Head & Facial Injuries

Name _____

Sports Medicine

Per ____ Date _____

Read Ch 9 "***Head injuries"*** and Ch 10 ***"Facial Injuries"*** of the Textbook *Fundamentals of Athletic Training 4th edition* [Tan color textbook cover]. Pp.91-118.

Answer the questions below online in Illuminate [LHUSD Test link] Click Link.

FHS - Student ID #######. Assess Code. **6PZPFPX**

You may print a copy of this assignment and answer the questions while you read, then enter your answers online.

CHECK YOU ANSWERS - After completing the assignment online. Log back into the Assignment and see your score.

DIRECTIONS: Pick the BEST answer below.

1. The brain is attached to the spinal cord by the
   a. cerebellum b. occipital lobe
   c. brain stem d. temporal lobe

2. Memory loss, either before or after an injury occurs, is called
   a. tinnitus b. Battle's sign
   c. amnesia d. diplopia

3. Persistent concussion symptoms that linger after a concussion has been received are often called
   a. a concussion b. an intracranial hematoma
   c. second-impact syndrome d. postconcussion syndrome

4. A temporary impairment of brain function is called
   a. a concussion b. an intracranial hematoma
   c. second-impact syndrome d. postconcussion syndrome

5. The brain is protected by which of these structures?
   a. skull b. cerebrospinal fluid c. scalp d. all of these

6. Which of these injury mechanisms is likely responsible for causing a brain injury on the opposite side from the impact?
   a. rotation b. contrecoup c. couptrecount d. skull fracture

7. A blow to the left side of the head will impair movement and function
   a. on the left side of the body b. on the right side of the body
   c. on the posterior aspect of the body d. on the anterior aspect of the body

8. An athlete who experiences _____ concussion(s) in one year must be pulled from competition for one year.
   a. one b. two c. three d. four

9. What does elevated blood pressure mean when there is a head injury?
   a. A hematoma is building inside the skull.
   b. A concussion is present.
   c. A sinus infection is starting.
   d. A scalp laceration has caused significant blood loss.

10. Postconcussion syndrome includes which of these symptoms?
    a. nausea b. lack of appetite c. headache d. low blood pressure

11. Which of these is required before an athlete can return to competition after a concussion?
    a. Blood pressure is normal. b. Headaches have stopped.
    c. Appetite has returned. d. A physician has given clearance.

12. The _____requires an AT to obtain information from the athlete that relates to orientation, immediate memory, concentration, and delayed recall. It also contains a neurological screening section whereby the AT examines loss of consciousness, memory loss, strength, sensation, and coordination.
    a. Standardized Assessment of Concussion (SAC)
    b. Cantu grading scale
    c. American Association of Neurology Scale
    d. Systematic Assessment of Continued Concussion (SACC)

13. The acronym AVPU stands for
    a. amnesia, verbal, pain, unconscious
    b. alert, verbal, pale, unresponsiveness
    c. alert, verbal, pain, unresponsiveness
    d. none of these

14. Which is NOT true of the brain?
    a. The brain consumes approximately 25% of the blood supply in the body.
    b. The brain weighs about 3 pounds.
    c. The brain requires about 20% of the total body oxygen.
    d. Brain cells grow and develop until age 18.

15. Which is NOT true of cerebrospinal fluid?
    a. It bathes the brain and spinal cord in chemicals for proper functioning.
    b. It is green in color.
    c. It helps maintain pressure around the brain.
    d. It protects the brain from impact.

16. Head injuries can be prevented by
    a. helmets b. mouth guards
    c. rules d. noncontact sports
    e. a and b f. a, b, and c

17. The visible portion of a tooth is the
    a. crown b. neck c. root d. socket

18. The eardrum is also known as the
    a. auditory canal b. pinna
    c. tympanic membrane d. hammer

19. The jawbone is most correctly called the
    a. maxilla b. mandible
    c. zygomatic bone d. nasal bone

20. The _____ lines the back of the eye and contains rods and cones.
    a. pupil b. lens c. retina d. sclera

21. The white outer covering of the eye is called the
    a. pupil b. lens c. retina d. sclera

22. The projecting portion of the external ear is called the
    a. auditory canal b. pinna
    c. tympanic membrane d. hammer

23. An eye injury that results in the athlete seeing lights, sparks, or flashes that nobody else can see is likely a
    a. detached retina b. corneal abrasion
    c. foreign body d. diplopia

24. The correct treatment of epistaxis includes
    a. instructing the athlete to lean forward
    b. instructing the athlete to lean her head backward
    c. instructing the athlete to pinch his nose
    d. a and c
    e. b and c

25. Cauliflower ear is formally known as
    a. otitis externa b. hematoma auris
    c. subconjunctival hemorrhage d. epistaxis

26. How can cauliflower ear be prevented?
    a. Avoid contact with dirty mats. b. Wear headgear.
    c. Avoid swimming. d. Avoid loud music.

27. Hyphema is a term for which of these injuries?
    a. torn retina b. subconjunctival hemorrhage
    c. blowout fracture d. blood in the anterior chamber of the eye

28. When a bright light shines into the eyes, a normal pupil will
    a. become unequal b. become larger
    c. become smaller d. change color

29. The portion of the eye responsible for focusing light onto the retina is the
    a. iris b. pupil c. lens d. sclera

30. The purpose of earwax is to
    a. keep dirt away from the eardrum b. make sure ears get cleaned
    c. improve transmission of sound waves d. deaden harmful sound waves

31. The purpose of saliva is to
    a. lubricate the vocal cords b. begin digestion
    c. keep germs away from the body d. all of these

32. The inability to move the eye when a blowout fracture occurs is the result of
    a. bleeding b. swelling
    c. muscle caught in the fracture site d. pain

33. A contact lens that is dislodged
    a. could get lost behind the eye if not found quickly
    b. should be moved back into place with clean hands
    c. should be removed, rewetted with saliva, and placed back in the eye
    d. should be left in place and removed by a physician

34. An athlete with a deviated septum may
    a. also suffer brain damage caused by lack of oxygen
    b. also have a broken nose
    c. have prevented it by wearing a mouth guard
    d. have additional nasal drainage

35. While an athlete with dislocated tooth is on the way to the dentist, the tooth should be kept in
    a. a moist, warm, dark container b. the socket it came out of
    c. a warm, dark container d. milk or saline

36. Which of these eye conditions is often referred to as pink eye?
    a. corneal abrasion b. conjunctivitis
    c. cornealitis d. detached retina

37. What does it mean to have 20/20 vision?
    a. It means that a person can see what most people can see from 20 feet away.
    b. It means that a person can see what most people see at 200 feet away.
    c. It means that a person can see what most people see at 1 foot away.
    d. It means that a person cannot see anything that is 20 feet away.

Head &Facial Injuries

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chapter 9

Head Injuries

Objectives

After completing this chapter, the student will be able to do the following:

- Describe the anatomy of the head.
- Understand that head injuries can be prevented.
- Understand the urgency involved with caring for brain injuries.
- Describe the types of head injuries.
- Understand the long-term effects of head injuries.

When an athlete has a head injury, the AT must act quickly to lessen the chance of death and permanent injury. In this chapter, we provide information to assist the student in understanding head injury and its prevention.

ANATOMY OF THE HEAD

The skull is composed of 28 bones that protect the brain (see figure 9.1). A suture line is the area where two bones in the skull come together. The single moveable bone in the skull is the mandible, or lower jaw.

The Brain

The brain is made of billions of cells. It weighs only about 3 pounds (1.4 kg), but it requires 20% of the

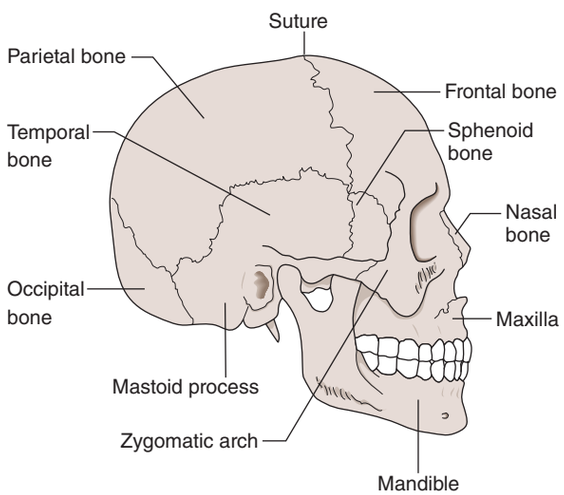

Figure 9.1 Bones of the skull.

total body oxygen and 15% of the blood supply. Brain cells grow and develop until age 18. After that, brain cells can be destroyed but not reproduced. Depriving the brain of oxygen will cause unconsciousness and then death—the pupils of the eyes will dilate within 60 seconds (dilation is an indication of the inability to control the muscle of the iris of the eye). After four to six minutes without oxygen, biological brain death occurs, which means that large numbers of cells are dead.

The brain is divided into lobes, each named after the bony structure of the skull that covers it: occipital lobe, temporal lobe, parietal lobe, and frontal lobe (see figure 9.2). Each lobe is responsible for specific body functions. The brain attaches to the spinal cord at the brain stem via a crossover, so the right side of the brain controls the left side of the body and vice versa. Preserving brain function is of the utmost importance to injured athletes. Their quality of life—that is, their degree of recovery—depends on how the brain injury is handled.

Cerebrospinal fluid bathes the brain and spinal cord in chemicals for proper functioning, helps maintain regular pressure around the brain and spinal cord, and protects the brain from impacts. The fluid is clear amber in color. In instances of severe head injury, cerebrospinal fluid may drain from an opening in the skull, the nose, or an ear, and it should be allowed to do so. Stopping the drainage will only increase the pressure within the skull and cause more brain damage.

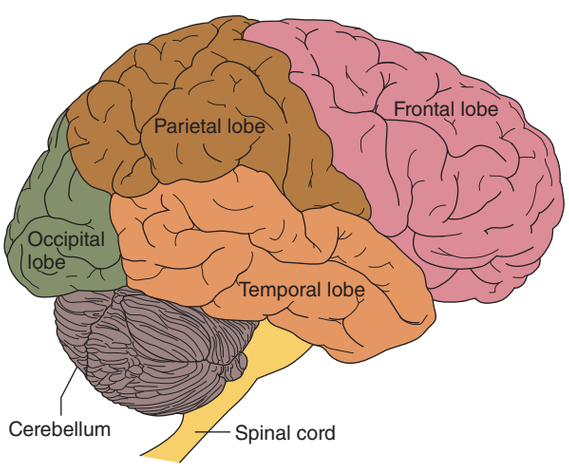

Figure 9.2 Brain areas.

FYI

The functions of the brain are based on location.

Frontal lobe: voluntary muscle movement, emotion, eye movement
Parietal lobe: sensation
Occipital lobe: vision
Temporal lobe: hearing, speech
Cerebellum: equilibrium, muscle actions, some reflexes

The Scalp

The scalp is the part of the skin that covers the skull, and it contains a large number of blood vessels, muscles, and hair. Skin protects against infections while hair protects the skin from the sun and keeps dirt and sweat away from the eyes. The blood vessels are so numerous in the scalp that even a small laceration will bleed profusely. Cartoonists draw a large lump when a character is hit in the head. This can also happen to athletes; a blow to the head may cause the many blood vessels to break open and bleed under the skin, causing a lump, or **hematoma**.

The scalp has the ability to decrease the force of an impact to the skull due to the additional padding it provides and the increased elasticity created by the tension of the connective tissue between the scalp and the skull. It is believed that without the scalp, the skull could be fractured with as little as 40 pounds (18 kg) of pressure. With the scalp, it may take 425 pounds (193 kg) of pressure before a fracture will occur. An athlete can sustain a serious head injury without a break in the scalp, however, so the AT should not be fooled by a lack of bleeding.

PREVENTING HEAD INJURIES

Head injuries are prevented by helmets, mouth guards, rules, and common sense. A commonly forgotten piece of equipment in the battle to prevent

head injuries is the mouth guard, which can prevent not only dental injuries but also concussions. If an athlete is not wearing a mouth guard, an impact to the chin can drive the mandible into the maxilla and cause the brain stem to twist slightly, resulting in loss of consciousness. A mouth guard provides spacing and shock absorption between the mandible and maxilla so that the force of the impact will not be transmitted to the brain stem. For a mouth guard to be effective, however, the athlete must be wearing one, and it must be in good condition. A mouth guard that has been chewed up or cut off will not prevent the knockout impact.

Wearing a helmet and face mask is also important in preventing head injuries. In the early years of football, players did not wear helmets. Today, a properly fitted helmet helps protect a player's head from direct impacts. The helmet prevents head injuries but not injuries of the face; thus, the face mask was introduced. With the head and face protected, athletes began to use the helmet as a weapon to punish opposing players. Using the head to make contact with another player is referred to as *spearing*. As spearing continued as a form of tackling, a progressive increase in the number of neck injuries resulting in permanent injury or death occurred—the helmet and face mask protected the head from direct impact but resulted in other forms of injury. Spearing has since been deemed a penalty, an offense severe enough to get a player ejected from the game.

Athletes should be taught the proper skills so that injury can be prevented. Coaches and ATs must teach athletes that they cannot lead with the head when trying to stop an opponent; this is crucial in preventing head injuries. At the beginning of each season, a film outlining sport safety should be shown. The AT should document attendance at this safety film; recording the date and an outline of the discussion should provide some legal protection if an athlete does sustain a serious head injury. The AT should also document days when safety skills are taught at practice and take attendance. She should explain the signs and symptoms of head injuries and proper care of helmets.

HEAD INJURY MECHANISMS

Injury to the brain can be caused by rotation of the head, but the most common mechanism is impact. The region most susceptible in the skull is the temporal region because the bone is thinnest there. **Contrecoup** injuries occur when the head is moving and receives a blow. On impact, the brain sloshes to the side opposite the blow, where it is stopped by the skull, and that is where the injury occurs. An athlete may complain of a headache opposite the impact, which is evidence of a contrecoup injury. Rotation of the head after an initial impact can cause the brain stem to stop functioning normally. The nerve receptors are overloaded with information to the brain, and brain overload causes unconsciousness. The unconscious state allows for a sorting of the impulses before the athlete returns to consciousness.

What Would You Do If . . .

You have been instructed to walk an athlete with a first-degree concussion into the locker room. Another athlete insists you can cure a concussion by cracking his neck. The athlete with the concussion says, "Yes, please make me better."

TREATING HEAD INJURIES

Potentially life-threatening head injuries include lacerations, skull fractures, intracranial hematomas, concussions, and chronic traumatic encephalopathy. This section discusses the evaluation of each of these types of injuries.

Laceration

A laceration to the scalp will bleed profusely because of the large number of blood vessels in the scalp. Direct pressure applied to the wound

will eventually stop the bleeding, but application of multiple gauze pads is usually necessary. Lacerations of the scalp may require suturing.

Skull Fracture

Skull fractures occur when there is significant force against the head. Types of skull fractures include depressed, linear, compound, and penetrating. A depressed fracture pushes a portion of the skull inside toward the brain. There will be bleeding under the skin or even a laceration requiring bleeding control. A linear fracture goes across the skull. Although no bones are moved out of place, there are tears in the blood vessels on the inside of the skull. A compound fracture will result in a portion of the skull sticking through the scalp and profuse bleeding. A penetrating fracture involves an object that has gone through the scalp, skull, and likely the brain. A skull fracture will discolor the area behind the ear; this discoloration is called a **battle sign**. Any skull fracture is significant and requires the immediate attention of a physician.

Intracranial Hematoma

An **intracranial hematoma** is severe bleeding within the brain caused by a blow to the head, particularly over the temporal or parietal regions. The hematoma causes a significant increase in pressure on the brain, and rapid death can occur. Sometimes an athlete is thought to have a concussion and is allowed to go home. If she has a hematoma, she may die during the night. If an athlete is found in a coma, the chances of survival are only 40%. Survival depends on early examination by a physician and prompt surgical care. Physicians usually drill a hole in the skull to allow drainage of the blood and attempt to repair the bleeding vessel. If the athlete is not in a coma, the physician must give medication to put her into a coma. The comatose state keeps the athlete calm and allows the brain to heal without movement.

Symptoms of an intracranial hematoma include headaches, nausea, vomiting, loss of consciousness, paralysis of extremities on the opposite side of the injury, and battle sign. If an intracranial hematoma is suspected, EMS should be contacted for immediate transportation to the hospital. The onset of these symptoms may be gradual, so the athlete must be continually monitored. With the first indication of a condition that is worsening, the athlete must be taken immediately to the hospital. An athlete with a possible head injury should be monitored for at least 24 hours, and he must be awakened every couple of hours to check his status.

RED FLAGS

Call 911 for any of the following:

- Rise in blood pressure and drop in pulse rate
- Pupil on same side of head injury is enlarged
- Athlete is unconscious
- Athlete has difficulty speaking
- Difficulty using extremities
- Balance issues

The signs of a hematoma are a rise in blood pressure with a drop in pulse rate. The pupil on the same side as the head injury will be enlarged. The athlete may have difficulty speaking, difficulty using the extremities on the side opposite the hematoma, stiffening of posture, rapid eye movements, unconsciousness or coma, and lack of coordination. Depending on the severity of the hematoma, the athlete may fully recover or she may suffer permanent brain impairment or death.

Concussion

A **concussion** is the temporary impairment of brain function caused by impact to the head or by a rotation force. A rotation of the head during the impact will send a massive number of impulses to the brain all at once. The brain, not knowing what to do with all the impulses, is overwhelmed, and the athlete may be confused or dazed or may even lose consciousness. Other symptoms of a concussion include nausea, dizziness, headache, vomiting, difficulty speaking, ringing in the ears (**tinnitus**), loss of balance, unconsciousness, difficulty remembering things before or after the impact (**amnesia**), possible battle sign, and disorientation.

The potential problems related to concussions in sport prompted NATA to create a position statement on the management of sport-related concussions

(Guskiewicz et al. 2004). The position statement provides guidelines for ATs, including the idea that ATs must be sensitive to both the causes of concussions and how concussions are presented when an athlete is injured. Also, ATs must recognize not only the common signs of a concussion (balance problems, loss of memory, and difficulty concentrating) but also the symptoms (headache, tinnitus, and nausea).

The NATA position statement also recommends that ATs collect baseline measures of mental function. This preinjury testing often involves using computers to assess an athlete's attention, reaction time, information-processing speed, concentration, and memory. The use of computer programs allows an AT to identify even subtle deficiencies in brain function. Such information can help determine when an athlete can safely return to play following a concussion.

Predisposing Risk Factors for Concussion

During the preparticipation physical, the AT can assess the risk factors each athlete may have in conjunction with concussions. Athletes are at a higher risk of concussion if they have a history of concussions or migraines, are under the age of 24, are female, or play collision team sports (Scopaz and Hatzenbuehler 2013). Once the AT has background knowledge of those who are more susceptible, he should conduct a concussion assessment after the trauma, even if it is not associated with the head.

Baseline Testing

A noncomputerized cognitive test that is often used by ATs is the Standardized Assessment of Concussion (SAC) (McCrea 2001). The SAC requires an AT to obtain information from the athlete that relates to orientation (e.g., does she know what day of the week it is?), immediate memory (e.g., remembering five words), concentration (e.g., can she reverse the order of a string of numbers?), and delayed recall (e.g., can she remember the initial five words given during the immediate memory test?). The SAC test also has a neurological screening section whereby the AT examines loss of consciousness, memory loss, strength, sensation, and coordination. An athlete is given 1 point for a correct response and no points for an incorrect response. The SAC score has 30 possible points. The SAC form creates a record of an athlete's cognitive function and can be used as a pretest so the post-traumatic score can be compared. A score of 25 on the SAC is also used as one criterion for returning an athlete to play.

Along with noncomputerized cognitive testing, computerized assessment is done prior to participation in sport. The test takes about 30 minutes. The assessment consists of memory questions, problem solving, response time, and attention span. The same test is administered in the event of a concussion. The pre- and postconcussion tests are compared. The computerized test is one element used to determine the significance of the injury. The assessment may be administered several times to determine when the athlete has returned to the pretest level.

Every athlete must receive baseline testing, since one never knows when or how a concussion will occur. Typically, baseline tests take place at the preparticipation physical examination (see chapter 6).

Grading Concussions

The severity of concussions is graded in the same manner as sprains and strains—as mild, moderate, or severe. According to the guidelines established by the American Academy of Neurology, the signs and symptoms of a mild, or first-degree, concussion include no loss of consciousness and the athlete's symptoms (e.g., dizziness) or abnormalities (e.g., loss of balance) being resolved in less than 15 minutes. A moderate, or second-degree, concussion will cause no loss of consciousness, but the athlete's symptoms and abnormalities last longer than 15 minutes. If the athlete is unconscious for any length of time, she has sustained a severe, or third-degree, concussion. The unconscious athlete may experience rapid eye movements that look like fluttering, and her pupils may be unequal in size. The pupil on the side of the head injury will be enlarged if the head injury is serious. The athlete may be in a coma, but she can hear what is being said, and it is important that someone talk to her while the AT is working. The AT will detect increased blood pressure, decreased pulse rate, and signs of shock. A severe concussion can lead to death or paralysis. The AT must be cautious when dealing with a concussion because other injuries may have occurred during the impact.

He should also consider the possibility of a neck injury and keep the athlete's head still.

Other grading systems exist for concussions. The Cantu grading system, similar to that of the American Academy of Neurology, uses a mild, moderate, and severe system. Grade 1 means no loss of consciousness occurs, loss of memory lasts less than 30 minutes, and postconcussion signs and symptoms last less than 24 hours. A grade 2 concussion involves loss of consciousness for less than a minute or post-traumatic loss of memory between 30 minutes and 24 hours and postconcussion signs and symptoms lasting one to seven days. A grade 3 concussion will show loss of consciousness of over a minute, memory loss longer than 24 hours, or postconcussion signs and symptoms lasting longer than seven days (Bailes and Hudson 2001).

When the athlete is removed from the playing field, it is not uncommon for teammates to hit the player on the head and say, "Hang in there." Although they are trying to be supportive, they're actually contributing to the concussion. Athletes must be instructed ahead of time to keep their hands off so that only the AT touches the injured athlete.

Assessing the level of consciousness should be done using the Glasgow Coma Scale, or GCS (see table 9.1). The scale is used to determine the severity of the brain injury. The scale assesses AVPU, which stands for **a**lert, **v**erbal, **p**ain, and **u**nresponsiveness. The scale is broken into three areas: motor response, verbal response, and eye opening. Each

Head Injury Classification

- Severe head injury—GCS score of 8 or less
- Moderate head injury—GCS score of 9 to 12
- Mild head injury—GCS score of 13 to 15

Adapted from: American Academy of Orthopedic Surgeons 2011.

Table 9.1 Glasgow Coma Scale

Response	Grading scale	Score
Eye opening		
Spontaneous eye opening	4	
Eyes open to speech	3	
Eyes open to pain	2	
No eye opening	1	
Verbal		
Oriented	5	
Confused conversation, able to answer questions	4	
Inappropriate words	3	
Incomprehensible speech	2	
No response	1	
Motor		
Obeys commands for movement	6	
Purposeful movement to painful stimulus	5	
Withdraws in response to pain	4	
Flexion in response to pain (decorticate posturing)	3	
Extension in response to pain (decerebrate posturing)	2	
No response	1	

From the Centers for Disease Control and Prevention.

category has a grading scale, and the final score is determined by adding all the scales together. The final score is assessed against the chart to determine the athlete's prognosis. The higher the number on the grading scale, the greater the chance of returning to normal.

A concussion with or without the loss of consciousness should make the AT wonder about other injuries that may have occurred. It is best to use a backboard for any athlete with a moderate or severe concussion. In the event that an athlete has lost consciousness, he must be referred to a physician the day of the injury.

An athlete who has suffered a concussion will need to be monitored by a physician to determine when it is safe to reenter competition (see figure 9.3). The NATA position statement on concussion management states that an athlete should be monitored every five minutes after the concussion until the condition clears or the athlete is referred for advanced care. In general, an athlete will not be allowed back into competition after the first concussion until there are no remaining signs or symptoms. Specifically, the athlete will have no headache, nausea, dizziness, or amnesia and will have regained full coordination and normal blood pressure. After a second concussion within a year, the athlete must have at least one month free of all signs and symptoms before returning. A third concussion in one year puts the athlete out of competition for one year, starting the day of the third concussion. An athlete who has suffered a concussion should be told about the signs and symptoms of concussions and the implications of repeated impacts. An athlete who has suffered one concussion is four times more likely to suffer another.

Decisions about returning to participation should be made by the AT and a team physician. In general, athletes who have suffered a concussion should not return to participation until completing a progression of physical activity and follow-up assessments that begin only after he is free of all concussion symptoms (see table 9.2). Assessments should be compared with previous SAC tests (if performed). The progression of activity involves engaging in exercises such as stationary biking, push-ups, sit-ups, and low-level running. The AT must reassess the athlete to determine if the concussion symptoms reoccur during activity. If symptoms occur at this time, the athlete is not ready to progress to other activities, and more rest is required. If the athlete is symptom free at this time, he can then participate in sport-specific activities that do not pose a risk of further injury, such as noncontact activities. These activities should be done for several days, with reassessments performed by the AT. At this point, the athlete can perform **neurocognitive testing** to make sure he is back to normal. Once this is the case, he can return to full sport activity, assuming clearance has been obtained by a physician. In general, a minimum guideline is for an athlete to be symptom free for at least seven days before returning to contact activities.

What Would You Do If . . .

The AT has instructed you to take the blood pressure of an athlete with a head injury every five minutes and let her know about any changes. The first blood pressure is 160/92. The athlete is responsive but talks about a headache. The next blood pressure is 126/84. The athlete then vomits.

Postconcussion Syndrome

Postconcussion syndrome is the persistence of symptoms after a concussion. Symptoms may include headache, ringing in the ears, dizziness, and confusion. The athlete should be seen by a physician for a follow-up evaluation. Returning to play too soon following a concussion increases the chance of developing this condition. Postconcussion syndrome usually does not last more than a week or two.

Return Protocols for Academics

The concussed athlete's brain may require rest or alternative learning experiences. The AT will need to engage teaching staff and administrators in postconcussion care. Athletes may have a number of difficulties when returning to the classroom, experiencing reductions in ability to concentrate and understand concepts, attention span, memory, and reaction time (McGrath 2010). The physician

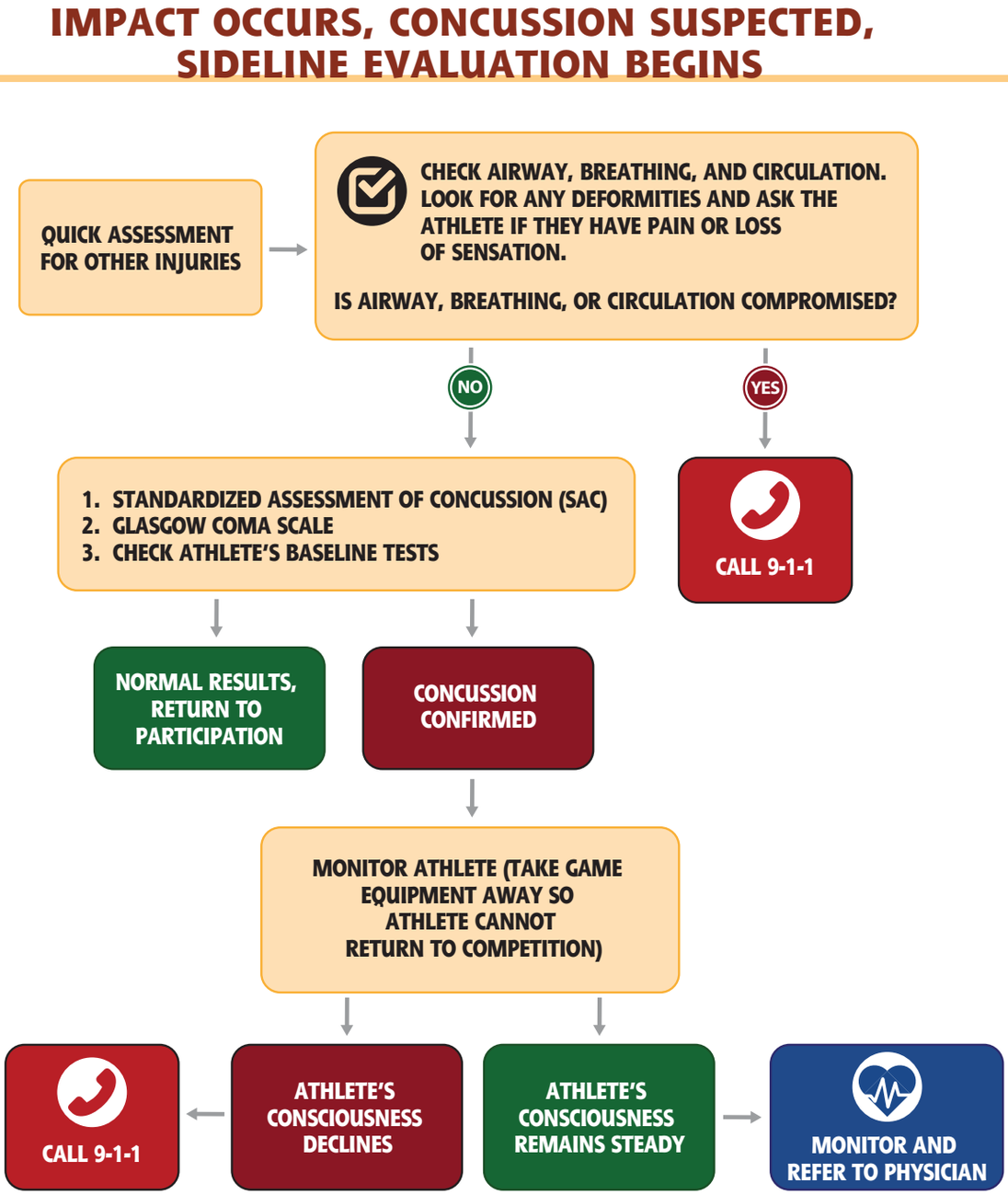

Figure 9.3 Sideline concussion evaluation and process.

may indicate that the athlete may be limited in his capacity to fully return to the classroom.

It has been found that the concussed athlete's brain needs rest to repair the damage (Centers for Disease Control and Prevention 2015). An athlete who returns to the learning environment taxes the injured brain, thus slowing the repair. It is important to follow a progression to allow the healing process to occur.

Nationwide Children's Hospital (2012) uses a five-stage approach to returning the cognitively impaired athlete to school.

Table 9.2 AT Concussion Assessment and Exertion Progression Log

Original assessment		
Return-to-play decisions	**Criteria for return to play**	
Return to play	☐	If athlete had no signs and symptoms of a concussion
Sit out for 15-30 min	☐	If signs and symptoms lasted fewer than 5 min and athlete had no more signs or symptoms and had completed exertional testing
Sit out for rest of game	☐	If athlete had all the signs of a concussion and had any episode of blacking out, can wait to refer but must see physician before return to play
Do not return to play	☐	If athlete was unconscious, call 911 for help

Exertional testing			
Activity	**Pass**	**Fail**	**Comments**
Run	☐	☐	
Jog	☐	☐	
Sprint	☐	☐	
3 broad jumps	☐	☐	
3 sets of 10 vertical jumps	☐	☐	
Figure 8	☐	☐	
Box drills	☐	☐	
Balance drills	☐	☐	
Sport-specific activity, treadmill, elliptical	☐	☐	

Based on McCrea (2001).

1. No school
2. Half day of school with accommodations
3. Full day of school with accommodations
4. Full day of school without accommodations
5. Full day of school and physical activity

The progression through each of these stages depends on how the athlete is improving and functioning. Athletes who have learning disabilities, migraines, or some mental health issues before the concussion may find that it takes longer to recover and thus may progress more slowly through the stages (Centers for Disease Control and Prevention 2015). The physician will determine how quickly the athlete can progress through each of the five stages.

Second-Impact Syndrome

It is thought that damage from concussions and brain injury is cumulative. Therefore, if an athlete is allowed to return to participation before the symptoms of his first concussion have completely subsided and he receives another blow to the head, he can quickly lose brain function and go into a coma. **Second-impact syndrome** can occur when an athlete receives more than one concussion or blow to the head in a relatively short time. Such trauma may disturb the blood supply to the brain and present signs of a minor concussion followed quickly by a semicomatose state. Athletes who have suffered brain injuries must not be allowed to return to participation until they are symptom free and have obtained written permission from a doctor.

The Real World

One afternoon, at 2:35 p.m., our high school dismissed students. My student trainers and I went to work in the training room. It was a fairly busy Monday. My students were preparing athletes for football, soccer, and volleyball, while I was checking a few of the injured athletes. At approximately 2:50 p.m., the athletic director announced over the PA system that I was needed in the parking lot—there had been an accident. By the sound of his voice, I could tell we had a big problem.

I ran out of my training room at full speed. When I hit the doors just outside the athletic office, the athletic director met me, and we ran on together. The accident had occurred at the far end of the parking lot. I surveyed the scene as we approached. Several students were standing around looking at something on the ground. On the right, next to a car, a distraught female student was talking with one of the teachers. I started asking questions as I made my way through the gathering of students. Someone said that a girl had fallen off the hood of the car while it was moving.

The next thing I saw took my breath away. Lying on the ground was a student who had been in my office earlier in the day to arrange for a tutor. She was pale, sweaty, not breathing, and bleeding from her ears, nose, and mouth. I saw a patch of bloody hair on the pavement about 2 feet (.5 m) from us and 8 to 10 feet (2.5-3.0 m) from the car. All I had to do was look at the athletic director, and he got on his radio to his secretary to call an ambulance. Because I suspected both head and neck injuries, I stabilized the student's head and neck. I immediately used the jaw thrust maneuver to open the airway with minimal head movement. When her airway opened, she made a gurgling noise and a bloody froth bubbled from the corners of her mouth. As I continued to stabilize her head and neck, I asked a health teacher, who was at my side, to check the girl's pulse. Her pulse was faint, and her breathing was irregular. She was nonresponsive, and her face was covered with blood. An assistant principal was there with gloves and paper towels, and I had him gently clean her face so I could determine the major source of bleeding. I told the athletic director to keep bystanders back, and I sent the head custodian to the school entrance to direct the ambulance to us. While I was stabilizing the girl's head and neck and maintaining her airway, I was also trying to get a response from her. As we waited for the ambulance, I realized that I did not have gloves on, but it was too late to worry about that. We seemed to wait forever. The girl started to choke, and we had to logroll her just as the ambulance made its way into the parking lot.

I continued to maintain the girl's head and neck while the paramedic checked her vitals. While he was doing this, she became combative. The paramedic got a collar on her, and I fought to maintain her head and neck stability while we put her on the backboard and then the stretcher. The paramedic asked me to ride in the ambulance to continue to maintain her head and neck. I held her head between my forearms while a second paramedic tried to get an IV going. In spite of her restraints, it took several attempts; she was a lot stronger than I ever could have imagined. We were about a block from the hospital when she started to vomit and she aspirated. Now, clearing her airway became the priority. The paramedic yelled at me to grab the suction line as he turned it on. As he was suctioning the bloody vomit from her mouth, I was trying not to vomit on both of them.

We arrived at the emergency room, and I was still maintaining her head and neck. They did a cross-table X-ray, which was negative for cervical spine fracture, and I was allowed to discontinue stabilization. I stayed with the girl in the ER until her parents got there. The doctor told me it was too early to tell how she would be. When I walked out of the ER, I met the athletic director waiting to give me a ride back to school. It was like coming back to the real world. I hadn't even thought about getting back to school or about practice.

The young woman spent two weeks in the ICU being treated for a subdural hematoma. She later returned to school, showing few effects of the injury. I, however, learned that my job extends far beyond the training room—and I always grab a pair of gloves on my way out the door.

Becky Clifton, ATC

Chronic Traumatic Encephalopathy

Repeated trauma to the head can lead to degeneration of the brain entitled **chronic traumatic encephalopathy (CTE)**. CTE is a condition that most often occurs in athletes who participate in contact or collision sports, such as lacrosse, mixed martial arts, boxing, football, rodeo, rugby, and ice hockey.

CTE is sometimes suspected while the athlete is alive when known normal behaviors change. Suicidal thoughts, balance issues, speech difficulty, aggressiveness, loss of memory, dementia, and depression are some signs and symptoms that may occur (Mayo Clinic 2017c; McKee et al. 2009). CTE is not definitively diagnosed until after death when an autopsy is performed on the brain. It is imperative that the AT follow strict guidelines for returning athletes to competition in hopes of preventing CTE.

SUMMARY

Although the brain is well protected by the skull, it is vulnerable to serious injury—the athlete may suffer intracranial bleeding, concussion, postconcussion syndrome, or second-impact syndrome. If the brain lacks oxygen for any appreciable time, cellular death occurs. Typical signs and symptoms of a head injury include vomiting, unequal pupils, skull depression, increased blood pressure, and unconsciousness, any of which call for immediate EMS attention. An athlete who has suffered a head injury must not have any signs or symptoms of the injury and must have clearance from a physician when he returns to participation.

KEY TERMS

Define the following terms found in this chapter:

- amnesia
- battle sign
- cerebrospinal fluid
- chronic traumatic encephalopathy (CTE)
- concussion
- contrecoup
- hematoma
- intracranial hematoma
- neurocognitive testing
- second-impact syndrome
- tinnitus

Go online to the web resource to find quizzes, activities for reinforcement, above and beyond activities, practical skill worksheets, and chapter-specific tasks for the semester-long project.

chapter 10

Facial Injuries

Objectives

After completing this chapter, the student will be able to do the following:

- Describe the basic anatomy of the face.
- Explain the common types of facial injuries, how they occur, and how to prevent them.
- Explain common steps of care for treating facial injuries.

Injuries of the face can lead to permanent disfigurement or visual impairment. Immediate action of the AT can lessen the chance of long-term problems, as can protective equipment such as eye guards.

ANATOMY OF THE FACIAL REGION

The face includes bones that are also part of the skull, so the discussion in the previous chapter may clarify the anatomy that follows. There are 18 bones in the face (some are in pairs). Major bones include the maxillae, the mandible, and the zygomatic bones (see figure 10.1). The maxillae are the two bones of the upper jaw, and the mandible is the lower jaw. The nasal bones make up the bridge of the nose. The zygomatic bones are also known as the cheekbones. Within the structure of the sphenoid bone are the sinuses, which become stuffed up when a virus or infection invades the upper respiratory tract. The sinuses are located above and below the eyes (see figure 10.2). After a facial fracture, blood can run into the sinuses rather than externally, so some fractures may remain hidden.

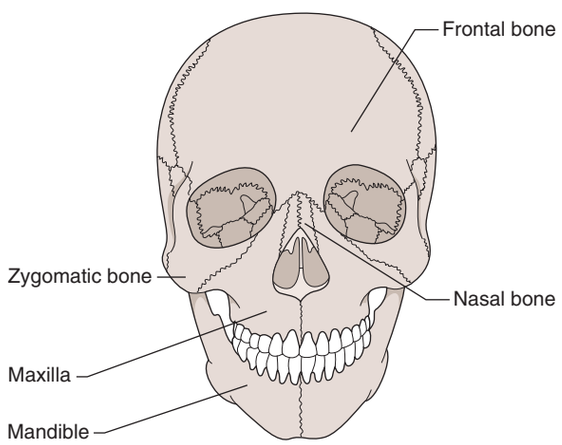

Figure 10.1 Facial bones.

The Eye

The eye sits in a socket known as the *orbital foramen*, or *orbit*. Most of the eye is hidden inside the

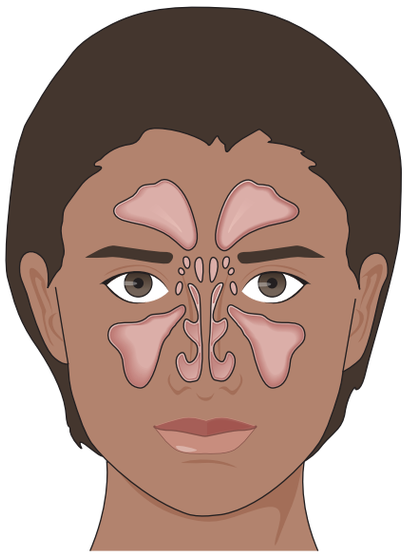

Figure 10.2 Sinuses.

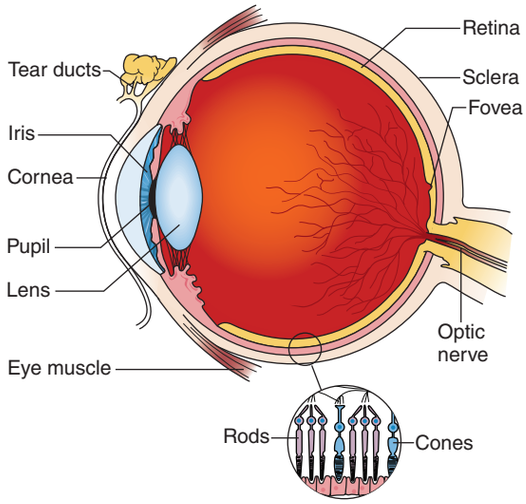

Figure 10.3 Anatomy of the eye.

orbital foramen, which protects the eye on three sides and serves as an attachment point for the muscles that move the eye. Lack of eye movement can indicate either a head injury or a serious eye injury (figure 10.3 shows the anatomy of the eye).

The eye itself consists of the anterior and posterior chambers. The two chambers are filled with fluid, which gives the eye its rounded shape. An injury that causes fluid to drain from the eye is likely to cause permanent damage, even blindness.

The covering of the eye has a white area and a clear center. The white outer covering of the eye is the sclera. A change in color of the sclera indicates that the athlete has a problem or an illness, such as liver disease, lack of oxygen, or poisoning. The clear center portion of the eyeball covering is the cornea. The cornea protects other important structures from injury. It covers the iris and pupil and admits light to the interior. The cornea is made up of thousands of tiny cells that can be injured by wearing contact lenses too long or by something that scratches the eye.

The iris is the contractile, colored portion of the eye, and in its center is the pupil, which is the opening in the iris. The iris responds to light, changing the size of the pupil. In bright light, the pupil gets smaller, thus limiting the amount of light entering the eye. In a dark room, the pupil gets larger, allowing all available light into the eye. Also located in the anterior portion of the eye is the lens, which focuses the entering light rays on retina. A poke in the eye may dislodge the lens, blurring or changing an athlete's vision. Finally, the **conjunctiva** lines the inner surface of the eyelid and continues over the forepart of the eyeball.

The main structures at the posterior aspect of the eye are the retina and the optic nerve. The retina lines the back of the eye and contains the rods and cones. Rods provide vision in black and white, and cones provide color vision. The retina receives the image formed by the lens and converts it into chemical and nerve signals that the optic nerve sends to the brain, where vision occurs. Damage to the optic nerve can cause blindness. Injury to the optic nerve that has resulted in blindness will also prevent the pupil from functioning.

In the upper outside (that is, superior lateral) edge of each eye is a gland that makes tears. Tears wash diagonally across to the nose and drain into it through a duct. In the rims of each eyelid are small glands that secrete lubricating fluid, allowing the eyelid to open and close smoothly.

Vision is measured by an arbitrary standard. Originally, the test consisted of reading letters on a chart from a distance of 20 feet (6 m). A person who could read the smallest letters was said to

What Would You Do If . . .

An athlete comes running into the athletic training room. She is in tears, cannot see, and has pain in her eyes. She reveals that she is wearing a friend's contact lenses because she wanted to try them out.

have 20/20 vision. Today's vision tests relate to that standard. A person who can see near objects more clearly than distant ones is nearsighted, and a person who can see distant objects better than near ones is farsighted. These common vision problems are treated with corrective lenses or eye exercises.

Muscles of the eye are divided into two categories: extrinsic and intrinsic. Table 10.1 provides muscle locations and functions.

The Ear

The ear has three distinct areas: the external ear, the middle ear, and the inner ear (see figure 10.4). The external ear is composed of the pinna, the ear canal, and the tympanic membrane. The pinna, which is the projecting portion of the external ear, is cartilage covered by skin. Its purpose is to catch sound and funnel it into the auditory canal.

The auditory canal carries sound from the pinna to the tympanic membrane, or eardrum. Earwax, which is designed to keep dirt away from the sensitive eardrum, is found in the auditory canal. Too much wax in the ear prevents or delays sound from reaching the middle ear.

Table 10.1 Muscles of the Eye

Extrinsic muscles	Attachments	Functions
• Lateral rectus • Medial rectus • Superior rectus • Inferior rectus • Superior oblique • Inferior oblique	Bones of the orbit and the eyeball	Movement of the eye superiorly and inferiorly, externally and internally, and obliquely
Intrinsic muscles	**Attachments**	**Functions**
• Iris • Ciliary	Interior layer of the eye	Size of the pupil and shape of the lens

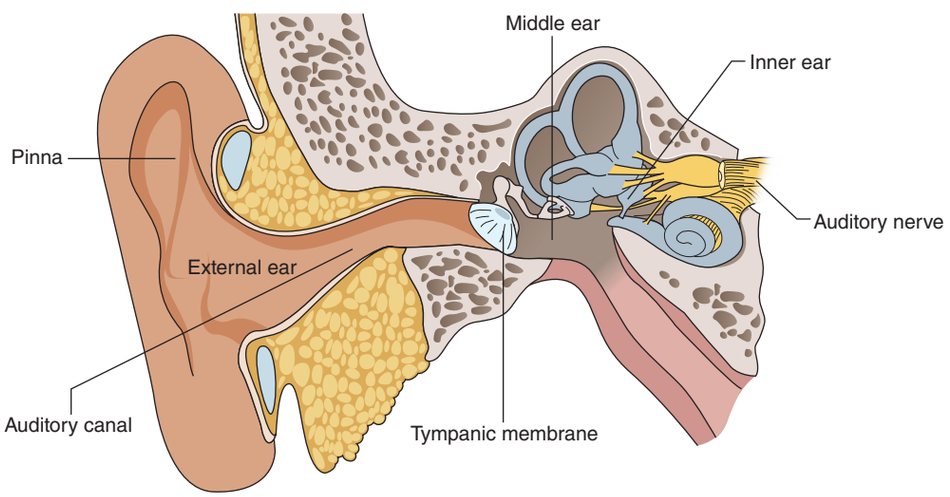

Figure 10.4 Anatomy of the ear.

The Nose

Two small bones, called the *nasal bones*, attach to the frontal bone of the skull. About an inch (2.5 cm) in length, the nasal bones make up the bridge of the nose. The rest of the nose is cartilage.

Inside the nose is the septum, which is a piece of cartilage that separates the left and right sides of the nose. Hairs inside the nose filter impurities from the air. The palate, which is the roof of the mouth, separates the mouth from the bottom of the nose.

Air that is inhaled through the nose is warmed, moisturized, and cleansed before reaching the lungs. In winter, breathing through the nose will decrease lung pain caused by inhaling cold air through the mouth. Athletes with asthma and upper-respiratory infections should breathe moist air.

The Mouth

The mouth is made up of the mandible (lower jaw), maxillae (upper jaw), temporomandibular joint, tongue, palate (roof of the mouth), and teeth.

The mandible attaches to the skull at the temporomandibular joint and is the only moveable bone in the face. The mandible moves during speaking and eating. The teeth give the face shape and are used to chew food; they are attached to both the mandible and the maxillae. An adult has 32 permanent teeth.

A tooth is composed of the crown, which is the visible portion above the gumline, and the root, which is below the gumline (see figure 10.5). The crown is capped with a thin layer of enamel, which protects against tooth decay. The root contains pulp and dentin. Dentin is the hard, bony portion of the tooth. The pulp is the soft portion of the tooth containing the nerve and blood supply. The nerve is sensitive to pain, pressure, and temperature, and the blood supply brings oxygen and food to the tooth to keep it alive. A live tooth is white in color, whereas a dead tooth is dark gray.

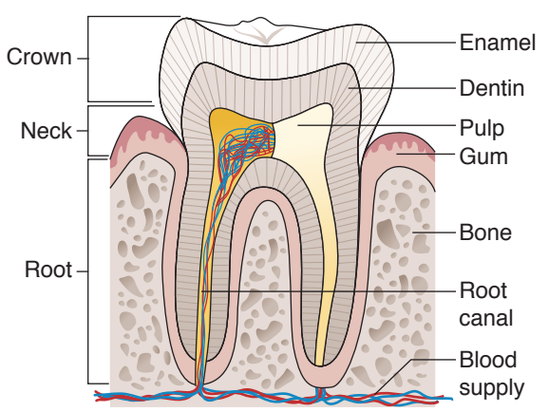

Figure 10.5 Cross section of a tooth.

The teeth, tongue, and saliva work together to prepare food to be swallowed. The salivary glands under the tongue and in the back of the mouth provide saliva to begin digestion. The saliva makes it easier for the teeth to break down food, and it binds the food together before the food is sent to the stomach.

The muscles used for chewing include the masseter, temporal, and pterygoid. Table 10.2 lists the muscles involved in chewing, including attachments and functions.

PREVENTING FACIAL INJURIES

Preventing facial injuries requires common sense. Athletes who fail to wear the proper equipment can easily become injured—a prime example is a catcher who does not wear a face mask when warming up a pitcher. Equipment is available in all sports to prevent facial injury; it includes helmets, mouth guards, face masks, goggles, protective eyewear, and headgear. Mouth guards are relatively inexpensive, but repairing injuries to the teeth and jaw is very expensive. A properly fitted athletic face mask decreases the number of eye, nose, face, and mouth injuries. The face mask should be spaced a minimum of 1 inch (2.5 cm) from the nose; if it is closer, an impact to the mask can cause it to distort inward, resulting in injury to the face or nose. When selecting a face mask, make sure that no game equipment, such as a hockey puck or stick blade, can get through the openings in the mask and hit the face. Protective eyewear is crucial in preventing blindness. All sports have the potential for eye injuries; balls, sticks, elbows, and fingers are common items that injure eyes. Because eye injuries are unpredictable, it is best for all athletes to wear eye protection designed for their sport. Eye guards, which are similar to glasses and generally

Table 10.2 Muscles of the Mandible

Muscle	Attachments	Functions
Masseter	Zygomatic arch and the mandible	Closing the mouth
Temporal	Temporal bone and mandible	Closing the mouth
Pterygoids	Inferior surface of skull and mandible	Grinding the teeth

Recommended Eye Protectors for Selected Sports

These are the specific types of eye protectors recommended for these sports; all other sports wear custom eyewear or polycarbonate eye protection.

- ASTM F803
  - Baseball/softball fielder
  - Basketball
  - Soccer
  - Track and field
- ASTM F3077
  - Lacrosse
  - Field hockey (also ASTM F27130)
- NOCSAE DOC.24: Baseball/softball catcher
- BS 5883: Water polo/swimming
- ASTM F513: Ice hockey forwards and defenders
- ASTM F1587: Ice hockey goalies

ASTM = American Society for Testing and Materials; BS = British Standard; NOCSAE = National Operating Committee on Standards for Athletic Equipment.

References: American Academy of Ophthalmology 2013; US Lacrosse 2017; Dain 2016.

consist of plastic frames and lenses, or goggles should be worn if face masks are not worn (see *Recommended Eye Protectors for Selected Sports*). Athletes with fractures of the nasal bones, skull, or jaw should wear special padding, masks, or helmets to prevent additional injuries.

TREATING EYE INJURIES AND CONDITIONS

Eyes are precious, and it is better to err on the side of caution and send the athlete to a doctor even if the eye injury doesn't seem serious than to discover later that the injury was serious and treatment could have prevented permanent injury or loss of vision. The AT also should be thinking about other injuries that might have occurred along with the eye injury. For example, a head injury is a definite possibility that should be assessed.

Eyes move in coordination. Even if an eye is injured, it still tends to move in cooperation with the noninjured eye. Thus, if an eye must be patched or shielded, the AT should cover both eyes. This will reduce the movement of both eyes and thus reduce irritation of the injured eye.

What Would You Do If . . .

You find the lost contact lens of a soccer player. It is covered with dirt and grass.

Conjunctivitis

Conjunctivitis is more commonly known as *pink eye*. The conjunctiva turns red and the eye appears to be irritated. Conjunctivitis has a variety of causes, including bacteria, allergies, eye irritants (e.g., soap), viruses, and diseases (Vorvick 2008). Symptoms of conjunctivitis include redness of the eye, eye irritation, crusting matter along the corners and lid of the eye, blurred vision, and itching.

A physician needs to examine and assess eye fluids to determine the cause. Pink eye is usually caused by a highly contagious virus, so to prevent others from getting it, the athlete should stay at home until effectively treated and no longer contagious. Eye drops will be necessary for effective treatment.

For those who have the allergic form of conjunctivitis, an antihistamine or removal of the athlete from the allergen will work. An athlete who has a bacterial infection will need antibiotics.

Foreign Body

A foreign body in the eye causes tears, which attempt to wash the foreign body toward the nose. In some instances, tears will not clear the eye. In these cases, rinsing with water from the nose outward can flush the particle out of the eye or over to one side where it can be removed.

If the object is stuck under the eyelid, the AT or athlete should lift the lid outward over the bottom lashes. The bottom lashes can brush the object out. If this process does not remove the object, it will be necessary to invert the upper eyelid. Inversion of the lid is accomplished by grasping the lid and pulling it outward; a cotton-tipped applicator is placed in the fold of the lid, and the lid is laid over the applicator. This exposes the underside of the lid so that the object can be removed. If the inversion technique fails, the athlete should be referred to a physician for care. Both eyes must be patched to decrease eye movement and prevent scratching of the cornea.

Embedded Object

An embedded object is one that is stuck in the eye; it may have been blown into the eye, for example, or a blow from a ball may have shattered a contact lens. No matter how the object entered the eye, the care received will determine the quality of the athlete's vision in the future. The athlete will know the object is in the eye. She will reach for the eye and tears will occur, resulting in pain, visual impairment, and anxiety.

The best treatment is to place an eye shield over both eyes and send the athlete to a physician. If the object is sticking out of the eye, the AT will not remove the object but will stabilize it with bulky dressings. The physician will determine the severity of the injury, surgically remove the object, and stop any fluid release. The physician will prescribe antibiotics, and the eye will remain patched for about a week. A vision test will be necessary to determine visual acuity. Eye guards and goggles will help the athlete protect the eye from reinjury.

What Would You Do If . . .

A golfer comes into the training room assisted by several others. They tell you that someone yelled, "Fore," and when the golfer turned to look, the ball hit her in the eye. The athlete is in extreme pain and wants you to remove her contact lens. You can see several pieces of her contact lens sticking into her eye.

Dislodged Contact Lens

Contact lenses come in two types: hard and soft. A hard contact lens covers the pupil of the eye, whereas a soft lens covers the entire cornea. A displaced hard contact lens feels like a rock in the eye. The athlete's vision will be impaired, and the displaced lens will irritate the eye. Usually the athlete knows where the lens is located in the eye because of the initial pain. When the eye is examined, the lens can be seen because of its color in contrast to the sclera. Some people believe that the lens can be lost behind the eye, but that is impossible. The lens will be in the eye—the AT just has to keep looking. The hard lens can be moved back over the pupil, and usually the athlete can do this himself if the AT provides a mirror. If he is unable to remove it, the AT can remove it using a small suction-cup device that is placed over the lens. The athlete should then clean the lens before placing it back in the eye.

The displacement of a soft lens is less uncomfortable. The athlete will know the lens is out of place because she won't be able to see. A soft lens is more difficult to put back in place because it tends to curl up like a soggy cornflake. The athlete should wash her hands and then gently grab the lens. She must use caution, because roughly handling a soft

lens will tear it. The lens should be cleaned with solution before being returned to the eye. Sometimes an athlete believes that rinsing the lens by putting it in her mouth is acceptable. The practice of placing a hard or soft contact lens in the mouth is like dipping it in garbage before reinserting it. This practice must be discouraged!

Corneal Abrasion

A **corneal abrasion** or laceration is caused by being poked in the eye with a foreign object or by wearing contact lenses too long. An abrasion is superficial, whereas a laceration is deeper and more severe. The athlete will experience pain and feel as if something is lodged in the eye. She will have tears and sensitivity to bright light. If the injury is not treated, the eye may become infected or the athlete may have permanent vision problems. The physician treats the abrasion by patching the injured eye for 24 hours and applying antibiotic ointment. The athlete will need help getting to the hospital because of limited vision. If wearing a contact lens too long caused the injury, a restriction will be placed on the athlete to keep this from recurring. Sunglasses may be worn while recovering. Corrective lenses may be necessary if the cornea becomes distorted. The athlete may have difficulty returning to competition for fear of reinjuring the eye, but using eye guards or goggles will help her overcome this fear.

Eyelid Laceration

Think of an athlete who reaches out to grab the head of the opposing wrestler to gain control for a takedown. The opponent jerks his head away from the grasp but gets poked in the eye and experiences immediate eye pain. The eye is bleeding, and the athlete refuses to pull his hand away so the AT can determine the extent of the injury. Once the athlete relaxes, the AT can see that the eyelid is lacerated, maybe all the way through to the margin of the eyelash.

The immediate procedure is to control the bleeding with direct pressure. The AT will question the athlete about his ability to see clearly in order to determine the extent of other possible consequences of the poke. An eyelid laceration is similar to most lacerations except the tear duct may also be injured, possibly resulting in permanent damage. Once the bleeding is controlled, the athlete must be referred to a physician to repair the lid.

A plastic surgeon should repair a laceration of the eyelid to prevent scarring or permanent deformity of the lid. The ophthalmologist will want to check the eye for proper vision and to ensure that there are no other complications.

Athletes should keep their fingernails cut to prevent eyelid lacerations (this is a rule in wrestling). Goggles can also prevent this type of injury.

Black Eye

A hard blow to the eye may cause a black eye. As with any contusion, a black eye is caused by bleeding and discoloration just under the skin, which affects the tissue surrounding the eye but not the eye itself. Therefore, the athlete will not complain of visual impairment, but there will be swelling and pain. If the athlete complains of any other difficulty, a referral to a physician is necessary. Ice application over a black eye is an accepted treatment.

Hemorrhage Into the Anterior Chamber (Hyphema)

A blow to the eye can cause bleeding within the eye. A **hyphema** is blood pooling in the anterior portion of the eye. When looking at the athlete, the athlete will complain of both the inability to see and of pain. She should have both eyes covered with a protective shield, but the AT should not apply an ice pack. The physician needs to determine the severity of the injury. The athlete with a hyphema may suffer permanent damage, blindness, or cataracts.

Detached Retina

A blow to the eye or even a hard sneeze can cause the retina to detach. The athlete will experience pain, but the surest sign of a **detached retina** is that the athlete sees sparks, lights, and flashes that nobody else can see. The athlete may indicate that he is having difficulty seeing or that things look foggy. The athlete should be referred to a physician who can do laser surgery to repair the detached retina. When the athlete returns to activity, he must wear protective goggles to prevent reinjury. If a physician does not repair the damage promptly, blindness could result.

Subconjunctival Hemorrhage

Athletes who have a terrible cough from an upper-respiratory infection are prone to **subconjunctival hemorrhage**. The constant coughing may cause the small vessels in the eye to rupture, turning the conjunctiva red. An athlete may also get poked in the conjunctiva or hit by a ball, which causes the same result.

Although the eye looks painful, the athlete experiences minimal or no pain and no visual impairment. It is best to refer the athlete to a physician for an eye exam to be sure no other structures are injured. The treatment for this hemorrhage is to do nothing. The athlete is allowed to participate without restriction. Her biggest problem will be the funny looks she gets from others concerned about the appearance of her eye.

Orbital Roof Fracture

A blow to the eye or the area just above the eye can cause a fracture in the roof of the orbit. When this happens, the athlete will experience pain, a headache, signs and symptoms of a concussion, and a hematoma over the area. The nose may bleed, and cerebrospinal fluid may drain from the nose. This injury requires immediate care by a physician. Hospitalization for observation and care of the fracture and rest will most likely be required. The athlete will not be able to return to competition for about a year.

Sinus Fracture

A sinus fracture can occur when there is a sharp blow to the face, for example, from a baseball taking a bad hop or from a stick across the face. A headache, dizziness, and unsteadiness may occur. The athlete's nose may bleed on the same side as the injury. He will experience pain, but once the bleeding has stopped, the AT should do a quick assessment of the injury. With this fracture, air seeps into the skin and tissues around the eye and nose, resulting in a crackling sensation when the area is touched. The AT should apply ice and immediately refer the athlete to a physician. The physician will require special X-rays to discover the exact location of the fracture.

A complication of this injury is a concussion, which could diminish the athlete's ability to give a history. In the case of a blow to the face, it is always prudent to recommend a physician's evaluation.

Blowout Fracture

A blow to the eye can force the eyeball backward into the socket. The thin bones beneath the eye absorb the sudden increase in pressure and fracture. This type of fracture is referred to as a **blowout**.

The athlete may experience double vision and may not be able to feel much pain as a result of damage to surrounding nerve endings. The athlete may also experience numbing of the lip and upper jaw on the same side as the injury. The muscles of the eye often get caught in the fractured bones. Therefore, the AT may notice that the athlete cannot control the injured eye—it will be looking in a different direction than the uninjured eye. The eye may appear to be sunken in the socket. There will be immediate swelling, and the conjunctiva will begin to discolor. The athlete may have a bloody nose on the same side as the injury, and the bleeding may fill the sinus, making it difficult to breathe. The eye may bulge when the athlete attempts to blow her nose.

The AT should call 911 and help control any bleeding. The athlete should be monitored in case her condition worsens. A physician may have to surgically repair the fracture and release the muscles. The athlete may suffer permanent vision problems, including glaucoma and cataracts. She will remain out of competition for several months.

Boxers wear headgear to prevent such eye injuries. Although blowout fractures are rarely seen in wrestling, basketball, and racquetball, athletes in these sports should wear some form of eye protection to prevent them.

Ruptured Globe

The globe—the eyeball itself—can be ruptured by any object small enough to enter the eye, such as a squash ball or racquetball. When examining the eye, the AT will notice a lack of roundness of the globe and a hemorrhage of the eye. Associated injuries may include an eyelid laceration, blood in the front

of the eye, the interior contents of the eye spilling out, or the pupil out of round (see figure 10.6). Any sign that the globe has been ruptured requires that the AT cover the eye with a protective eye shield that will not allow external pressure. The athlete must be taken to the emergency room immediately and referred to an ophthalmologist if his eyesight is going to be saved. He will not be able to return to competition for months.

Figure 10.6 Any time there is excessive swelling with possible leakage of fluid, a ruptured globe should be suspected. Patches must be put over both eyes and the athlete sent to the emergency room immediately.

RED FLAGS

Call 911 for any of the following:

- The globe of the eye is leaking fluid.
- The globe of the eye is outside the socket.
- The athlete can no longer move his eye after injury.
- A glass lens has been embedded in the eye.

TREATING EAR INJURIES

The external ear helps to funnel sound to the inner ear, and the inner ear plays a role in equilibrium. With its placement on the side of the head, the ear does not have a high incidence of injury. In high school athletics, earrings are barred from competition because of the potential for ear injury.

Swimmer's Ear (Otitis Externa)

Proper care of the ear requires that the ear and the canal be dried after swimming. There are times when a swimmer cannot remove water from her ear, such as when she is hurrying to get home or water is stuck in the ear. If water remains in the ear, an inflammation of the canal can occur, which is referred to as *otitis externa*, more commonly called **swimmer's ear**. The athlete will experience pain, itching, hearing loss, and possibly a smelly discharge from the ear. It will be easy to notice the discharge and the swollen, red canal. If the infection is not controlled, it can spread deeper into the canal. The athlete should be sent to a physician for ear drops and antibiotics. Prevention of swimmer's ear can be as simple as drying the ear after swimming by using a hair dryer on a low setting. Rubber or wax plugs are sometimes used to lessen the flow of water into the ear, but these can actually increase the risk of infection because they irritate the ear canal. Also, when using plugs, hearing is impaired, making it difficult to hear coaches. Some athletes prefer to use alcohol-based ear drops, which dry the ear canal.

Many athletes clean their ears regularly to prevent infection, but this too can become problematic. Cerumen, or earwax, is an important barrier to infection, and regular cleaning that forces wax out of the canal may not only irritate the canal but also increase the risk of infection (American Academy of Otolaryngology 2013).

Foreign Body

In athletics, foreign bodies in the ear are rare, but bugs have been known to take a look in an ath-

The Real World

One night while I was covering a high school football game, an athlete whose nickname was Cowboy came over to the sidelines as the defense came off the field. The team physician and I were there when the athlete stated that he was experiencing ear pain. After removing his helmet, I examined his ear and saw a fly at the entrance to the ear canal. I must have startled the poor insect because it retreated back into the ear. The physician asked if I had a penlight. I produced one, she aimed it at the ear, and the fly immediately came forward—drawn to the light—and buzzed away, solving Cowboy's dilemma.

Todd Keasling, ATC

lete's ear. The athlete will have the sensation that something is in the ear and may experience pain.

Probing the ear with a cotton-tipped applicator may push the object farther into the ear and should be avoided. The AT could also rupture the eardrum while trying to get the object out. A physician can remove an object using mineral oil or special tweezers.

Cauliflower Ear (Hematoma Auris)

Wrestlers are the athletes who suffer the most from **cauliflower ear**. The wrestler involved usually is not wearing his headgear and gets hit hard in the ear, or his head is pushed hard into the wrestling mat. The pinna of the ear begins to bleed internally, causing swelling, redness, and pain. As the ear heals, there is an excessive growth of reparative tissue, which distorts the pinna, causing it to look like a piece of cauliflower (see figure 10.7).

Treatment of cauliflower ear starts with ice and compression with moldable material, performed by the team physician. The team physician may lance, or drain, the ear to reduce the swelling and use steroid medication to keep the hemorrhage under control. In more complicated cases, the physician may remove the tissue through surgery. Some athletes opt for plastic surgery to fix the ear if it is permanently distorted. Wearing headgear and applying petroleum jelly to reduce friction can prevent cauliflower ear.

Pinna Laceration

Ears stick out from the head enough that they may get in the way. Athletes should never wear earrings in practices or competitions because they increase the vulnerability of an already exposed body part. An earring can be caught by another athlete's finger, tearing the ear lobe. Even in sports in which the ears are protected by a helmet, earrings may be jammed against the wearer's head if the head is struck, causing serious discomfort and even injury. A laceration of the pinna is treated the same as any other wound—by controlling the bleeding with direct pressure, which can be applied on both sides for rapid control.

When a portion of the pinna is no longer attached, the missing piece must be found so that it may be reattached. The detached part should be wrapped in sterile gauze, put in a plastic bag, and placed in a container full of ice. (It is appropriate to place it on ice as long as the ear is not directly touching the ice.) In the case of a laceration, the athlete should be referred to a physician for stitches and a tetanus shot. The athlete can prevent lacera-

Figure 10.7 Cauliflower ear.

tions and other wounds of the pinna by wearing proper protection and removing earrings.

Ruptured Eardrum

A tear of the tympanic membrane, or **ruptured eardrum**, can occur from an ear infection, a blow to the side of the head, loud noises, and atmospheric pressure. The athlete may experience loss of hearing, buzzing in the ear, and drainage from the ear. A physician will have to examine the ear and do a hearing test to determine the extent of the injury. In some cases, no treatment is necessary and the membrane will heal on its own. In some cases, antibiotics will be necessary to deal with the ear infection if that was the cause. For severe ruptures or ruptures that do not heal, surgery may be necessary. An athlete will need to wear headgear to protect the membrane and must not put anything in the ear, such as a cotton swab.

TREATING NOSE INJURIES

For some athletes, the nose is always in the way. In boxing, it is constantly being smashed by a fist. Wrestlers can find their noses rubbed into the mat and even used as a carrying handle by opponents. And basketball players' noses seem to be attracted to the elbows of opposing players. The nose is vital: It warms incoming air and acts as a filter to catch particles.

Nosebleed (Epistaxis)

When an athlete goes up to head a soccer ball and it lands on her nose, the impact can cause an **epistaxis**, or bloody nose. An athlete may get a nosebleed from constantly blowing the nose during a cold. Athletes taking special medications, as well as those who have had a recent nosebleed, are prone to epistaxis.

The nose will bleed from one or both nostrils, and if the nosebleed is from a blow, it will be painful. The AT should instruct the athlete to lean forward while pinching the nose. Applying ice and packing the nose with gauze that has been soaked with an astringent (medication that slows bleeding) are helpful. Leaning the head backward forces the blood into the throat, obstructs the airway, and should be avoided. The athlete should lean forward to allow blood to discharge from the nose and should spit out any blood draining into the throat—swallowing blood will cause vomiting. Discourage any attempt to blow the nose, because this will start the bleeding process again. If there is excessive bleeding (gushing like a faucet) from the nose, the athlete should be treated for shock and sent to the hospital for evaluation. The physician may cauterize the bleeding vessel.

Deviated Septum

The septum is the piece of cartilage that separates the left and right sides of the nose. A deviated septum has moved to one side, causing decreased airflow through the nasal passageway. Any form of direct impact to the nose can cause a deviation.

The blow to the nose will have caused a nosebleed, so follow the instructions for epistaxis first. Then wait a day or two to test the athlete for a deviated septum by blocking off one nostril and having the athlete force air out of the nose and then repeating the procedure on the other side. If one nostril forces more air through than the other does, the septum may be deviated. If the athlete has a deviated septum, the nose may also be broken. The athlete should be referred to a physician to determine if surgery is necessary. Many athletes who have a deviated septum choose not to have surgery. Wearing a face mask will prevent further injury to the nose.

Nasal Fracture

A direct blow to the nose can fracture one or both of the nasal bones. There will be a severe nosebleed, often similar to water running from a faucet. The AT will treat the athlete by having her lean forward. Pinching the nose may not be possible. The AT uses gauze to catch the blood as it comes out of the nose and applies ice. Gauze should not be forced into the nostril to slow bleeding.

The athlete may indicate that she heard a snap and may have pain and difficulty breathing. The AT should observe deformity (flat on one side) and swelling. He may hear **crepitus**, or crunchiness, during palpation and observe a deviated septum. The athlete should be referred to a physician for care. The physician may proceed with surgery to

put the bones back into place. Some athletes who opt to avoid surgery suffer from a permanently deformed nose. In the days after a nasal fracture, the athlete will have black eyes from internal bleeding that pools underneath the orbits of the eyes. See figure 10.8 for more on assessment and care of an injury to the nose.

TREATING MOUTH INJURIES

Although some people believe that losing teeth is no big deal because they can always get false teeth, they are wrong. False teeth are not nearly as

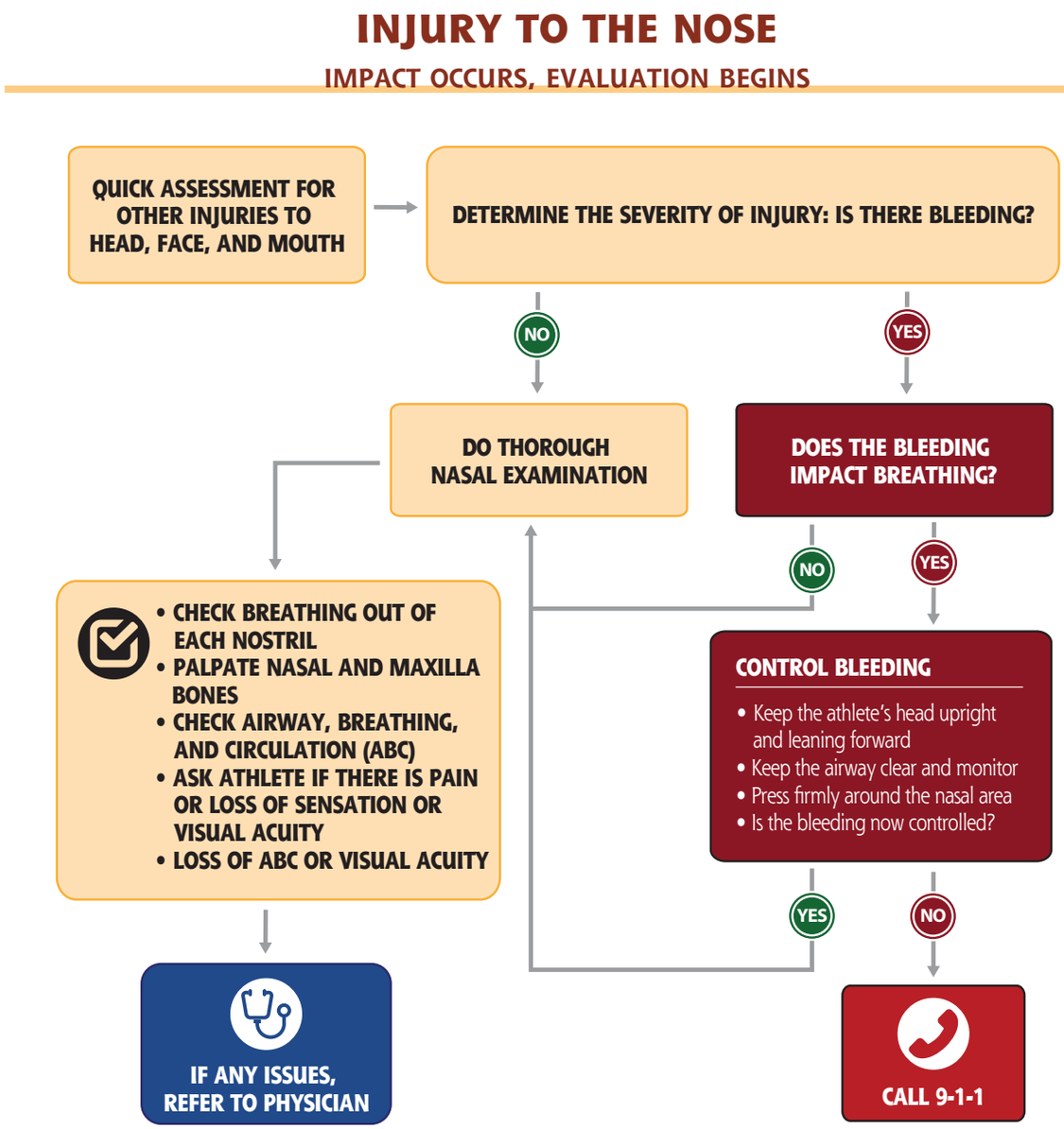

Figure 10.8 Care of an injury to the nose.

What Would You Do If . . .

A couple of volleyball players are horsing around in the locker room. One slips and hits her mouth on the edge of the sink. She brings her two fractured front teeth into the training room and hands them to you.

good as real teeth at biting and chewing, making it difficult to maintain healthy nutrition. The AT should use caution when treating the mouth—some athletes may bite because of a seizure or because they are gagging.

Tongue or Cheek Laceration

The mouth is an area that has a significant blood supply, so a lot of blood flows if the mouth is injured. This can be scary. Lacerations can occur in a variety of ways, including accidentally biting oneself. Bleeding can be controlled by applying direct pressure in most cases. If the cheek is pierced through to the inside of the mouth, direct pressure should be applied, both internally and externally. The cheek and tongue do not usually require stitches unless the laceration is very large and deep.

Tooth Fracture

Direct impact to the lower jaw or the teeth can result in a tooth fracture. The athlete will experience pain and difficulty closing his mouth. A fracture can be seen if the tooth is examined closely. In some instances, a portion of the tooth will be gone. If a portion has broken off, it should be sent with the athlete to the dentist. Although the portion cannot be put back on, the dentist may find it helpful when reconstructing the tooth. The broken tooth may die and have to be removed.

Tooth Dislocation

Direct impact to a tooth can knock it out of the jaw. The athlete will experience severe pain, bleeding, and swelling. The tooth is dislodged and needs to be handled carefully. After putting on gloves, the AT should pick up the tooth with a sterile gauze pad. It must be kept moist and should be placed in a designated saline tooth container or a glass of milk. The athlete must be seen by a dentist so that the tooth can be put back in place, assuming it is not too severely injured to be reinserted. The AT should treat the bleeding socket, placing a piece of sterile gauze where the tooth was located and having the athlete gently bite down to keep it in place with direct pressure.

Jaw Fracture

Imagine getting hit in the face by a sharply hit baseball, a scenario that is not uncommon in athletics. A direct blow to the jaw, either upper or lower, can result in a fracture. The athlete will experience pain that increases with movement. When the AT observes the area of impact, she will be able to see swelling. If the lower jaw has been fractured, she may be able to observe a space between teeth that was not there previously. The athlete will have discoloration under the tongue, and his teeth may not line up. Palpation will reveal crepitus, and the athlete will be cautious about moving the jaw. The AT should make sure all the teeth are in place and the airway is clear.

Ice should be applied to the area, as tolerated by the athlete, who should be referred immediately to a physician for care. The physician will realign the jaw for proper closure and wire the mouth shut. The athlete will eat through a straw for four to six weeks. Some athletes are allowed to return to activity as long as a special face mask protects the jaw.

Improper care or neglect of a jaw fracture can result in permanent deformity. The jaw may not

What Would You Do If . . .

One of your friends shows you his ice hockey helmet, which has a crack in the back portion that he has glued together. He says there is no rule that prevents him from playing in a game with his repaired helmet.

The Real World

I was covering a girls' soccer match. With two minutes left in the first half, the opposing team was inside the scoring circle. From where I was standing I could see a lot of bodies kicking and flailing around as our team was defending. Then our goalie was on the ground with the ball in her hands, and I knew something was wrong by the reaction of our players. The official summoned me onto the field. Our goalie had been kicked in the mouth, and there was blood everywhere. Unfortunately, she had not been wearing a mouth guard. She was conscious and spitting out blood. I did a head and neck evaluation and found no other problems. When examining her mouth, I saw blood coming up from her gums in the molar region. She was able to move her mouth to talk, but her jaw was painful in the front. I packed sterile gauze between her gums and teeth all the way around her mandible. I had her put ice on the jaw where she had pain. Her father wanted to drive her to the emergency room because that was quicker than calling an ambulance. I felt she was stable enough and agreed he should take her. I gave her a pan to hold on her lap because she was still spitting blood.

The textbooks say to use a wrap around the patient's jaw and apply ice if there is a suspected jaw fracture. However, in this case, I chose not to follow that protocol. The athlete was spitting blood that would have gone into her stomach if I had strapped her jaw the way the books say. Blood is an irritant to the stomach, and chances are she would have started vomiting, thus complicating matters. The emergency room physician said I did the right thing. The mandible was fractured in two places in the front of the jaw. On the X-ray, it looked as if a triangle had been cut into the mandible. This player's soccer season was over. However, she was back in goal next year, wearing a mouth guard.

Suzy Heinzman, ATC

be able to open wide enough to allow for eating a hamburger, and malalignment of the teeth can lead to further mouth problems.

Temporomandibular Dislocation

A blow to the chin or a violent, forced opening of the mouth can cause a dislocation. The athlete will immediately grab and hold his mouth to keep it from moving. The jaw will lock itself in place by spasm of the local muscles, and the athlete will be in extreme pain. His jaw will look deformed, locked open, or to one side. The AT can feel that the condyles are out of normal position. The AT should never try to put the jaw back in place, because the area around the jaw is filled with nerves and cartilage that can be permanently damaged. The team physician should relocate the jaw, which must be kept shut for several weeks. Some physicians wire the jaw shut to ensure this rest.

Temporomandibular Joint Dysfunction

Temporomandibular joint (TMJ) dysfunction is a condition in which the muscles surrounding the joint spasm. The spasms can be caused by stress, a blow to the mandible, or an injury to the muscles. The dysfunction can cause misalignment of the teeth, inability to open the mouth fully, clicking of the jaw, earache, pain in the musculature of the mouth, and headaches.

During examination, the AT may find a lack of range of motion, holding of the jaw, poor alignment when opening or closing, or crepitus. Treatment of TMJ dysfunction includes relaxation of the muscles of the jaw, such as from massage or trigger-point techniques. In some instances, the athlete may require muscle relaxants or pain medication. A dentist may choose to make a bite splint to prevent TMJ dysfunction from reoccurring.

Piercing Issues

Some athletes opt to have their body parts pierced, commonly the ears but also the tongue, lips, or nose. This can be problematic because some body parts, such as the mouth, are not sterile. Other complications for piercing include infections, broken teeth, irritation of the soft tissue, allergic reactions to metal, and nerve damage (California Dental Association 2017). Adding to the complication is the fact that people who do the piercings do not have to be licensed or use sterile equipment. Some piercers lack the knowledge of anatomy to understand where blood supply and nerves are located.

What Would You Do If . . .

You observe a basketball player chewing the end off his mouth guard.

An athlete who suffers an infection or nerve damage should be referred to a physician for care. An athlete with an allergic response can remove the jewelry and replace it with a plastic piece or remove it all together. An irritation is generally caused by the post of the jewelry. It may be dealt with by removing the piercing or using dental wax over the area.

Orthodontic Concerns

Braces are common among athletes; therefore, the AT will need to be prepared for emergencies that may result. It can be alarming when athletes experience discomfort from their braces being tightened or protruding wires. Athletes could even swallow a piece of their braces. The most common issues associated with braces are as follows:

- ***Irritation of lip or cheek.*** Braces can rub against the inside of the mouth, causing irritation. This can be resolved by using a dental wax that is applied to the brace. The wax can be made pliable by rolling it between the fingers.
- ***Embedded braces.*** An impact to the mouth can cause braces to be stuck to the soft tissue of the cheek. This can be painful and cause a lot of bleeding. The first step for the AT is to control the bleeding with direct pressure to be able to examine the area. Next, the AT will have to carefully remove the tissue from the brace. Once the tissue is removed from the braces, the AT will control the bleeding that may result. To prevent future incidents of this kind, the AT will recommend a mouth guard.
- ***Wire protrusion.*** Sometimes a wire from the braces will come off and stick outward, causing irritation. It is best to use a cotton-tipped applicator and press the wire so that it lies flat against the teeth (American Association of Orthodontists n.d.). If the protruding wire cannot be pushed into a position of comfort, apply dental wax to the wire. It will require the athlete to see her dentist so the brace can be properly repaired.
- ***Soreness after tightening.*** When braces are adjusted, it is normal for the athlete to experience soreness for about a week. When this happens, the AT can offer solace that this pain is only temporary. The AT may recommend soft food or a liquid diet during this time frame.
- ***Ligature comes off.*** A ligature is a rubber band that attaches to the braces. These rubber bands are very small but easy to reattach. The AT can use a pair of tweezers to put the ligature back in its original placement (American Association of Orthodontists n.d.). If the ligature breaks off, it is best to have the athlete go to his dentist.
- ***Swallowing a piece of the bracing.*** In rare cases, an athlete may swallow a piece of the brace. First, make sure the athlete does not have an obstruction of the airway. If there is an obstruction, follow the instructions in chapter 24 for care. If the airway is not obstructed, have the athlete go to her physician to determine next steps.

SUMMARY

Any impact to the face could injure the eyes, nose, ears, or jaw and could result in permanent disfigurement. Impairment of the facial organs can be devastating to the injured athlete. To prevent facial injuries, an AT should work with the equipment staff to make sure proper equipment is provided and with coaches to make sure the athletes wear the equipment. Facial injuries should be treated conservatively and evaluated by the team physician and dentist.

KEY TERMS

Define the following terms found in this chapter:

blowout
cauliflower ear
conjunctiva
conjunctivitis
corneal abrasion
crepitus
detached retina
epistaxis
hyphema
ruptured eardrum
subconjunctival hemorrhage
swimmer's ear
temporomandibular joint (TMJ) dysfunction

Go online to the web resource to find quizzes, activities for reinforcement, above and beyond activities, practical skill worksheets, and chapter-specific tasks for the semester-long project.