acute anterior uveitis
- Acute retinal tear
- Acute RD
- Hyphema
- Lid laceration
- Acute vitreous hemorrhage

18

Acute Urgencies

- Requires care within 6-12 hours same day
- AACG
- Blunt ocular trauma with or without vision loss
- Severe corneal pain associated with CL wear

19

Subacute Urgencies

- Requires care within 12 to 24 hours
- K abrasion (vs. K laceration)
- K foreign body
  - Must r/o penetrating injury
- Dull aching pain without vision loss

22

Retinal Detachment

- Macula on or off?
- If macula on, stat refer to retinal surgeon
  - Instruct patient NPO
- If macula off
  - How long has the macula been off?
  - Good outcome for good VA is off <24 h
  - Macula off longer than 1 week – no real sense of urgency
  - Refer within 24 – 48 hours

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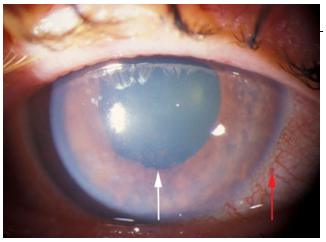

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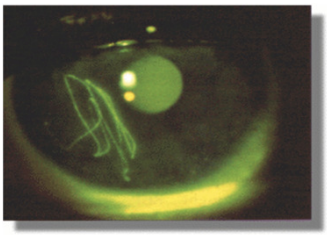


23

Ocular Trauma Examination

Careful and complete history!!

26

21

ASAP

- Painful lesion
- Insidious painful eye
- New onset diplopia

24

History

- How did the injury occur?
- What are the circumstances surrounding the injury?
- Has the injured eye had any prior eye surgery?

27

Ocular Trauma Examination

- Physical Examination
  - Gross exam of head, eyes, ears, nose, face
  - Blood pressure and pulse rate
  - Review of systems
  - Medical history
    - including tetanus vaccine status
  - HPI
    - changes in vision, eye pain, swelling, discharge, etc.

28

Types of Ocular Trauma

- Mechanical
  - Superficial corneal/conj abrasions
  - Corneal/conj/scleral foreign bodies
  - Blunt and penetrating injuries
- Chemical
- Thermal
- Combination

31

BETTS Terminology

- **Rupture**: Full-thickness wound of eyewall, caused by *blunt* object
  - eyewall yields at its weakest point to momentary increase in IOP, "inside-out" mechanism

34

Ocular Trauma Examination

- Unaided and pinhole acuities in BOTH eyes
- Topical anesthetic if necessary
- If chemical exposure
  - begin emergency treatment before VA
- Pupils and EOMs
- Lids and orbits
- Anterior segment
- IOP
  - unless ruptured globe
- DFE
- B-scan
  - if indicated

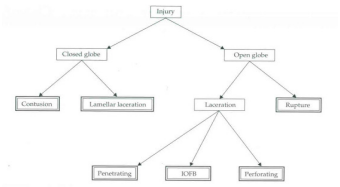
29

Birmingham EyeTrauma Terminology System (BETTS)

- **Eyewall**: Sclera and cornea
- **Closed globe injury**: No full-thickness wound of eyewall
  - **Lamellar laceration**: Partial-thickness wound of eyewall, created by a *sharp object*
  - **Contusion**: tissue damage created by energy of *blunt force trauma*
  - **Superficial foreign body**

32

Birmingham Eye Trauma Terminology System



35

Methods to Reduce Anxiety

- Reassure the Patient you can help him/her
- Explain procedures in advance, esp. to children
- Never patch both eyes unless both eyes are injured
- Place the Patient in a calm, quiet setting
- Be mindful of Patient's privacy/modesty
- Be realistic, but not overly pessimistic about potential outcomes; impart a sense of hope and optimism (but never lie!)
- Explain in such a way the Patient understands the extent of injury; deliver the message with compassion and candor

30

BETTS

- **Open globe injury**: Full-thickness wound of eyewall
  - **Laceration**: Full-thickness wound of eyewall, caused by *sharp* object
    - wound at impact site, "outside-in" mechanism
      - **Penetrating injury**
        - Entrance wound only – corneal foreign body
      - **Perforating injury**
        - Entrance and exit wound, both caused by same agent – IOFB

33

Classification of Ocular Trauma

4 categories of globe injury at initial examination:

- Type
- Grade
- Presence or absence of APD
- Extent (zone) of injury

36

Classification of Ocular Trauma

TABLE 2–2 CLOSED GLOBE INJURY CLASSIFICATION

Type
- A. Contusion
- B. Lamellar laceration
- C. Superficial foreign body
- D. Mixed

Grade (Visual acuity)
- A. ≥20/40
- B. 20/50 to 20/100
- C. 19/100 to 5/200
- D. 4/200 to light perception
- E. NLP

Pupil
- A. Positive, relative APD in injured eye
- B. Negative, relative APD in injured eye

Zone (see Fig. 2–2)
- I. External (limited to bulbar conjunctiva, sclera, cornea)
- II. Anterior segment (includes structures of the anterior segment and the pars plicata)
- III. Posterior segment (all internal structures posterior to the posterior lens capsule)

37

Classification of Ocular Trauma

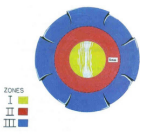


FIGURE 2–1 Zones for open globe injury. Zone I, wound involves only cornea. Zone II, wound extends into anterior 5 mm of sclera. Zone III, wound involves sclera extending more than 5 mm from the limbus.

40

Corneal Abrasion

- One of the most common globe injuries
  - 10% of new patient ER visits
- Frequently accompanies deeper ocular trauma
- Results when basal epithelial cells are removed from the basement membrane
- Scarring occurs if Bowman's layer is breached
- Source of corneal epithelial restoration is believed to be limbal stem cells at the corneoscleral junction
  - damage to these cells result in healing problems

43

Classification of Ocular Trauma

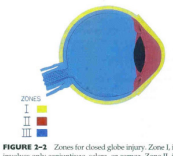


FIGURE 2–2 Zones for closed globe injury. Zone I, injury involves only conjunctivae, sclera, or cornea. Zone II, injury to structures in the anterior chamber including the lens and zonules. Zone III, injury to posterior structures including the vitreous, retina, optic nerve, choroid, and ciliary body.

38

Recommended Timing of Intervention

Timing	*Condition*
Absolute emergencies	Chemical injury (alkali > acid)
	ECH
	Appearance of intraocular gas bubble†
	Orbital abscess
	Vision loss due to expanding orbital hemorrhage
Urgent	High-risk IOFB
	Endophthalmitis
≈24 hours	IOFB‡
	Open wounds requiring surgical closure
Within a few days (24 to 72 hours preferred)	Medically uncontrollable IOP elevation in the presence of hyphema
	Medically uncontrollable IOP elevation as a result of lens injury
	Retinal detachment
	Thick submacular hemorrhage
Within 2 weeks	IOFB‡
	Secondary reconstruction if retina is detached
	Media opacity in the amblyopic age group

ECH = Expulsive Choroidal Hemorrhage

41

Corneal Abrasion

- Symptoms appear out of proportion to the severity of the injury
- Photokeratitis (UV-induced corneal damage, welder's burn) presents with similar symptomology to abrasion, but symptoms are delayed 6-12 hours post-exposure
- Topical antibiosis (4GFQ), NSAID and cycloplegia the preferred tx. PO analgesia. Bandage CL ?
- RTC 24 h

44

Classification of Ocular Trauma

TABLE 2–1 OPEN GLOBE INJURY CLASSIFICATION

Type
- A. Rupture
- B. Penetrating
- C. IOFB
- D. Perforating
- E. Mixed

Grade (Visual acuity)
- A. ≥20/40
- B. 20/50 to 20/100
- C. 19/100 to 5/200
- D. 4/200 to light perception
- E. NLP

Pupil
- A. Positive, relative APD in injured eye
- B. Negative, relative APD in injured eye

Zone (see Fig. 2–1)
- I. Cornea and limbus
- II. Limbus to 5 mm posterior into sclera
- III. Posterior to 5 mm from the limbus

39

Mechanical Injuries

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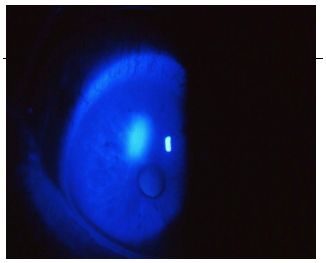

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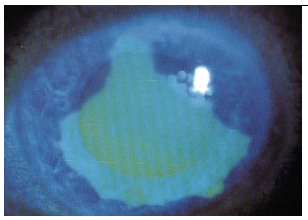

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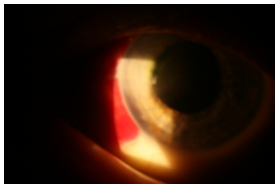
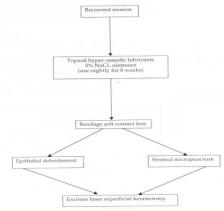
Man vs. weedeater



49

RCE Flowchart



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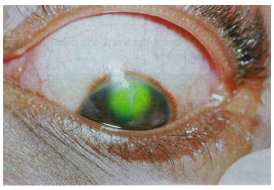
Corneal Abrasion



47

Recurrent Corneal Erosion

- 7-8% of corneal abrasions result in RCE
- RCE represents abnormal adhesion in the base of the epithelial defect
- Especially common if injury involves:
  - Fingernail
  - Paper cut
- Classic AM syndrome

50

Corneal Foreign Bodies

- Represent 40% of eye injuries
- Strong association with high-risk activities without safety Rx – hammering, welding, grinding
- R/O any intraocular material
- Remove superficial FB with FB spud or 30-gauge needle, cycloplege, topical Ab and NSAID

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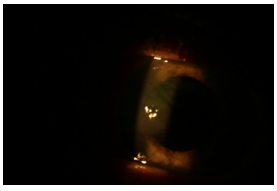
Man vs. Weedeater



48

Recurrent Corneal Erosion

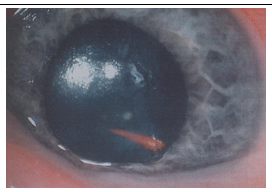
51

Corneal Foreign Bodies

- Symptoms are frequently out of proportion to severity of injury
- Determine depth with thin optic section, esp. for transparent FB – glass or plastic . R/O self-sealing lacerations
- To ensure no corneal perforation/IOFB: Seidel's, Gonioscopy, DFE
- Deep stromal FB: Leave in place if inert, small, non-toxic/antigenic, non-vegetative

54

Full-Thickness Corneal Foreign Body



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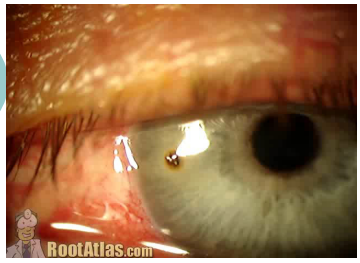


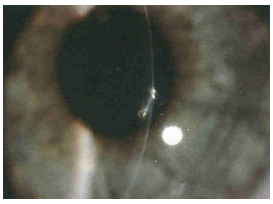
58

Intraocular Foreign Body

- Intraocularly retained projectiles
- History is crucial diagnostic tool
- Primary purpose in detection is to prevent associated conditions (endophthalmitis, RD)
- MRI safety with metallic foreign bodies is still controversial; CT preferred imaging modality

61

Corneal Foreign Bodies



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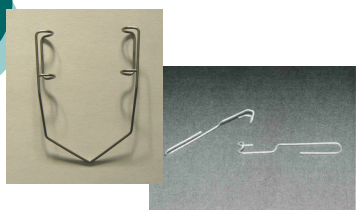
Corneal Foreign Bodies



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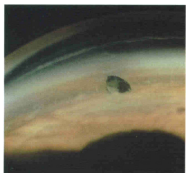
Intraocular Foreign Bodies



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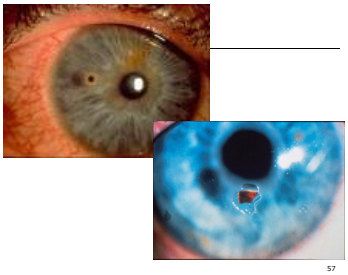

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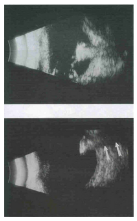
Don't Forget the Conjunctiva !

60

Photo courtesy Mamta Somaiya, MD

63

Intraocular Foreign Bodies



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67

Corneal Lacerations

Lens opacification suggests injury to deeper intraocular tissues

70

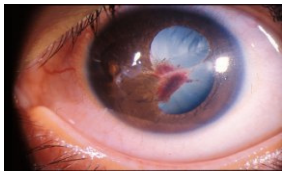
Corneal Lacerations

- Determine partial or full-thickness
- Check IOP, if possible
- If cannot check IOP, evaluate AC depth compared to fellow eye

65

68

Corneal Laceration with Iris Damage



71

Corneal Lacerations

- Small, self-sealing
  - topical antibiotic
- Large, self-sealing
  - bandage CL or corneal glue + Ab
  - suture if high risk of reopening
- Flaps
  - in place → bandage CL + Ab
  - displaced → flap repositioned, sutured in place
  - if epithelial ingrowth → flap debridement + BCL

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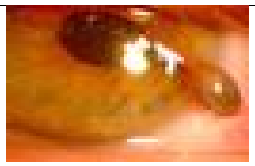

69

Scleral and Corneoscleral Injuries

- Traumatic corneoscleral defects occur:
  - acutely from traumatic event
  - secondarily from tissue necrosis of post-traumatic inflammation/infection
  - most always require surgical intervention
    - Suturing or patching
- Management goals:
  - restore integrity of globe
  - avoid further injury to ocular tissues
  - prevent corneal scarring and astigmatism

72

Case #1

- 32 year-old mechanic
- Fan belt broke and hit OD 15 min. ago (no safety glasses)
- VA OD 20/200 PHNI, OS 20/20
- SLE: Corneal, scleral and lid lacerations, distorted pupil OD
- What do you want to know next?
  - Presence or absence of APD OD

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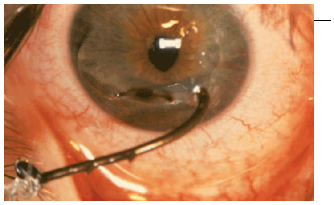
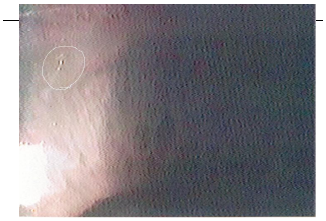


Man vs. Fishhook

76



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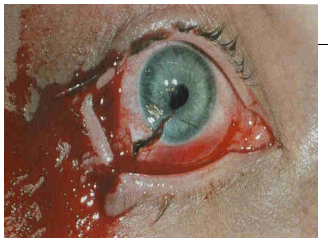


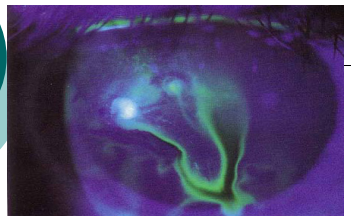
74

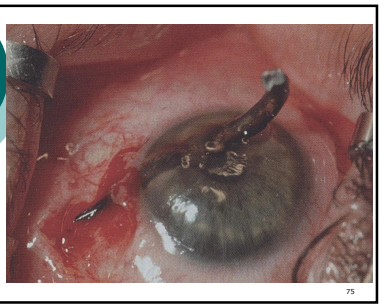
Scleral and Corneoscleral Injuries

Role of the O.D.:

- Recognize the full extent of injury
- If questionable, treat as open globe
  - tissue prolapse is diagnostic
- If appropriate, exclude or confirm presence of IOFB
- Institute medical therapy if indicated prior to surgical evaluation

77





75

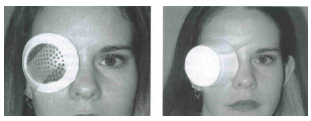
Open Globe Injury

- Signs that suggest the presence, or possibility of open globe trauma include:
- Obvious open wound
- Collapsed or severely distorted eye
- Prolapsed uveal tissue
- Peaked pupil
- SCH with shallowing, or deepening of the AC
- Ocular hypotony

78

Global Rupture (Open Globe Injury)

If global rupture is suspected, protect globe and orbital adnexa… *Never patch!*



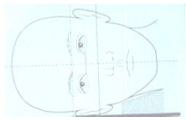
81

Global Rupture (Open Globe Injury)

- *Protect the eye with a rigid cover (not a patch!)*
- *Do not instill any eye medications before evaluation by oculo-plastic specialist*
- *Oculo-plastic specialist will order imaging studies*
  - *X-ray with Caldwell, Waters and Lateral views*
  - *CT scan with axial, coronal and sagittal views*

82

Lateral (Sagittal) View



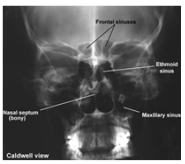
85

Blunt Force Trauma Eye Injuries

- Eye is struck with a solid object
- Extent of injury is dependent on size and speed of object
  - Smaller the object, greater the velocity
  - Small solid objects traveling at high speeds can cause global rupture (e.g., BB's, paintballs)

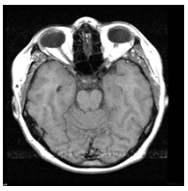
88

Caldwell (Coronal) View



83

Axial View



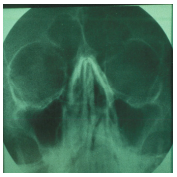
86

Case # 2

- 34-year-old attorney attending New Year's Eve party
- His law partner shouts, "Watch this!"
- Young attorney turns to "watch this"…

89

Waters View



84

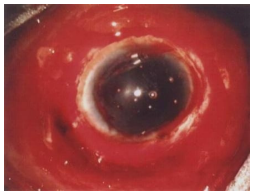
Blunt Force Trauma

87

Case # 2

90

Case # 2



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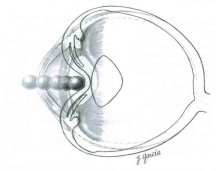
94

Blunt Force Trauma Eye Injuries



97

Sub-Conjunctival Hemorrhages

- SCH w/ superficial conj *abrasion*, good VA
  - antibiotics and analgesics
- SCH w/ superficial conj *laceration*, good VA
  - reorganization of conj, possible suture with topical antibiotic
- Suspect posterior globe rupture if conjunctival abrasion/laceration accompanied by:
  - lid swelling
  - extensive SCH ("jelly roll")
  - deepened AC
  - poor VA
  - APD

92

Mechanisms of Blunt Ocular Trauma

- Coup
  - Initial force produced at point of impact
- Contracoup
  - Shock wave transmission through ocular structures
- Equatorial expansion
  - Equator expands and distorts normal ocular architecture
- Global repositioning
  - Compression and indentation at moment of impact, damaging internal ocular structures

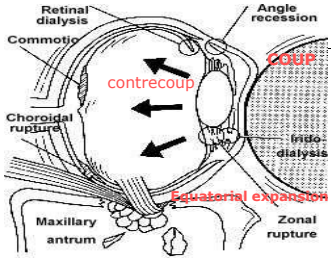
95

Traumatic Iritis

- Inflammatory reaction of the iris or CB
- Commonly seen after blunt trauma
- Pain, photophobia, epiphora
- May not present until 2-3 days post-trauma

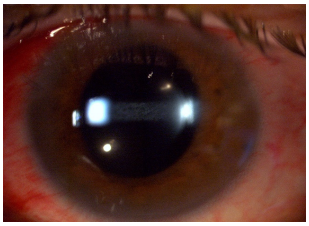
98

93



96

Traumatic Iritis



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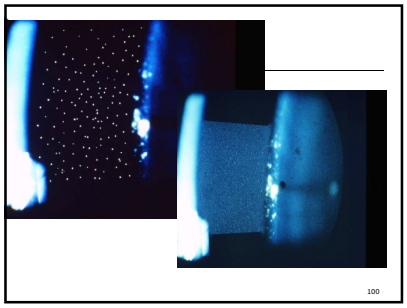
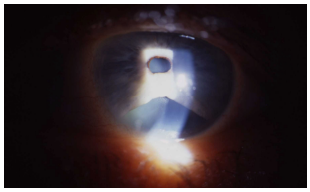


100

Iridodialysis

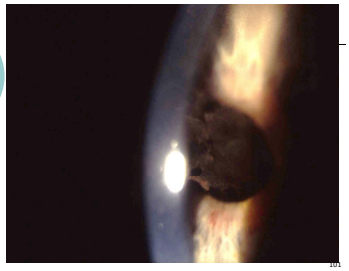


103

Case # 3

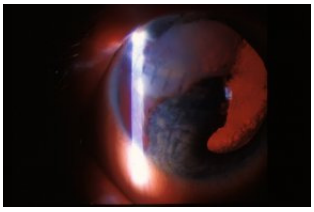
- 12-year-old boy gets paintball gun for Christmas
- Parents ignore Dr. Mason's article in *Southern Medical Journal* and allow Junior to play war games in wooded area behind their home
- Moderate discomfort, photophobia OS
- Entering unaided acuities:
  - OD 20/20
  - OS 20/100 PHNI
- SLE OS reveals…

106



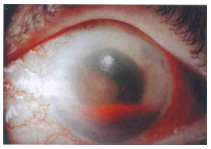
101

Iris Sphincter Rupture



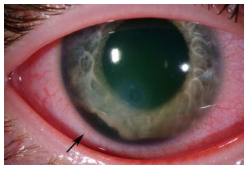
104

Case # 3



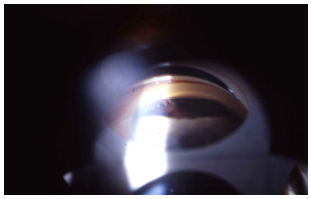
107

Iridodialysis



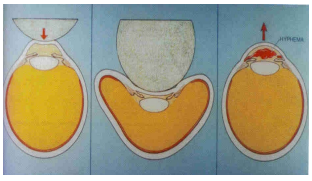
102

Iridodialysis



105

Hyphema



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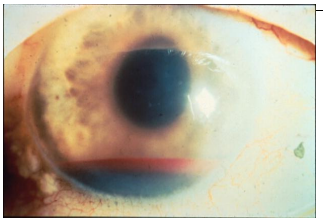


109

Management Guidelines - Traumatic Hyphema

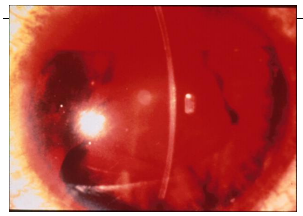
- Limited activity or bedrest w/ bathroom privileges
- Elevate head 30 degrees. Fox shield r-t-c !
- Atropine 1% t.i.d., or b.i.d. if microhyphema
- No ASA or NSAIDs; mild analgesics only (acetaminophen). No sedatives !
- If traumatic iritis develops (usu. 2-3 days after trauma), add prednisolone acetate 1% 4-8x daily
- For elevated IOP: beta blocker 1st; then alpha agonist. Avoid prostaglandin analogs & miotics

112

Traumatic Glaucoma

- Early onset
  - TM obstruction, inflammation
  - TM disruption
  - Hyphema
- Delayed onset
  - Angle recession
  - Lens-Associated
    - Phacomorphic, phacolytic, lens particle

115



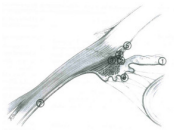
110

Management Guidelines - Traumatic Hyphema

- Office visit daily for 3 days post-trauma/rebleed
  - Check VA, IOP, SLE (check for new bleeds)
- Glasses or eye shield during the day and at night for 2 weeks post-trauma/rebleed
- No strenuous activities (including Valsalva) for 2 weeks after initial trauma/rebleed
- Perform gonioscopy one month post-trauma/rebleed
- Treat increased IOP as indicated

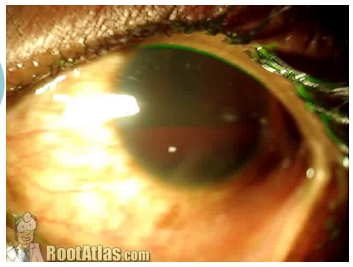
113

Traumatic Glaucoma



Commonly injured intraocular structures following contusion: 1. Iris sphincter 2. Iris root (iridodialysis) 3. Between CB longitudinal and circular m. (angle recession) 4. CB insertion (cyclodialysis) 5. TM 6. Zonules (subluxated/dislocated lens) 7. Retinal tears/dialysis

116



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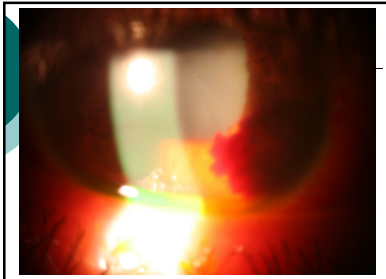
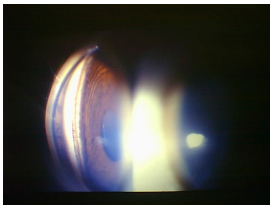


Case CW – woman vs. fish lead sinker

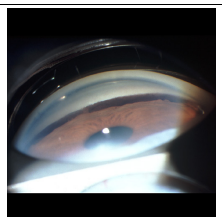
114

Angle Recession



117

Angle Recession



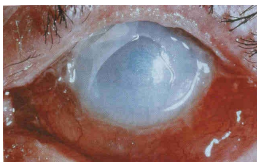
118

Pathophysiology of Chemical Eye Injury

- Both alkalines & acids cause ocular surface epithelial cells to die upon contact
- Retained particulate matter in superior fornix can cause continued exposure
- Penetration of alkalines and acids into corneal stroma result in keratocyte death & loss of stromal clarity
- Hydration of collagen fibrils lead to thickening of TM and increase in IOP
- Time of penetration into AC varies (immediate for ammonia) & can result in secondary glaucoma, cataract, CB damage, hypotony, and phthisis bulbi with prolonged pH >11.5

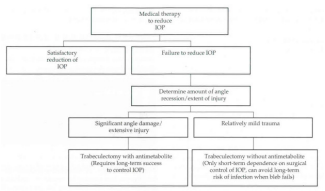
121

Alkaline Eye Injury



124

Flowchart for Management of Traumatic Glaucoma

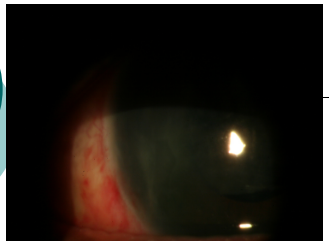


119

Pathophysiology of Chemical Eye Injury

- Complete corneal epithelial injury requires epithelium from the limbus, where stem cells of corneal epithelium reside
- The recovery of an intact and phenotypically normal corneal epithelium is the most important determinant of a favorable outcome following chemical eye injury
- With extensive corneal and limbal epithelial injury, the surrounding conjunctival epithelium provides the only source of epithelial regeneration

122



Case SM - unresolved chemical burn s/p 4 weeks

Chemical Eye Injuries

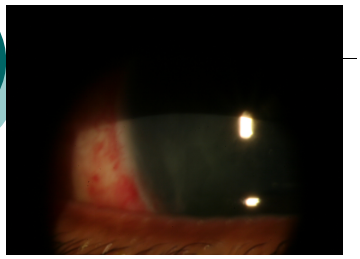
- Devastating injuries that may lead to blindness
- Alkaline agents penetrate ocular tissues rapidly and continue to do so, causing severe damage
- Acids cause proteins to coagulate on corneal epithelium and stroma, and acids precipitate out quickly, which limits ocular penetration

120

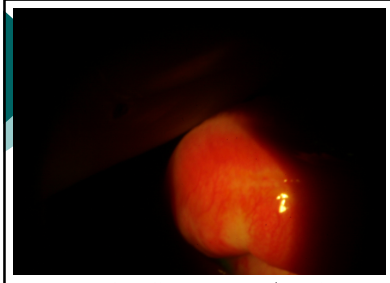
Alkaline agents commonly associated with eye injuries

- Ammonia*
  - fertilizers, household cleaning agents
- Lye*
  - drain cleaners
- Magnesium hydroxide
  - sparklers
    - produce thermal and alkali burns
- Lime
  - plaster, mortar, cement, whitewash

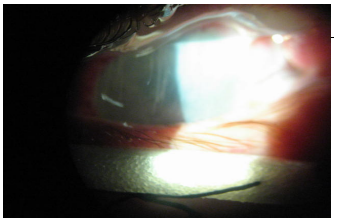
123



Case SM - s/p 4 weeks chemical burn

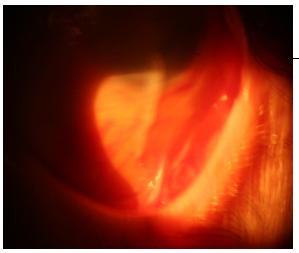


Case SM - Chemical burn to conjunctiva s/p 4 weeks



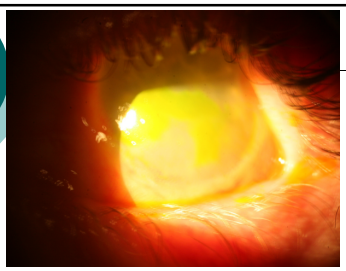
Case RC – amniotic membrane graft s/p 2 w chemical burn

130



Case RC – s/p 1 month chemical burn OS

Case RC - Chemical Burn OS s/p 3 days

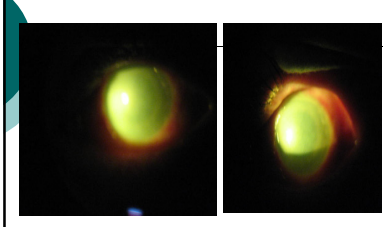


Case RC - s/p 1 m Chemical Burn OS – Note K re-epithelizing

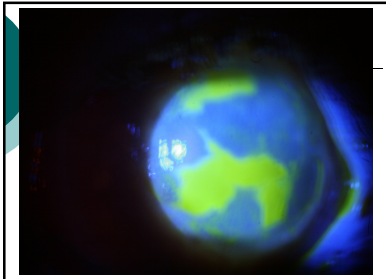
Management of Alkaline Eye Injuries

- Prompt and copious irrigation minimize duration of contact b/w chemical and eye in order to protect limbal stem cells
- Irrigate for 15-30 min; evert upper lid, irrigate fornices
- Check pH after irrigation; continue until pH 7.0
- Remove remnants of agents. *double evert*
- Debride necrotic corneal and conjunctival epithelium
- Administer topical and oral Ab's/steroids, cycloplegic, BCL/patch (relief) and indicated glaucoma agents

134



Case RC - chemical burn OS s/p 3 days



Case RC – s/p 1 m chemical burn OS. K repithelizing but w/ defect remaining

Acid agents commonly associated with eye injuries

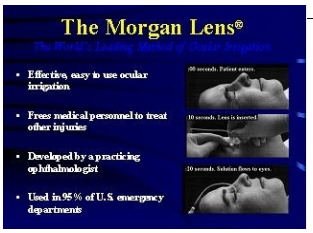
- Sulfuric
  - Industrial cleaners, batteries
  - Produces thermal injury also
- Sulfurous
  - Fruit/vegetable preservatives
- Hydrofluoric
  - Glass polishing, gasoline
- Acetic
  - Vinegar

135

Acid Eye Injury

136

Morgan Lens



139

Morgan Lens: Procedure

- Attach IV infusion tubing to the lens & start a minimal flow

142

Management of Acid Eye Injuries

- Prompt and copious irrigation
  - minimize duration of contact b/w chemical & eye in order to protect limbal stem cells
  - Irrigate for 15-30 min; evert upper lid, irrigate fornices
  - Check pH after irrigation; continue until pH 7.0
  - Remove remnants of agents. *double evert*
  - Debride necrotic corneal and conjunctival epithelium
  - Administer topical & oral Ab's/steroids, cycloplegic, BCL/patch (relief) and indicated glaucoma agents

137

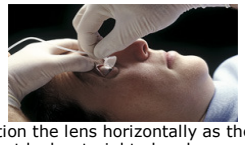
Morgan Lens Instrumentation

- Morgan Lens
  - Molded Scleral lens with an aqueous lock that is attached to an IV bag
  - IV bag with sterile 0.9% saline/lactated Ringer's
  - Litmus paper
  - Emesis basin or fluid management system
  - Topical anesthetic

140

Morgan Lens: Procedure

Have the patient look down and insert the Morgan lens under the upper lid



- Position the lens horizontally as the patient looks straight ahead

143

Management of Chemical Eye Injuries

- Bandage contact lens
- 4GFQ: 1 gtt 4-6x/day (prevents infection)
- Prednisolone phosphate: 1 gtt q 1-2 hr while awake (reduces inflammation)
- Vitamin C: 1-2 gm po QD (reduces corneal thinning/ulceration)
- 10% sodium citrate: 1 gtt q 2 hr while awake (chelates Ca++ and impairs PMN chemotaxis)
- Scopolamine 0.25%: 1 gtt TID (reduces pain/scarring with AC inflammation)
- 10% Mucomyst (n-acetyl-cysteine): 1 gtt 6x/day (mucolytic agent and collagenase inhibitor)
- Doxycycline 100 mg po bid (collagenase inhibitor)
- Glaucoma gtts/oral diamox if IOP elevated

138

Morgan Lens: Procedure

- Instill topical anesthetic

141

Morgan Lens: Procedure

- Adjust the flow to the desired rate

144

Curling Iron Burn

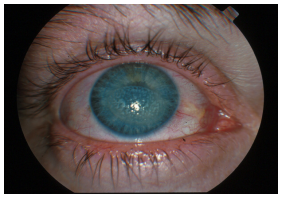
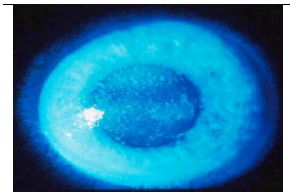
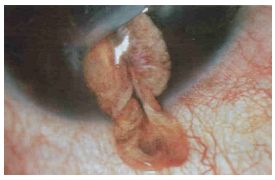


Photo courtesy Sandra M. Brown, MD



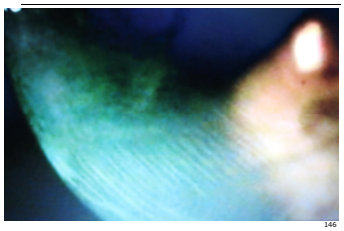
148

Uveal Prolapse through Corneal Laceration (Extrabulbar)



151

Corneal Thermal Burn



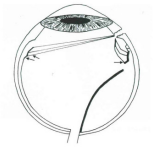
146

Tissue Prolapse

- Defined as extrusion of intraocular content outside its normal compartment
- Classified as intrabulbar or extrabulbar
- Intraocular tissue prolapse should be suspected in all open globe injuries

149

Vitreous Prolapse into Anterior Chamber (Intrabulbar)

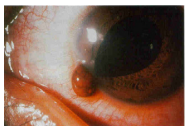


152

UV Keratitis

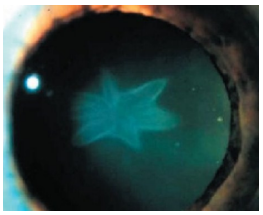
- welder's flash, tanning booth-eye
  - luckily these risk factors seldom co-exist
- sx - pain, tearing, photophobia
  - 6-12 h after exposure
- slit lamp + fluorescein
  - superficial punctate keratitis = microdots
- cycloplegia, eryth. ung., pressure patch o/n
- consider oral narcotic. It hurts!

Iris Prolapse through Limbal Surgical Wound (Extrabulbar)



150

Lens Injury

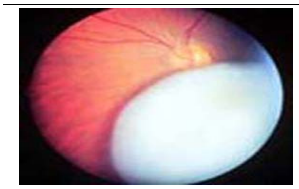


153

Lens Injury

- Blunt trauma can break zonules
- If 25% or more zonules are broken, the lens produces iridodonesis (trembling of the iris)
- If enough zonules are disrupted, the lens may:
  - dislocate into the AC
  - occlude pupillary space (pupillary block glaucoma)
  - subluxate into PC
  - be expulsed altogether
- Contusion injuries can cause immediate traumatic cataracts

154

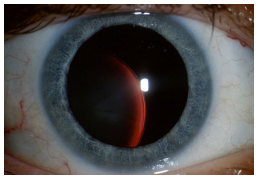


Reference: Rappon

157

160

Lens Subluxation into Posterior Chamber



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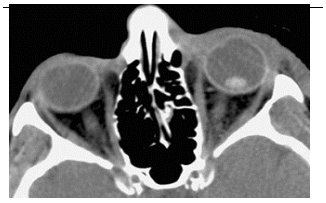

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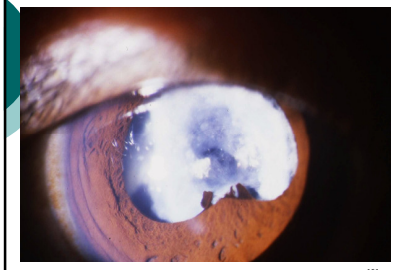
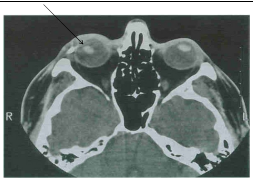
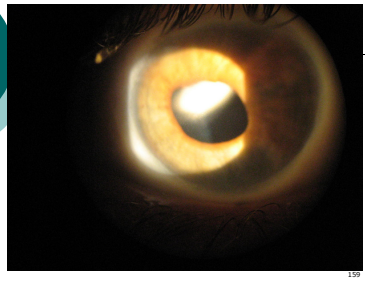


161

Lens Subluxated into Posterior Chamber



156



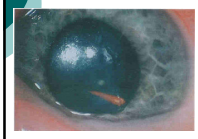
159

Penetrating Eye Injuries

- Eye is pierced by sharp object or high velocity missile (BB, glass, metal-on-metal)
- Patient should be admitted to hospital for broad-spectrum IV antibiotics within 6 hours of injury
  - Cephazolin or fortified vancomycin *plus*
  - Gatifloxacin or moxifloxacin
  - Tetanus update
- Endophthalmitis may develop, leading to permanent blindness
- Nearly 25% of eyes that suffer penetrating wounds are eventually enucleated

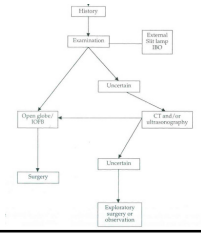
162

Penetrating Eye Injuries



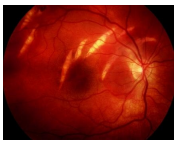
163

Flowchart for Evaluation of Possible Open Globe Injury



166

Ruptured Globe



Traumatic Choroidal Rupture

Photo courtesy Robert Morris, MD

169

Ruptured Globe

- Nearly 20% of patients with ruptured globes do not have apparent signs of perforation
- Vision may be excellent and the most important clue to occult rupture may be…
  - what the patient was doing at the time of injury !

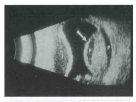
164

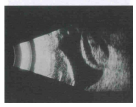
Ruptured Globe

Fireworks injury

167

Ruptured Globe





170

Ruptured Globe

- If rupture suspected from clinical presentation, findings or history, apply metal shield or other protective covering
- *Never patch!*
- Slightest manipulation of a ruptured globe may compound an already serious problem

165

Ruptured Globe

Traumatic retina and vitreous hemorrhage with choroidal rupture

Photo courtesy Robert Morris, MD

168

Orbital Blow-Out Fracture

- A patient presenting with an orbital blow out fracture has a history of blunt trauma to orbit
  - Example: fist, baseball, beer bottle

171

Signs of Blow-out Fracture

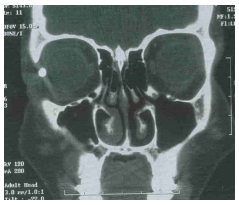
- Restricted globe movement, esp. on elevation
- Orbital crepitus (subcutaneous emphysema)
- Lid edema & ecchymosis
- hypoesthesia of the ipsilateral cheek, due to entrapment of the infraorbital nerve

172

175

178

173



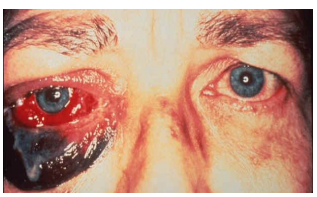
176

Shaken Baby Syndrome

- 15% mortality rate
- Typical victims are male < 6 moa, who is alone with the perpetrator at the time of injury
- Incidence unrelated to race, socio-economic status or education
- Presenting sign is eye-related in 4 to 6% of cases
- Retinal hemorrhages in 50% - 80% of shaken babies

179

Blowout Fracture



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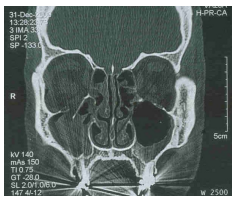
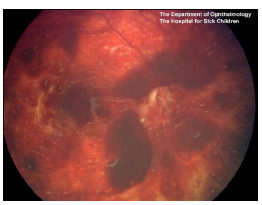


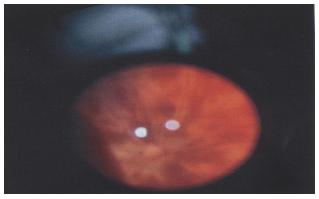
177

Shaken Baby Syndrome



180

Shaken Baby Syndrome



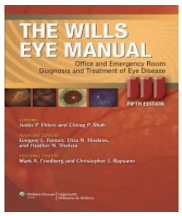
181

Predicting Functional Prognosis – The OTS

Table 1. Computational method for deriving the OTS score

Initial Visual Factor	Raw points
A. Initial visual acuity category	NLP = 60 LP to HM = 70 1/200 to 19/200 = 80 20/200 to 20/50 = 90 ≥20/40 = 100
B. Globe rupture	-23
C. Endophthalmitis	-17
D. Perforating injury	-14
E. Retinal detachment	-11
F. Afferent pupillary defect (Marcus Gunn pupil)	-10
Raw score sum = sum of raw points	

184



187

Predicting Functional Prognosis

- Global rupture and endophthalmitis carry poor prognosis for vision recovery
- Variables such as age, extent of wound, hyphema, initial VA, intraocular FB, lens injury, RD – controversial

182

Predicting Functional Prognosis - The OTS Score

Table 2. Estimated probability of follow-up visual acuity category by the OTS Score

Raw Score Sum	OTS Score	NLP	LP/HM	1/200-19/200	20/200 to 20/50	≥20/40
0-44	1	73%	17%	7%	2%	1%
45-65	2	28%	26%	18%	13%	15%
66-80	3	2%	11%	15%	28%	44%
81-91	4	1%	2%	2%	21%	74%
92-100	5	0%	1%	2%	5%	92%

185

Disclosures

- I have no financial interest in any products mentioned in this presentation. I wish I did. I have 2 kids in college …

188

Predicting Functional Prognosis

- More pathology = less vision recovery
- Strongly associated with poor vision outcomes:
  - Vitreous hemorrhage
  - Absence of lens
  - Severe distortion of eyewall

183

In Conclusion:

- Have a low threshold for an open globe injury
- Never use anesthetics except to examine a patient
- Be extra vigilant with contact lens wearers
- Always do a fundoscopy if you suspect child abuse
- Encourage trauma prevention with safety glasses

186

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189

Thank you !!!

190