Cognitive Objectives

Upon completion, the participant will
1. identify the anatomical structures of the face.
2. describe the incidence and mechanism of injury for various types of facial fractures.
3. discuss the assessment for facial injuries including an evaluation of cranial nerve function.
4. compare and contrast airway control options for patients with maxillofacial injuries.
5. interpret assessment findings and establish treatment priorities for patients with upper, middle and lower maxillofacial injuries.
6. describe the prehospital management of facial injuries.
7. discuss specific maxillofacial injuries including mandibular fractures, TMJ dislocations, maxillary fractures, zygomatic fractures, orbital fractures, naso-ethmoid-orbital fractures, nasal fractures, dental fractures and avulsions, and soft tissue injuries.
8. anticipate the complications of maxillofacial injury.
9. evaluate the responses to prehospital interventions and revise treatment as needed.

Psychomotor Objectives

1. demonstrate airway control measures applicable to OMFS trauma.
2. perform an assessment of the face for maxillofacial trauma including soft tissue, bony and nerve injuries.
I. Epidemiology of facial injuries

A. Definition: Injury to structures of the face, bones, sinuses, nerves, vascular supply, glands, ducts and/or integument.

B. Incidence
1. Estimated 3 million facial fracture/year secondary to MVCs or motorcycle crashes.
2. Majority of patients in MVCs suffer some form of facial injury
3. Incidence of concomitant c-spine injury ranges from 0.3 - 4%. Merritt & Williams (1997) cited a 1.8% incidence with 52% of them being unstable with C-2 the most common site.
4. 50-70% of patients with facial injuries will have injury to other systems.
5. Males have a higher propensity for facial trauma (Houdek et al, 1997).
6. Respectively, 50% and 14% of all gunshot-related suicide attempts and assaults result in head and neck injuries (Cunningham et al, 2003).

C. Mechanisms of injury: The face acts like a shock absorber. Injury occurs when the tolerance level of facial structures is exceeded. The maxilla can withstand three times the force of gravity before it fractures. Impacts greater than 20 mph usually result in facial bone fractures, especially the nose, maxilla and zygoma (Bower, in Cardona).
1. Automobile crashes
2. Interpersonal violence (domestic violence vs. assault and battery)
3. Motorcycle crashes
4. Sports injuries
5. GSW/stabbings/shotgun
6. Falls
7. Industrial accidents
8. Bites

D. Morbidity
1. OMFS injuries rarely cause death; however, airway obstruction and hemorrhage are realistic immediate threats.
2. Facial injuries can be very devastating to the self-esteem and the care provider must be careful to "do no further harm" via verbal and/or non-verbal responses to the injury's presentation. A 1997 study of facial trauma patients found 27% suffering post-traumatic stress syndrome, which was often poorly recognized (Bisson et al, 1997).

II. Anatomy of the face: Bony structures generally divided into thirds

A. Upper third
1. Frontal bone
2. Glabella
3. Supraorbital ridge
4. Temporal bone
5. Nasal bone
6. Lacrimal bone
7. Ethmoid bone
8. Frontal sinus (paired; develop after age 5)
9. Most susceptible to fracture: frontal sinuses, nasal bones

Bledsoe et al, 2006
B. **Middle third**

1. Orbit: Most susceptible to fracture
2. Maxillary sinuses
3. Vomer (Nasal septum)
4. Zygoma bone and process
5. Maxilla body
6. Palate
7. Maxillary teeth with alveolar process

C. **Lower third**

1. Mandible: largest and strongest bone in the face; should be the only mobile bone
   a. Condyle, neck
   b. Body, angle
   c. Ramus
   d. Parasymphysis, symphysis
   e. Mental protuberance
2. Mandibular teeth with alveolar process

D. **Cranial nerves**

1. CN I - Olfactory: CNS tissue, origins in cribriform plate. Provides sense of smell. May be injured with midface fractures involving the base of the skull/glabella.
2. CN II - Optic: CNS tissue provides for vision; sensory limb of pupillary light reflex. Dysfunction is associated with orbital fracture.
3. CN III/IV - Oculomotor/Trochlear
   a. CN III: Moves eye up, down, in to nose; lifts eyelid; constricts pupil
   b. Associated with orbit and midface trauma
   c. Results in diplopia, limited extra-ocular movement and pupillary change
4. CN V – Trigeminal
   a. 3 branches: ophthalmic, maxillary, mandibular
   b. Exits near (deep) to parotid gland
   c. Sensory component: Entire face
   d. Motor component: Muscles of mastication
   e. Test sensory component by assessing ability to discern touch on forehead, cheeks, and chin. Test motor component by asking the patient to make a chewing motion or to move the jaw from side to side.
5. CN VII – Facial
   a. Five branches spread across the face from origin just in front of the ear.
   b. Responsible for innervation of all muscles involved in facial expression and taste on anterior 2/3 of tongue.
   c. Test by asking the patient to raise eyebrows, smile, frown, pucker the lips, puff out the cheeks and close the eyelids tightly.

E. **Facial muscles**

1. **Function**: To open, close and adjust shape and size of the orifices through which we see, breathe, and speak.
2. **Muscles groups**
   a. Scalp and auricle
   b. Surrounding orbit
   c. Nasal
   d. Mouth
   e. Platysma
3. **Types of movement**
   a. Retraction
   b. Protraction
   c. Lateral movement
   d. Depression
   e. Occlusion
   f. Elevation

F. **Vascular supply**
   1. Face has rich arterial supply; enables rapid healing and resistance to infection
   2. Two main arteries: facial and superficial temporal
   3. Venous drainage ultimately feeds into internal jugular vein

G. **Parotid gland**: Gland and duct may be injured concurrently with facial structures, especially deep lacerations of the lateral cheek.

III. **Assessment**
   A. **Scene size up**: Evaluate scene of injury to determine MOI or potential for abuse. Up to 25% of women and more than 50% of children with OMF trauma are victims of abuse (Hawkins, 2003).
   B. **Initial assessment**: need a good source of light
      1. Assess for **impaired or ineffective airway clearance** while maintaining C-Spine immobilization. Up to 4% of facial lacerations will have concomitant C-spine injury (lower incidence with penetrating trauma) and precautions/maintenance of C-spine integrity is imperative.
         a. Listen for snoring, stridor or noisy breathing; verify air exchange
         b. **Airway obstruction is the principal cause of death in this population.**
      2. **Sources of airway obstruction**
         a. Tongue - associated with flail mandible fractures, concomitant closed head injury with coma and laxity of muscles
         b. Blood
            (1) Frank bleeding from arterial/venous sources
            (2) Hematomas that compromise the airway; specifically retropharyngeal, lateral pharyngeal, nasopharyngeal and submandibular spaces.
         c. Bony displacement - split palate and mandibular fragments occur infrequently but are significant if noted
         d. Broken teeth
         e. Other foreign bodies, frequently grass and mud
         f. Vomitus
         g. Laryngospasm, fractured larynx
      3. **Establish and maintain an effective airway** with appropriate positioning of the mandible, airway adjuncts, and institute strategies to prevent aspiration. The key is to anticipate airway obstruction and provide an adequate, patent airway before it becomes an emergency.
         a. If not contraindicated: sit patient up or place in lateral decubitus position to facilitate secretion clearance
         b. Provide a container for copious oral secretions
         c. **Suction**: Liberal use of large-bore suction is often necessary
         d. **Mechanical maneuvers**: Chin lift, modified jaw thrust and digital sweep
         e. **Mechanical adjuncts:**
Access devices remain controversial; however, it seems logical and prudent to abstain from rigid intranasal devices in midface trauma. Soft, nasopharyngeal airways are acceptable.

Assess need for intubation, rescue airways, or cricothyrotomy. Consider presence of concomitant brain injury (20-50% of patients) when performing drug-assisted intubation on a patient with intact protective airway reflexes (Hawkins, 2003). Lidocaine premedication is advocated in some EMS systems. Etomidate is hemodynamically neutral and may actually decrease ICP. Paralytics are avoided in these patients as anatomic disruption may make BVM ventilations difficult or impossible if intubation is unsuccessful.

Traditional approaches to instrumented intubation may be difficult or impossible with mandibular and maxillary injuries due to disrupted bony leverage points or significant anatomical deformity. Retrograde intubation is especially attractive in immobilized patients with deforming injuries. In extreme emergencies if the airway is completely obscured, inspect for bubbling (generated by ventilations), and place the tube there (directed intubation)(Hawkins, 2003).

If the airway is impaired, intubation is unsuccessful and the patient cannot be ventilated with a BVM, perform a cricothyrotomy

4. Assess for ineffective ventilations: Determine general respiratory rate, depth, and effort (work of breathing); assess for retractions and adventitious breath sounds. Assist ventilations as needed with a pocket mask or BVM.

5. Assess for impaired gas exchange/hypoxia: assess SpO₂; administer supplemental oxygen as indicated.

6. Assess for alteration in tissue perfusion and fluid volume deficit related to uncontrolled bleeding - especially if one of the facial arteries (external maxillary or superficial temporal artery) is involved.
   a. Note site, amount, rate, and color of bleeding or discharge. Superficial injuries will bleed; however they seldom bleed sufficiently enough to produce shock unless there is massive bleeding from scalp lacerations or in a peds patient. If patient is in shock, look for another source of blood loss (thoracic, abdominal, pelvic or retroperitoneal injury).
   b. Compare carotid and temporal pulses; assess general pulse rate
   c. Assess skin color and temperature.
   d. Control bleeding - Options for hemostasis:
      (1) Direct pressure - Nasal bleeding can be controlled by using bilateral digital pressure just below the nasal bones. Soft tissue bleeding can be controlled by applying sterile pressure dressings or using bandage material to apply circumferential pressure.
      (2) Pressure points
      (3) Apply cold packs over blunt trauma and penetrating trauma after bleeding is controlled to decrease edema and hematoma formation
   e. Venous access: Assess need for IV medications and/or volume replacement
   f. Apply ECG monitor if potential for shock

7. Assess for alteration in mental status related to associated central nervous system trauma; use GCS

C. Focused history and assessment
1. SAMPLE history
2. **Full set of VS**

3. **Inspect for general signs of injury.** Systematically move from top to bottom (scalp to chin), anterior to posterior and medial to lateral (nose to ear) inspecting for DCAP, BLS
   a. General appearance; observe facial expression for pain, anxiety
   b. Facial asymmetry i.e., palpebral fissures, nasal labial folds, nose and mouth midline? Eyes on the same level? Telecanthus?
   c. Eyelid, periorbital injury, aqueous or vitreous fluid leaks; hyphema
   d. Edema, ecchymoses, soft tissue trauma, foreign bodies
   e. Epistaxis, rhinorrhea
   f. Oral cavity
      (1) Submandibular space: Blood accumulating in this space will displace the tongue and soft tissue posteriorly into the airway. A parasymphyseal fracture commonly results in an expanding hematoma in this space.
      (2) Dental occlusion/malocclusion; loose, chipped, missing or displaced teeth
   g. **Ears:** Check for intact tympanic membrane if possible; otorrhea, Battle sign

4. **Palpate:** Assess for
   a. tenderness/pain: type, duration, location;
   b. instability, malalignment, deformity;
   c. limited or abnormal movement;
   d. crepitus;
   e. Trismus (locked jaw); and
   f. edema.

5. **Integrity of cranial nerves II - VIII**
   a. **Assess and evaluate**
      (1) **Optic (II):** Visual acuity (vital sign of the eye), diplopia
      (2) **Oculomotor (III):** Pupil size, shape, equality; light response - direct and consensual; ptosis
      (3) **EOM’s (III, Trochlear (IV), Abducens (VI)):** With head held still, have patient look up, down, and to both sides. Assess for conjugate/dysconjugate gaze, gaze palsies. Ask about pain with eye movement.
      (4) **Trigeminal (V):**
         (a) Motor: Palpate the temporal and masseter muscles for strength as the patient clenches his teeth and moves his jaw laterally Assess for malocclusion.
         (b) Sensory: Stroke skin across forehead, upper lip and chin. Determine areas of altered sensation.
      (5) **Facial (VII):** Assess for asymmetry, weakness of portion(s) of the face
         (a) **Temporal branch:** raise eyebrows, wrinkle forehead
         (b) **Zygomatic branch:** squeeze eyes tightly shut (orbicularis oculi muscles)
         (c) **Buccal branch:** elevates upper lip, helps wrinkle the nose, "puff out the cheeks"
Facial Trauma

Connie J. Mattera M.S., R.N., EMT-P

(d) **Marginal mandibular branch**: particularly important. Serves much of the orbicularis oris muscle. Damage causes a depression and loosening of lower lip. Patient can't whistle.

(e) **Cervical branch**: primary target platysma muscle to "pull up the neck": - not functionally important in man.

(f) May have a post-traumatic Bell’s Palsy (stunning of the nerve) (Hawkins, 2003)

(6) **Acoustic vestibular (VIII): Test** hearing by whispering in each ear and assessing for deficits

D. **Analgesia**: Morphine: Excellent analgesic; histamine producer so patient may experience itching or hypotension in addition to respiratory depression. Reversible with naloxone.

Facial injuries are divided into two classifications: soft tissue injuries & facial fractures

IV. **Specific facial fractures**

A. **Mandibular fractures/temporomandibular joint dislocation**

1. **Epidemiology**
   a. Third most commonly fractured bone (50-70% of all facial fractures excluding nasal bones)
   b. Strongest facial bone
   c. 50% are multiple or bilateral; always exclude a second fracture
   d. Males: females 3:1
   e. 30-40% occur in the 20-30 year-old age group

2. **Etiology**
   a. Vehicular crashes: 23-43%
   b. Assaults: 34-68%
   c. Work and fall-related: 7% each
   d. Sports: 4%
   e. GSW: 4%

3. **Location in descending order of occurrence**
   a. Condyle
   b. Angle
   c. Body
   d. Parasymphysis
   e. Ramus/Alveolar
   f. Coronoid
   g. Midline symphyseal

4. **Areas of weakness**
   a. Angle - unerupted 3rd molar
   b. Canine - longest root
   c. Condyle neck - keeps the condyle from being impacted through the glenoid fossa into the middle fossa

5. **Forces**
   a. 190 kg force at symphyseal area causes one condyle to fracture
   b. 250 kg for bilateral fracture
   c. 380-420 kg for symphyseal fracture

6. **Clinical presentation** (must look externally as well as inside of mouth if possible)
   a. Swelling/deformity of facial contour
   b. **Malocclusion** - Sensitive up to 1 mm offset. Assess if teeth come together normally and painlessly. Any patient presenting with malocclusion has a mandibular fracture until ruled out. Schwab et al (1998) reported that malocclusion and facial asymmetry are the strongest predictors of fracture.
c. Dental trauma/avulsed teeth: Bleeding around the teeth adjacent to the fracture
d. Anesthesia of the lower lip and chin
e. Hematoma in the floor of the mouth
f. Drooling and potential airway compromise
g. Tenderness/pain in the area of the fracture/dislocation whenever the patient attempts to open or close the mouth
h. Assess and r/o pharyngeal, c-spine and intracranial injuries
i. **TMJ dislocation**: Forward and superior displacement of the jaw in which spasms of the masseter muscles prevent the condyles from returning to their normal position. **S&S**: Malocclusion, inability to close mouth, pain.

7. **Interventions**
   a. Clear oral cavity of F/B and gross debris; establish patent airway. A fractured mandible can occlude the airway quickly especially if a flail mandible as the tongue can fall backwards into oropharynx!
   b. **Initial splinting**: Barton's bandage may provide comfort and initial stabilization
c. Vomiting precautions
d. Control external bleeding
e. Apply ice/cold pack
f. **Management of TMJ dislocation**: Manual reduction after mandibular fractures is ruled out. Conscious sedation to facilitate reduction; analgesics for home use; soft diet for 3-4 days.

B. **Maxillary fractures (midface)**

1. **Epidemiology**
   a. Incidence is 6-25% of all facial fractures
   b. Often occur in combination with other facial fractures secondary to the significant force necessary to cause them.

2. **Classification and clinical presentation by type**
   a. In 1901, the French anatomist, Rene Le Fort, used clubs and cannon balls on cadavers to produce extensive maxillary fractures. He mapped the typical fracture lines encountered. Le Fort fractures typically result from blunt trauma, are usually bilateral and are frequently associated with other facial and intracranial injuries. All have malocclusion.

![Le Fort I, Le Fort II, Le Fort III](image-url)
b. **Le Fort I**: Transverse horizontal maxillary alveolar fractures, palate-facial dysjunction (Guerin fracture): Occurs through the lower maxilla into the nasal cavity including the maxillary alveolar process, portion of the maxillary sinus, the hard palate, and the lower aspect of the pterygoid plates. Detaches the tooth-bearing portion from the rest of the maxilla. One fracture line. There are usually no airway complications.

**Presentation**: Ecchymosis and edema of the upper gums. Malocclusion of the teeth possible. Upper teeth/palate mobile on palpation. Epistaxis may be present.

c. **Le Fort II** (pyramidal dysjunction): Fracture line forms a triangle, passing above the nasal bones through the lacrimal bones, orbital floor, infraorbital margin, across the upper portion of the zygomatic-maxillary suture line and maxillary sinus and pterygoid plate along the lateral wall of the maxilla into the pterygopalatine fossa. Two fracture lines result in a floating maxilla and nose with a possible cribiform plate fracture.

**Presentation**: Mobile midface with intact zygomatic arches. The nose moves with the dental arch when fragment is shifted. Edema of entire midface. Subconjunctival hemorrhage is usually present and epistaxis may be seen. Assess for CSF rhinorrhea.

d. **Le Fort III** (craniofacial dysjunction): Three fracture lines traverse through the orbits and across the top of the nose resulting in complete separation of the facial bones from their cranial attachments. Most complex of all facial fractures. Fracture passes through the nasofrontal suture, the junction of the ethmoid and frontal bone, the superior orbital fissure, lateral wall of the orbit, zygomaticofrontal and temporal suture, with a high fracture of the pterygoid plate producing a dish-face deformity that is difficult to correct secondarily.

**Presentation**

1. By definition, there is communication with the cranial vault and CSF rhinorrhea may be evident due to the fracture of the cribiform plate. Do not pack nose or impede drainage. Collect on a moustache dressing. Do not let patient blow their nose.

2. When the fragment is shifted, all of the facial bones, including both malar prominences and the bridge of the nose show anterior, posterior and inferior mobility. Palpation of facial architecture reveals mobility of the teeth and zygomas.

3. Visual impairments

4. Periorbital ecchymoses and massive edema

5. At risk for airway obstruction secondary to dissection of hematoma into the palate, pharyngeal walls, or tonsillar pillars

6. Frequently have associated mandibular fractures.

3. **EMS Interventions**

   a. Assume spine injury
   b. Assure patent airway/adequate ventilation
   c. Control exterior bleeding
   e. Apply ice/cold pack
   f. Vomiting precautions
   g. Adequate analgesia

4. Maxillary fractures in children: More unusual in children younger than 6. Sinuses are less developed and they have a thicker and stronger midface.
C. **Zygomatic fractures**

1. **Epidemiology**
   
a. Second most common fracture. Malar eminence articulates with temporal, frontal, greater wing of sphenoid and maxillary bones to form the zygomatic arch.

   b. Prone to fracture due to prominence.

   c. MOI: Usually due to a blow to the side of the face or something similar. Can be associated with significant eye injury.

2. **Classification**
   
a. **Non-displaced body:** Result of mild to moderate force and involves zygomaticofrontal suture, inferior orbital rim and maxillary sinus.

   b. **Displaced body:** Degree of separation will vary and may cause orbital floor displacement limiting eye movement, coronoid process impingement with difficulty opening/closing mouth. Contusion of the infraorbital nerve numbs the lower lid, medial cheek and upper lip.

   c. **Comminuted body:** Results from violent force; associated injuries are common. Optic nerve and globe injury must be ruled out.

   d. **Isolated arch:** Results from lateral blow to the arch causing limited mandibular movement secondary to muscle trapping and/or pain.

3. **Clinical presentation**
   
b. Flattening of the upper cheek zygomatic depression/step-off

c. Decreased zygomatic height

d. Eye droop causing diplopia- muscle entrapment 10%

e. Periorbital ecchymoses and edema

f. Inferior orbital tenderness

g. Subconjunctival hemorrhage

h. Enophthalmos

i. Hypo/anesthesia of the lower lip, medial cheek and upper lip

j. Subcutaneous emphysema

k. Nosebleed (epistaxis) on the injured side

l. Trismus or pain on chewing from impingement of temporalis muscle, difficulty opening the jaw

4. Tripod fracture mnemonic
   
a. **T**: Trismus

   b. **I**: Infraorbital anesthesia

   c. **D**: Diplopia

   d. **E**: Epistaxis

   e. **S**: Lack of symmetry

5. **Interventions:** Ice bag, pain meds prn, control epistaxis, position patient for comfort

D. **Orbital fractures: Blow out fracture**

1. **Epidemiology**
   
a. Seven bones join to form the orbit (frontal, zygoma, maxilla, lacrimal, ethmoid, sphenoid and palatine)

   b. Weakest portion is the medial wall followed by the floor

   c. Most common fracture is the floor alone or in combination with the medial wall.

2. **Classification:** Orbital floor fracture - **Clinical presentation**
a. Periorbital edema and ecchymoses
b. Deformity/tenderness or orbital rim
c. Enophthalmos or exophthalmos
d. Areas of anesthesia
e. Limited ocular motility: Decreased vertical ocular rotary movements. Eye cannot look up above midline. It often looks down and out with ptosis due to disruption of CN III.
f. Vertical diplopia from entrapment of inferior rectus muscle, fat or orbital septa; muscle paresis, and edema of orbital tissue.
g. Pain on upward gaze

3. **Treatment:** Warn patient not to blow their nose and to avoid sneezing if possible to protect against seeding the orbit with sinus bacteria

4. **Complications**
   a. Blindness
   b. Orbital atrophy with enophthalmos
   c. Ectropion

**E. Nasal fractures**

1. **Epidemiology:** Most frequently fractured facial bone due to its prominence. Generally caused by blunt trauma to the front or side of the nose.

2. **Classifications**
   a. **Greenstick:** Benign fracture of nasal bone or septum but no complete fracture is visible
   b. **Linear:** Can be displaced or non-displaced
   c. **Comminuted:** Open fracture with mucosal tear exposing the bone
   d. Depressed
   e. Laterally angulated

3. **Clinical presentation**
   a. Asymmetry, deformity, depressed
   b. Bleeding: internal and external
   c. Swelling, pain, tenderness
   d. Septal hematoma: complication which may cause permanent nasal deformity if not diagnosed and treated appropriately
   e. Crepitus and instability
   f. Obstruction of nasal cavity on fractured side
   g. Ecchymosis
   h. Septal fracture/ hematoma or submucosal hemorrhage

4. **Interventions**
   a. Upright position if able
   b. Control hemorrhage; cold packs
   c. Analgesics prn
   d. Do not let patient blow their nose. They may have a large septal hematoma. Looks like a “plum” protruding into the airway from the septum.

**F. Dental fractures/avulsions**

1. **Types of teeth**
   a. Incisors
   b. Canines
   c. Premolars
   d. Molars

2. **Epidemiology**
   a. More than 5 million teeth avulsed each year
b. MOI: Falls, play and athletic injuries, battery, MVCs, foreign bodies hitting the oral structure, domestic violence, seizure activity

c. Maxillary central incisors most commonly involved teeth

3. Tooth anatomy

4. Teeth are connected to surrounding bone by the periodontal ligament (PDL). When the alveolar plates are injured, this ligament may be stretched or torn. If a tooth is avulsed, part of the ligament stays on the tooth root, and a portion stays on the socket wall. If the two portions of the PDL are kept viable, the tooth can be reimplanted.

5. Clinical presentation: Fracture may involve any part of a tooth or related structures: crown (enamel, dentin, pulp cavity) and/or root. Teeth may be fractured, avulsed, or subluxed. Fractures into the pulp expose the nerve of the tooth.

a. Physical exam

   (1) Look for foreign bodies (pieces of fractured tooth in oral cavity) that may obstruct the airway.
   (2) Determine if primary or permanent tooth; number involved
   (3) Assess for disfigurement of the tooth; change in color of affected tooth
   (4) Inspect for involvement of enamel, dentin, pulp and/or root
   (5) Inspect for injuries to oral mucosa or gingiva; extraoral wounds.
   (6) Assess pain from the affected tooth (dentin/pulp injury)
   (7) Determine if there was a loss of consciousness/amnesia associated with the injury
   (8) Headache
   (9) Significant drooling, nausea, or vomiting
   (10) Malocclusion
   (11) If patient has a head injury, assess for associated dental trauma

6. Interventions

a. Fractures involving enamel and dentin

   (1) Application of calcium hydroxide to protect tooth from further injury or exposure to saliva and air, which may lead to pulpitis
   (2) Oral analgesic
   (3) Dental referral

b. Fracture involving pulp

   (1) Application of calcium hydroxide to exposed crown surface
   (2) Oral analgesic
   (3) Exploration of soft tissue for possible tooth fragments
   (4) Referral to dentist or oral surgeon

c. Injury to the root: Consult oral surgeon

d. Totally avulsed teeth: Permanent teeth have good survival rate (up to 90%) if handled and stored appropriately. Deciduous “baby” teeth are not generally replanted.

   (1) The PDL connected to the avulsed tooth must be protected from two potentially destructive forces: cell crushing and loss of normal cell metabolism (Krasner, 2005).
(2) Finger pressure on the root will cause cell crushing. Handle tooth by the crown. Avoid touching root to protect periodontal ligaments.

(3) Leave adherent membrane or fibrous tissue intact to avoid stripping the periodontal membrane and ligament. Do not clean, rub, scrape or disinfect the outside of the tooth.

(4) Never place on anything that can dry or crush the outside of the tooth. Do not hold in paper or cloth. Avoid contact with hard surfaces such as glass, plastic or cardboard.

(5) Place tooth in break-resistant storage device with a tightly fitted top and soft inner walls. Ex: Save-A-Tooth System.

(6) **Maintain cell metabolism:** Normal tooth pH is 7.2. When avulsed, the tooth’s stored nutrients are depleted within 15 minutes (Krasner, 2005). Store in a pH-balanced, isotonic, glucose-Ca-Mg-enriched cell-preserving fluid like Hank’s Balanced Salt Solution (HBBB). May use refrigerated whole milk as next best alternative or sterile NS. Saline and milk will not cause cell swelling, but lack metabolites and glucose necessary to maintain normal cell metabolism. No tap water or ice. Gently agitate the solution to clean the tooth without scrubbing (Krasner, 2005).

(7) Saliva as a storage medium is problematic. It is filled with microorganisms that can severely infect the tooth root. When re-implanted, the cells become necrotic and infected (Krasner, 2005).

7. Ongoing challenges relative to dental trauma include the possibility of damaged nerves requiring root canals, root resorption, and need for orthodontics, dental implants and crowns which can result in significant costs.

G. **Soft tissue injury**

1. **Etiology:** Most common causes include MVC, interpersonal altercations, violent crimes, animal and human bites.

2. **Presenting signs and symptoms:** May range from simple isolated facial laceration to those accompanied by massive facial trauma, fractures, hemorrhage, edema, airway obstruction and multi-system injuries.

3. **Areas of special concern**

   a. **Lips and perioral area:** Maintaining the vermillion-cutaneous border is a priority. The two sides of the wound must remain in proper proximity to guarantee that the patient won’t end up with a staggered lip line.

   b. **Tongue and oral cavity:** often heals amazingly well. Intraoral irrigation is common post-repair.

   c. **Facial nerve and parotid salivary gland:** any deep laceration carries a danger of parotid duct or facial nerve injury. Stensen’s duct drains the gland. Assess for bloody drainage into the mouth, saliva in the wound.

   d. **Ears:** poor viability due to limited vascularity and cartilage construction

   e. **Eyebrows:** Don’t shave! Hair will often not grow back uniformly.

   f. **Impaled objects:** Like any other part of the body, these should not be removed until surgical examination; however, due to both internal and external access, objects in the check may be removed.

V. **Evaluation of responses to interventions**

Monitor the following:

A. Airway clearance and ventilatory status
B. Oxygenation status
C. Hemodynamic stability
D. Changes in level of consciousness
E. Changes in motor/sensory status
F. Associated injuries
G. Response to interventions

VI. Complications
A. Airway compromise
B. Head injury
C. Hemorrhage
D. Loss of vital senses: sight, hearing
E. Infection
F. Malunion/non-union
G. Cosmetic defects
H. Chronic pain/arthritis
E. Psychological trauma: Post-traumatic stress disorder, severe depression in nearly 1/3 of patients (Hawkins, 2003)

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<thead>
<tr>
<th>S/S of Facial Fractures</th>
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<tbody>
<tr>
<td>Deformity</td>
</tr>
<tr>
<td>Inability to move jaw</td>
</tr>
<tr>
<td>Irregular bite</td>
</tr>
<tr>
<td>Loose bone fragments</td>
</tr>
<tr>
<td>Swelling</td>
</tr>
<tr>
<td>Bleeding, bruises</td>
</tr>
<tr>
<td>Absent or loose teeth</td>
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</tbody>
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CJM: Facial 08
References


