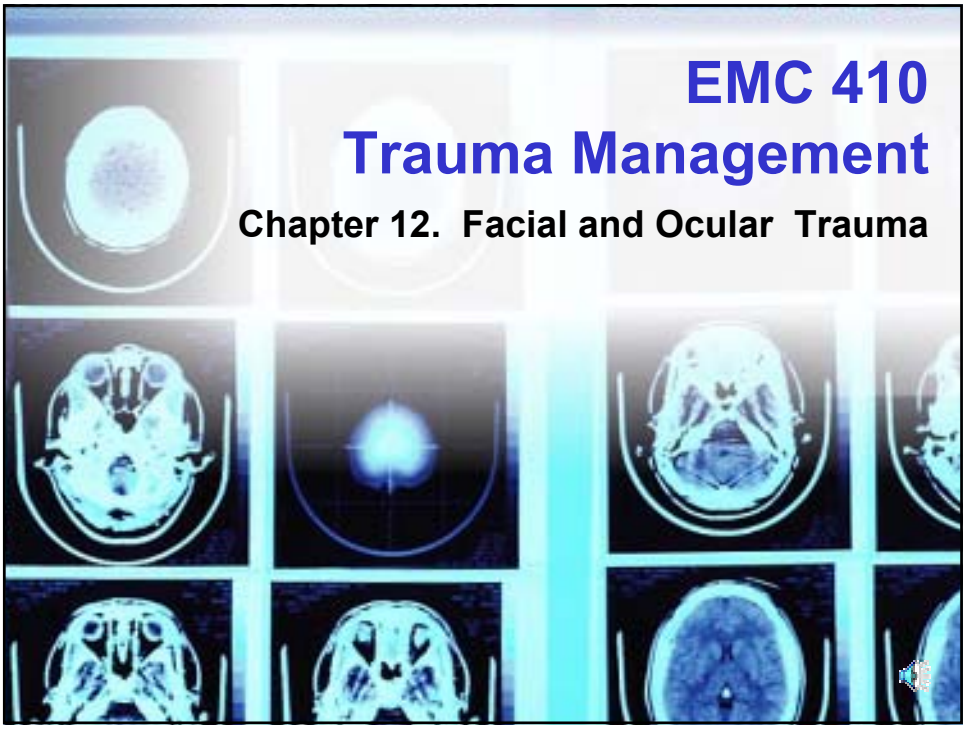


EMC 410
Trauma Management
Chapter 12. Facial and Ocular Trauma

Unit Objectives

- **Upon completion of this chapter, you should be able to:**
  - Describe basic maxillofacial and ocular anatomy.
  - Discuss the etiology and epidemiology of facial and ocular injuries.
  - Discuss the pathophysiology of facial soft tissue injuries, impaled objects and penetrating trauma, facial fractures, epistaxis, dental injuries, temporomandibular joint dislocation, and tympanic membrane perforation.
  - Describe the assessment and management of the patient with facial or ocular trauma.
  - Discuss the pathophysiology of conjunctival injuries, corneal injuries, eyelid lacerations, ocular burns, hyphema, iris and ciliary body injuries, retinopathies, penetrating eye injuries, and ocular avulsions.
  - Describe the assessment and management of the patient with facial or ocular trauma.

Introduction

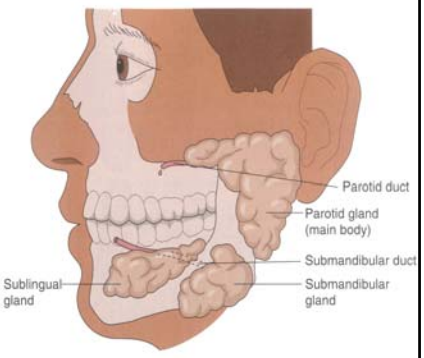
- **Most of these injuries are not immediately life-threatening**
- **Frequently associated with other potentially life-threatening problems**
  - Head injury
  - Airway obstruction
  - Cervical spine injury
- **Potential to be debilitating and disfiguring**

Maxillofacial Trauma

- **Epidemiology and Etiology**
  - Most commonly the result of blunt force to the face.
  - Most common causes are assault, MVC, falls, and sports-related injuries
  - Men are involved in more penetrating trauma and assaults while women usually receive injuries from MVCs and falls
  - 25% of patients with facial fractures also have basilar skull fractures
  - The greater the number of facial fractures the higher the likelihood of basilar skull fracture
  - 18% have closed head injury

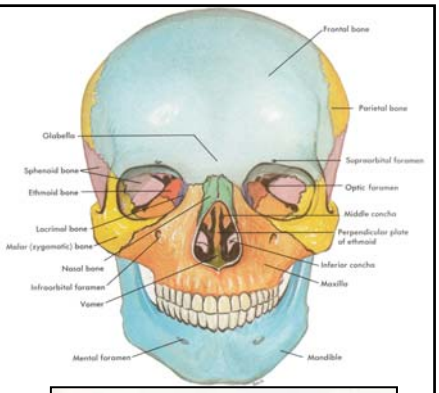
Anatomy and Physiology

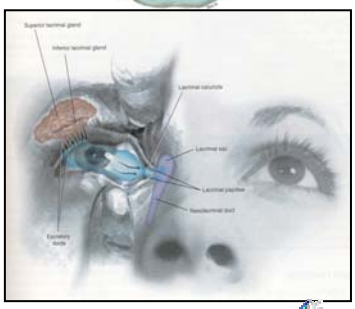
- **Soft tissue structures**
  - Highly vascularized that may result in profuse bleeding as well as disguise landmarks when injured.
  - Injury to the mandible, palate, or tongue may result in glossoptosis and airway compromise.
  - Thin protective layer for major vessels.
- **Salivation**
  - Multiple glands for salivation
  - Main parotid duct is superficial and easily damaged in facial lacerations.
  - Sublingual and submandibular glands are injured less often than the parotid gland.



Anatomy and Physiology continued

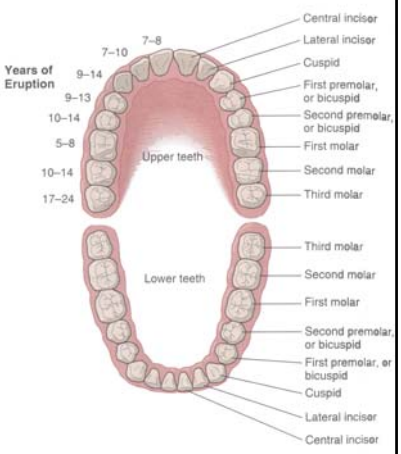
- **Lacrimation**
  - Paired lacrimal glands found in the anterosuperolateral aspects of the orbits.
  - Tears flow in a superolateral to inferomedial direction.
  - Tears empty medially via the nasolacrimal duct to just beneath the inferior turbinate.
- **Bony structures**
  - Maxilla
  - Sphenoid
  - Ethmoid
  - Zygoma
  - Mandible





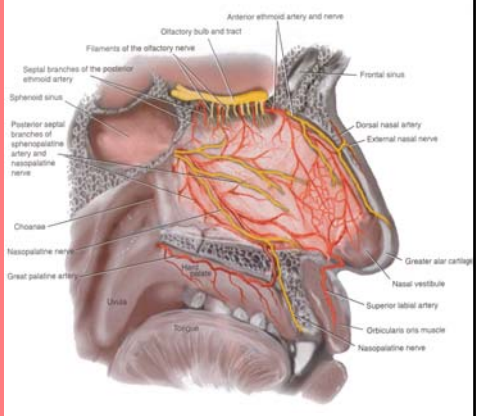
Anatomy and Physiology continued

- **Oral cavity and dentition**
  - **32 teeth**
  - **2 central incisors, 2 lateral incisors, 2 canines, 4 premolars, and 6 molars on upper and lower dental arches**
- **Cranial nerves**
  - **Most of the face is innervated by the trigeminal nerve (CN V) and facial nerve (CN VII).**
  - **CN V controls sensation of the face and muscular control for mastication**
  - **CN VII controls facial muscles, lacrimation and salivation.**



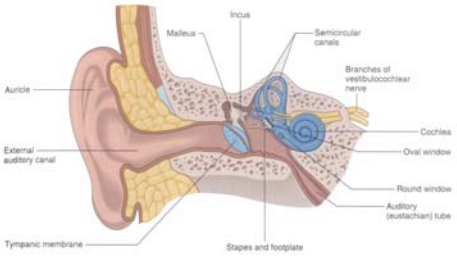
Anatomy and Physiology continued

- **Vascular structures**
  - Carotid sheath contains the common carotid artery, internal jugular vein and cranial nerves IX (glossopharygneal), X (vagus), and XII (hypoglossal).
  - The common carotid branches into the external carotid which supplies the thyroid gland, pharynx, tongue, face, scalp, and all maxillary structures below the orbits, and the internal carotid which supplies the ocular structures and brain.
  - The internal jugular drains the cranial vault and the external jugular drains the face and scalp.
  - The external jugular lies superficially and is easily transected.
  - The nasal cavity has a rich vascular supply called Kiesselbach's plexus.



Anatomy and Physiology continued

- **Ear and auditory canal**
  - Auricle (entrance)
  - Tympanic membrane
  - Ossicular chain and vestibulocochlear apparatus
  - These structures may be injured by fractures of the temporal bone.

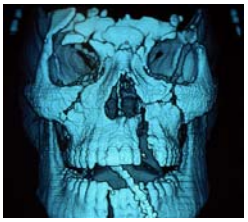


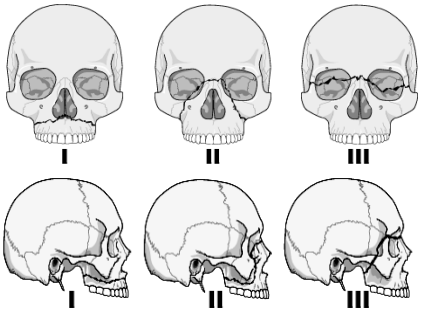
Pathophysiology

- **Soft tissue injuries**
  - Tend to bleed profusely.
  - Rich vascular supply also allows injuries to heal quickly with minimal risk of infection.
  - Hemorrhage is unlikely to result in shock.
  - Large hematomas may form clots with fibrotic encapsulation that will lead to permanent deformity.
  - Children are at risk of severe injury from biting electrical cords. Saliva is heated to extreme temperatures resulting in burns.
- **Impaled objects**
  - May compromise the airway or impinge on vessels and nerves.

Pathophysiology continued

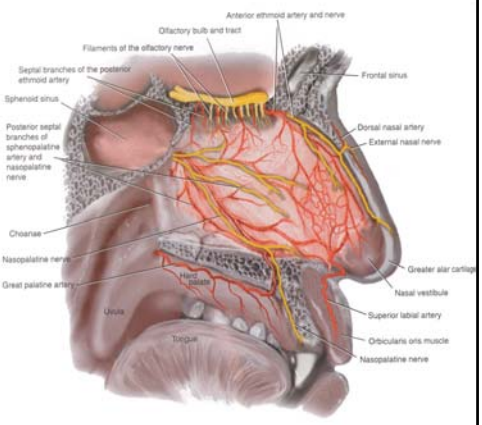
- **Facial fractures**
  - Nasal bones, zygoma, and mandibular condyle are most susceptible to fracture.
  - Orbital ridge fractures very difficult to fracture and frequently associated with other life-threatening injuries.
  - Mandibular fractures are most often the result of assault
  - Some mandibular fractures may result in glossoptosis and airway compromise.
  - Zygomatic fractures frequently have associated ocular trauma
  - Maxillary fractures
    - Le forte I - separates hard palate and lower maxilla from remainder of skull
    - Le forte II - separates nasal skull and lower maxilla from facial skull and remainder of the cranial bones
    - Le forte III - separates the entire midface from the cranium
  - Orbital blowout fracture





Pathophysiology continued

- **Epistaxis**
  - **Usually associated with disruption of Kiesselbach's plexus in the anterior nose.**
  - **Less frequently, posterior epistaxis is associated with disruption of the sphenopalatine artery.**
  - **Posterior bleed more difficult to control because it is impossible to apply direct pressure without nasal packing.**
  - **Massive posterior bleed may be life-threatening.**
- **Dental injuries**
  - **If avulsed teeth cannot be found, they must be assumed to have been aspirated**



Pathophysiology continued

- **Temporomandibular joint (TMJ) dislocation**
  - Patient cannot close his mouth.
  - May have facial asymmetry.
  - Pain may be severe due to spasm of the pterygoid muscles
  - Should not be reduced in the field.
- **Tympanic membrane perforation**
  - May result from direct blows or from barotrauma.
  - Ossicular involvement may result in conductive hearing loss.
  - Otorrhea suggests compromise of deeper structures.
  - Following head trauma, otorrhea suggests basilar skull fracture until proven otherwise.

Focused Assessment

- ABCs
  - Do not clamp hemorrhaging vessels
- Inspect mouth for tooth fragments, hemorrhage, laceration
- Mandibular fractures are recognized by instability, immobility, malocclusion and occasionally a laceration through the buccal membranes.
- Assess the supraorbital ridges, orbits, and globes for symmetry.
- Palpate zygoma for tenderness.
- Assess face and cheeks for numbness.
- Assess visual and hearing acuity.

Treatment

- **Airway and breathing**
  - Orotracheal intubation preferred over nasotracheal
  - Surgical airway may be required
- **Circulation**
  - Bleeding from lacerations usually controlled by direct pressure
  - Standard treatment for epistaxis with patient in seated position if possible
- **Impaled objects**
  - Stabilize in place unless object is in the cheek in which case it may be removed, followed by internal packing and external dressing and bandage.

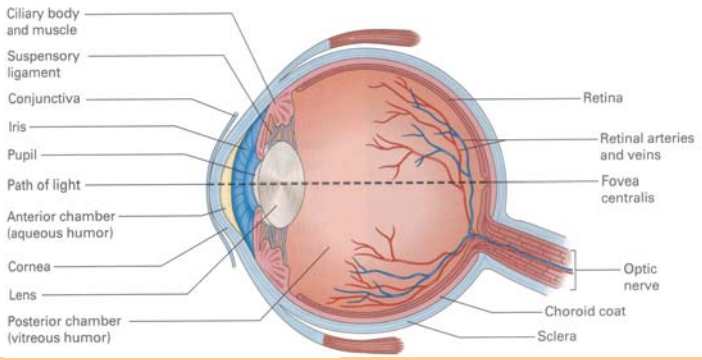
Treatment continued

- **Dental emergencies**
  - Handle avulsed tooth only at the crown
  - Transport tooth in normal saline
  - Attempt to re-implant if transport time exceeds 20 minutes and there are not other injuries requiring treatment.
    - Flush socket with saline
    - Align tooth comparing to other side
    - Firmly push in place
    - Have patient bite down on gauze roll and hold for at least 20 minutes
- **TMJ dislocation**
  - No field treatment
- **Auditory injury**
  - Cover lightly with dressing; Otherwise no field treatment

Ocular Trauma

- **Epidemiology and Etiology**
  - Trauma is the second leading cause of blindness.
  - Lifetime prevalence of ocular injury is 14%
  - Twice as common in men.
  - MVCs, sports, assaults, work-related injury, and consumer products are primary causes.

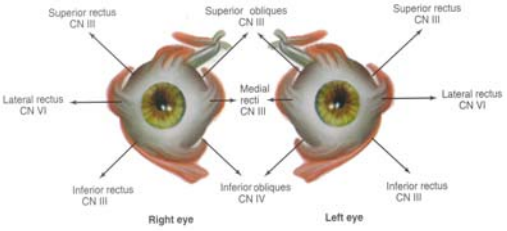
Anatomy and Physiology

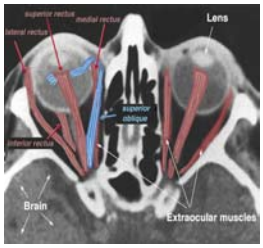


- Sclera is the outer fibrous coat.
- Cornea
- Iris
- Ciliary muscle
- Pupil
- Retina
- Anterior chamber (between lens and cornea)
- Posterior chamber

Anatomy and Physiology continued

- **6 extraocular muscles controlled by oculomotor nerve (CN III), trochlear nerve (CN IV), and abducens nerve (CN V).**





Anatomy and Physiology continued

- Optic nerve (CN II)_ carries photoreceptive information from the retina to the brain.
- Trigeminal nerve (CN V) provides sensory innervation to the cornea.
- Facial nerve (CN VII) provides motor innervation to the muscles controlling the eyelid.
- Pupil diameter controlled by the parasympathetic system via the oculomotor nerve (CN III) and the sympathetic system via the cervical ganglia.

Pathophysiology

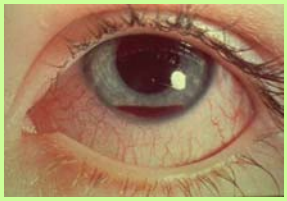
- **Conjunctival injuries**
  - Minor injury that usually resolves spontaneously.
  - Frequently associated with injury to the globe.
- **Corneal injuries**
  - Corneal abrasions are the most common ocular injury.
  - Can occur in an unconscious patient with contact lens.
  - Patients complain of pain, foreign body sensation, excessive lacrimation, photophobia, blurred vision, and blepharospasm.
  - Motion of the eye underneath a closed eyelid increases the pain.
- **Eyelid lacerations**
  - Frequently more serious than they appear.
  - May involve ocular and lacrimal structures
  - Through and through lid lacerations and lacerations involving muscles of the eyelid are evaluated and repaired in the operating room.

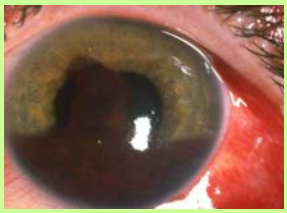
Pathophysiology continued

- **Thermal, chemical, and radiation injuries**
  - Thermal injuries frequently seen with facial burns.
  - Chemical burns require immediate and aggressive irrigation to prevent permanent damage.
  - Alkaline injuries are more serious because the chemicals can easily penetrate into the tissues by disrupting cell membranes.
  - Acid burns tend to remain localized but still can be severe.
  - Most radiation burns are from ultraviolet or infrared sources such as sunlight, welding arcs, and tanning beds.

Pathophysiology continued

- **Hyphema**
  - Blood collects in the anterior chamber of the eye, typically from blunt trauma.
  - When the patient is upright, blood collects in the inferior chamber.
  - Must rule out globe rupture





Pathophysiology continued

- **Iris and ciliary body injuries**
  - Patients complain of pain and photophobia with no gross physical findings.
  - Ciliary body injury may result in traumatic mydriasis or traumatic miosis.
  - Iridodialysis - tearing of the iris from the ciliary body
- **Traumatic retinopathies**
  - Retinal detachment, retinal concussion, and retinal hemorrhage
    - Detachment, a surgical emergency, results in painless flashes of light alternating with black spots, dimmed vision, or a filmy sensation, and visual field defects such as a "curtain."
    - Concussion results in retinal edema.
    - Hemorrhage into the posterior chamber may result from disrupted retinal capillaries or from a retinal tear.

Pathophysiology continued

- **Penetrating injuries and globe rupture**
  - Globe rupture is a serious injury and frequently associated with blindness.
  - Penetrating injury to the eye with loss of aqueous humor may not result in blindness as aqueous humor is gradually replaced.
  - Once lost, vitreous humor cannot be replaced.
  - Intraocular bodies frequently result from metal on metal contacts.
  - Perforation may exist with a normal exam, or the patient may exhibit decreased visual acuity, decreased intraocular pressure, flattened anterior chamber, chemosis, subconjunctival hemorrhage, laceration, grossly irregular pupil, hyphema, and irregularities when compared to the uninjured eye.

Pathophysiology continued

- **Ocular avulsions**
  - Complete avulsion of the globe results in permanent loss of vision.

Focused Assessment

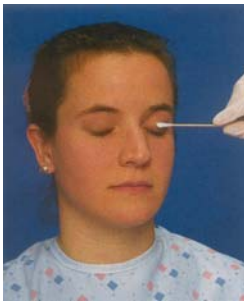
- **Ophthalmologic history**
  - Nature of the injury
  - Change in vision
  - Change in the appearance of the eye
  - Pain and discomfort
  - Use of corrective lens
  - Ophthalmological diseases and surgery
  - Systemic diseases with ocular manifestations (diabetes)
  - Systemic symptoms of ophthalmic diseases, such as headache or nausea.

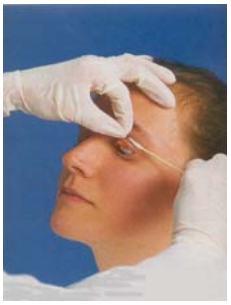
Focused Assessment continued

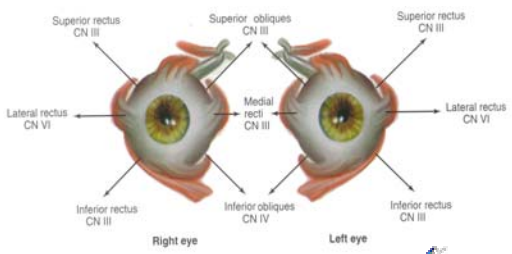
- **Visual acuity**
  - Snellen chart or Rosenbaum card, or any printed material
  - Test uncorrected vision before corrected vision
  - If unable to read first line of chart, test gross vision such as counting fingers, perception of hand movement, and perception of light.
- **Pupillary reactions**
  - PERRLA
  - Consensual constriction to light
  - Normal variance in pupillary size is less than 1 mm

Focused Assessment continued

- **External examination**
  - Examine orbit, lids, and conjunctive for ecchymosis, edema, foreign bodies, lacerations.
  - Examine globe for infection, hemorrhage, shape, laceration, and penetrating objects.
  - Invert the upper eyelid and visualize underlying conjunctive.
- **Ocular motility**
  - EOMs through all six positions of gaze.
  - Diplopia suggests involvement of extraocular muscles and is a common finding in orbital fractures.
  - Have patient cover one eye, if diplopia persists, suspect injury to lens or cornea rather than extraocular muscles.

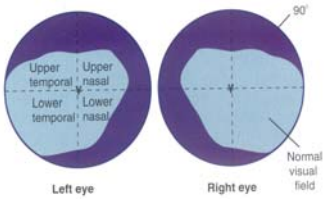






Focused Assessment continued

- **Visual field testing**
  - With patient covering one eye and looking straight ahead, move object into the peripheral vision until the patient indicates he can see the object.
  - The visual field is tested from 8 directions starting at the top of the visual field circle and incrementing 45 degrees around the circle.
  - Normal visual fields are slightly restricted at the top by the brow and medially by the nose.
- **Advanced assessments**
  - Fundoscopic exam
    - Red reflex off retina indicates there is no pathologic obstruction between the observer and the retina.
    - The optic nerve is inspected for evidence of atrophy, cupping, edema, or hemorrhage.
    - All vessels converging at the optic disc are followed to the periphery.
    - The normal optic disc edge is sharp and distinct.
  - Fluorescein stain and intraocular pressure



Treatment

- Shielding and stabilization of foreign bodies
- Cover both eyes.
- Soft patch corneal abrasions (contraindicated in globe injuries)
- Remove contact lens for chemical injuries.
- Copious irrigation of chemical burns throughout transport. Avoid cross-contamination.