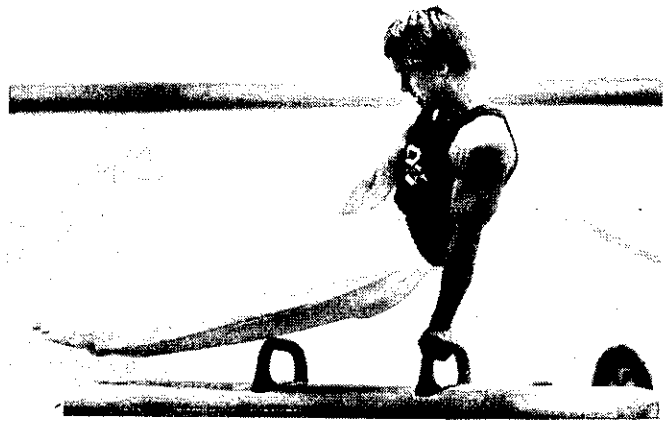


# Chapter 10

## The Elbow, Forearm, Wrist and Hand



The elbow joint is an intricate collection of bones, muscles, ligaments and nerves. It permits the movements of flexion, extension, pronation and supination, which are used in numerous sports. From this joint run the muscles and nerves that control the detailed movements of the hand, wrist and fingers.

### Elbow

Many sports place specific demands on the elbow, and each movement can lead to a specific injury. In addition, the elbow joint often delivers, and sometimes receives, accidental blows that can cause bruising, fracture, dislocation or nerve damage.

Massive stresses are placed on the elbow in throwing sports, such as baseball, softball and field sports (javelin, shot, discus). For example, while a baseball player uses all the joints of the arm in pitching, the elbow provides the high-velocity, whipping movement to propel the ball with speed. In addition, the elbow's rotation helps provide the break in a curve ball.

Racquet sports, such as tennis and racquetball, bring their own special demands to the elbow joint. In fact, the elbow is the most frequently injured joint in tennis. As in baseball, a tennis player also uses the elbow to both propel and twist the racquet.

The elbow is a factor in balance and support in gymnastics, and in numerous other activities and exercises (push-ups, pull-ups).

In this chapter, you will learn the unique anatomy and injuries of the elbow joint. You will learn to treat and prevent common injuries such as tennis elbow and little league elbow.

### Anatomy

The elbow joint is composed of three bones: the humerus, the ulna and the radius. The humerus, the largest bone of the arm, is similar to the femur of the leg, in that it has two articulating condyles at its lower end.

Of the two bones of the lower arm, the ulna acts as a stationary axle; the radius turns around it as the forearm and hand rotate.

Hang your arm at your side with the palm facing forward. The small bony prominence closest to the body is the medial epicondyle of the humerus. Just as with the femur in your leg, there is also a lateral epicondyle on the opposite side. And, just as knee ligaments and tendons attach to the femur's epicondyles, arm ligaments and tendons use the distal knobs of the humerus as a base of attachment.

The medial condyle (the one that presses into your side when the arm hangs loose), articulates with the ulna of the lower arm to allow flexion and extension of the elbow. The lateral condyle of the humerus articulates with the radius, allowing pronation and supination of the lower arm and hand.

The elbow joint is considered to have very strong ligamentous and muscular support. Just as with the knee, the elbow joint is stabilized by medial and lateral collateral ligaments. The medial collateral ligament is attached to the humerus and the lower arm's ulna; the lateral collateral ligament is attached to the humerus and the radius.

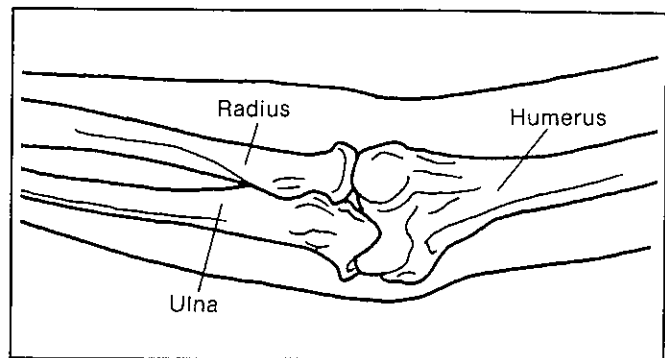
Adding further to the elbow's stability is the annular ligament. This ligament attaches to the ulna and completely encircles the head of the radius. The annular ligament helps keep the radius and ulna from separating.

The muscles that control the elbow's movement originate above the elbow, on the humerus and the scapula (shoulder blade). These muscles include:

1) Biceps — originate on the humerus and scapula, split into two parts, and attach individually to the ulna and radius. The primary function of the biceps group is flexion of the elbow.

2) Triceps — originate at three sites (the scapula, and both the lateral and posterior side of the humerus). The triceps attach to the ulna. This muscle group's primary function is extension of the elbow.

3) Brachialis — originate low on the humerus, attaching to the ulna. The brachialis group also assists in elbow flexion.



*As the forearm and hand rotate, the radius turns around the ulna, which acts as a stationary axle.*

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The numerous muscles that control the movements of the forearm, wrist and fingers originate on the two epicondyles of the humerus, as well as on the radius and ulna.

### Elbow Dislocations

Dislocations of the elbow are among the most serious elbow injuries in athletics and often occur when an athlete falls on an outstretched hand; or, the elbow could receive a direct, forceful blow, causing dislocation.

Upon impact, the lower arm's radius and ulna are forced away from the humerus. Naturally, ligaments are stretched and torn.

Because so many arteries and nerves pass through the elbow joint, dislocation of a bone could cause serious damage to circulation or to the nervous system. Permanent paralysis of the fingers, hand and arm is a possibility with elbow dislocations.

Because of the danger of further damage, an athlete with a dislocated elbow must be taken immediately to the hospital. The person providing first aid should **never** attempt to reduce the dislocation, straighten the arm or put the arm in a sling. This responsibility belongs to the emergency room physician. The dislocation should be splinted as is, and cold should be applied.

The student trainer's responsibility is to alert the coach to the potentially dangerous injury. The coach will arrange emergency transportation.

For complete recovery of a dislocated elbow, and for eventual full range of motion, the athlete's rehabilitation program needs to be closely supervised by the physician.

### Elbow Hyperextension

The hyperextension injury occurs when the elbow is fully extended and is then forced past its normal range of motion. This often happens when the athlete tries to

stop a fall by landing on an outstretched hand with the elbow locked. Or, the athlete may complain that someone fell on the arm when it was trapped. The athlete will hold the elbow in a bent position and will be apprehensive about trying to straighten the arm.

Depending on its severity, the injury can occur to the ligaments, the joint capsule and/or muscle attachments. Unless the injury is a severe hyperextension, the muscle attachments are seldom injured.

If the elbow is deformed from the injury (compare it with the other arm), or if the athlete is in a great deal of pain, the student trainer should assume that the injury is a fracture or a dislocation. The student and the coach should arrange emergency transportation and treatment in these cases.

If the elbow is hyperextended, it will be swollen throughout the joint, depending on the injury's severity. It may not be possible for the athlete to pinpoint the area of most tenderness. The pain may be deep within the elbow joint.

First aid for an elbow hyperextension is cold and compression. Apply an elastic wrap for compression and insulation, wrapping evenly above and below the elbow. Then completely encase the joint in ice or cold packs for 20-30 minutes. Repeat the cold application every 60-90 minutes for the rest of the day.

Instruct the injured athlete to remove the wrap before bed, re-applying it first thing in the morning. The athlete should keep the injured elbow out of a hot bath or shower and try to keep the joint elevated.

After the physician has determined that all hemorrhaging within the joint has stopped (usually in a couple of days), the athlete can begin rehabilitation to regain range of motion and strength.

### Vocabulary

*carpals* — bones of the wrist

*distal* — farthest away from the center of the body

*extension* — straightening a joint or increasing the angle between two bones

*flexion* — bending at a joint or decreasing the angle between two bones

*humerus* — bone of the upper arm

*hyperextension* — excessive, forceful extension of a limb beyond its normal limits

*lateral* — away from the midline of the body; toward the side

*medial* — toward the midline of the body

*navicular* — one of the carpal bones of the wrist

*phalanges* — bones of the fingers or toes

*pronation* — turning downward

*proximal* — closest to the center of the body

*radius* — outer and shorter bone of the forearm; turns partially around the ulna as the forearm and hand rotate

*supination* — turning upward

*ulna* — inner and longer bone of the forearm; acts as stationary axle about which the radius partially rotates

## The Elbow, Forearm, Wrist and Hand

*A method for taping the elbow to prevent hyperextension*



The athlete can flex and extend the elbow while receiving a warm (102°F) whirlpool treatment. Until the athlete regains a full range of motion, isometric and isotonic exercises can be performed throughout the attainable range. Exercises can begin the day after the injury to maintain muscle tone. Pain should be the guide in determining activity level.

As always, if at any time progress is not being made, the treatment must be reassessed. If the soreness increases and heat can be felt coming off the joint, the student trainer should apply cold treatments.

When the physician allows the athlete to begin practicing with the team again, the joint must still be protected from reaching full extension. One way to do this is with a restrictive tape job. The athlete should be

taped daily until pain-free range of motion returns and strength is equal to that of the uninjured arm. One such tape job is pictured.

### **Tennis Elbow**

Tennis elbow is, in most cases, an inflammation of the lateral epicondyle of the humerus that is caused by overuse, weakness, poor technique, lack of flexibility or inadequate warm-up. In tennis, a racquet that is strung too tightly or that has improper grip size can lead to tennis elbow.

Besides treating the symptoms of tennis elbow, the cause of the problem also needs to be corrected.

There may be very little swelling with tennis elbow. Depending on the degree of inflammation, the student trainer may feel heat emanating from the elbow. The

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athlete may experience general weakness of the muscles of the lower arm. These muscles can be tested by resisting flexion and extension of the wrist and pronation and supination of the forearm. The affected arm's strength may be much less than the strength of the opposite arm.

As this is an inflammation, cold treatments should be used. With an acute case, a sling may need to be applied to give the arm adequate rest. As pain permits, strengthening exercises can begin.

The student trainer can help many athletes suffering from tennis elbow by providing a neoprene sleeve or an elastic band that fits just below the elbow. These devices give support and may reduce any vibration that occurs through the arm when a ball is hit.

### Little League Elbow

Numerous muscular-related injuries can be grouped under the heading "little league elbow." Besides young baseball players, athletes in other sports can also suffer from this condition.

The cause is often too much stress on the elbow. In younger athletes, when the muscle is stronger than the bone to which it is attached, a chip of bone can be pulled away by the muscle.



*Too much stress on the elbow can lead to an injury in which a chip of bone is pulled away by a muscle. This is sometimes referred to as "little league elbow."*

It is also possible for the ulnar nerve, which crosses the medial epicondyle of the humerus, to be injured in throwing sports. In this case, the athlete will feel numbness, tingling or weakness in the forearm, hand and fingers.

This injury can occur to either the medial or lateral side of the elbow.

The team physician should evaluate potential cases of little league elbow. The student trainer can apply compression and cold, as in a case of tennis elbow.

### Wrist and Hand Injuries

The wrist joint is an area at the base of the hand. It is formed by the distal ends of the two bones of the lower arm (the ulna and radius) and the eight small carpal bones of the hand. (See adjacent drawing.)

Because the carpal bones are so small, grouped tightly together, not easily distinguishable, and difficult to individually palpate, they are often overlooked.

The wrist is stabilized by numerous ligaments and the tendons of the many muscles of the wrist that produce flexion, extension, adduction and abduction.

Unfortunately, the wrist is often injured. Think of all the sports in which the wrist is used. Also, the wrist is used for actions such as pushing and is often the area that absorbs the first impact of a fall.

Despite the numerous injury possibilities, the extent of wrist injuries is often left undetermined. Therefore, the wrist is often undertreated when it is injured.

Incomplete treatment can cause permanent problems for the athlete. Too often, a fracture of a carpal bone is treated as a sprain. As such, the injury never heals.

### Wrist Sprains

Of all upper extremity injuries, the wrist sprain is one of the most common. As stated previously, this injury is often poorly treated and rehabilitated.

Because improper treatment can result in permanent disability and pain, the student trainer should alert the team physician to any wrist injury. Never assume the injury is a simple sprain.

The physician will obtain a history of the injury to try to rule out a fracture. The athlete will be asked how the injury occurred and if a noise, such as a "pop," was heard. Such a noise, along with deformity and swelling, is a sign of a fracture or dislocation of one of the carpal bones.

# The Elbow, Forearm, Wrist and Hand

For first aid, the student trainer will apply compression, cold and elevation. With minor sprains, the team physician may recommend that the athlete begin rehabilitation as early as the day after injury.

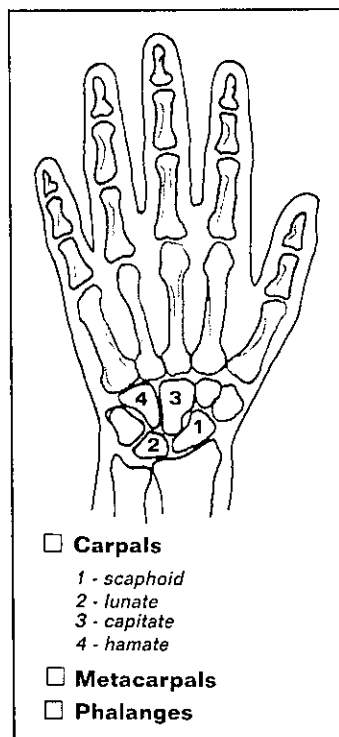
It is difficult to try to support the wrist with taping. However, one method is pictured in this chapter.

## Wrist Fractures

The same mechanism of injury for wrist sprains will often cause a fracture. Wrist fractures occur most often to three bones: the radius, the ulna and one of the carpals, the navicular. As you would expect, fractures of the larger two bones are more obvious than a fractured carpal.

Navicular fractures are often mistaken for severe sprains. If the injury is treated as a sprain, rather than a fracture, the wrist will not be splinted in first aid. As with any broken bone that is not set and splinted, improper or incomplete healing will then occur. In the case of the fractured navicular bone, which has a poor blood supply to begin with, the blood supply may be inadequate, leading to necrosis, or death of the bone. Lack of treatment could leave the athlete with a permanently painful wrist.

Signs of a fracture include swelling over the carpals and point tenderness at the navicular. This area is sometimes known as the anatomical snuff box. Pain can sometimes be elicited by pushing on the end of the straightened thumb on the injured hand.



*Injuries to the hand must be treated promptly and correctly to prevent improper healing, which can lead to lifelong functional problems and deformity. The most common hand injuries involve spraining the thumb, "jamming" a finger and finger dislocations.*

## Hand and Finger Injuries

### Hand Injuries

The most common injuries to the hand are to the thumb and fingers. Just as with injuries to the wrist, these injuries must be treated correctly to avoid improper healing and life-long problems and deformity.

Hand injuries are usually caused by falling on the hand or by a direct blow, and can occur in any sport.

Joining the carpal bones of the wrist are five metacarpal bones, one for each finger and the thumb. You can feel the metacarpals most easily on the back of your hand.

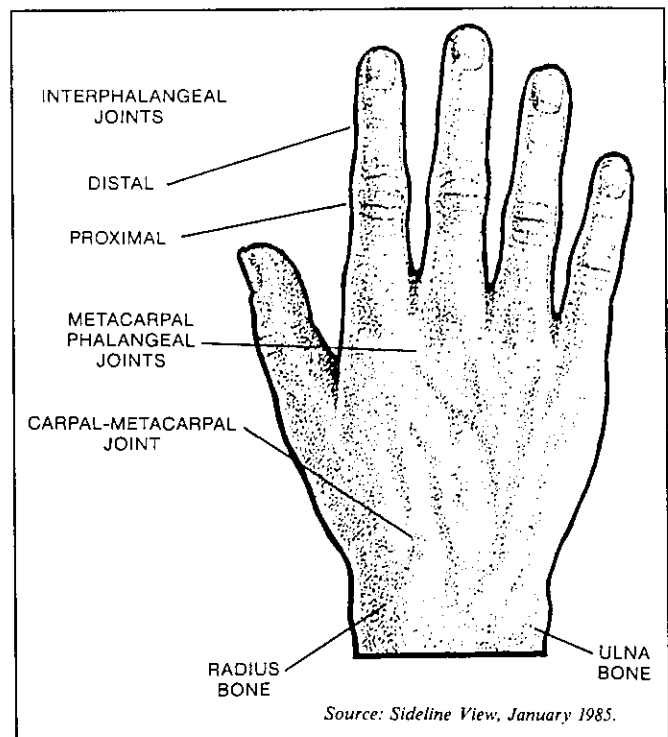
The other bones of the fingers are called phalanges. The knuckles are the heads of the metacarpals. Each finger has three phalanges: the thumb has two.

Naturally, there are numerous ligaments connecting and supporting the bones of the hand. Also, there are many functional muscles that control the intricate finger and thumb movements.

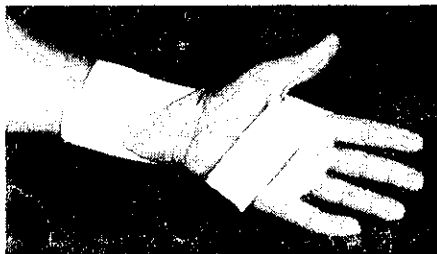
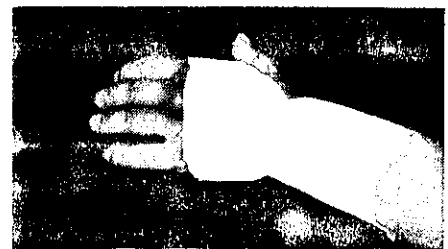
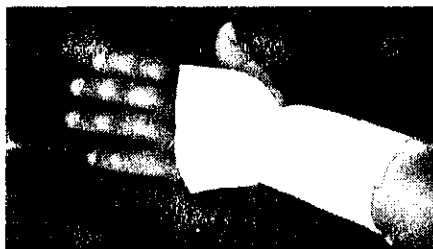
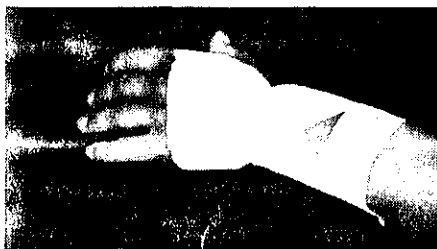
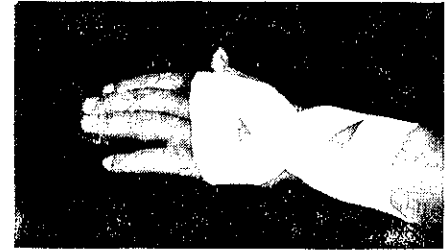
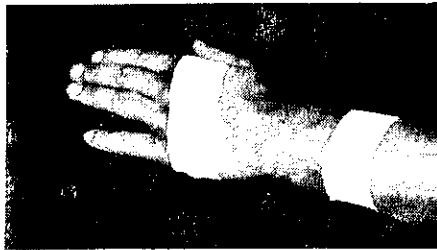
### Sprained Thumb

The sport of basketball produces numerous thumb sprains, although other sports (football, skiing) also get their share. A ball that hits the end of the thumb or any twisting motion can sprain the joint at the thumb's base.

This often-injured joint, located between the metacarpal of the hand and the proximal phalange, is called the metacarpophalangeal joint. (Simply refer to it as the M-P joint.)



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*The wrist sprain is one of the most common upper-extremity injuries. Here is a method of taping the wrist to prevent hyperflexion.*

There will be a certain amount of swelling, depending on the severity of the injury. Pain will be localized at the base of the thumb. If there is pain going up the thumb or toward the wrist, suspect a fracture, not a sprain. To be safe, a physician should evaluate all thumb and finger injuries.

If the athlete is unable to pinch the thumb and first finger together, this injury may be a severe sprain, which will require diagnosis by the team physician.

In order to put compression on thumb or finger sprains, 1" elastic tape is probably the best material to use.

For all finger and hand injuries, rehabilitation is very important. If the hand is left in a weakened state, the athlete could suffer chronic sprains that could eventually lead to a fracture. One simple method of maintaining hand strength is by squeezing a tennis ball.

When the physician has released the athlete to begin practicing, the student trainer can tape the thumb to help prevent it from being forced into hyperextension and abduction. A common thumb taping method is pictured.

### "Jammed Finger"

When an athlete suffers a jammed finger, the joint most commonly sprained is the proximal interphalangeal joint. (Refer to it as the PIP joint.) This is the finger joint

with the greatest amount of flexion and extension.

Any force that causes abnormal movement of the PIP joint will cause the ligaments to be sprained. A ball striking the end of the finger is a frequent mechanism of injury. Soreness will be localized in the joint. Swelling from the hemorrhage will occur immediately, causing the joint to look fat.

Jammed fingers are very painful right after they occur, but the pain usually subsides quickly. Longer-lasting pain and pain above or below the joint may indicate a fracture.

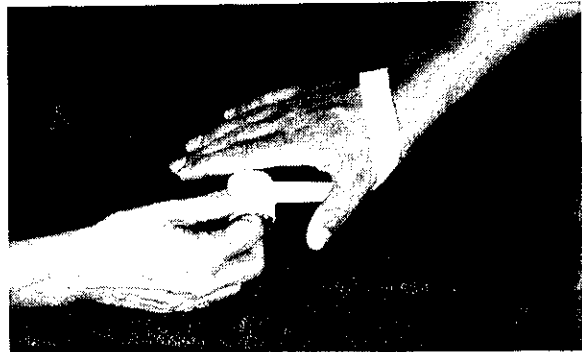
In treating jammed fingers, elastic tape is an excellent way to maintain compression. After the elastic tape is wrapped around the entire finger, probably the best way to get cold to the injury is to have the athlete put the finger in ice water for 15 minutes. Following the treatment, a wooden or metal splint will immobilize the joint and may make the athlete more comfortable.

Probably the best way to protect the sprained finger during practice is to use "buddy" taping; the injured finger is taped to the stronger adjacent finger for support. Always use a thin layer of felt or foam between the fingers when taping to keep their position more natural. A common taping method is pictured.

### Dislocated Finger

Occurring often in volleyball and football, a dislocated finger usually occurs from a direct blow to the tip of a finger. Most often, the middle phalangeal joint is

## The Elbow, Forearm, Wrist and Hand



*Taping the thumb can help prevent it from being forced into hyperextension and abduction. Here is a common thumb taping method.*

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dislocated upward with obvious deformity.

As with all dislocations, the joint should be splinted as is. Cold should be applied, and the athlete must be taken to the physician for treatment.

### Mallet Finger

Another injury that can occur from a direct blow to the finger is referred to as "mallet finger." With this injury, the extensor tendon of one of the distal phalanges is torn from the bone. Or, the tendon could pull off part of the bone (an avulsion fracture). Because the tendon that extends the end of the finger is no longer attached at its insertion, the finger can no longer be held straight; the end will appear to be hanging.

This injury should be splinted in full extension; cold should be applied, and the athlete must be taken to the team physician for x-rays and treatment.

### Ripped Hands

The palms and fingers of a gymnast's hands can develop calluses from friction on the various gymnastic equipment. These calluses can become painful, and because of the tissue's inelasticity, subject to cracks and tears.

Hand calluses can be controlled by proper toughening procedures, such as gradual build-up, and by the use of gloves or taping.



*Gradual build-up and the use of gloves or taping can help control the formation of hand calluses, which are especially common among gymnasts.*



*One of the best ways to protect a sprained finger is with "buddy" taping, in which the injured finger is taped to the stronger adjacent finger for support.*



### Review Questions — Part One

1. The bones that form the elbow are the \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
2. The joint most commonly injured when a finger is jammed is the \_\_\_\_\_.
3. The best material to use to put compression on thumb or finger sprains is \_\_\_\_\_.
4. The three wrist bones most often fractured are the \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
5. The \_\_\_\_\_ is similar to the femur of the leg, as both have two \_\_\_\_\_ at their \_\_\_\_\_, or lower ends.
6. Of the two bones of the lower arm, the \_\_\_\_\_ acts as a stationary axle.
7. The lateral condyle of the humerus articulates with the radius, allowing \_\_\_\_\_ and \_\_\_\_\_ of the lower arm and hand.
8. The elbow joint has very \_\_\_\_\_ ligamentous and muscular support. As is the knee, the elbow joint is stabilized by medial and lateral \_\_\_\_\_ ligaments.
9. Helping to stabilize the elbow by attaching to the ulna and encircling the head of the radius is the \_\_\_\_\_ ligament.
10. The three muscle groups that control the movement of the elbow are the \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
11. For elbow dislocations, the person administering first aid should \_\_\_\_\_ attempt to reduce the dislocation.
12. Tennis elbow is often an inflammation of the \_\_\_\_\_.
13. The wrist joint is formed by the distal ends of the \_\_\_\_\_ and \_\_\_\_\_, and by the eight \_\_\_\_\_ bones.

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### Review Questions — Part Two

1. Name the ligaments of the elbow and describe where they attach.
2. Describe how an elbow dislocation usually occurs.
3. What is tennis elbow? What causes this condition?
4. Explain “buddy taping.”
5. What are the signs of a jammed finger, and how should such an injury be treated?
6. Name the bones that make up the wrist.
7. Name the groups of bones of the hand.
8. What might happen if a navicular fracture is mistaken for a severe sprain?
9. Why are elbow dislocations so potentially serious?
10. Describe an elbow hyperextension injury.
11. Name two common injuries or conditions in which a chip or section of bone is pulled away by a muscle or tendon.
12. What causes Little League elbow? What are the symptoms of this injury?
13. What is mallet finger?