This chapter discusses the epidemiology, diagnosis, and treatment of injuries to the skin, soft tissue, and bones of the face. A complex structure vital to the function of the person, the face comprises airway openings, entry to the gastrointestinal tract, and special sensory organs, including eyes, ears, and nose. Facial functioning is essential for eating, speaking, and effective nonverbal communication. The appearance and attractiveness of the face have significant implications for social interactions, and self-esteem. In one study, patients who had sustained facial trauma experienced long-term sequelae including unemployment, incarceration, marital difficulties, and negative body image.

Apart from immediate threat to the patient’s airway and special sense organs, injuries to the face can have serious implications for the patient’s mental health and future functioning. Post-traumatic patients with facial injuries often describe physical, financial, social, and psychological loss. In one study of predominantly unemployed young African American and Hispanic men, 25% had symptoms of post-traumatic stress disorder 1 month after having been treated emergently for a midface fracture. Some institutions are now including screening evaluations regarding supportive interventions as well as initiating support groups and online resources for facial trauma patients.

Although the emergency physician’s first goal is to address life-threatening problems successfully, the care of facial injuries is aimed at optimizing the patient’s function and cosmetic appearance. Four main specialties—ophthalmology, plastic surgery, otolaryngology, and oral and maxillofacial surgery—participate in the care of facial injuries. In teaching hospitals, the specialties of plastic surgery, otolaryngology, and oral and maxillofacial surgery participate in approximately equal proportions. In level 1 trauma centers, plastic surgeons and oral and maxillofacial surgeons predominate. Early consultation with the appropriate specialist can expedite the care of facial injuries.

### Epidemiology

In 2008 there were more than 40 million injury-related visits to U.S. emergency departments (EDs). Facial injuries accounted for a significant proportion of these visits and resulted from either intentional violence (assaults and attempted suicide) or unintentional trauma (falls, sports injuries, and motor vehicle crashes [MVCs]). The type of injury mechanism can be a good predictor of the extent of facial trauma sustained; for example, MVCs were related to multiple facial fractures, whereas assaults more often involved isolated mandibular fractures. Although MVCs used to be the most common cause of facial injuries, windshield improvements, increased use of safety belts, and the prevalence of air bags in vehicles are changing the epidemiology of facial trauma. Dual front-impact air bags have been required in all new vehicles since 1999, and safety belts are required for all passengers in the front row in 49 states (all except New Hampshire). Seat belts and air bags significantly reduce the incidence and severity of facial injury in adults. Because they effectively prevent ejection, safety belts specifically avert the extensive scalp and facial degloving injuries associated with being ejected through the windshield.

Alcohol use by vehicle occupants decreases safety belt use and independently increases the risk of facial injury in MVCs. It also increases the risk of interpersonal violence. In one series, alcohol played a role in 49% of all maxillofacial fractures in patients requiring subspecialty care. Of the fractures related to alcohol use, 78% were a result of interpersonal violence and 13% of MVCs. Interpersonal violence is increasingly cited as the cause of facial injury, particularly in inner-city populations. Falls, dog bites, some athletic activities, and flying debris are other common causes of facial injuries.

Because of the lack of external protection, facial injuries are common among riders of other motorized vehicles, particularly those who are not wearing helmets with face guards, including all-terrain vehicles (ATVs) and motorcycles. In one series in Alabama, 32% of injured ATV riders had a facial injury, and the presence of a facial injury was associated with increased overall injury severity. Among the youngest riders, facial injuries predominate: 31.1% of 0- to 5-year-olds injured while riding an ATV required emergency treatment for a facial injury in 2001 through 2003, although multiple safety and medical groups recommend no ATV use by people younger than age 16 years.

In motorcyclists, there is a significant association between facial injury and brain injury. Helmets reduce the risk of brain injury but may not protect against facial trauma unless they include a face guard.

Unfortunately, a separate group of the injured must now be considered: combat veterans. A review of injuries sustained in battle by combatants in Operation Iraqi Freedom and Operation Enduring Freedom and treated by U.S. military medical facilities for at least 72 hours revealed that 19% of patients sustained injuries to the face, ears, or eyes. Of all these injuries, 19% were caused by gunshots, 79% by explosive devices, and 2% by MVCs.

In children younger than age 17 years, sports injuries account for 21% of facial and 29% of nasal fractures requiring specialist evaluation. Baseball and football helmets with face guards are successful at preventing childhood facial injuries, and their use should be encouraged by emergency physicians.

Children younger than age 6 years seem to be at significant risk...
for severe facial injuries from bites from the family dog.\textsuperscript{37} Interactions between pet dogs and young children require careful supervision.

Facial injuries are a common acute presentation for victims of domestic violence. In one series, 81% of domestic violence victims had maxillofacial injuries on presentation, 30% of them with facial fractures. The location of the injury was consistent with the predominance of fistled assaults; left-sided injuries predominated.\textsuperscript{38,39} Women visiting the ED with facial injuries should be interviewed privately to allow an opportunity for disclosure and intervention for domestic violence.

Pediatric facial injury accounts for less than 10% of all facial trauma, and the face is the most common area of trauma in children suspected of being victims of abuse.\textsuperscript{40} However, the epidemiology of facial trauma among children reflects their physical development and behavioral patterns: toddlers learning to walk have a “falling zone” of trauma to the perioral region, nose, and forehead. Younger children are significantly more likely to have minor soft tissue injuries and to have been the recipient of a dog bite. Severe facial injuries in all pediatric age groups are more likely to be the result of an MVC or assault.\textsuperscript{41} Care should be taken by the emergency physician to correlate the child’s age and behavioral ability with the history of the injury and the physical findings. In particular, injuries to the lips or frenulum in a nonambulatory infant suggest “bottle jamming,” and bruises to the cheeks or neck are less common in falls. Although dental fractures in young children are relatively common, facial fractures before age 5 years are rare. If there is any question, the appropriate local authorities are contacted.

Even in high-energy MVCs, appropriate use of child safety restraints protects against many facial injuries. The law in all 50 states requires the use of such restraints for children younger than age 4 years, and currently 48 states require booster seats until at least age 7 years and many beyond that age.\textsuperscript{14} Children younger than age 15 years involved in frontal crashes or exposed to a deploying frontal impact air bag had a higher incidence of minor facial and chest injuries and severe upper extremity injuries, mostly related to being struck by the bag.\textsuperscript{42} As part of preventing facial trauma, parents should be encouraged to ensure that children younger than 12 years ride in the rear seat of the vehicle and that all are properly restrained.

### PRINCIPLES OF DISEASE

#### Anatomy

The face is a complex hollow space encapsulated by a bony structure overlaid with muscle and skin. It includes several special sensory organs: the eyes, ears, nose, and mouth.

#### Bones

The posterior portions of the face form the anterior wall of the calvaria, placing the face and its features in an intimate relationship with the structures of the central nervous system. The anterior facial skeleton is composed of the frontal bone, nasal bones, zygomatica, maxillary bones, and mandible (Fig. 42-1). The sphenoid, ethmoid, lacrimal, vomer, and temporal bones lie deep within the facial structure, providing support and important sites for muscular attachments, including the muscles of mastication, speech, and deglutition. This musculature is innervated by cranial nerves IX and X.

#### Nerve Supply

The most anterior muscle layer includes the muscles of facial expression that are innervated by the seventh cranial nerve, which lies just inferior to the external auditory canal. The trigeminal nerve (cranial nerve V) supplies sensation to the face through three major divisions (I–III). The ophthalmic division (cranial nerve V1) supplies the upper third of the face, including the eye and the nose down to the tip. The maxillary division (cranial nerve V2) provides sensory innervation to the midface and includes the infraorbital nerve. The mandibular division (cranial nerve V3) supplies sensation to the lower third of the face.

#### Ears

The ears lie laterally along the sides of the face with the auditory canal exiting through the mastoid process of the temporal bone. The skeleton of the pinna is cartilage covered in closely apposed skin and rolled into a helical shape with a second ridge, the antihelix, defining the inner concha. The external auditory canal, middle ear, cochlea, semicircular canals, and superior origin of the eustachian tube all lie within the temporal bone.

#### Eyes

The structure of the globe and surrounding ocular musculature is discussed in detail in Chapter 71. The bony orbit is composed superiorly of the frontal bone. The zygoma forms the lateral wall and lateral floor of the orbit. The medial floor and anteromedial wall are formed by the maxilla. The lacrimal and ethmoid bones complete the medial wall, where the orbit is at its most delicate. The medial wall of the orbit forms the lateral walls of the intra-nasal space.

#### Nose

The nose serves as a major entryway for air and is composed of cartilage and bone covered by skin with mucosa lining the internal surface. Alar cartilage arches over the entrances to the symmetrical, mucosa-lined nares, separated by the anterior cartilage of the septum. Superiorly, the nasal bones create the bridge of the nose. With the head held in a neutral upright position, the floor of the nose is perpendicular to the ground and leads back into the nasopharynx, passing the turbinate laterally and the bony septum medially. The ethmoid bone lies superiorly and crosses midline, behind the nasal bridge, to form the superior portion of the bony nasal septum and the cribriform plate. The vomer makes up the inferior portion of the bony septum, and the palatine process of the maxillary bone forms the posterior floor of the nose and the hard palate.
Air-containing sinuses are structural features unique to the facial skeleton. They warm and humidify inhaled air and form chambers that create the unique tone of human voices. These sinuses develop over the period of human growth. At birth, only the ethmoid air cells and the mastoid antrum are aerated. The sphenoid sinus and the remainder of the mastoid air cells become aerated at approximately age 3 years. Frontal sinuses form at approximately age 6 years, and maxillary sinuses are not fully developed until age 10 years.

Mouth

The mouth serves as an entryway for the respiratory and gastrointestinal tracts. In addition, the fine motor movements of the mouth and tongue give humans the ability to communicate through speech. With the mouth in the closed position, the tongue fills the oral cavity. Single rows of teeth lie within the alveolar ridges of the maxilla and the mandible. With the mouth closed, the teeth in normal individuals occlude, with the lower row lying just internal to the upper row. The “usual” occlusion for individuals varies widely; the patient’s perception may be the best determinant of whether or not the teeth are meeting as usual. Anterior to the teeth is the vestibule, a fold of mucosa and flexible soft tissue that allows the lips to remain closed while various motor movements occur behind them. The mandible is a U-shaped bone that forms the chin and completes the lower facial skeleton. Containing the lower row of teeth, the body of the mandible meets in midline at the symphysis, which is completely fused by age 2 years. Posterior to the last molar, the bone turns to form the angle of the jaw and continues upward as the ramus of the mandible. At the most superior point of the ramus is the articular surface of the condyle, separated from the superior surface of the temporomandibular joint (TMJ) by an intervening meniscus of fibrocartilage. Anterior to the condyle lies a thin projection, the coronoid process, which provides the insertion point for the temporal muscle.

The skin of the face is among the thinnest of the body, draping over the underlying musculature. Facial skin falls visibly into predictable creases with age, following Langer’s lines (Fig. 42-2). At the mouth, nares, and palpebral fissures, the skin is contiguous with the mucosa lining these structures. The skin of the lips is particularly thin and lined with vascular papillae, which give the lips their vermilion hue. Lips are particularly important as part of communication; understanding their movement can allow language without sound (lip reading).

The face is a highly vascular structure; this can have grave implications for the treatment of facial injuries. With the exception of the ophthalmic artery, the superficial blood supply comes from the external carotid artery via the facial, superficial temporal, and maxillary arteries (Fig. 42-3). Soft tissue injuries and fractures that involve these vessels can lead to significant hematomas or exanguinations. Because the face has extensive anastomotic connections across the midline and between arterial territories, however, ligation of major branches causes minimal ischemia.

Buried within the structure of the face are a series of glandular structures and ducts that are susceptible to injury. In the eye, the lacrimal glands lie within the orbits, superior and lateral to the globes, and secrete tears through ductules into the folds of the conjunctiva. The liquid flows medially into the puncta of the lacrimal canaliculi and drains into the lacrimal sac and then via the nasolacrimal duct into the nasopharynx.

The salivary system consists of the parotid, sublingual, and submandibular glands. The parotid is the largest of these glands, lying just anterior to the ear and wrapping around the mandible. The parotid is superficial to the masseter muscle and drains via Stensen’s duct, a 5-cm tube that curves around the anterior edge of the masseter to enter the mouth opposite the second upper molar. In normal subjects, this duct is large enough to be palpated with the masseter clenched (Fig. 42-4). The sublingual glands lie entirely within the floor of the mouth and drain into the mouth via ductules. They surround the ducts draining the submandibular glands (Wharton’s ducts). The body of the submandibular gland is folded around the mylohyoid muscle so that a portion lies within the floor of the mouth and a portion lies external to it. The submandibular (Wharton’s) ducts run from the external portion of the gland to empty into the mouth on either side of the frenulum of the tongue.

Pathophysiology

The basic mechanism of all injury is the transfer of energy, most often kinetic, to the structures of the body. When the energy overcomes the tolerance of the underlying tissue, injury results. Trauma traditionally has been classified as blunt or penetrating, but in many cases the effect is a combination of the two, such as the forehead injury (contusion and complex laceration) resulting from a child’s fall against the sharp corner of a coffee table. The likelihood of injury is related to the amount of energy transferred and the condition of the underlying tissue. Significant injury may result when an 80-year-old falls from standing to a carpeted floor, but it is more likely to result when the face strikes the steering wheel or dashboard in a high-speed MVC.

The mechanism can be broken down into low-energy events, such as a fall from standing or walking into the corner of a piece of furniture, and high-energy events, such as an MVC. Understanding the mechanism of injury can help predict not only the severity of the facial injury but also the risk of associated cervical or brain injuries.

Traditional teaching has been that the face protects the brain from injury and that patients with facial trauma are less likely to have a significant brain injury. This does not appear to be correct. Instead, recent work suggests a significant increase in risk for brain injury among blunt trauma patients with facial fractures.

The association between cervical injury and facial injury is unclear. The traditional teaching has been that the presence of a facial injury should increase the suspicion of an injury to the
Penetrating trauma to the face from gunshots, stab wounds, blast debris, or impalement is often obvious and dramatic (Fig. 42-5). The astute emergency physician should search avidly for associated intracranial, spinal, or vascular injuries, which are common in these cases. Facial penetration from pellets (BBs) or small blast debris or shrapnel may be less obvious, and the emergency physician should be alert to the possibility based on the history and should carefully search for small skin lesions. Recreational hobbies such as paintball and new law enforcement weapons such as the “flash ball,” which can have substantial kinetic energy, have caused significant facial and upper body trauma.

**CLINICAL FEATURES**

**History**

The history can provide information about the mechanism of the patient’s injury. The emergency physician, however, should be alert to limitations of the history in cases in which the patient’s consciousness is altered by head injury or intoxication, there is an issue of secondary gain, the police are involved, or abuse is suspected. Patients with a clear sensorium are able to describe the events leading up to the injury and localize pain; deficits in motor or sensory function; and abnormalities of vision, hearing, taste, or
should be evaluated for symmetry. The appearance of the zygomatic buttress may be difficult to assess. During the primary assessment, attention is initially on the patient’s airway, and inspection of the oropharynx is an essential first step. Airway compromise is often a result of intraoral trauma, and the examiner should note excessive bleeding, drooling, dysphonia, swelling of the tongue or posterior pharynx, and the presence of avulsed teeth. When the patient is stabilized, a secondary survey should include a systematic examination of all facial structures and functions. Bony prominences should be palpated for abnormal motion, bony crepitus, tenderness, or step-off. Tenderness and massive swelling associated with facial trauma may preclude reliable palpation of a fracture. Consequently, areas of significant swelling should be imaged radiographically. Assessment of bony integrity includes testing for possible Le Fort fractures. The upper incisors are grasped and pulled anteriorly. Movement of the upper alveolar ridge (type I), midface (type II), or entire face (type III) indicates a fracture. Wounds may need to be palpated for underlying bony injury or foreign objects; anesthesia may be required for a thorough examination within the wound. Complex lacerations involving the cartilage of the nose or ear, eyelids, lacrimal apparatus, eyebrows, or vermilion border of the lips should be identified because their repair requires special techniques.

Eyes and Orbits

In addition to examination of lacerations and contusions, the face should be evaluated for symmetry. The appearance of the zygomatic buttress may be evaluated by looking at the patient from above. This technique also draws attention to the relative position of the eyeballs. Orbital fractures may result in enophthalmos, and a large retrobulbar hematoma may cause exophthalmos. The anterior chamber of the globe should be inspected for hyphema or globe rupture. A hyphema is caused by bleeding in the anterior chamber and appears as a layer of blood in the dependent portion of the anterior chamber. A complete examination of the eye requires specific testing. If the patient is able to cooperate, visual acuity should be documented. Contact lenses should be removed. In the event of a significant potential chemical exposure, the pH of the eye may need to be measured. Fluorescein examination of the eye should be performed if there is any concern about corneal abrasion. Victims of MVCs often have particles of glass in the conjunctiva or on the cornea, and these should be sought and removed. Extraocular motions should be tested. Blow-out fractures of the orbit may result in diplopia on upward gaze secondary to entrapment of the inferior rectus muscle or anesthesia of the midface and upper lip in the distribution of the second division of the fifth cranial nerve secondary to neuropraxia resulting from a fracture through the infraorbital foramen or compression by a local hematoma.

Oropharynx

The integrity of the mouth and nasal complex may be evaluated by listening to the patient’s speech. A muffled or overly nasal voice may indicate occlusion of the nose or nasopharynx, whereas dysarthria may indicate a mandibular fracture, tongue injury, or neurologic problem. Oral injury may result in progressive airway compromise, and dysphonia should alert the clinician to the possible need for active airway management. The intraoral examination includes inspection of the palate, teeth, tongue, and gums and palpation with a gloved finger (the latter only if the patient is able to cooperate). The range of motion of the mandible should be determined. If the maximal incisor opening is less than 5 cm, a mandibular fracture may be present. Trismus is likely to indicate a fracture or significant hematoma within the face. If awake, the patient’s impression about the normalcy of bite occlusion is a more sensitive determinant of a fracture of the mandible than the physician’s impression. Being able to perform a tongue blade test (grasping and holding a tongue blade between the teeth while the examiner pulls gently) is associated with greatly reduced probability of mandibular fracture. If the patient is able to crack the tongue blade by biting on both sides of the mouth, the negative predictive value for a mandibular fracture is 95%. Injury to the parotid area should raise suspicion of disruption of Stensen’s duct. The opening of the duct opposite the second upper molar should be examined for bleeding while the gland is compressed. If blood
is expressed from the duct or the severed ends of the duct are identified within a facial wound, specialized repair over a stent is required to prevent formation of a cutaneous fistula.

Ears

Otoscopy is performed to evaluate the integrity of the external canal, look for hemotympanum, and assess for otorrhea. Clear fluid from the ear after trauma should raise the possibility of a cerebrospinal fluid (CSF) leak. At the bedside, a drop of the fluid may be placed onto filter paper. A rapidly advancing halo of clear fluid around red blood defines a positive test result. This is a quick bedside test with good sensitivity (>86%) as long as the mix is approximately 50:50 between blood and other fluid, but it does not differentiate between CSF and saline, saliva, or other clear fluids.50

The ear should be inspected for subcutaneous hematomas because these need to be drained.

Nose

The nose is palpated for tenderness, crepitus, or abnormal movement, and then each naris is held closed in turn to ensure the patient is able to breathe through either side. The septum should be examined visually to look for septal hematoma, which appears as a large purple mass extending from the septum. If there is any concern about CSF rhinorrhea, the aforementioned filter test may be performed.

Neurologic Examination

Light touch should be tested for all three branches of the fifth cranial nerve. Motor function (cranial nerve VII) can be examined by having the patient actively wrinkle the forehead, fully open and close the eyelids, smile widely, and bare the teeth. Asymmetry of these movements indicates a potential nerve injury. Peripheral injuries to the seventh cranial nerve should cause discernible weakness in the forehead as well as the orbital and oral musculature, whereas central injuries will result in preserved forehead function because of crossing fibers distal in the course of the nerve. The fifth cranial nerve (the ophthalmic branch of the trigeminal nerve) and the seventh cranial nerve in an altered or uncooperative patient can be assessed by testing the corneal reflex.

The final part of the physical examination is documentation. Facial injuries may be evidence of assault, domestic violence, or child abuse. Careful documentation of findings, including photographs or drawings or both, not only communicates initial findings to other practitioners but also can provide crucial legal evidence because many of these cases have forensic implications or result in litigation.

DIAGNOSTIC STRATEGIES

Imaging

The choice of imaging for facial fractures depends on the patient’s stability, the patient’s ability to cooperate, and the availability of various options. The two main options are plain x-ray examination and computed tomography (CT). Fractures are better visualized with CT than with magnetic resonance imaging, so magnetic resonance imaging is not an optimal imaging choice. In patients who cannot cooperate for plain x-ray examination or in whom a fracture or penetrating injury is obvious from the physical examination, CT is the imaging modality of choice.51 For a complete evaluation, CT scans of the face should include coronal and sagittal reconstructions. Interpreting facial CT scans is an art that requires attention to bones, sinuses, orbital contents, and soft tissue and is best handled by radiologists.

With the increasing use of CT in emergency medicine and the advent of telemedicine, most 24-hour EDs have access to CT scanners for facial injuries. CT is now the first choice for all patients in whom a midface fracture is suspected. However, when no scanner is available and in patients with low to moderate pretest probability of a midface or maxillary fracture and who are stable and able to cooperate, the current recommendation is for a single screening view (Water’s or occipitomental view), followed by CT if the film is positive for a fracture or air-fluid level in any sinus.52-54

The U shape of the mandible and the presence of nearby bony structures make isolating the mandible on flat film impossible. Simple radiographs of the mandible are less sensitive than panorex radiographs and particularly tend to miss fractures of the condyle (Fig. 42-6). If available, panorex imaging is indicated for isolated mandibular fractures, dental fractures, or fractures of the alveolar ridge. In children, if fracture of the condyle is suspected, coronal CT is more sensitive and specific than panorex studies.55 Although the traditional teaching has been that the mandible’s shape results in two fractures if it is fractured at all (Fig. 42-7), a case series using CT evaluation found that 42% of mandibular fractures were unifocal.56

For patients with complex fractures, new imaging techniques may help improve surgical planning and esthetic outcomes. In displaced orbital fractures, use of CT data to measure orbital

Figure 42-6. Panoramic radiograph of the mandible shows fractures through the left angle and the right body. A dental appliance is in place on the lower incisors.
volumes has shown that after repair an orbital volume greater than 4% larger than on the unfractured side is associated with visible postoperative enophthalmos.\textsuperscript{57} This method seems to be useful in predicting which patients might benefit from operative repair.\textsuperscript{59} In conjunction with more standard two-dimensional facial CT scans, three-dimensional CT scans seem to improve the diagnosis and aid preoperative planning for patients with complex fractures of the midface (Fig. 42-8B).\textsuperscript{59-62}

Patients with tenderness and swelling isolated to the bony bridge of the nose who do not have a septal hematoma, can breathe through each naris, and have a straight nose do not require nasal bone radiographs in the ED because imaging results would not alter treatment. If these criteria are not met, early reduction or referral for surgical intervention may be indicated, and plain films (for truly isolated injuries) or CT scanning (if concern for other injuries exists) is indicated. Plain x-ray examination may also be performed in the setting of legal concerns. If there is concern for a foreign body in a superficial wound, two standard x-ray views (Water’s and Caldwell’s or occipitofrontal view) are indicated to triangulate the position of the observed foreign material.

Patients with suspected ocular injuries may benefit from a bedside ultrasound as a noninvasive and economical diagnostic tool, particularly if there is a need for urgent operative management of other injuries and no time for a dedicated facial CT. The different acoustic impedances of the orbit’s anatomic structures make the modality operator friendly, and an ultrasound of the eye can readily detect vitreous hemorrhage, retinal detachment, and globe rupture (Figs. 42-9 and 42-10). The operator should position the transducer in a transverse orientation, scanning in a cephalad-to-caudad direction, making sure to scan the entire anatomy of the eye, and using special care to minimize the pressure exerted over the eye, especially when evaluating for specific ocular emergencies. Prior findings have suggested that high-resolution ultrasound has at least a 94% correlation with axial and coronal CT imaging in the detection of orbital fractures and emphysema.\textsuperscript{63,64}

**MANAGEMENT**

Management of facial injuries occurs within the overall resuscitation of the patient. Unless the airway is threatened or exsanguination is a concern, treatment of most facial injuries can be deferred until more life-threatening injuries have been stabilized. Care of the patient with penetrating trauma to the face should center
on standard trauma care, with initial attention focused on maintenance of a patent airway, adequate ventilation, and systemic perfusion.

**Out-of-Hospital Care**

The indications for airway management of a patient with a facial injury are the same as those for other patients: Does the patient have a currently patent airway and, if so, can the patient be expected to maintain it without intervention? If the answer to either question is “no,” the patient needs to be intubated. If other injuries preclude the patient from ventilating appropriately, intubation is also required.

Patients with expanding hematomas after facial injury present a special dilemma. Injuries to the facial vasculature may cause significant hematomas that can extend into the neck or down to the supraclavicular area. Such hematomas greatly distort the normal anatomy of the pharynx and neck, making intubation and cricothyroidotomy particularly difficult. If the patient has a patent airway, he or she can speak without difficulty, and the transport time is expected to be short, no intervention should be performed and the receiving institution should be notified so that planning can begin for a difficult airway. If intubation must occur in the field, awake orotracheal intubation should be considered. If certified in its use, emergency medical services personnel should be ready to perform a surgical airway as needed. Gunshot wounds to the lower third of the face are particularly likely to require intubation for airway protection, and a significant proportion of these require a surgical airway.

In the setting of significant facial trauma, active bleeding can obscure the view and make intubation considerably more difficult.

**Figure 42-9.** Bedside sonograms of the eye. In each image, a small white dot is placed to identify the front of the eye, and thin arrows identify the lens. Sonogram A demonstrates a normal eye. Sonogram B shows a detached retina (large arrow), and sonogram C demonstrates a ruptured globe. (Images courtesy Keith Boniface, MD.)

**Figure 42-10.** Ultrasound image of a globe rupture with lens dislocation. At the top of the image the cornea is visible, and just below that is the dislocation with hemorrhage visible posteriorly.
Double suctioning may be required, which involves an assistant holding one suction catheter in the posterior oropharynx while the operator uses a second device more anteriorly or inferiorly as needed during the procedure. Conversely, patients with fractures of the mandible may be easier to intubate because increased mobility of the mandible may allow wider opening of the mouth.

Blind nasotracheal intubation is controversial in the literature and is rarely indicated in facial trauma because of concerns about complications.66 Patients with multiple injuries who require intubation may not be breathing actively enough for this method to be of use, and out-of-hospital rapid sequence intubation is associated with a higher success rate and fewer complications.66 Some alternative airway techniques may include submental or submandibular intubations or anesthesia-assisted intubations with the use of adjuncts such as the GlideScope or lighted stylet.57a,67b Although reports of intracranial placement of an endotracheal tube in facial trauma are rare, this catastrophic complication is known to occur after blind nasotracheal intubation.68,68a Any concern about an injury to the skull base or cribiform plate is a contraindication to this method of intubation.

Control of local bleeding is the other significant out-of-hospital consideration in facial trauma. In many areas, external compression is sufficient to control bleeding during transport. Epistaxis and significant intraoral bleeding can be more difficult to treat. Even in the setting of significant nasal trauma, the soft portions of the nares can be compressed to stop anterior nasal bleeding. In an awake, alert patient with intraoral bleeding, 4 × 4-inch gauze packing may be placed into the buccal space to provide control. If these maneuvers are insufficient and the patient's injuries require spinal immobilization, intubation may be a necessary first step to control intraoral or nasopharyngeal bleeding. After intubation, large amounts of gauze can be placed via the mouth into the oropharynx and nasopharynx to obtain control via direct pressure.

If out-of-hospital personnel suspect a ruptured globe, special protection against compression of the eye (eye cup or noncontact shielding) should be provided in the field. Avulsed parts, including ears, the tip of the nose, teeth, or completely avulsed flaps, should be transported with the patient in saline-soaked gauze.

Completely avulsed teeth should be removed and carried with the patient during transport. Neurologically normal, un intoxicated patients may be able to carry avulsed teeth in their mouths, held between gum and buccal mucosa. Patients who are not neurologically normal, who are intoxicated, who require cervical spine immobilization, who are nauseated, or who cannot be transported upright should not be transported with avulsed teeth held in the mouth. In such cases, the risk of aspirating the teeth outweighs any other concerns, and the teeth should be transported in a container with sterile saline. Incompletely avulsed teeth should be left in place and not manipulated.

General Measures

The initial evaluation in the ED should readdress the question of intubation. In the setting of significant distortion of the mouth, oropharynx, or upper neck by avulsion or hematoma, the awake fiberoptic method may optimize the chances of a successful intubation. When there is significant distortion of the oropharynx or larynx, a laryngeal mask airway may not achieve a sufficiently tight fit to allow ventilation. Emergent cricothyroidotomy is the procedure of choice if endotracheal intubation is impossible.

Unless there is life-threatening hemorrhage from the face, after the airway has been secured, facial injuries can be safely left to the secondary survey. The emergency physician should avoid being distracted by a facial injury and search intensively for head, neck, chest, abdominal, pelvic, and extremity injuries. In-depth ocular examinations and other special testing should not be performed until other serious injuries have been managed emergently.

Significant bleeding can often be controlled by compression. If compression fails, hemostasis can be achieved in the ED by ligation of the relevant vessel. Great care should be taken, however, not to clamp or tie structures blindly deep within the face because serious iatrogenic injury of nerve or ductal structures could result. Massive, uncontrollable bleeding from facial fractures occurs rarely and is best treated with arterial embolization, if available.69,70 Intra-arterial vasopressin has recently been suggested as an option for hemostasis.71

In the rare case of a patient acutely exsanguinating from a facial wound, the external carotid artery can be emergently ligated. This ligation is best accomplished with surgical assistance.

Bite wounds, gross contamination, or significant tattooing from foreign bodies should be addressed definitively as soon as possible, given the needs of the patient's other injuries. Definitive treatment of simple soft tissue injuries can be left for 24 hours, if needed, after irrigation and temporary approximation. Ideally, facial fractures are treated early, before significant swelling occurs, or after several days when return of more normal facial contours can aid in the repair. The need for tetanus prophylaxis should be considered for all open wounds. If the injury is an animal bite, the need for rabies prophylaxis should be considered. Because the rabies virus is transmitted to the brain along nerve axons, and symptomatic disease theoretically may occur sooner with wounds of the head, face, and neck, initiating rabies treatment within 5 days of the injury is recommended.

Finally, because lead poisoning has been reported from the ingestion of shotgun pellets in patients with primarily facial injuries, consideration should be given to looking for the presence of pellets in the gastrointestinal tracts of these victims. A plain x-ray film of the abdomen suffices. Early endoscopic removal of the pellets should limit future toxicity.72

Soft Tissue Injuries

Soft tissue injuries to the face present an acute cosmetic concern for the patient. Areas may be contused, lacerated, abraded, or any combination of the three. When cleaned of any debris, abrasions may be covered in a thin layer of antibiotic ointment and left exposed or covered (as possible given their location). Patients with significant tattooing will benefit from topical lidocaine for anesthesia before vigorous scrubbing is begun to remove the embedded material. Careful attention should be paid to removing all of the embedded material as soon as possible because epithelialization requires the creation of a new wound to remove debris later. For contusions, ice and sleeping with the head elevated may limit the degree of swelling anticipated on days 2 and 3. The patient should be cautioned to anticipate the development of periorbital swelling or ecchymosis or both over time as a result of gravity when the primary contusion has been to the brow, forehead, or bridge of the nose.

The most appropriate person to close an open wound may be either the emergency physician or a consultant. Decisions about which wounds to close personally and which to ask a consultant to repair are based on the personal judgment of the emergency physician. Factors that may be considered in the decision include resource availability; the size, shape, depth, and location of the wound; and the time commitment that careful, cosmetic wound closure can entail for the emergency physician in a busy ED. The patient's priority with facial lacerations is cosmesis, and therefore a patient may request specialty services for even minor wounds.73 Children and patients with behavioral problems may require
suction to allow sufficient control for a cosmetic repair. Repair of facial wounds in uncooperative patients who are acutely intoxicated may be delayed until they become sober enough to cooperate for the procedure.

After anesthesia has been achieved, wounds should be explored for depth, foreign bodies, and underlying fractures. Irrigation may not be necessary in simple, clean facial wounds closed within 6 hours. For nongaping wounds less than 3 cm, a single-layer closure may be sufficient. For gaping wounds deeper than the dermis, subcuticular buried sutures of absorbable materials should be placed to close any potential space and relieve any tension on the skin. For skin closure, tissue adhesive is faster and less painful, results in equal cosmetic results in adults and children, and can be used to close the skin over deeper sutures. Compared with sutures, tissue adhesive has the additional benefit of not requiring later removal, but care must be taken not to unintentionally glue the eye, nares, or mouth closed.

Antibiotics are not required for simple facial wounds, which rarely become infected. Bite wounds, wounds with any evidence of devascularization, wounds through and through the buccal mucosa, wounds involving the cartilage of the ear or nose, and wounds with extensive contamination (particularly with barnyard fecal matter) are exceptions to this rule.

The choice of antibiotic therapy will likely be an evolving topic in light of the emergence of community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA). Among spontaneous skin infections requiring an ED visit, the prevalence of CA-MRSA is now quite significant for both adults and children. In addition, it appears that the incidence of such spontaneous infections requiring ED care is also increasing. However, current literature does not suggest choosing antibiotics with MRSA coverage for wound prophylaxis. If prophylactic antibiotic therapy is needed, the antibiotic should be selected based on the normal bacterial flora associated with the affected site.

**SPECIAL CONSIDERATIONS BY SITE**

**Mouth**

**Lacerations**

Lip lacerations are common and require special consideration to maintain the appearance of the lip edge or vermilion border and the natural architecture of the philtrum. Because infiltration of even a small volume of local anesthetic may distort and blanch the soft tissue, marking the vermilion border (without permanent ink or a scratch of a sterile needle) before anesthesia facilitates a cosmetic repair. To minimize any divots and maximize cosmesis and function, wounds that include the muscular layer should be closed in multiple layers. Skin may be closed with nylon or other nonabsorbable suture; the lip and mucosa should be closed with absorbable suture. Lip lacerations are not amenable to closure with wound adhesives.

Through-and-through lacerations of the mouth should be closed in layers, beginning with the intraoral mucosa and working outward in layers toward the skin. After closure of the mucosal layer, copious irrigation of the external wound is indicated to remove lingering bacteria that otherwise would be incorporated into the wound. In small case series, prophylactic treatment with penicillin has been shown to decrease the risk of infection after significant through-and-through lacerations. Lacerations that approach the parotid (Stensen’s) or submandibular (Wharton’s) ducts should be evaluated before intervention for ductal integrity. Saliva milked from the gland should be thin and clear and should readily exit the duct. If a duct is involved or there is any doubt, a facial specialist should be consulted for evaluation and repair.

Small lacerations of the tongue or oral mucosa do not require repair. Lacerations that gape (including deep tongue lacerations), collect food, and are likely to heal with a significant divot or thick scar that may hinder eating and speaking functions require repair. Deep or gaping lacerations of the tongue or oral mucosa should be closed (in layers if necessary) with absorbable sutures that do not require removal. To facilitate repair, an assistant may be needed to expose the laceration by grasping the tongue between gauze and holding a segment outside of the mouth. Some advocate placing a thick temporary suture through the distal tongue (after appropriate anesthesia) to facilitate this exposure. Discharge instructions for intraoral lacerations (whether or not repaired) should include gentle cleansing (swish and spit) with a mild antiseptic.

**Perioral Burns**

Young children use their mouths to explore their environment and may lick electrical outlets or bite electrical cords. The wet oral mucosa provides little electrical resistance, and the current penetrates to deeper structures, often causing a full-thickness burn at the commissure of the lip. These children need a systemic evaluation for other electrical injuries (see Chapter 142); this discussion is limited to the evaluation and treatment of facial wounds. Perioral burns resulting from electrical injury can result in severe cosmetic problems and microstomia. The initial appearance of the wound may be misleadingly trivial; edema and necrosis progress over several days, and even with healing the defect may become quite disfiguring. Traditionally, a more acute concern has been bleeding from the labial artery when the maturing burn eschar separates from underlying structures 5 to 21 days postburn, and it was previously recommended that patients be admitted so that such bleeding could be urgently addressed if it occurred. In general, current practice is discharge with close observation at home and follow-up with otolaryngology specialists, plastic surgery specialists, or both to address cosmesis. Large wounds can cause significant early difficulty with eating, however, and patients may require placement of a nasogastric tube for maintenance of nutrition. Initial ED treatment of the wound is aimed at treating discomfort and keeping the area clean.

Treatment of these injuries is controversial; options include conservative treatment with early oral splinting, immediate surgery aimed at reconstruction, or delayed excision of the burned area. Later reconstructive repair may be required to preserve mouth opening, eating, and speech clarity. Early involvement of consultants is indicated, even when the burn seems to be trivial. The possibility of abuse or neglect should be considered when a child is presented with a perioral burn.

**Cheeks**

Contusions of the cheek should raise concern for an underlying zygomatic or maxillary fracture. Lacerations of the lateral cheek may involve the parotid gland or Stensen’s duct. Failure to identify and repair ductal injury results in retention of salivary fluid and enlargement of the gland or formation of a cutaneous fistula. Lacerations in the area anterior to the tragus may include injury to the facial nerve, and careful neurologic examination should be carried out before closure. Langer’s lines change from mostly horizontal in the superior cheek to diagonal at the nasolabial fold, then curve convexly around the mouth; these changes should be taken into consideration when débridement is required as part of a complex repair.
Nose

Because of its anterior position, soft tissue injuries to the nose are common. Almost any trauma can result in epistaxis. In general, epistaxis is controllable by pinching the cartilaginous anterior nose closed between two fingers and holding compression for approximately 10 minutes. If it is not controlled, anterior packing is indicated. Intranasal inspection is required in any nasal injury to assess for a septal hematoma, which appears as a dark purple or bluish mass against the septum. Hematomas require drainage because they are associated with necrosis of the septum if left untreated. Simple incision and expression of the clot followed by anterior packing are sufficient. Traditional teaching has been that any patient with nasal packing should receive prophylactic antibiotics to cover *Staphylococcus* and *Streptococcus* species to prevent sinusitis and toxic shock syndrome. Toxic shock syndrome is a rare but measurable complication of postoperative nasal packing, occurring in approximately 16 per 100,000 cases; the incidence with primary packing is unknown. There is no evidence that but measurable complication of postoperative nasal packing, still in use, they have no clinical utility.86-88

Swelling over the bridge often precludes determination of the acceptability of the appearance at the time of injury. The patient may be provided with a referral for outpatient specialty follow-up in 3 to 5 days if the appearance at that time (when the swelling has improved) is unacceptable. In a series of surgically repaired simple nasal bone fractures, septal fractures were present in more than 50% of cases. CT did not provide any advantage in diagnosing septal fractures and should be reserved for evaluating patients suspected of having other, more complex fractures.

Children with nasal fractures may have premature closure of sutures and uneven growth, particularly of the vomeroseptal line. In a child, no imaging studies are indicated, but a consultant should evaluate swelling and tenderness over the nose, preferably approximately 10 minutes. If it is not controlled, anterior packing is indicated. Intranasal inspection is required in any nasal injury to assess for a septal hematoma, which appears as a dark purple or bluish mass against the septum. Hematomas require drainage because they are associated with necrosis of the septum if left untreated. Simple incision and expression of the clot followed by anterior packing are sufficient. Traditional teaching has been that any patient with nasal packing should receive prophylactic antibiotics to cover *Staphylococcus* and *Streptococcus* species to prevent sinusitis and toxic shock syndrome. Toxic shock syndrome is a rare but measurable complication of postoperative nasal packing, occurring in approximately 16 per 100,000 cases; the incidence with primary packing is unknown. There is no evidence that but measurable complication of postoperative nasal packing, still in use, they have no clinical utility.86-88

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Ears

Blunt trauma to the ear may cause hematoma formation in the subperichondrial potential space. Such hematomas are the prelude to the development of a “cauliflower ear” and should be drained by aspiration. Reaccumulation of the hematoma is prevented with a compressive dressing of the ear, but reexamination is crucial, and reaspiration should be performed as necessary.

Ear lacerations often involve the cartilage. The ear may be anesthetized with a field block: 1% lidocaine without epinephrine is injected subcutaneously into the skin around the base of the ear. Simple skin wounds may be closed in a single layer. Lacerations to the underlying cartilage should be repaired with absorbable material. If there is significant degloving or loss of overlying tissue, a consultant should be involved; portions of aural cartilage may be saved temporarily in a distant dermal pocket for later reconstruction. Because cartilage is avascular, chondritis, when it occurs, requires extensive débridement and is disfiguring. No randomized trials have been performed, but when the cartilage of the pinna requires repair, antibiotic prophylaxis is recommended. Composite ear dressings (splints) are indicated after any significant repair. Ear injuries occurring before age 1 year or injuries to both ears in children are rare and should raise the suspicion of abuse.

Eyes

Simple eyelid lacerations may be repaired in a single layer. Wound adhesives should be used with great caution anywhere near the eye; care must be taken not to glue the eyelids open or shut. Lacerations that involve deeper structures, loss of tissue, or the lid margin should be referred to a consultant. The integrity of the lacrimal apparatus can be assessed by instilling fluorescein into the eye and assessing for dye in the wound. A consultant should handle any injury to the sac or lacrimal duct.

Eyebrow lacerations are common because of the overhanging supraorbital ridge. Careful wound exploration should be performed to assess the integrity of the underlying bony structure. No shaving should be performed because the brow hairs may not regrow, and the hairs are necessary for realignment. If débridement is required, it should be done parallel to the hair follicles (skived) rather than perpendicular to the skin. This approach minimizes the bald area of the scar. Closing the deeper muscular layers preserves the normal expressive function of the brow. Injuries to the globe are discussed in Chapter 71.

FRACTURES AND DISLOCATIONS

For the emergency physician, the key to facial fractures is accurate diagnosis and appropriate referral. Many nondisplaced or minimally displaced facial fractures may be handled on an outpatient basis, with definitive repair or fixation delayed several days. In adults, fractures develop firm fibrous union within approximately 10 to 14 days; however, definitive repair is performed most easily before day 7. Methods for diagnosing fractures were discussed previously. Fractures to the face of young children are relatively rare and may be incomplete or greenstick fractures. Fibrous union in these cases is rapid; early reduction (within 3 days) is recommended.

Antibiotics are indicated for open fractures and fractures that violate a sinus. Patients with fractures through the nasoethmoid complex that violate the maxillary bones or the floor of the orbit should be cautioned to avoid sneezing and blowing the nose because these activities force air out into the soft tissues of the face. Surgical repair of simple nasal fractures may be performed closed and the nose splinted internally or packed. Repair of fractures of the floor of the orbit, when necessary, may require the placement of a silicone patch to occlude the opening into the maxillary sinus. Operative repair of most other fractures of the face is performed with use of small metal plates (microplates), screws, or wires to stabilize fragments by attaching them to unbroken segments of bone. Efforts are made to return the features to their unfractioned locations and to regain facial symmetry, if possible. Complex facial fractures may have to be repaired in a staged fashion, depending on the patient’s degree of illness and the amount and quality of the bone remaining. Much of this surgery
is best accomplished when the fragments are still freely mobile but initial swelling has been reduced, on postinjury days 3 to 5.

**Specific Considerations by Site**

**Forehead**

Fractures through the superior forehead may occur above the level of the frontal sinus. These are actually skull fractures rather than facial fractures and should be addressed with special attention to risk of injury to the underlying brain. Unlike other skull fractures, frontal skull fractures often require repair for cosmesis alone. More often, fractures in this area involve the anterior portion of the frontal sinus. If even minimally displaced, these fractures require elevation for cosmesis. Fractures through the anterior wall of the frontal sinus are likely to continue through the posterior wall, and a CT scan should be performed to look carefully for this complication; if present, a CSF leak should be assumed until proved otherwise. CSF leaks into the frontal sinus may also manifest in a delayed manner, days or years after the initial injury. With many frontal sinus fractures, complex repair or obliteration may be required to treat this complication.

**Orbit**

The most common simple fracture of the orbit is blow-out fracture of the orbital floor, often caused by a fist or blow or ball striking the globe, increasing intraorbital pressure enough to force orbital contents through the floor. This injury may happen without other significant bony facial injury. When displaced, the bony fragments sag into the underlying maxillary sinus. If the inferior rectus muscle is entrapped in the defect, the patient is unable to elevate the globe on the affected side, resulting in diplopia on upward gaze. Stretch or compression of the infraorbital nerve, which passes through the floor, may cause anesthesia over the anteromedial cheek and upper lip. Because signs of entrapment may result from contusion and edema and be self-limited, immediate repair is not necessary, but careful follow-up is required. Repair typically is performed 1 or 2 weeks after the injury for persistent enophthalmos or diplopia. Because of the acute limitation in the visual field, discharge instructions for patients with acute diplopia should include patching for comfort and a request not to drive until the diplopia is resolved.

Fractures of the medial orbital wall, through the lamina papyracea, are often associated with nasal injury or more general midface fractures, particularly with telescoping of the midfacial skeleton. Herniation of orbital contents into the ethmoids may occur. In one study, patients with orbital fractures with a medial component were more likely to have ocular signs of diplopia or exophthalmos than patients with fractures that did not involve the medial wall. Fractures involving the superior orbit include the base of the frontal sinus, and all of the concerns about the anterior skull mentioned previously apply. Herniation of orbital structures into the frontal sinus is rare but can occur.

Many orbital fractures involve more than one wall of the orbit and may be present in a constellation with complex midface fractures (Fig. 42-11). Several classification schemes aimed at improving communication among emergency physicians, radiologists, and maxillofacial surgeons have been proposed, but no classification system is generally accepted.

Injury to the orbit, particularly fractures, can cause a hematoma to form within the orbit, behind the globe. If significant in size, a retro-orbital hematoma can elevate retro-orbital pressure causing acute exophthalmos and a compartment syndrome of the retro-orbital space. Stretch on the retinal artery limiting flow to the retina or neuropraxia of the retinal nerve may cause decreased visual acuity or blindness. Orbital emphysema associated with fractures of the medial wall or floor rarely results in a space-filling lesion with the same effect. This is a true emergency; drainage of the air or blood via lateral canthotomy with cantholysis is indicated to save the patient’s vision. Needle aspiration of entrapped air may also be attempted, but this may be best left to a consultant, given the proximity of the globe.

**Midface**

Tripod (or trimalar) fractures are among the simplest fractures of the midface and include fractures of three bones: the lateral orbit, the zygoma, and the maxilla (see Fig. 42-10). Typically caused by a direct blow, these fractures are often displaced and require operative stabilization. If left untreated, the area may “sink” posteriorly and inferiorly, giving an unacceptable appearance of facial asymmetry emphasized by the inferior position of the orbit and malar flattening. On the initial physical examination, there may be a large contusion over the cheekbone, enophthalmos, or malocclusion of the upper teeth. Fractures through the anterior wall of the maxillary sinus may denervate the maxillary teeth because the dentoalveolar nerves run in tunnels in this area.

More complex fractures of the midface are classified with the Le Fort system, although many complex fractures defy classification with this system. A Le Fort I fracture involves a transverse fracture through the maxilla above the roots of the teeth and may be unilateral or bilateral. Patients may report malocclusion, and the maxilla may be mobile when the upper teeth are grasped and rocked. A Le Fort II fracture is typically bilateral and pyramidal in shape. It extends superiorly in the midface to include the fracture of the nasal bridge, maxilla, lacrimal bones, orbital floor, and rim. In these cases the nasal complex moves as a unit with the maxilla when the teeth are grasped and rocking. In the current age of CT scans, in which the full extent of comminution can be appreciated, simple Le Fort III fractures are rare but essentially involve fracturing of the connections between the elements of the skull and the face (craniofacial dysjunction). These fractures start at the bridge of the nose; extend posteriorly along the medial wall of the orbit (ethmoids), along the floor of the orbit (maxilla), and through the lateral orbital wall; and finally break through the zygomatic arch.
Intrasnally, they extend through all the lesser bones to the base of the sphenoid and frequently are associated with a CSF leak.

Significant force to the bridge of the nose may fracture the deep nasoethmoid complex without creating a formal Le Fort pattern. CT is the initial test of choice in this setting. Fractures to the central portion of the ethmoid bone (cribriform plate) are likely to be associated with a CSF leak and commonly result in anosmia.

If possible, patients with a CSF leak should have the head elevated 40 to 60 degrees. Head elevation minimizes the intracranial pressure, with the idea of decreasing the flow and allowing the leak to seal. Often these patients are treated with antibiotics; however, this practice is controversial, and most of the studies supporting it involve small, local case series. In one meta-analysis, antibiotics did not decrease the rate of meningitis in the setting of CSF leak. Neurosurgeons should be involved in the care of patients with CSF leaks, although many leaks will spontaneously resolve.

Fractures involving the deeper structures of the midface may be associated with significant bleeding into the nose or oropharynx. Anterior nasal packing may be performed safely in the adult patient with multiple trauma. Even a 10-cm anterior pack should not reach the skull base in a skeletally mature person. Significant or massive bleeding into the posterior nasopharynx presents a complex problem and occurs in less than 1% of patients with midface fractures. It may be treated with nasal packing and immediate fracture reduction. Unless the anatomy is well understood and the skull base known to be intact, the use of a long balloon catheter (Foley) should be avoided for control of posterior bleeding. The unintended positioning of these items within the intracranial or intraspatial space during blind nasal insertion has been well documented, and when the face is grossly distorted, preinsertion measurement or other methods of preventing this outcome have not been adequately tested. There are no reports of the intracsnial placement of commercial catheters designed for posterior epistaxis, but if the midface is significantly distorted or telescoped, they may be long enough to reach the intracranial space. An alternative method for containing posterior nasal bleeding is to provide compression by packing the area with gauze by hand from the oropharynx after intubation.

Zygoma

Isolated fractures of the zygoma are relatively rare, usually the result of a direct blow, and are often displaced. Because the condyle of the mandible may disturb zygomatic fragments while moving, fractures with significant displacement are likely to result in trismus or discomfort with mouth opening. Surgical repair is usually required to return the cheekbone to an acceptable position.

Mandible

Fractures of the mandible can result from any significant force applied to its U shape. Because of its shape, multiple fractures may result from a single blow, and the fracture sites may be distant from the site of impact. Depending on the location of the fractures, the patient may have trismus (fractures of the coronoid process, neck, or rami), dental malocclusion, swelling, and tenderness intraorally or externally. Anesthesia of the lower lip may occur if there is damage to the inferior dental nerve.

Fractures of the symphysis, body, or rami usually require early splinting, typically by the placement of arch bars to accomplish interdental fixation, commonly known as "wiring the jaw shut." Fixation limits fracture motion, decreases the patient’s discomfort, and, if the fracture is minimally displaced, may provide complete fracture care. Impacted and nondisplaced fractures are treated with only a soft diet, and fractures of the coronoid alone usually require no intervention, but these decisions should be made in consultation with an oral surgeon or other specialist. Arch bars may be placed in the ED or operating room and typically are placed by a specialist (see Fig. 42-6). Fracture reduction may require the extraction of teeth adjacent to the fracture line. Patients with open fractures require antibiotics and usually hospitalization. When the fractures are closed and adequate stabilization can be obtained, elective operative repair can be performed as an outpatient procedure in 3 to 5 days.

In one study, 17 to 22% of pediatric patients 4 to 11 years old developed facial growth disturbances after a fractured mandible and required later orthognathic surgery for correction. Children younger than 4 or older than 11 years were much less likely to develop this complication. Because of the frequency of this complication, children in this age group who have sustained a blow to the chin and who have any trismus or tenderness over the TMJ should be assessed carefully with panorex imaging for condylar fracture and referred appropriately.

### Dental and Alveolar Trauma

Trauma to the teeth may occur with or without other facial injury. In the setting of caries, tooth fractures may occur with eating relatively soft foods. Tooth fractures are classified by the Ellis system. Class I fractures involve only the enamel of the tooth, are not painful, and can await dental evaluation on an outpatient basis. Class II fractures expose the yellow dentin and may be painful. These also can await dental care, but they may be covered with a dressing of calcium hydroxide and aluminum foil. Class III fractures expose the dental pulp, seen as a red line or dot, and are exquisitely painful. These require early evaluation by dentists or endodontists.

Sufficient energy to the area avulses teeth from their sockets. Multitrauma patients, particularly patients who are intoxicated, required to be supine for cervical spine immobilization, or neurologically impaired, should have avulsed or mostly avulsed teeth removed from the mouth and placed externally in saline as an aspiration precaution. In a critically ill multitrauma patient, avulsed teeth should be among the lowest priorities and are reimplanted only if the care of other injuries allows it and there is no risk of aspiration if the teeth loosen.

To perform a reimplantation, the physician disturbs the socket as little as possible, gently rinses off the tooth (the root should not be wiped), and places it into the socket where it “clicks” into place. If the tooth is only partially avulsed, extruded, or laterally luxated, it should not be removed; it should be reimplanted or relocated. Intruded teeth should not be manipulated. Reimplantation can be painful and may require local anesthesia with a regional dental block. Alternatively, the area of a single socket may be anesthetized by placing approximately 0.5 mL of 1% lidocaine without epinephrine into the buccal sulcus and gum on the outer side of the alveolar ridge. After reimplantation, the tooth requires stabilization with acrylic splint or wiring to the adjacent teeth.

Reimplanted teeth may or may not “take” acutely, but it can take weeks to assess the final success of reimplantation. The length of time out of the socket and storage process seem to play a critical role in the initial success. Among teeth successfully reimplanted in less than 1 hour, more than 66% have been found to be radiographically healed and functionally normal after 5 years. For teeth successfully reimplanted after 3 hours, more than 80% have been found to have signs of inflammation and bone resorption after the same period of time.

In children, the front maxillary incisors are most commonly avulsed. After reimplantation, these teeth may ankylose and fail to “grow out” normally, requiring later extraction or orthodontic intervention for cosmesis. This situation is most common in children age 6 to 10 years with avulsed adult teeth.
Avulsed teeth missing after significant trauma should be carefully sought, including via a chest x-ray examination. In an acute event, the patient may not recall aspirating a tooth; this is more likely if the patient is intoxicated or neurologically impaired. If the tooth is below the diaphragm on the film, it does not require retrieval. Teeth lodged in a bronchus or the esophagus require bronchoscopic or endoscopic retrieval. Aspirated teeth result in pulmonary abscess formation unless removed.

Fractures through the alveolar ridge may result in a group of teeth being dislodged and out of position, often leaning inward. These teeth require stabilization with wire or acrylic splinting after fracture reduction has returned the teeth to their correct location. The involved teeth may or may not survive after such a fracture, and careful follow-up with a dentist or oral surgeon is required.

Temporomandibular Joint

The TMJ is complex, with the condyle of the mandible undergoing rotation and translation anteriorly during normal mouth opening. The function of the joint is preserved by a meniscus, which overlies the condyle. Essentially, the joint between the meniscus and the condyle is a hinged joint, allowing rotation, and the joint between the meniscus and the temporal bone is a sliding joint, allowing translation. A formal, thick joint capsule does not exist at the anteromedial portion of the joint; loose, relatively weak synovial tissue is positioned here to allow translation to occur.

Trauma to the TMJ may tear the meniscus or injure the collateral ligaments holding it in a normal position. This injury can cause the meniscus to fail to translate normally, resulting in clicking or popping as it catches up to the condyle or inability to open the mouth fully because the meniscus completely fails to translate. Patients without fracture but with acute pain and difficulty with mouth opening should be placed on soft foods, asked not to yawn or struggle to open their mouths widely, and referred to an oral surgeon with expertise in TMJ pathology. Pediatric patients with post-traumatic internal derangements of the TMJ are prone to asymmetry of facial growth and retrusion. In one study, 88% of children injured before their ninth birthday had significant facial abnormalities years later.111

Because of the anatomy and function of the joint, anterior dislocation of the TMJ can occur after widely yawning, laughing, kissing, singing, or other activities that involve spontaneous, wide opening of the mouth. When the condyle is out, spasm of the muscles of mastication prevents spontaneous reduction. Significant trauma is more likely to cause a fracture-dislocation. Simple dislocation may be unilateral or bilateral, and the patient reports being unable to close the mouth. In unilateral dislocation, the jaw is rotated laterally away from the affected joint; bilateral dislocation causes significant protrusion of the jaw. The jaws of these patients are often so widely open that they cannot swallow their secretions and are actively drooling. Speech is often garbled by the patient’s inability to touch the tongue to the roof of the mouth or the maxillary teeth. There is a depression in the area of the affected TMJ on inspection of the patient’s face.

If the mechanism of injury suggests a fracture, the area should be imaged with plain x-ray or panorex examination before reduction is attempted. For reduction of a simple dislocation, the patient should be seated upright. For leverage to be maximized, the best position may be for the patient to be seated in a regular chair with the operator standing in front of the patient. As in dislocations of other joints, adequate analgesia and sedation are required for success. With the thumb or index finger placed into the buccal sulcus on either side of the mouth, the angle of the jaw is pressed downward while the symphysis is rotated (chin) upward and backward. Care should be taken not to place fingers along the crowns of the teeth; when relocation occurs, spasm of the muscles of mastication snaps the mouth shut with force. If this is the only location possible for the physician’s fingers, gauze wrappings should be placed to protect them.

Panorex or x-ray films are suggested after the first episode of dislocation. The patient is discharged with pain medicine, a soft diet for 2 weeks, and outpatient follow-up with an oral surgeon. Patients with an episode of dislocation are predisposed to a recurrence. In patients who experience frequent dislocation, interdental fixation may be required for 2 or 3 weeks.

DISPOSITION

The decision to discharge or admit patients with facial trauma depends on their associated injuries, general injury severity, and plans for treatment. Patients with isolated facial trauma that has been repaired or stabilized and with no airway issues are usually discharged.

KEY CONCEPTS

- The face is central to the patient’s ability to breathe, eat, and communicate. Injuries to the face can have serious psychological and psychosocial consequences.
- Facial injuries may be prevented by the appropriate use of safety belts, child restraints, air bags, helmets, and mouth and face guards.
- The epidemiology of facial injury is changing, with an increasing proportion of injuries occurring as a result of interpersonal violence. A careful history is required, and the possibility of abuse should be considered for every patient.
- Shock from facial trauma is rare and results only from obvious external bleeding. Facial injuries should not distract the emergency physician from aggressively searching for other causes of shock.
- Assertive management of the airway is indicated in a patient with significant facial injuries. Surgical management (cricothyroidotomy) may be required, particularly with gunshot wounds.
- Directed facial CT scanning is the best imaging technique in patients with obvious injuries.
- Definitive treatment may be delayed if necessary to allow other serious injuries to be addressed.

The references for this chapter can be found online by accessing the accompanying Expert Consult website.
References