

CHAPTER



The Arm and Hand

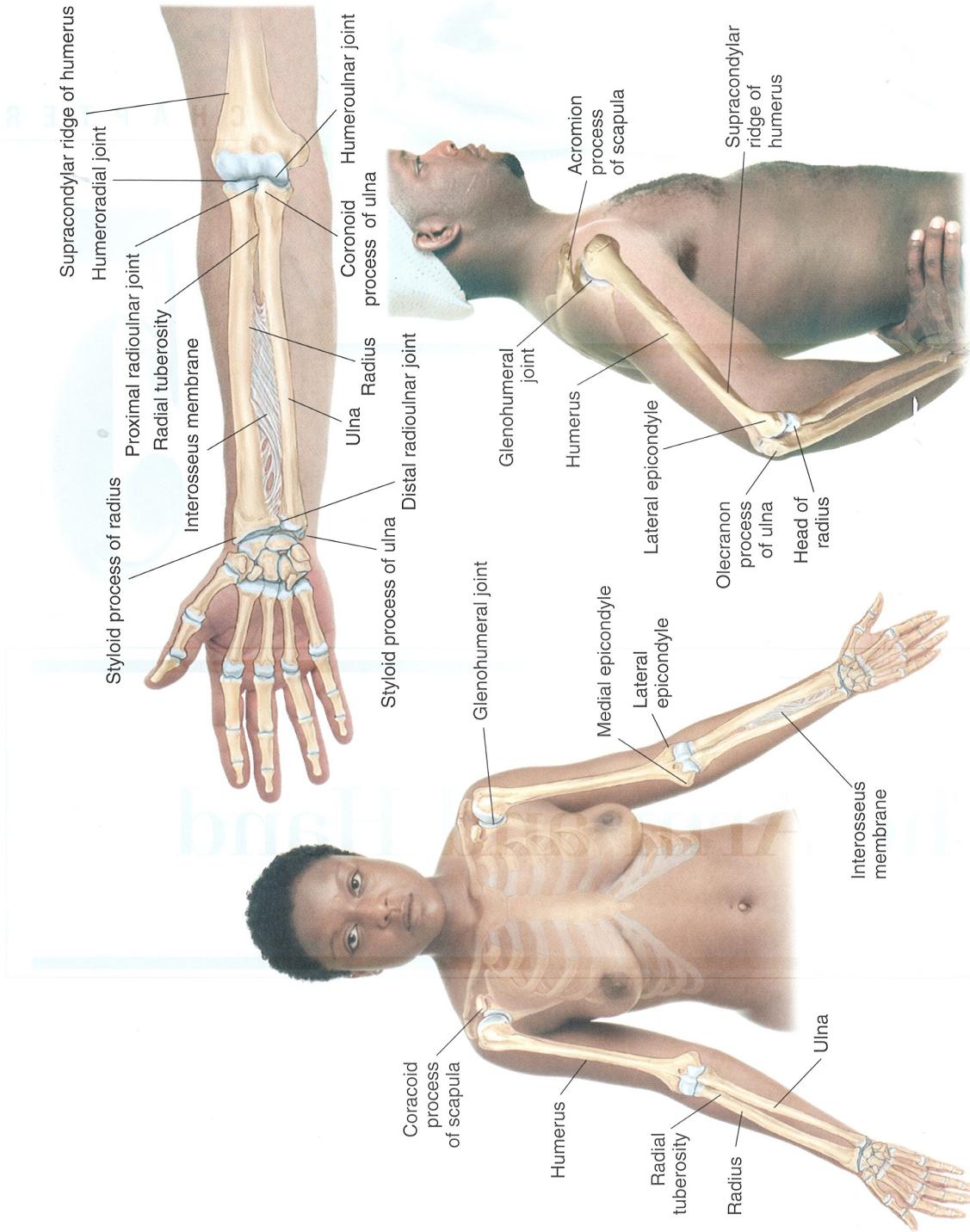


Plate 5-1 Skeletal features of the arm

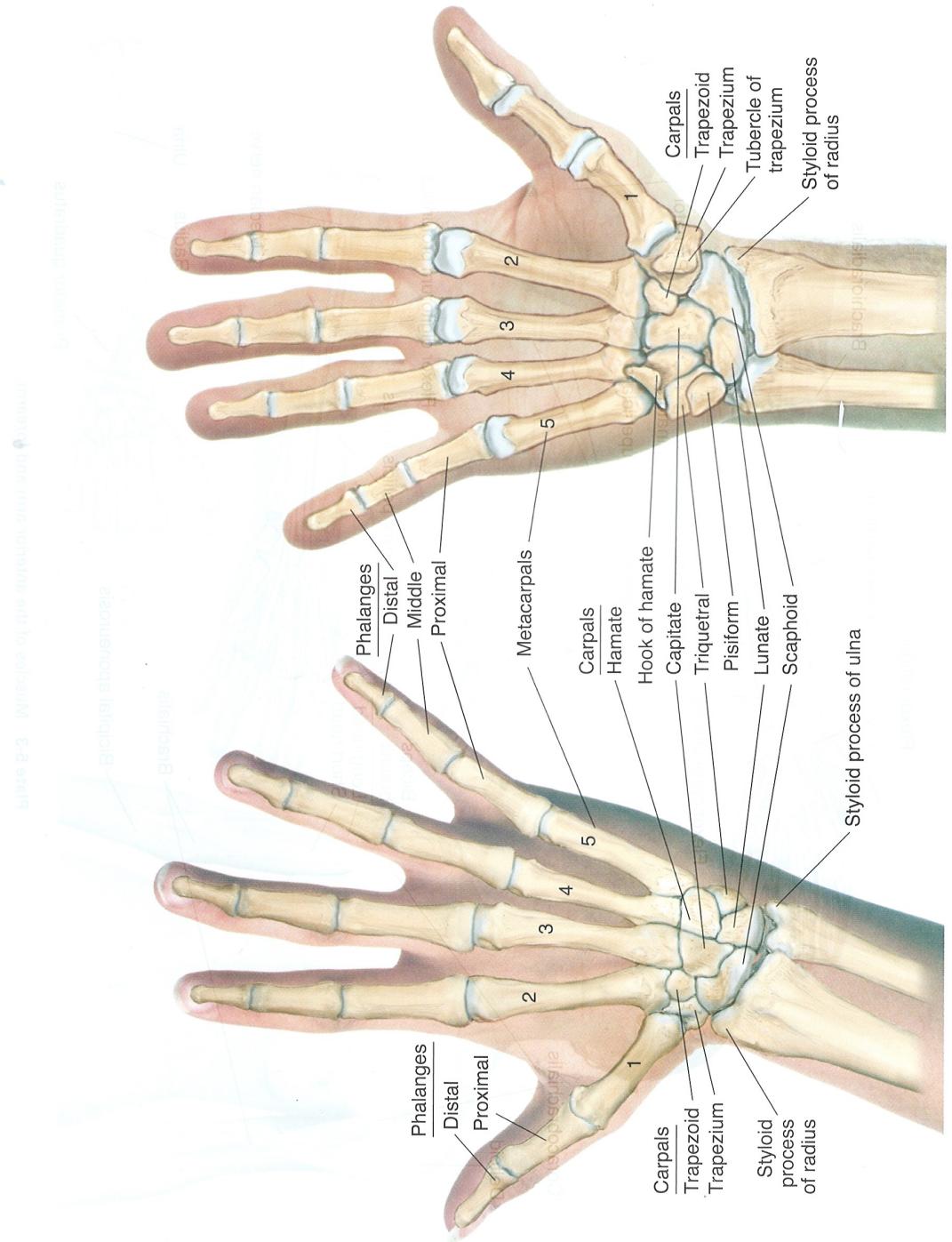


Plate 5-2 Skeletal features of the hand and wrist

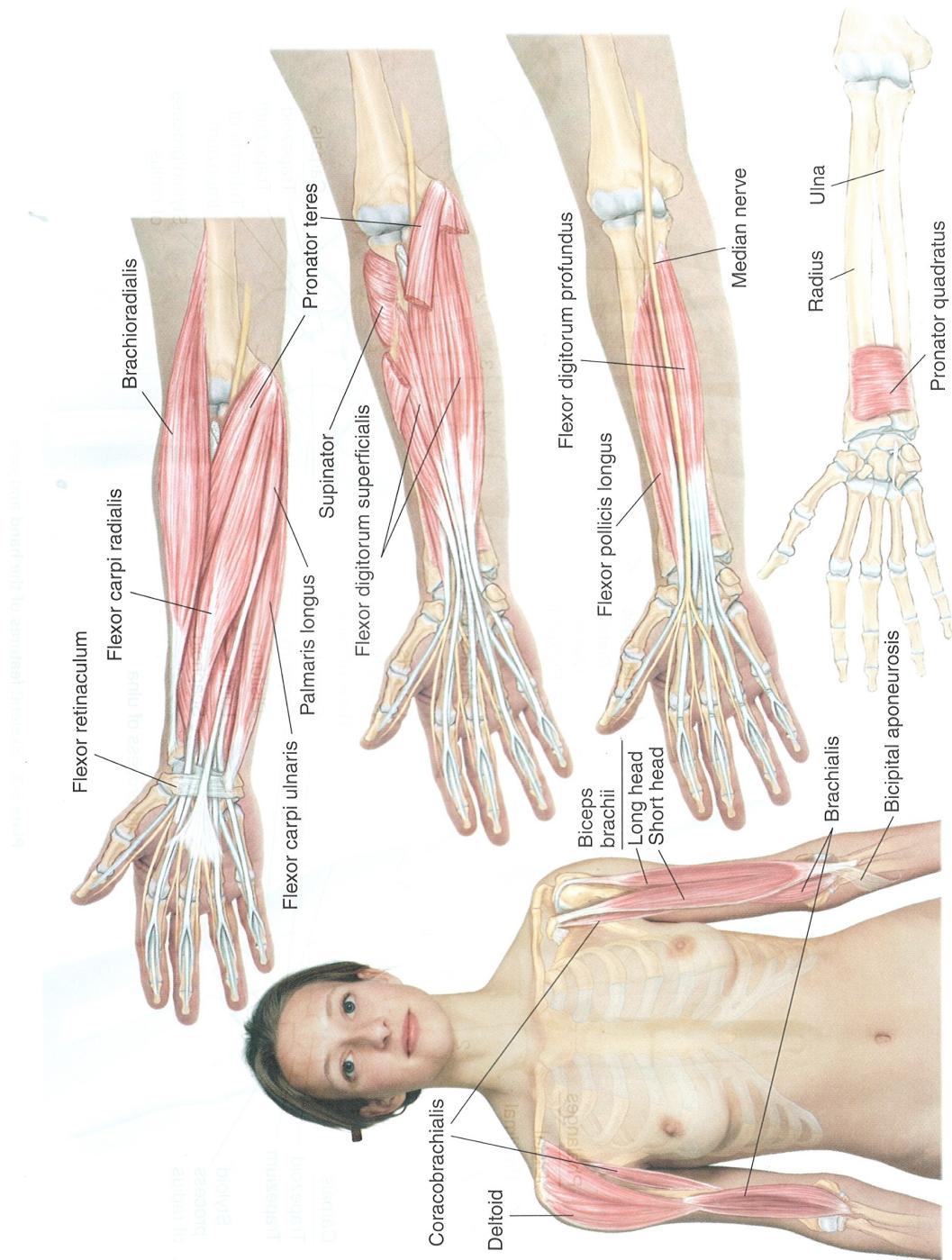


Plate 5-3 Muscles of the anterior arm and forearm

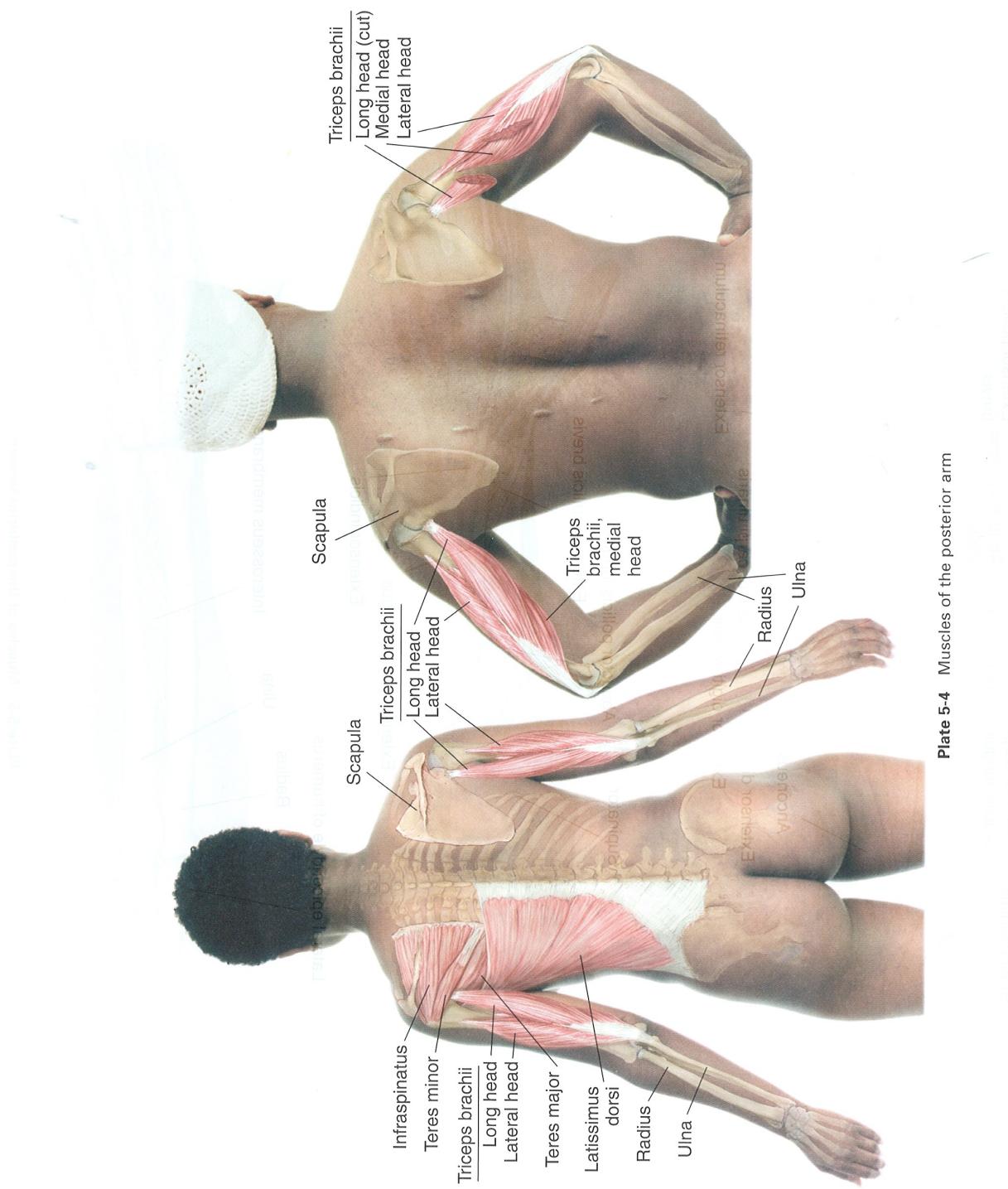


Plate 5-4 Muscles of the posterior arm

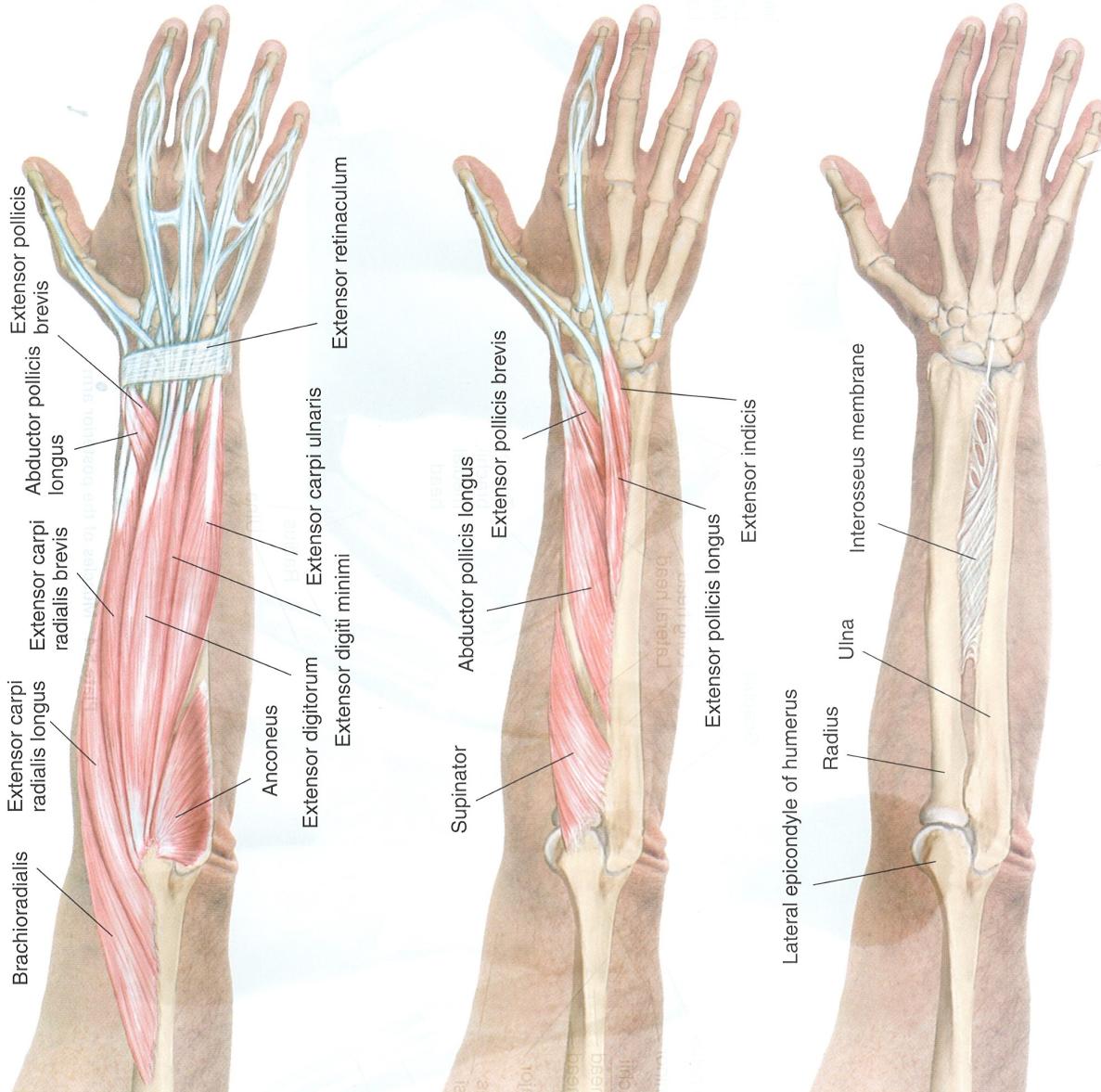


Plate 5-5 Muscles of the posterior forearm

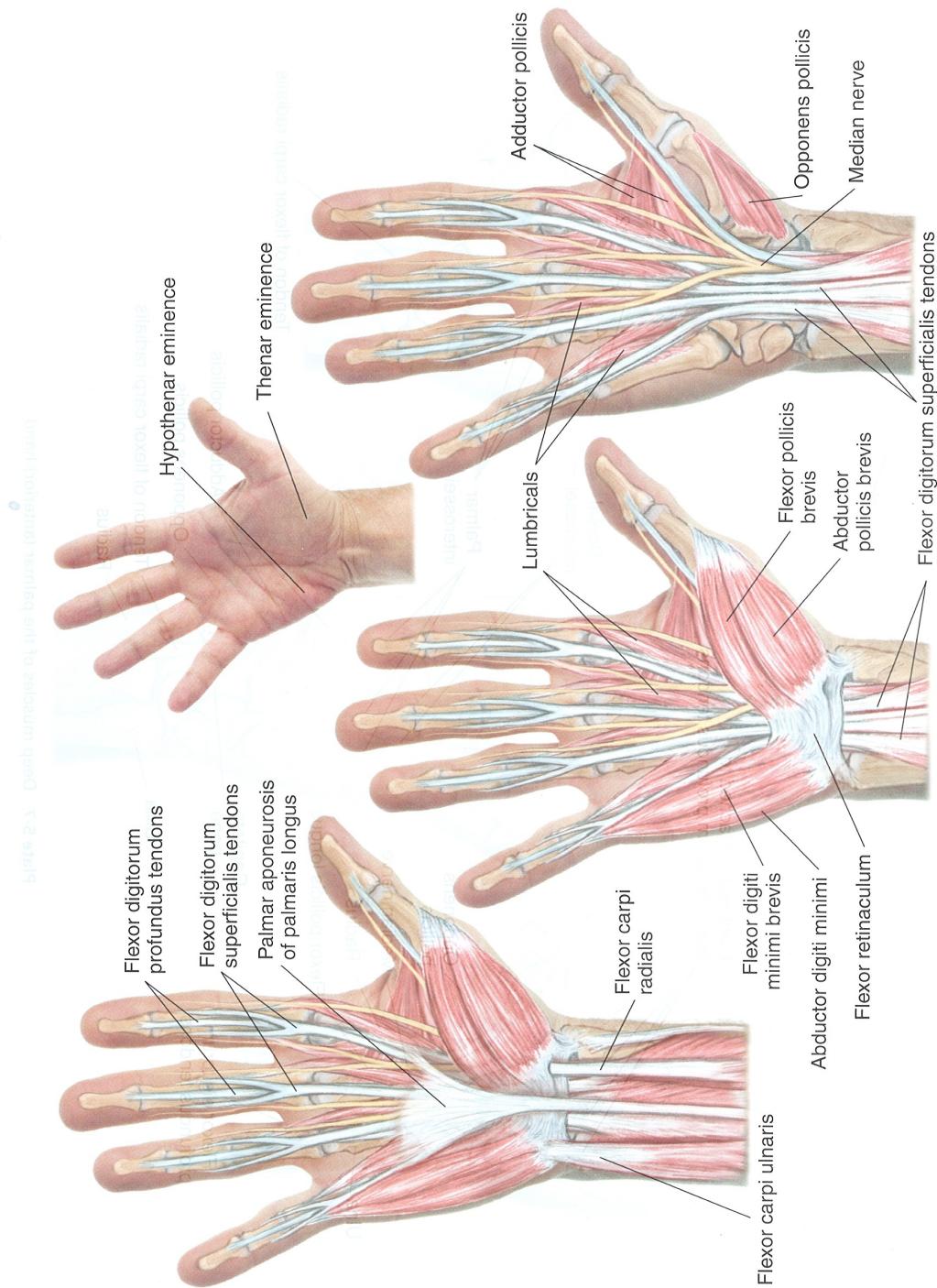


Plate 5-6 Superficial muscles of the palmar (anterior) hand

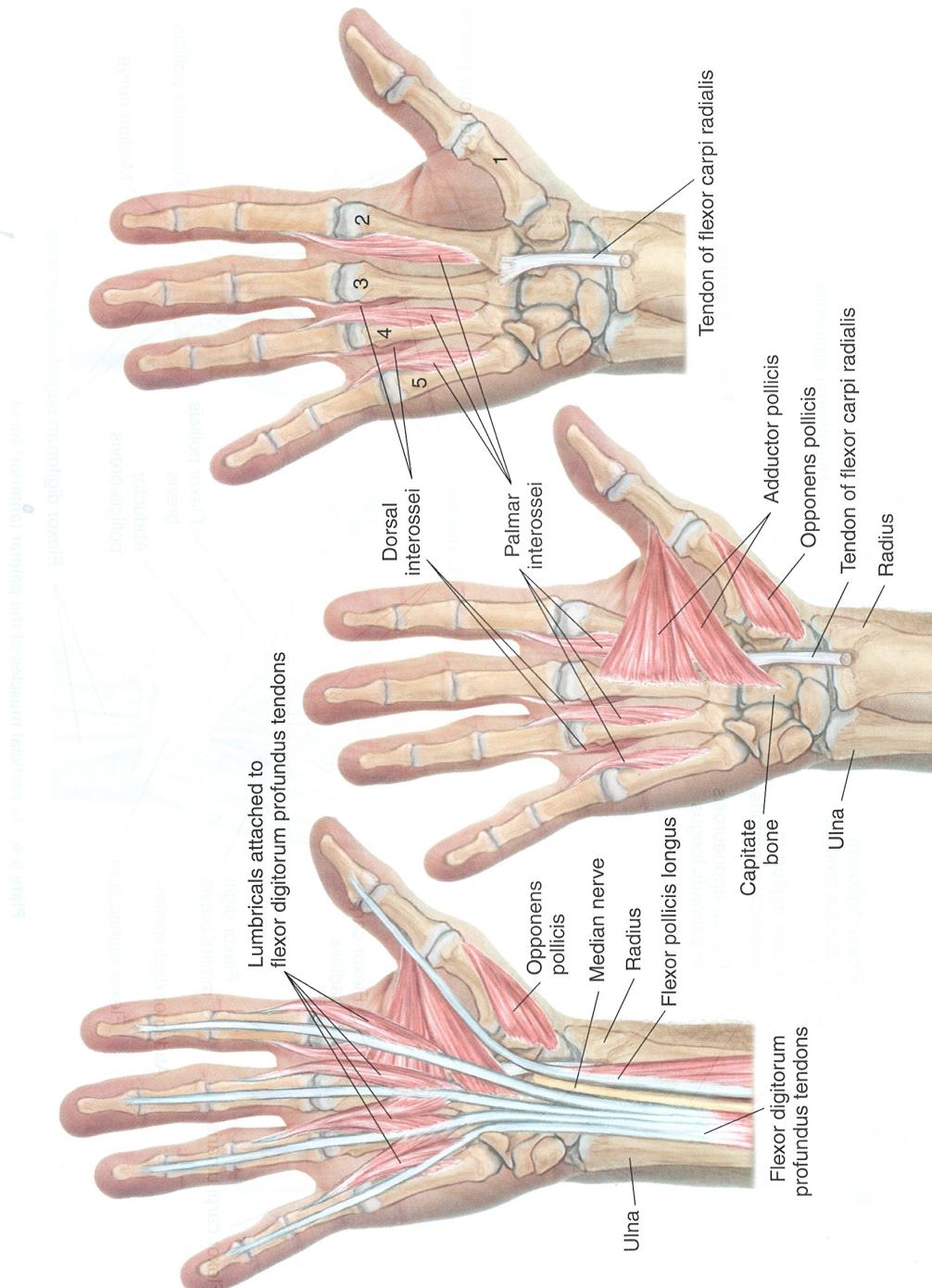


Plate 5-7 Deep muscles of the palmar (anterior) hand

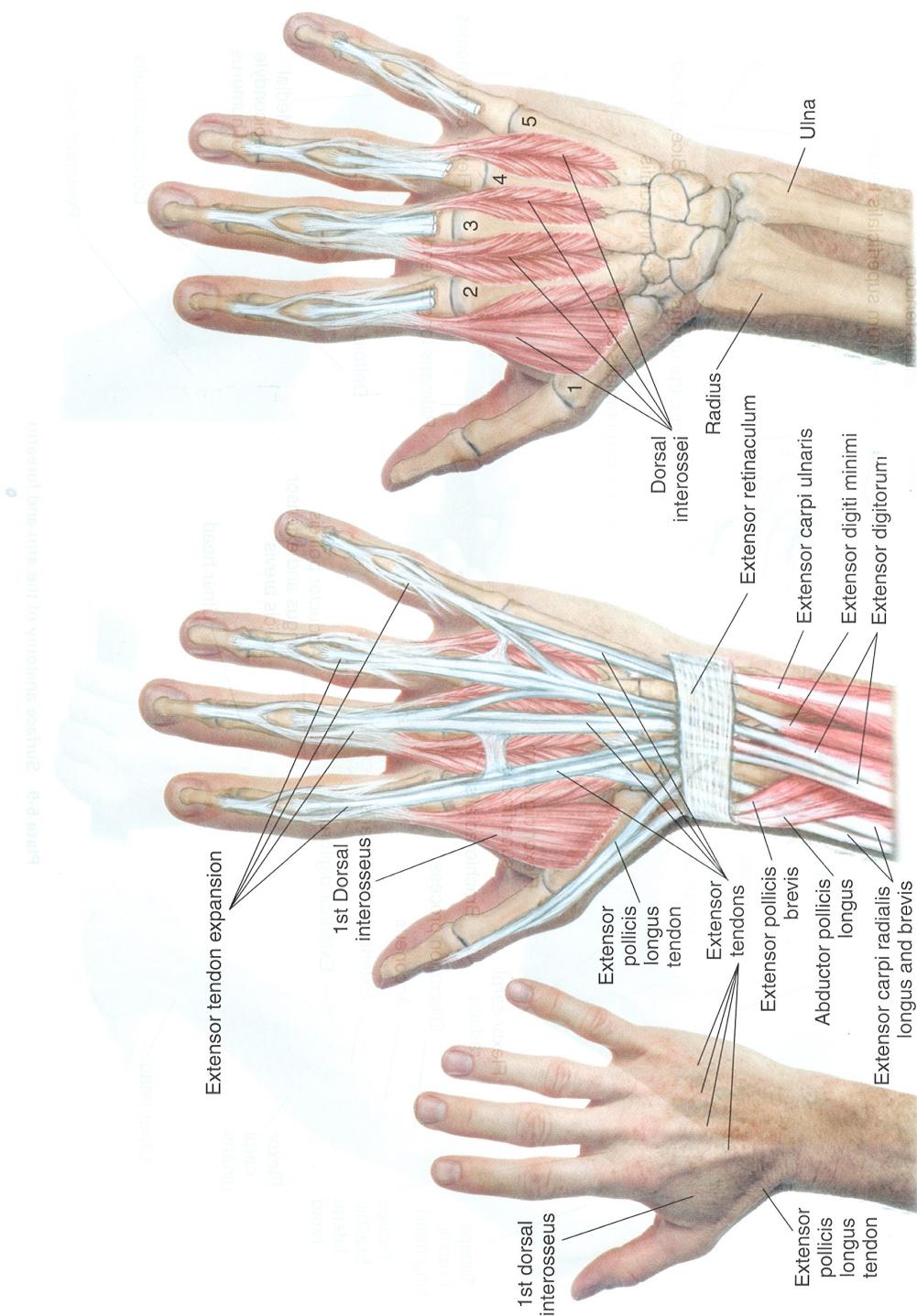


Plate 5-8 Muscles of the dorsal (posterior) hand

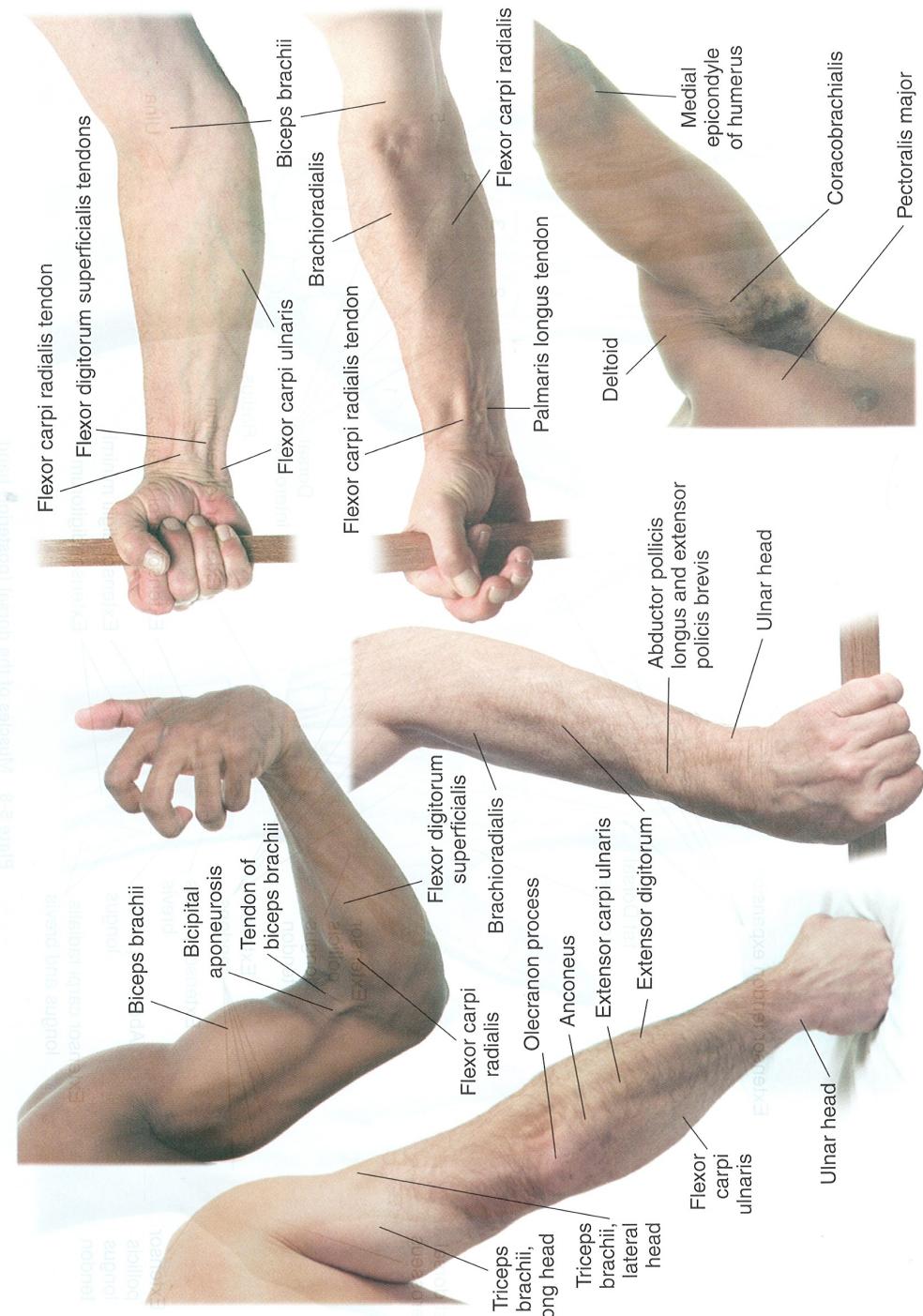


Plate 5-9 Surface anatomy of the arm and forearm

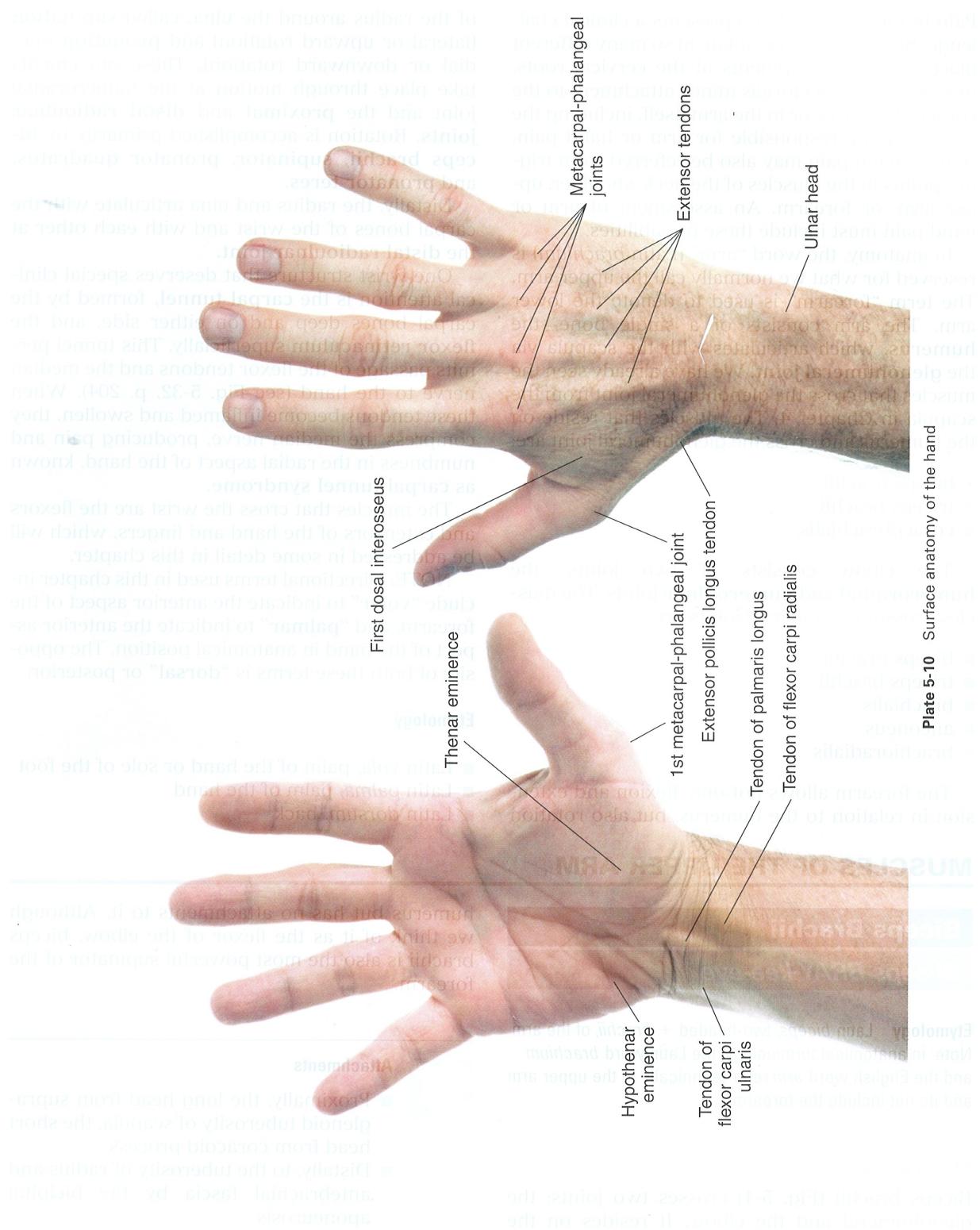


Plate 5-10 Surface anatomy of the hand

OVERVIEW OF THE REGION

Pain in the arm and hand presents a clinical challenge, because it can originate in so many different places. Nerve entrapments at the cervical roots, thoracic outlet, pectoralis minor attachment to the coracoid process, or in the arm itself, including the wrist, may be responsible for arm or hand pain. Arm or hand pain may also be referred from trigger points in the muscles of the neck, shoulder, upper arm, or forearm. An assessment of arm or hand pain must include these possibilities.

In anatomy, the word "arm" (Latin *brachium*) is reserved for what we normally call the upper arm. The term "forearm" is used to denote the lower arm. The arm consists of a single bone, the **humerus**, which articulates with the scapula via the **glenohumeral joint**. We have already seen the muscles that cross the glenohumeral joint from the scapula in Chapter 4. The muscles that reside on the humerus and cross the glenohumeral joint are:

- biceps brachii
- triceps brachii
- coracobrachialis

The elbow consists of two joints: the **humero桡ial joint** and **humero尺桡 joint**. The muscles crossing this pair of joints are:

- biceps brachii
- triceps brachii
- brachialis
- anconeus
- brachioradialis

The forearm allows not only flexion and extension in relation to the humerus, but also rotation

of the radius around the ulna, called **supination** (lateral or upward rotation) and **pronation** (medial or downward rotation). These movements take place through motion at the humeroradial joint and the **proximal** and **distal radioulnar joints**. Rotation is accomplished primarily by **biceps brachii**, **supinator**, **pronator quadratus**, and **pronator teres**.

Distally, the radius and ulna articulate with the carpal bones of the wrist and with each other at the **distal radioulnar joint**.

One wrist structure that deserves special clinical attention is the **carpal tunnel**, formed by the carpal bones deep and on either side, and the **flexor retinaculum** superficially. This tunnel permits passage of the flexor tendons and the median nerve to the hand (see Fig. 5-32, p. 204). When these tendons become inflamed and swollen, they compress the median nerve, producing pain and numbness in the radial aspect of the hand, known as **carpal tunnel syndrome**.

The muscles that cross the wrist are the flexors and extensors of the hand and fingers, which will be addressed in some detail in this chapter.

NOTE: Directional terms used in this chapter include "**volar**" to indicate the anterior aspect of the forearm, and "**palmar**" to indicate the anterior aspect of the hand in anatomical position. The opposite of both these terms is "**dorsal**" or posterior.

Etymology

- Latin *vola*, palm of the hand or sole of the foot
- Latin *palma*, palm of the hand
- Latin *dorsum*, back

MUSCLES OF THE UPPER ARM

Biceps Brachii

Bi-seps BRAY-kee-eye

Etymology Latin *biceps*, two-headed + *brachii*, of the arm
Note: in anatomical terminology, the Latin word *brachium* and the English word *arm* refer technically to the upper arm and do not include the forearm.

Overview

Biceps brachii (Fig. 5-1) crosses two joints: the glenohumeral and the elbow. It resides on the

humerus but has no attachments to it. Although we think of it as the flexor of the elbow, biceps brachii is also the most powerful supinator of the forearm.

Attachments

- Proximally, the long head from supraglenoid tuberosity of scapula, the short head from coracoid process
- Distally, to the tuberosity of radius and antebrachial fascia by the bicipital aponeurosis

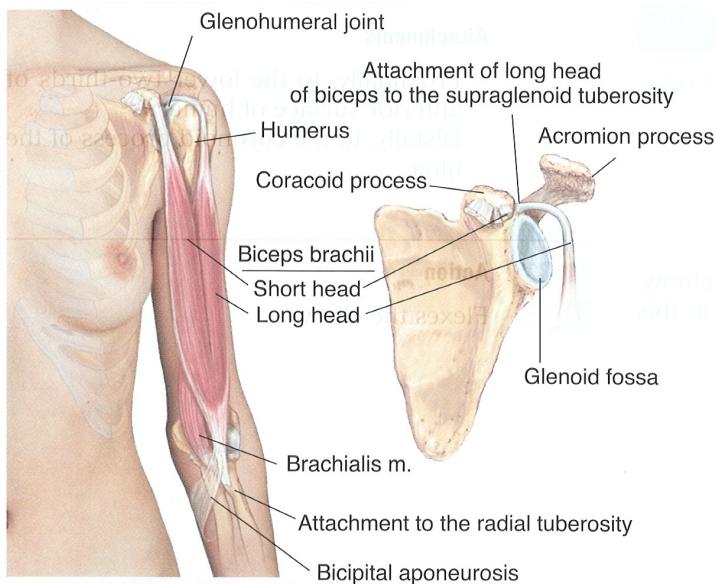


Figure 5-1 Anatomy of biceps brachii

**Action**

Flexes the elbow and supinates the forearm

**Referral Area**

Over the area of the muscle itself, to the inner aspect of the elbow, to the area of the middle deltoid, and to the area just proximal to supraspinatus

**Other Muscles to Examine**

- Brachialis
- Supinator
- Brachioradialis
- Middle deltoid
- Rotator cuff muscles

**Manual Therapy****STRIPPING**

- The client lies supine.
- The therapist stands beside the client at the hip.
- Place the knuckles on the muscle at the elbow.
- Pressing firmly into the tissue, slide the knuckles proximally along the muscle (Fig. 5-2) to the head of the humerus.

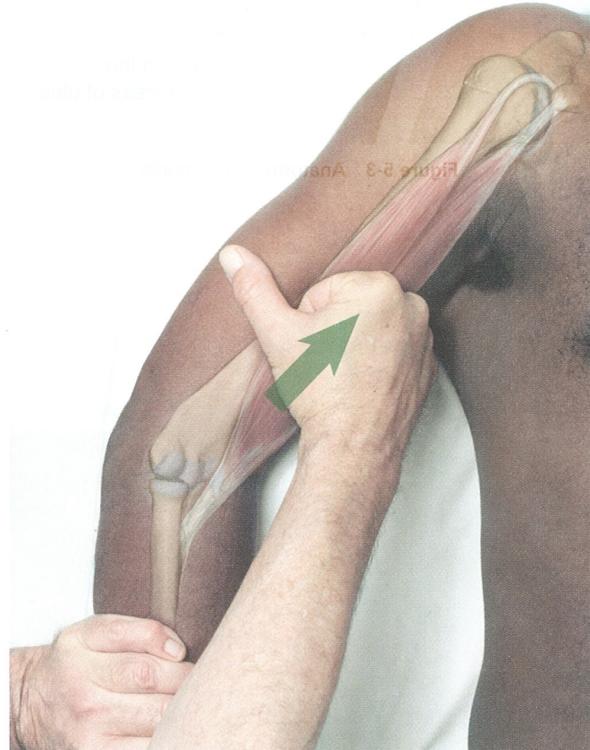


Figure 5-2 Stripping massage of biceps using knuckles

Brachialis**BRAY-kee-AL-is****Etymology** Latin *brachium*, arm**Overview**

Brachialis (Fig. 5-3) is a prime flexor of the elbow. Biceps brachii must be displaced to work on this muscle.

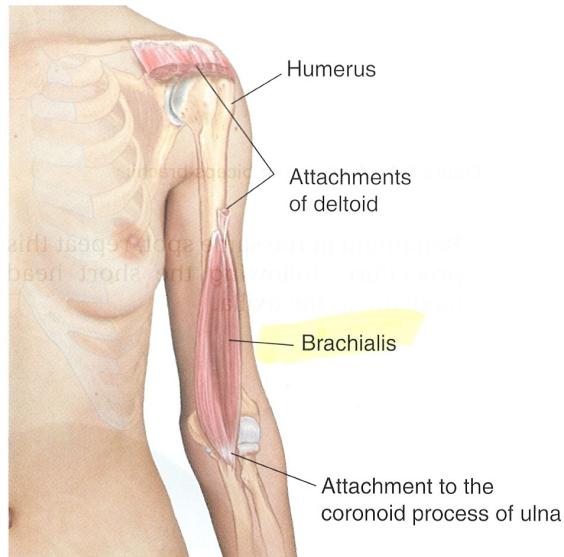


Figure 5-3 Anatomy of brachialis

Attachments

- Proximally, to the lower two-thirds of anterior surface of humerus
- Distally, to the coronoid process of the ulna

Action

- Flexes the elbow



Figure 5-4 Stripping massage of brachialis using supported thumb (from lateral side)



Referral Area

To the anterior surface of the arm up to the acromion, to the anterior aspect of the elbow, and to the lateral and posterior aspect of the base of the thumb.



Other Muscles to Examine

- Biceps brachii
- Supinator
- Brachioradialis
- Opponens pollicis
- Adductor pollicis



Manual Therapy

STRIPPING

- The client lies supine.
- The therapist stands beside the client at the hip.
- Place the thumb on the lateral aspect of the distal extent of brachialis just proximal to the elbow, pushing biceps brachii medially out of the way.
- Pressing firmly into the tissue, slide the thumb along brachialis (Fig. 5-4) to its attachment on the humerus just distal to the attachment of the middle deltoid.
- Repeat the stroke on the medial side of the muscle (Fig. 5-5), continuing about halfway up the humerus.

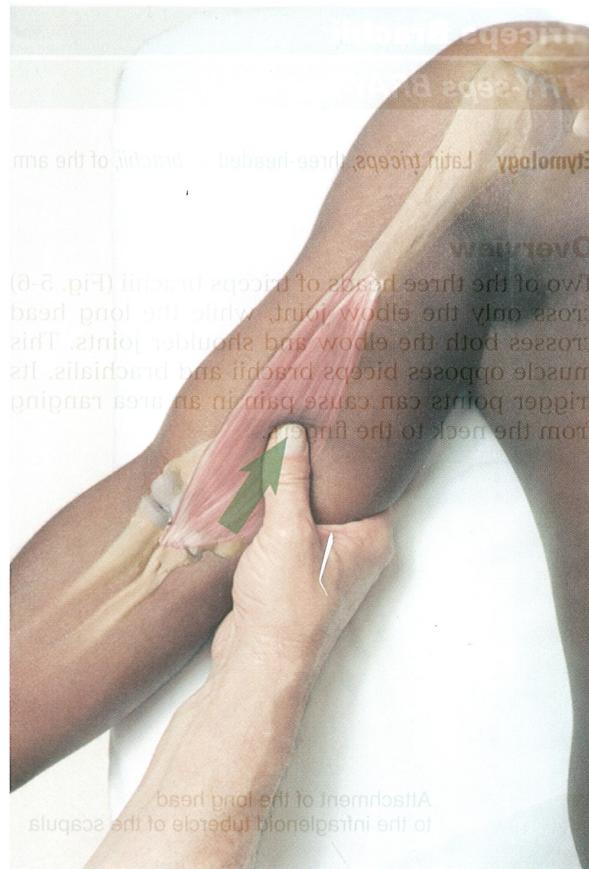


Figure 5-5 Stripping massage of brachialis using thumb (from medial side)

Triceps Brachii

TRY-seps BRAY-kee-eye

Etymology Latin *triceps*, three-headed + *brachii*, of the arm

Overview

Two of the three heads of triceps brachii (Fig. 5-6) cross only the elbow joint, while the long head crosses both the elbow and shoulder joints. This muscle opposes biceps brachii and brachialis. Its trigger points can cause pain in an area ranging from the neck to the fingers.

Attachments

Proximally:

- long or scapular head: to the infraglenoid tubercle at the lateral border of scapula inferior to the glenoid fossa

- lateral head: to the lateral and posterior surface of humerus below greater tubercle a medial head: to the distal posterior surface of humerus

Distally, to the olecranon of ulna

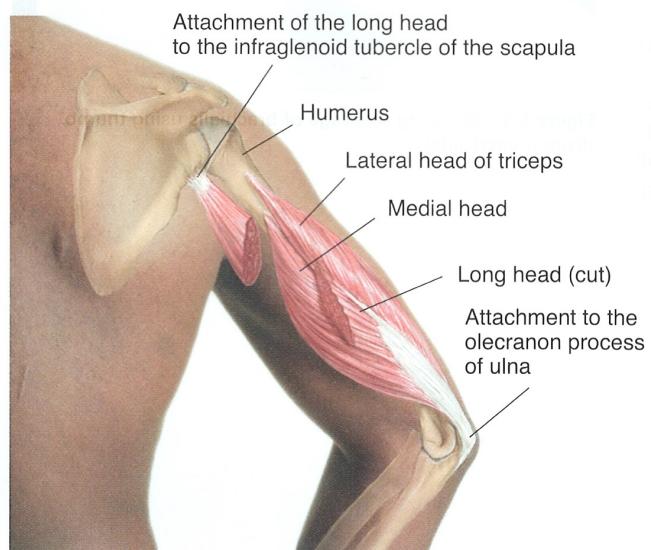


Figure 5-6 Anatomy of triceps brachii

Action	elbow flexor
Extends elbow flexes elbow externally to abduct shoulder internally to adduct shoulder	elbow extensor flexes elbow internally to adduct shoulder externally to abduct shoulder

Referral Area
To the dorsal surface of the arm proximally over the back of the shoulder and distally to the back of the hand into the fourth and fifth fingers; also over the volar surface of the forearm and just proximal to the elbow.

Other Muscles to Examine
All the muscles of the arm and forearm Rotator cuff muscles Pectoralis minor Pectoralis major



Figure 5-7 Stripping massage of triceps using thumbs

Manual Therapy
STRIPPING

- The client lies supine.
- The therapist stands beside the client at the waist.
- Place the thumb, knuckles, or fingertips on the muscle just proximal to the olecranon process.
- Pressing firmly into the tissue, slide the thumb, knuckles, or fingertips (Figs. 5-7 and 5-8) along the muscle to the attachment of the posterior deltoid.

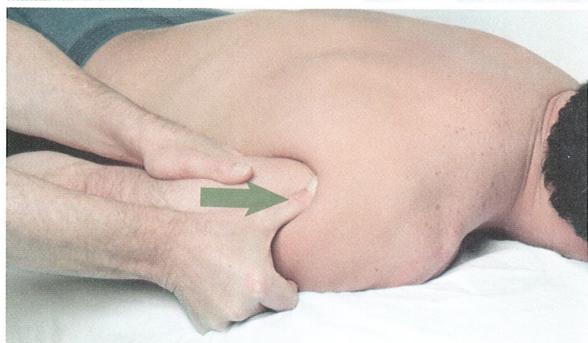


Figure 5-8 Stripping massage of triceps using knuckles and thumb

Anconeus (Fig. 5-9)**ang-KO-knee-us, an-KO-knee-us****Etymology** Latin *ancon*, from Greek *ankon*, elbow**Overview**

Anconeus is a small muscle that assists triceps brachii in elbow extension. Its pain referral zone is local.

Local pain may refer to the elbow, forearm, and hand.

Attachments

- Proximally, to the posterior aspect of the lateral condyle of the humerus
- Distally, to the olecranon process and the posterior surface of the ulna

Action

- Extends elbow

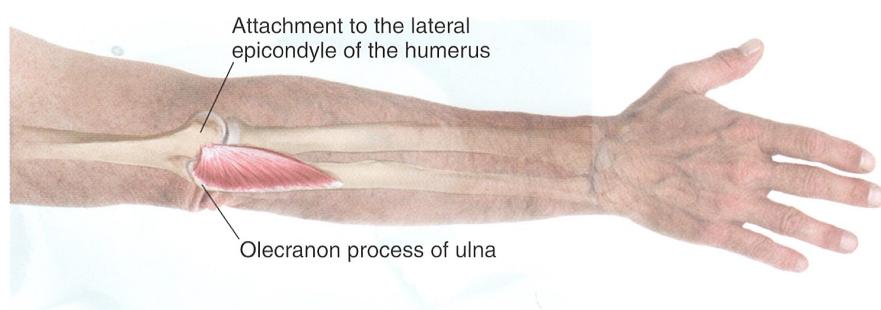


Figure 5-9 Anatomy of anconeus, dorsal (posterior) view

**Referral Area**

Area over the lateral condyle of humerus

**Other Muscles to Examine**

- Triceps brachii
- Scalenes
- Supraspinatus
- Serratus posterior superior

**Manual Therapy****STRIPPING**

- The client may be in any position that makes the dorsal aspect of the elbow easily accessible.
- Place the thumb on the proximal posterior aspect of the ulna just distal to the olecranon.
- Pressing firmly into the tissue, slide the thumb along the muscle (Fig. 5-10) diagonally to its attachment on the lateral epicondyle of the humerus (a very short distance!).



Figure 5-10 Stripping massage of anconeus

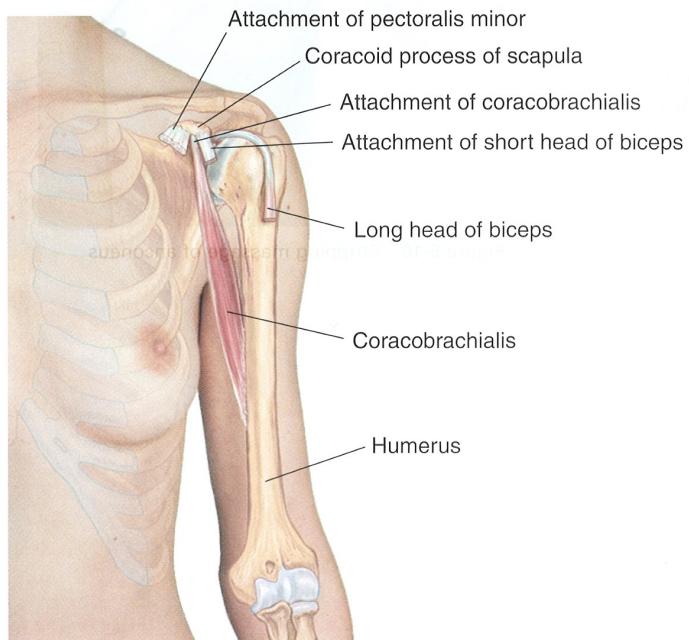
Coracobrachialis (Fig. 5-11)

KOR-a-ko-BRAKE-ee-AL-is

Etymology From *coracoid* (Greek *korakodes*, like a raven's beak, from *korax*, raven + *eidos*, resemblance) + Latin *brachialis*, relating to the arm (*brachium*).

Overview

Coracobrachialis is one of three muscles that attach to the coracoid process of the scapula, and that maintain the complex, three-way interaction of the arm, scapula, and chest (rib cage). The other two muscles are biceps brachii and pectoralis minor.



Attachments

- Proximally, to the coracoid process of the scapula
- Distally, to the middle of the medial border of the humerus

Actions

- Adducts and flexes the humerus
- Resists downward dislocation of shoulder joint.

Figure 5-11 Anatomy of coracobrachialis



Referral

To the posterior aspect of the upper arm, forearm, and hand, and to the area of the middle and anterior deltoid.



Other Muscles to Examine

- All the muscles of the arm and forearm
- Rotator cuff muscles
- Deltoids



Manual Therapy

STRIPPING AND COMPRESSION

- The client lies supine. The therapist stands at the client's side, facing the client's head. The therapist holds the arm to be treated at the elbow with the non-treating hand.
- With the treating hand (i.e., the hand nearest the client), grasp the upper arm from the medial side in such a way that the thumb can comfortably extend along the medial side of the humerus.
- Press the thumb under biceps brachii to the medial side of the humerus about halfway up the humerus, seeking the distal attachment of coracobrachialis. Hold for release.
- Glide the thumb proximally along the muscle, holding for release where tenderness is found (Fig. 5-12).
- The thumb will finally follow the muscle deep into the axilla to the upper attachment to the coracoid process.

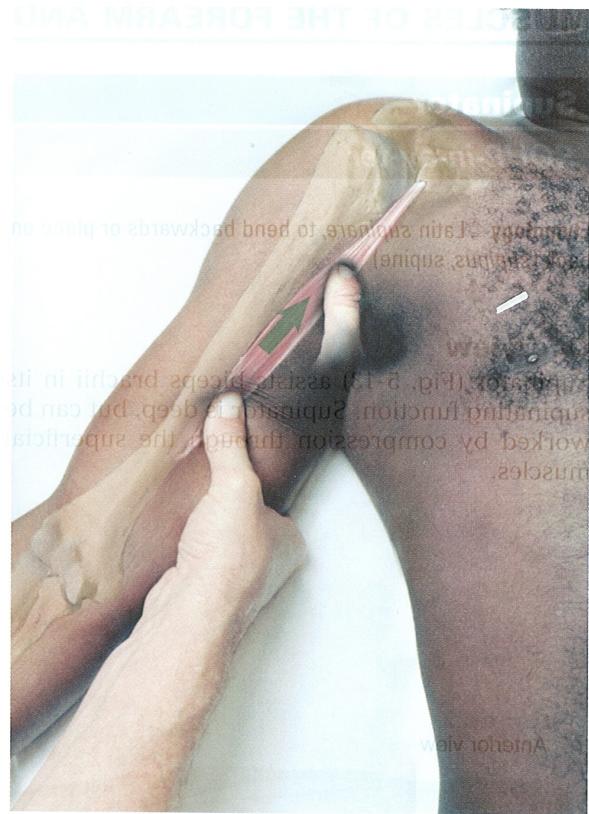


Figure 5-12 Stripping and compression of coracobrachialis using thumb



In working in the axilla, take care to maintain contact with the muscle, and avoid the nerves and blood vessels that pass under the coracoid process into the arm.

MUSCLES OF THE FOREARM AND HAND

Supinator

SOUP-in-ay-ter

Etymology Latin *supinare*, to bend backwards or place on back (*supinus*, supine)

Overview

Supinator (Fig. 5-13) assists biceps brachii in its supinating function. Supinator is deep, but can be worked by compression through the superficial muscles.

Attachments

- Proximally, to the lateral epicondyle of humerus radial collateral and annular ligaments, and to the supinator ridge of ulna
- Distally, to the anterior and lateral surface of radius

Action

Supinates the forearm

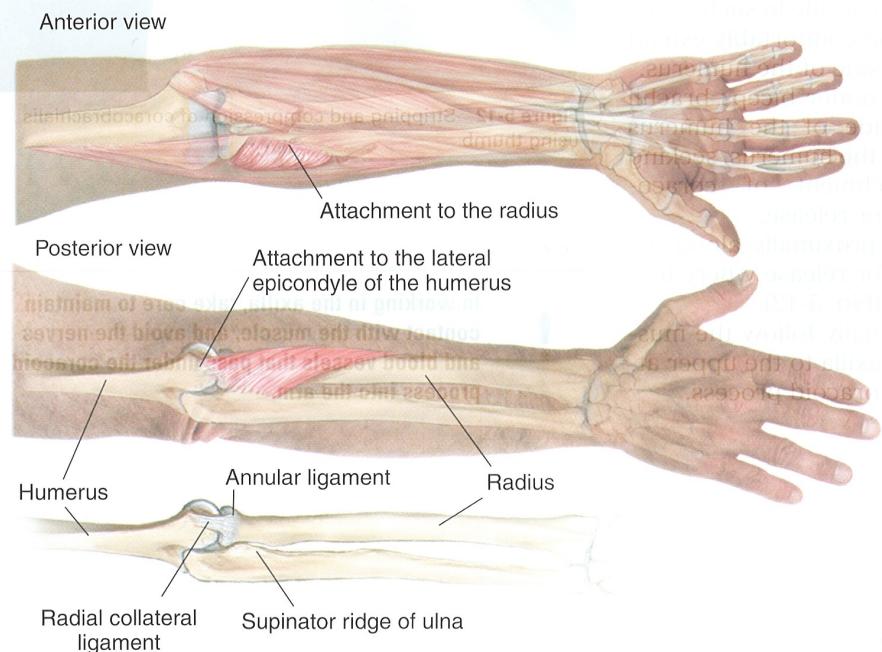


Figure 5-13 Anatomy of supinator



Referral Area

To the volar elbow and over the lateral epicondyle, and to the dorsal side of the hand at the base of the thumb and index finger.



Other Muscles to Examine

- Infraspinatus
- Subclavius
- Scalenes
- Brachialis
- Anconeus
- Brachioradialis
- Extensors of the hand



Manual Therapy

COMPRESSION

- The client lies supine.
- The therapist stands beside the client at the hip.
- Holding the forearm in pronation, place the thumb of the other hand on the ulnar side of the large extensor bundle just distal to the elbow.
- Displace the extensor bundle laterally to press into the interosseous space.
- Press firmly into the tissue, looking for tender spots. Hold for release (Fig. 5-14).

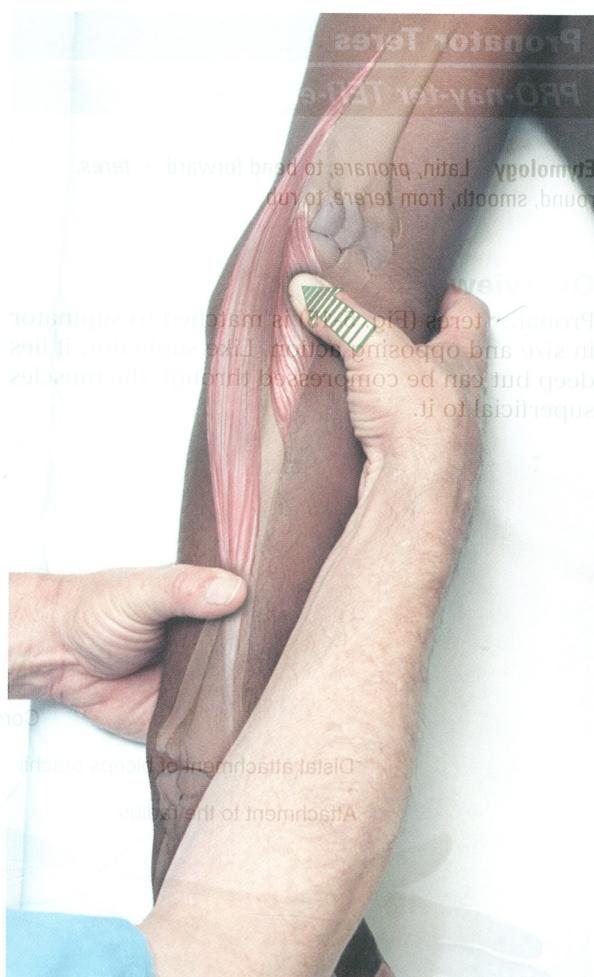


Figure 5-14 Compression of trigger point in supinator

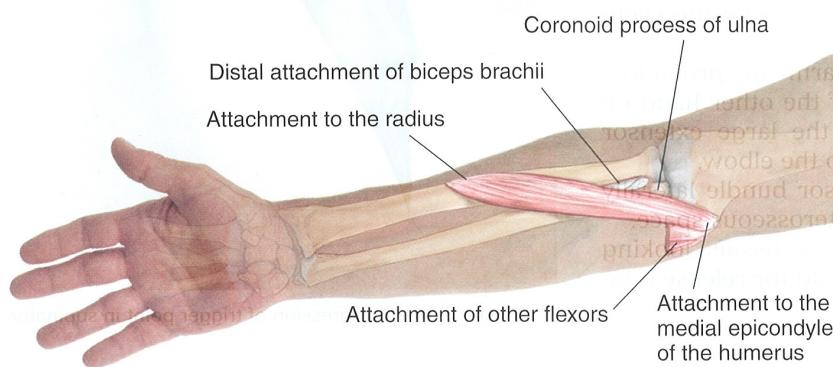
Pronator Teres

PRO-nay-ter TER-ease

Etymology Latin, *pronare*, to bend forward + *teres*, round, smooth, from *terere*, to rub

Overview

Pronator teres (Fig. 5-15) is matched to supinator in size and opposing action. Like supinator, it lies deep but can be compressed through the muscles superficial to it.



Attachments

- Proximally, the superficial (humeral) head from the common flexor origin on the medial epicondyle of the humerus, deep (ulnar) head from the medial (ulnar) side of the coronoid process of the ulna
- Distally, to the middle of the lateral surface of the radius

Action

- Pronates forearm
- Assists elbow flexion

Figure 5-15 Anatomy of pronator teres, volar (anterior) view



Referral Area

Over the radial edge of the volar forearm, especially to the wrist, and into the base of the thumb



Other Muscles to Examine

- Scalenus
- Infraspinatus
- Subclavius



Manual Therapy

STRIPPING

- The client lies supine.
- The therapist stands beside the client at the hip.
- Holding the arm with the volar side up, place the thumb on the center of the forearm just distal to the crease of the elbow (Fig. 5-16).
- Pressing firmly into the tissue, glide the thumb in a proximal and ulnar direction across the crease of the elbow to the attachment on the medial epicondyle of the humerus.

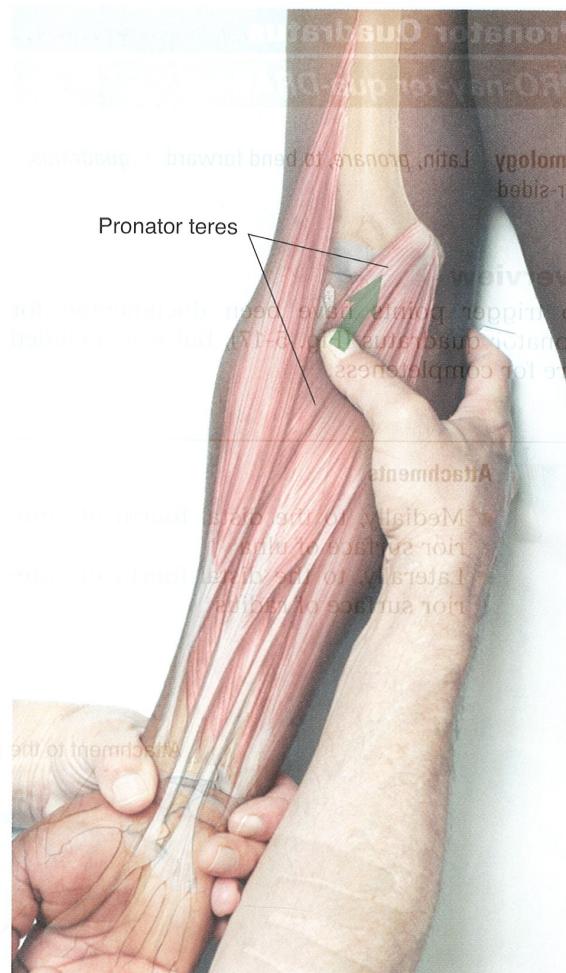


Figure 5-16 Stripping of pronator teres

Pronator Quadratus

PRO-nay-ter qua-DRAY-tus

Etymology Latin, *pronare*, to bend forward + *quadratus*, four-sided

Overview

No trigger points have been documented for pronator quadratus (Fig. 5-17), but it is included here for completeness.



Attachments

- Medially, to the distal fourth of anterior surface of ulna
- Laterally, to the distal fourth of anterior surface of radius



Action

Pronates forearm



Referral Area

Not applicable



Other Muscles to Examine

Not applicable



Manual Therapy

Not applicable

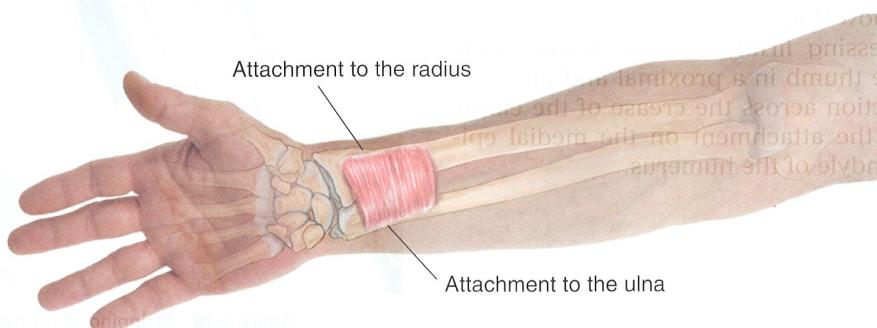


Figure 5-17 Anatomy of pronator quadratus, volar (anterior) view

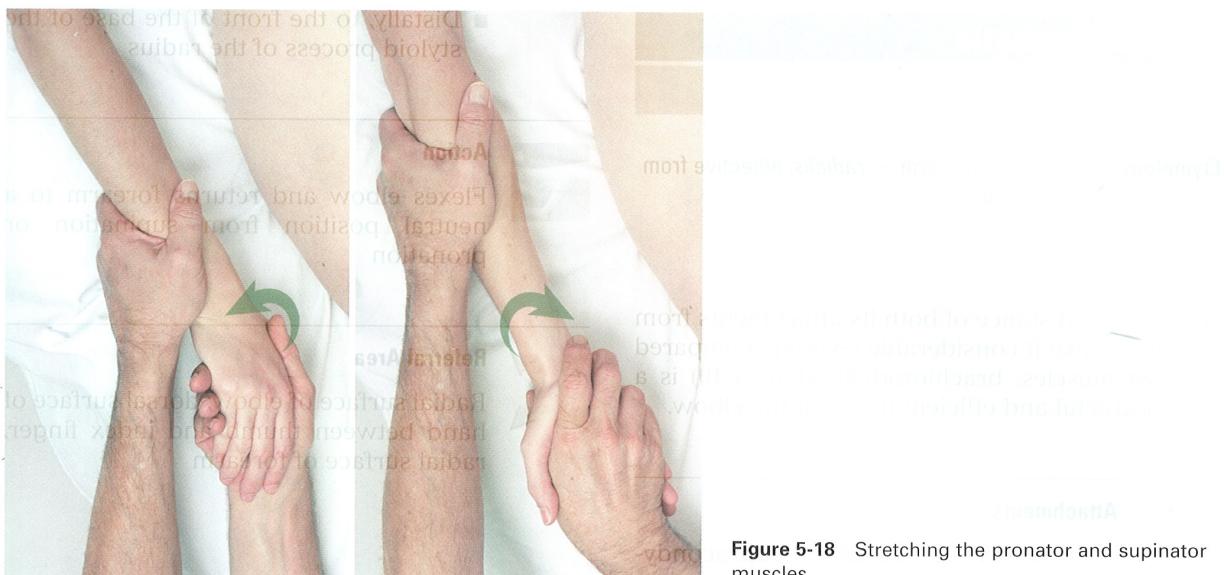


Figure 5-18 Stretching the pronator and supinator muscles



Manual Therapy for the Pronator and Supinator Muscles

STRETCH AND MOBILIZATION

- The client lies supine.
- The therapist stands beside the client at the hip.
- With the hand that is further from the client, grasp the client's forearm just proximal to the wrist.

- With the hand that is nearer the client, grasp the client's hand as if shaking hands.
- Turn the hand firmly into supination, then into pronation.
- Shift the other hand to the middle of the forearm and repeat the stretch.
- Shift the other hand to just distal to the elbow and repeat the stretch (Fig. 5-18).

Brachioradialis

BRAY-key-oh-ray-dee-AL-is

Etymology Latin *brachium*, arm + *radialis*, adjective from *radius*, spoke of a wheel

Overview

Because the distance of both its attachments from the elbow give it considerable leverage compared to most muscles, brachioradialis (Fig. 5-19) is a very powerful and efficient flexor of the elbow.

Attachments

- Proximally, to the lateral supracondylar ridge of humerus



- Distally, to the front of the base of the styloid process of the radius

Action



Flexes elbow and returns forearm to a neutral position from supination or pronation

Referral Area



Radial surface of elbow, dorsal surface of hand between thumb and index finger, radial surface of forearm

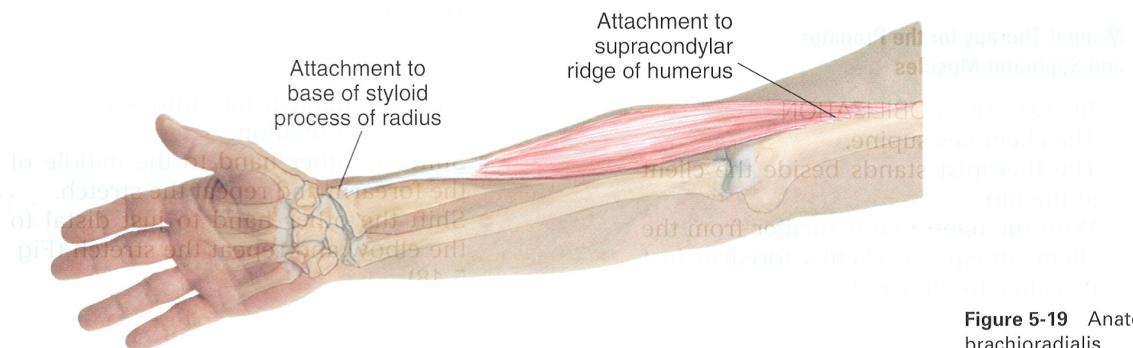


Figure 5-19 Anatomy of brachioradialis

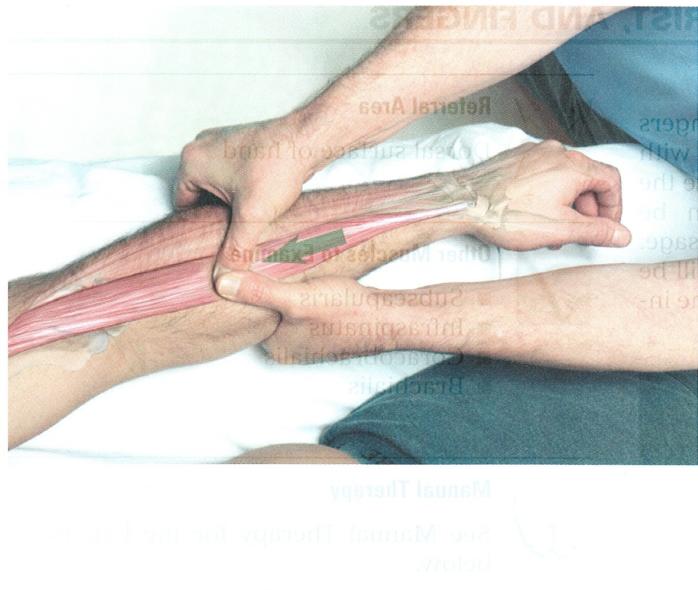


Figure 5-20 Stripping of brachioradialis with supported thumb

Other Muscles to Examine

- Infraspinatus
- Supraspinatus
- Scalenes
- Subclavius



Manual Therapy

STRIPPING

- The client lies supine.
- The therapist stands beside the client at the hip.
- Using the supported thumb, find the brachioradialis at its attachment near the distal end of the radius.
- Pressing firmly into the tissue, glide the thumb (Fig. 5-20) proximally along the muscle across the elbow to its attachment on the humerus.

EXTENSORS OF THE HAND, WRIST, AND FINGERS

Overview

The muscles that extend the hand and fingers cover the dorsal aspect of the forearm. Along with the flexors on the volar forearm, they stabilize the wrist during hand movements. They can be treated effectively as a group with deep massage. For this reason, manual therapy for them will be covered at the end of the descriptions of all the individual extensors.

Extensor Carpi Radialis Brevis (Fig. 5-21)

**ex-TEN-ser CAR-pie ray-dee-AL-is
BREV-is**

Etymology Latin *extensor*, extender + *carpi*, of the wrist + *radialis*, adjective from *radius*, spoke of a wheel + *brevis*, short

Attachments

- Proximally, to the lateral epicondyle of humerus
- Distally, to the base of the third metacarpal bone

Action

Extends and abducts wrist radially

Referral Area

Dorsal surface of hand

Other Muscles to Examine

- Subscapularis
- Infraspinatus
- Coracobrachialis
- Brachialis

Manual Therapy

See Manual Therapy for the Extensors, below.

Extensor Carpi Radialis Longus (Fig. 5-22)

**ex-TEN-ser CAR-pie ray-dee-AL-is
LONG-gus**

Etymology Latin *extensor*, extender + *carpi*, of the wrist + *radialis*, adjective from *radius*, spoke of a wheel + *longus*, long

Attachments

- Proximally, to the lateral supracondylar ridge of humerus
- Distally, to the back of base of second metacarpal bone

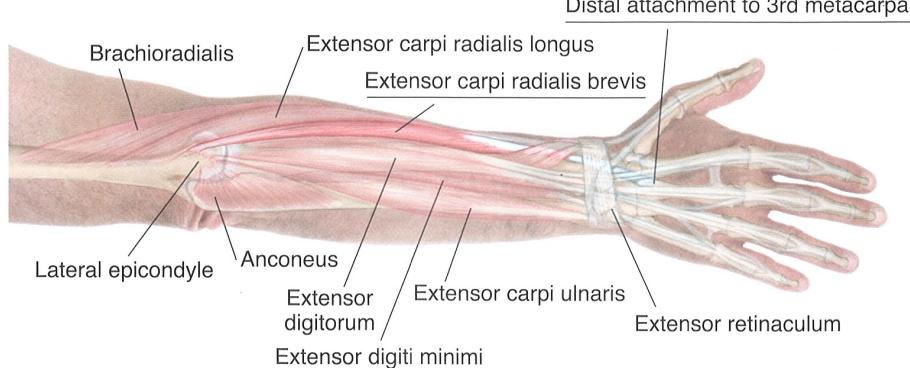


Figure 5-21 Anatomy of extensor carpi radialis brevis, dorsal (posterior) view

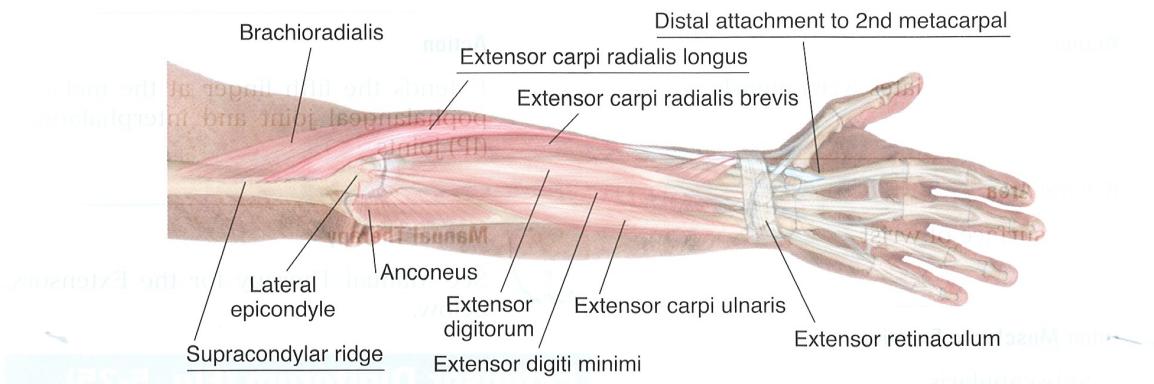


Figure 5-22 Anatomy of extensor carpi radialis longus, dorsal (posterior) view

**Action**

Extends and deviates wrist radially

**Referral Area**

Surface of elbow, radial aspect of dorsal hand, dorsal forearm

Injury to elbow or forearm can result in referred pain to shoulder, neck, and head.

**Other Muscles to Examine**

- Extensor carpi radialis brevis
- Supinator
- Extensor indicis
- Brachialis
- Infraspinatus
- Serratus posterior superior
- Scalenes

**Manual Therapy**

See Manual Therapy for the Extensors, below.

Extensor Carpi Ulnaris (Fig. 5-23)**ex-TEN-ser CAR-pie ul-NAR-is**

Etymology Latin *extensor*, extender + *carpi*, of the wrist + *ulnaris*, adjective from *ulna*, elbow or arm

**Attachments**

- Proximally, to the lateral epicondyle of humerus (humeral head) and posterior border of proximal ulna (ulnar head)
- Distally, to the base of the fifth metacarpal bone

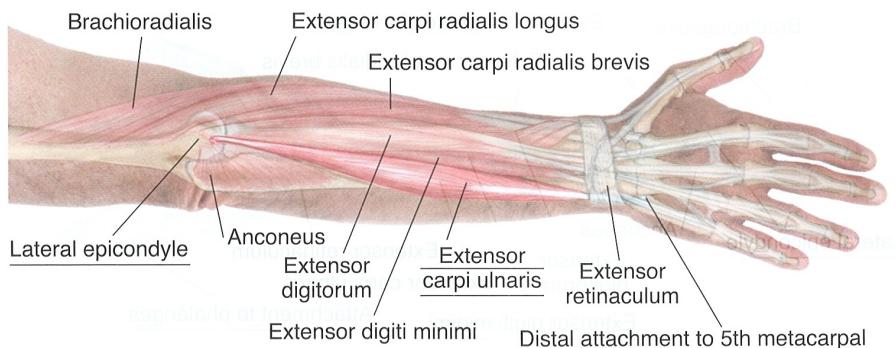


Figure 5-23 Anatomy of extensor carpi ulnaris, dorsal (posterior) view

**Action**

Extends and deviates wrist ulnarly

**Referral Area**

Ulnar surface of wrist

**Other Muscles to Examine**

- Subscapularis
- Serratus posterior superior

**Manual Therapy**

See Manual Therapy for the Extensors, below.

Extensor Digiti Minimi (Fig. 5-24)**ex-TEN-ser DIH-jih-tea MIH-nih-mee**

Etymology Latin *extensor*, extender + *digiti*, of the finger + *minimi*, smallest

**Attachments**

- Proximally, to the lateral epicondyle of the humerus
- Distally, to the dorsum of the proximal, middle, and distal phalanges of little finger

**Action**

Extends the fifth finger at the metacarpophalangeal joint and interphalangeal (IP) joints

**Manual Therapy**

See Manual Therapy for the Extensors, below.

Extensor Digitorum (Fig. 5-25)**ex-TEN-ser dih-jih-TOR-um**

Etymology Latin *extensor*, extender + *digitorum*, of the fingers

**Attachments**

- Proximally, to the lateral epicondyle of humerus
- Distally, by four tendons into the base of the proximal and middle and base of the distal phalanges or four fingers

**Action**

Extends four fingers at the metacarpophalangeal joints and interphalangeal (IP) joints

**Manual Therapy**

See Manual Therapy for the Extensors, below.

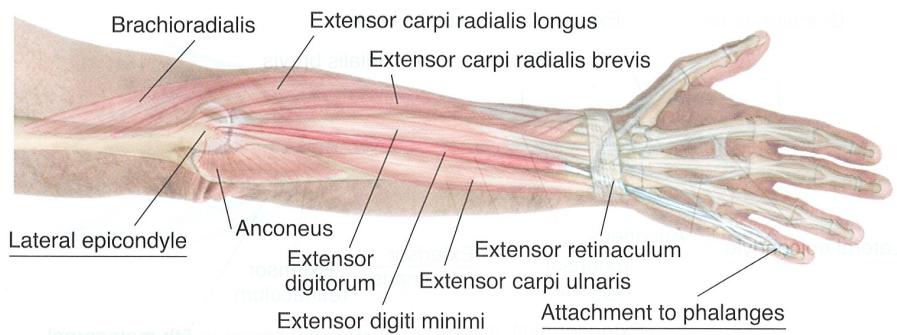


Figure 5-24 Anatomy of extensor digiti minimi, dorsal (posterior) view

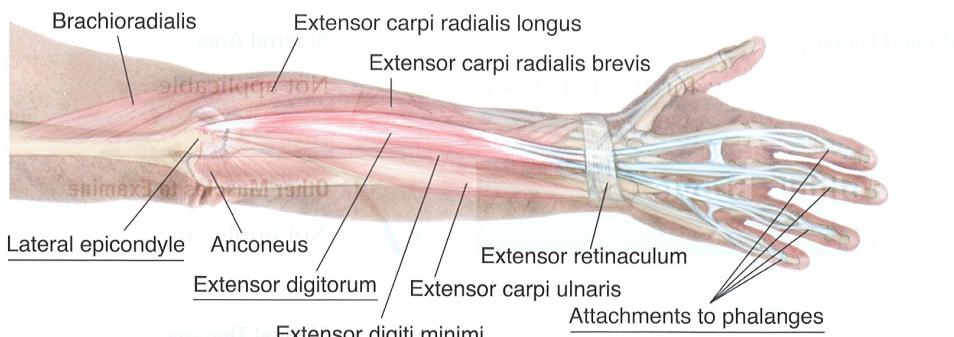


Figure 5-25 Anatomy of extensor digitorum, dorsal (posterior) view

Extensor Indicis (Fig. 5-26)

ex-TEN-ser IN-dis-sis

Etymology Latin *extensor*, extender + *indicis*, of the forefinger

Attachments

- Proximally, to the dorsal surface of the ulna and interosseous membrane
- Distally, to the dorsal extensor aponeurosis of index finger



Action

Extends the forefinger at the metacarpophalangeal joint



Referral Area

Dorsal surface of the hand to the dorsal forefinger



Other Muscles to Examine

- Coracobrachialis
- Subclavius

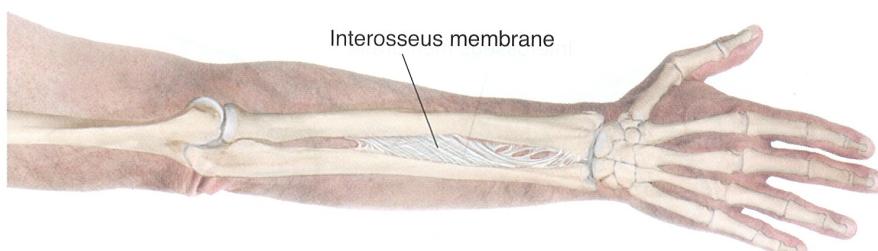
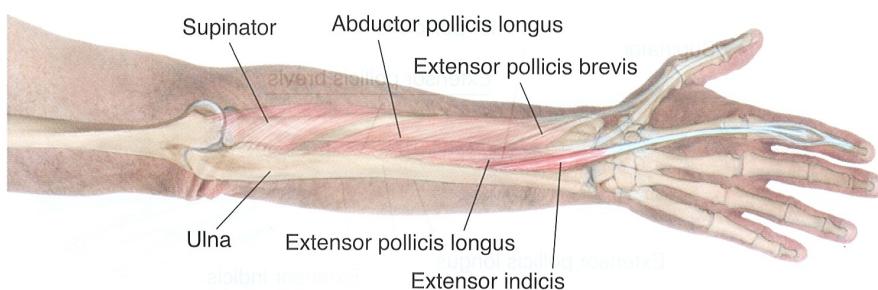


Figure 5-26 Anatomy of extensor indicis, dorsal (posterior) view

Manual Therapy

See Manual Therapy for the Extensors, below.

Extensor Pollicis Brevis (Fig. 5-27)

ex-TEN-ser PAHL-is-siss BREV-iss

Etymology Latin *extensor*, extender + *pollicis*, of the thumb + *brevis*, short

Attachments

- Proximally, to the dorsal surface of radius and interosseous membrane
- Distally, to the base of proximal phalanx of thumb

Action

Extends and abducts the thumb

Referral Area

Not applicable

Other Muscles to Examine

Not applicable

Manual Therapy

See Manual Therapy for the Extensors, below.

Extensor Pollicis Longus (Fig. 5-28)

ex-TEN-ser PAHL-is-siss LONG-gus

Etymology Latin *extensor*, extender + *pollicis*, of the thumb + *longus*, long

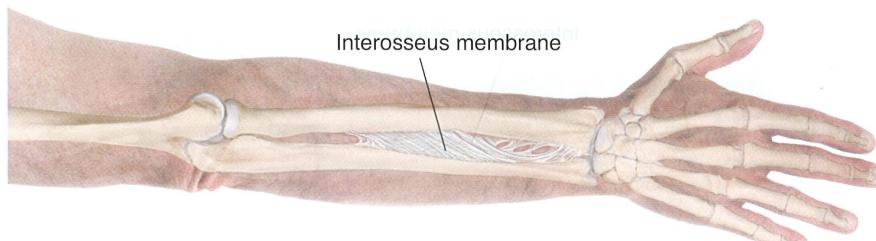
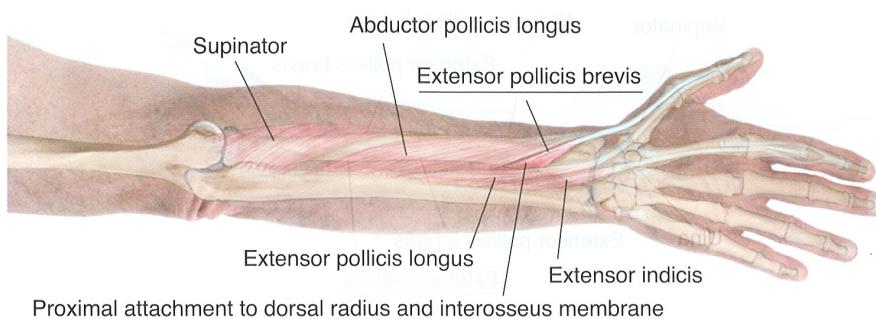


Figure 5-27 Anatomy of extensor pollicis brevis, dorsal (posterior) view

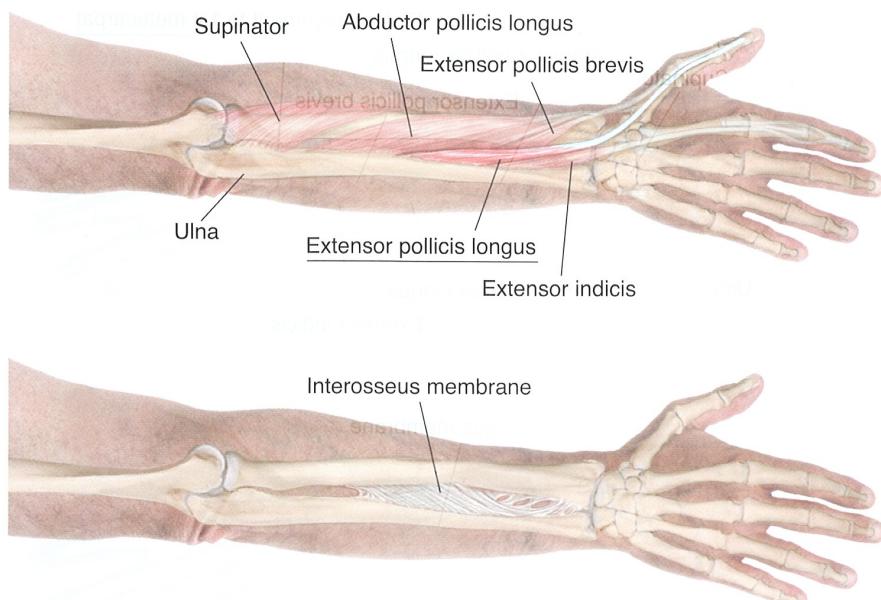


Figure 5-28 Anatomy of extensor pollicis longus, dorsal (posterior) view



Attachments

- Proximally, to the posterior surface of the ulna and middle third of the interosseous membrane
- Distally, to the base of distal phalanx of thumb at the interphalangeal joint



Action

Extends distal phalanx of thumb



Referral Area

Not applicable



Other Muscles to Examine

Not applicable

Abductor Pollicis Longus (Fig. 5-29)

ab-DUCK-ter PAHL-is-siss LONG-gus

Etymology Latin *abductor*, that which draws away from + *pollicis*, of the thumb + *longus*, long



Attachments

- Proximally, to posterior surfaces of radius and ulna and the interosseous membrane
- Distally, to the lateral side of the base of the first metacarpal bone



Action

Abducts and assists in extending thumb



Referral Area

Not applicable



Other Muscles to Examine

Not applicable



Manual Therapy

See Manual Therapy for the Extensors, below.

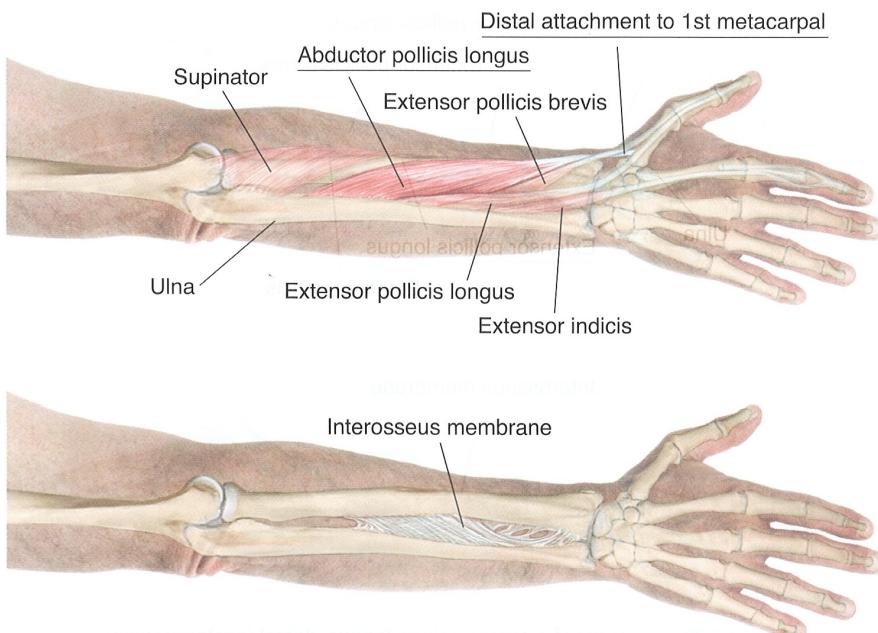


Figure 5-29 Anatomy of abductor pollicis longus, dorsal (posterior) view



Manual Therapy for the Extensors of the Hand, Wrist, and Fingers

Stripping Massage of Individual Extensor Muscles

- The client lies supine with the forearm and hand pronated and slightly flexed at the elbow.
- The therapist stands beside the client at the hip.
- With the non-treating hand, hold the client's hand to steady the arm and wrist.

- Place the thumb on the wrist next to the head of the ulna.
- Pressing firmly into the tissue, glide the thumb proximally (Fig. 5-30) to the lateral epicondyle of the humerus.
- Shifting the thumb to a point slightly farther toward the radius, repeat this movement, sliding along a line parallel to the last motion to the distal humerus.
- Repeat the same procedure, following parallel lines, until the whole extensor (dorsal) aspect of the forearm has been covered.



Figure 5-30 Stripping massage of the extensors using the thumb



Stripping Massage of the Extensor Group

- The client lies supine.
- The therapist stands beside the client at the hip.
- Place the knuckles or the heel of the hand on the dorsal wrist.
- Pressing firmly into the tissue, glide the knuckles (Fig. 5-31) or heel of the hand slowly along the muscle group across the elbow to the distal humerus.

Figure 5-30 shows the stripping massage of the extensor muscles using the thumb. The therapist's thumb is applied firmly to the muscle tissue, and three green arrows indicate the direction of the stroke moving upwards along the forearm.

Stripping Massage of the Flexor Group

- The client lies supine.
- The therapist stands beside the client at the hip.

Figure 5-31 shows the stripping massage of the extensor muscles using the knuckles. The therapist's knuckles are applied firmly to the muscle tissue, and a green arrow indicates the direction of the stroke moving downwards along the forearm.

Figure 5-32 shows the stripping massage of the flexor muscles using the heel of the hand. The therapist's hand is applied firmly to the muscle tissue, and three green arrows indicate the direction of the stroke moving upwards along the forearm.

Figure 5-33 shows the stripping massage of the extensor muscles using the heel of the hand. The therapist's hand is applied firmly to the muscle tissue, and a green arrow indicates the direction of the stroke moving downwards along the forearm.

Figure 5-34 shows the stripping massage of the extensor muscles using the heel of the hand. The therapist's hand is applied firmly to the muscle tissue, and a green arrow indicates the direction of the stroke moving downwards along the forearm.

Figure 5-35 shows the stripping massage of the extensor muscles using the heel of the hand. The therapist's hand is applied firmly to the muscle tissue, and a green arrow indicates the direction of the stroke moving downwards along the forearm.

Figure 5-36 shows the stripping massage of the extensor muscles using the heel of the hand. The therapist's hand is applied firmly to the muscle tissue, and a green arrow indicates the direction of the stroke moving downwards along the forearm.

Figure 5-37 shows the stripping massage of the extensor muscles using the heel of the hand. The therapist's hand is applied firmly to the muscle tissue, and a green arrow indicates the direction of the stroke moving downwards along the forearm.

FLEXORS OF THE HAND, WRIST, AND FINGERS

Overview

Most of the tendons of the flexors of the hand, wrist, and fingers pass through the carpal tunnel, a passage formed by the carpal bones and the flexor retinaculum. When these tendons are swollen, they can entrap and irritate the median nerve, causing carpal tunnel syndrome. Keeping the flexor muscles in the forearm relaxed can help prevent this condition. Like the extensors, the flexors can be massaged deeply as a group. Manual therapy will follow individual descriptions of all the muscles.

Flexor Retinaculum (Transverse Carpal Ligament) (Fig. 5-32)

FLEX-er ret-in-ACK-yu-lum

Etymology Latin *flexor*, bender + *retinaculum*, band or halter (from *retinere*, to hold back)

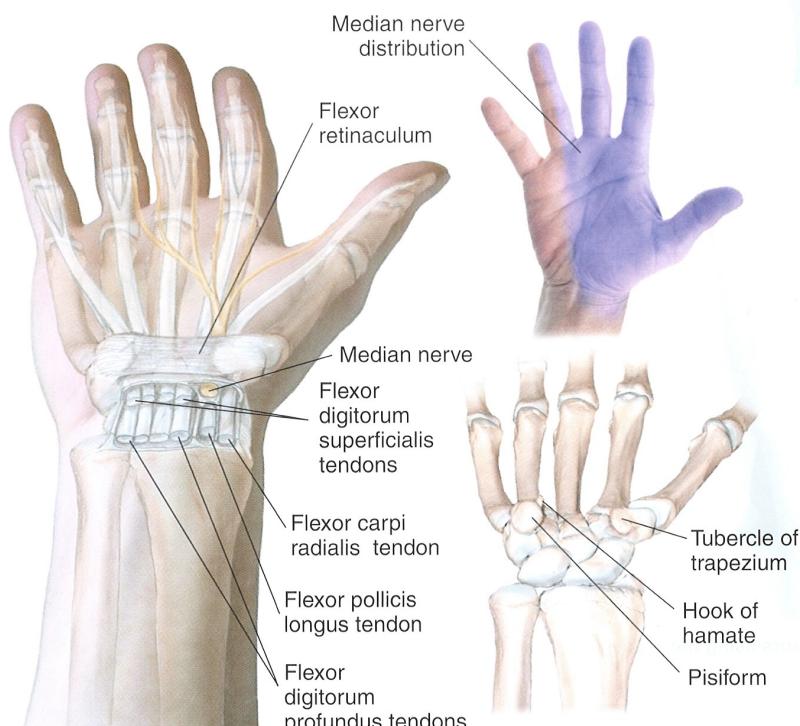


Figure 5-32 Carpal tunnel and flexor retinaculum, volar (anterior) view

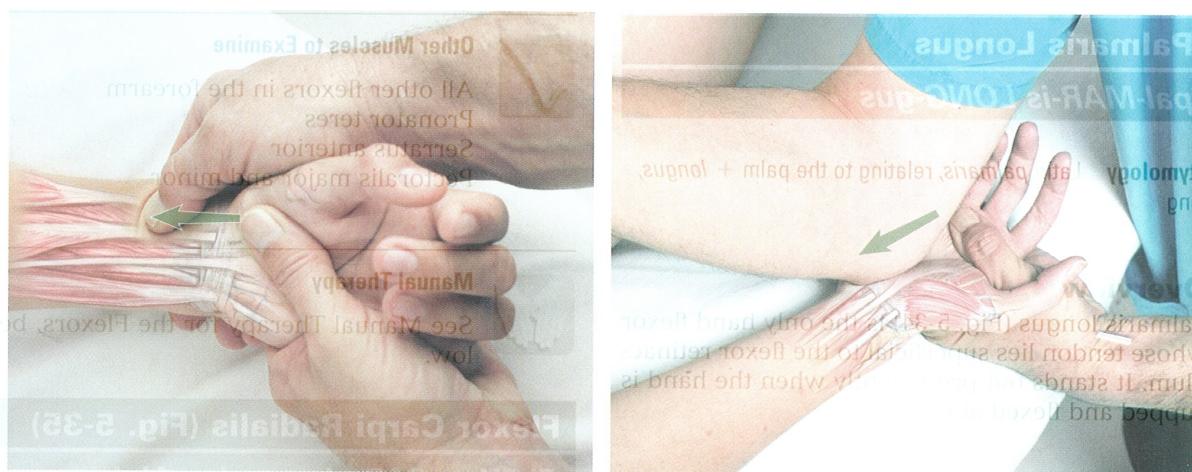


Figure 5-33 Stretching the flexor retinaculum using the thumb and elbow



Action

Binds down the flexor tendons of the digits, the flexor carpi radialis tendon, and the median nerve, creating the carpal tunnel

Anatomical Area

The carpal tunnel is located on the palmar aspect of the wrist, just distal to the transverse carpal ligament. It is bounded by the scaphoid and lunate bones laterally and the pisiform and three other carpal bones medially. The median nerve and the tendons of the flexor pollicis longus, flexor digitorum profundus, and flexor digitorum superficialis muscles pass through the carpal tunnel.



Manual Therapy

DEEP CROSS-FIBER STROKING

- The client lies supine with the volar aspect of the forearm facing up.
- Place the thumb or elbow on the palmar surface of the hand about an inch distal to the wrist.
- Slide proximally in a series of parallel lines (Fig. 5-33) shifting gradually from one side of the volar wrist to the other to stretch the retinaculum.

Palmaris Longus

pal-MAR-is LONG-gus

Etymology Latin *palmaris*, relating to the palm + *longus*, long

Overview

Palmaris longus (Fig. 5-34) is the only hand flexor whose tendon lies superficial to the flexor retinaculum. It stands out prominently when the hand is cupped and flexed at the wrist.



Attachments

- Proximally, to the medial epicondyle of the humerus
- Distally, to the flexor retinaculum of the wrist and palmar fascia



Action

- Tenses palmar fascia
- Flexes the hand at the wrist
- Flexes the forearm



Referral Area

Prickling pain along the volar surface of the forearm and concentrated in the palm



Other Muscles to Examine

All other flexors in the forearm
Pronator teres
Serratus anterior
Pectoralis major and minor



Manual Therapy

See Manual Therapy for the Flexors, below.

Flexor Carpi Radialis (Fig. 5-35)

FLEX-er CAR-pie ray-dee-AL-iss

Etymology Latin *flexor*, bender + *carpi*, of the wrist + *radialis*, adjective from *radius*, spoke of a wheel



Attachments

- Proximally, to the common flexor origin of the medial epicondyle of humerus
- Distally, to the anterior surface of the base of the second and third metacarpal bones



Action

Flexes wrist and abducts wrist radially



Referral Area

Middle of the volar wrist toward the radial side

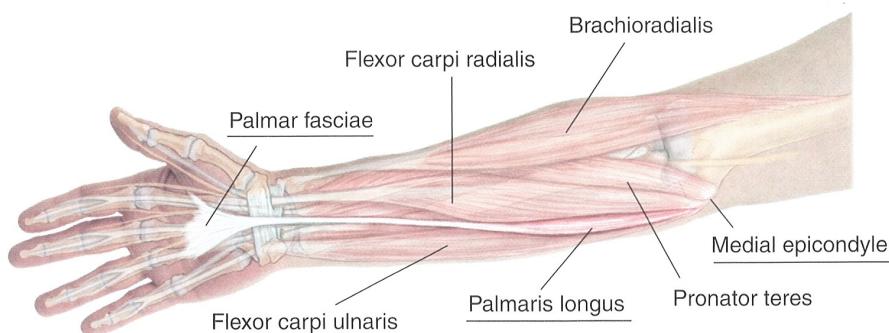


Figure 5-34 Anatomy of palmaris longus, volar (anterior) view

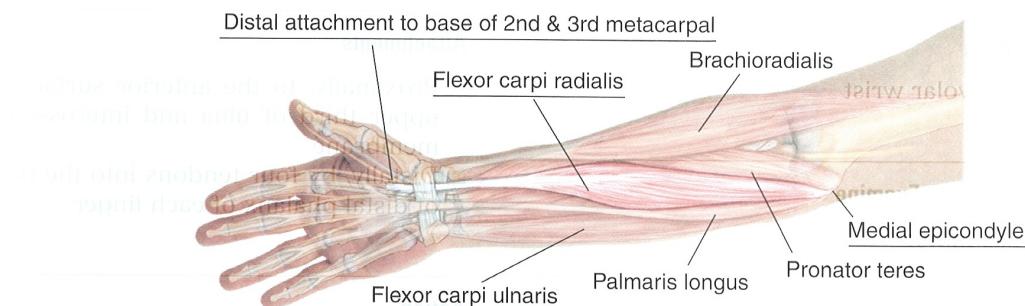


Figure 5-35 Anatomy of flexor carpi radialis, volar (anterior) view



Other Muscles to Examine

Pronator teres



Manual Therapy

See Manual Therapy for the Flexors, below.

Flexor Carpi Ulnaris (Fig. 5-36)

FLEX-er CAR-pie ul-NAR-iss

Etymology Latin *flexor*, bender + *carpi*, of the wrist + *ulnaris*, adjective from *ulna*, elbow or arm



Attachments

- Proximally, the humeral head of the muscle to the medial epicondyle of humerus, ulnar head of the muscle to the olecranon process and upper three-fifths of posterior border of ulna
- Distally, to the pisiform bone—the pisometacarpal ligament, and base of the fifth metacarpal



Action

Flexes wrist and deviates wrist ulnarly

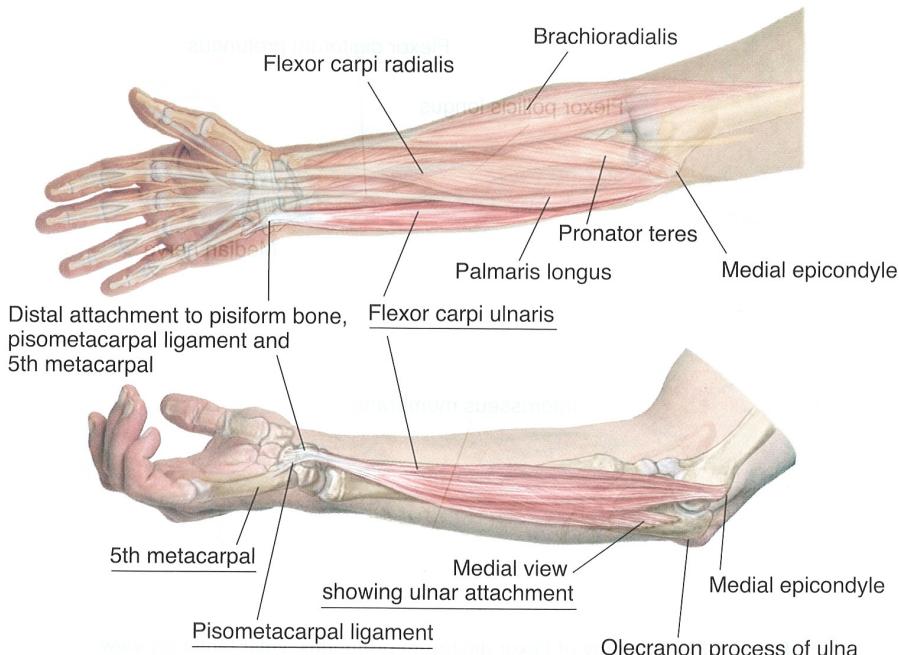


Figure 5-36 Anatomy of flexor carpi ulnaris, volar (anterior) and ulnar (medial) view

**Referral Area**

Ulnar and volar wrist

**Other Muscles to Examine**Pectoralis minor
Serratus posterior superior**Manual Therapy**

See Manual Therapy for the Flexors, below.

Flexor Digitorum Profundus (Fig. 5-37)

FLEX-er dih-jih-TOR-um pro-FUN-dus

Etymology Latin *flexor*, bender + *digitorum*, of the fingers + *profundus*, deep

**Attachments**

- Proximally, to the anterior surface of upper third of ulna and interosseous membrane
- Distally, by four tendons into the base of distal phalanx of each finger

**Action**

Flexes distal interphalangeal joint of four fingers

**Referral Area**

Not applicable

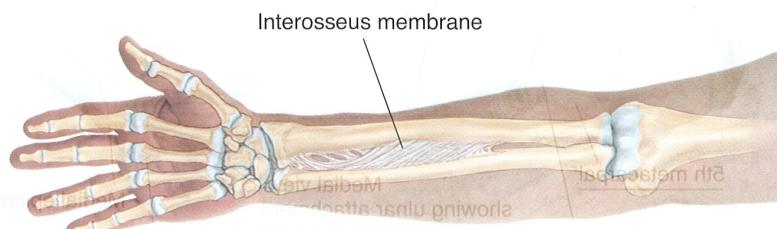
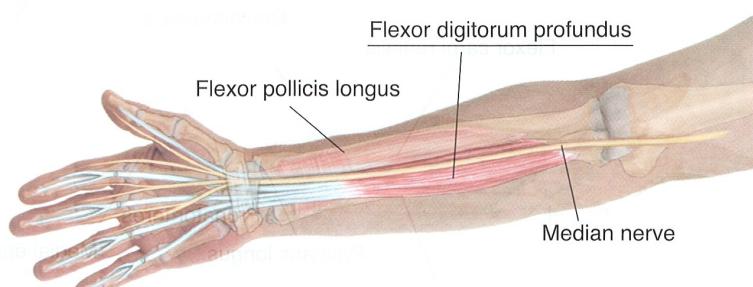


Figure 5-37 Anatomy of flexor digitorum profundus, volar (anterior) view

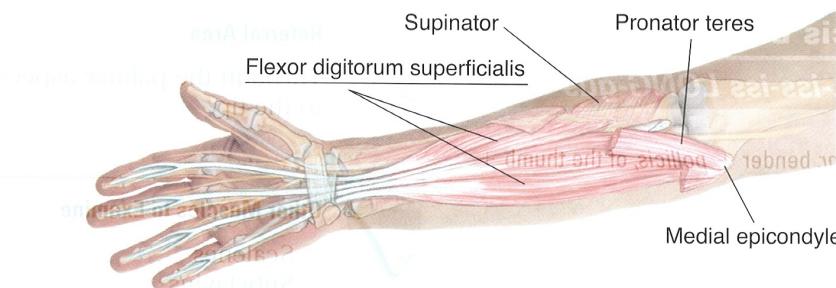


Figure 5-38 Anatomy of flexor digitorum superficialis, volar (anterior) view



Other Muscles to Examine

Not applicable



Manual Therapy

See Manual Therapy for the Flexors, below.



Flexor Digitorum Superficialis (Fig. 5-38)

FLEX-er dih-jih-TOR-um SOUP or fishy Alice

Etymology Latin *flexor*, bender + *digitorum*, of the fingers + *superficialis*, superficial



Attachments

- Proximally, the humeroulnar head to the medial epicondyle of the humerus, the medial border of the coronoid process, and a tendinous arch between these points, the radial head to the anterior oblique line and middle third of the lateral border of the radius

- Distally, by four split tendons, passing to either side of the profundus tendons, into sides of middle phalanx of each finger



Action

Flexes proximal interphalangeal joint of the fingers



Referral Area

Not applicable



Other Muscles to Examine

Not applicable



Manual Therapy

See Manual Therapy for the Flexors, below.

Flexor Pollicis Longus (Fig. 5-39)

FLEX-er PAHL-is-iss LONG-gus

Etymology Latin *flexor*, bender + *pollicis*, of the thumb + *longus*, long

Attachments

- Proximally, to the anterior surface of the middle third of the radius and interosseous membrane
- Distally, to the distal phalanx of the thumb

Action

Flexes distal phalanx of thumb at interphalangeal joint

Referral Area

Through the palmar aspect of the thumb to the tip

Other Muscles to Examine

- Scalenes
- Subclavius

Manual Therapy

See Manual Therapy for the Flexors, below.

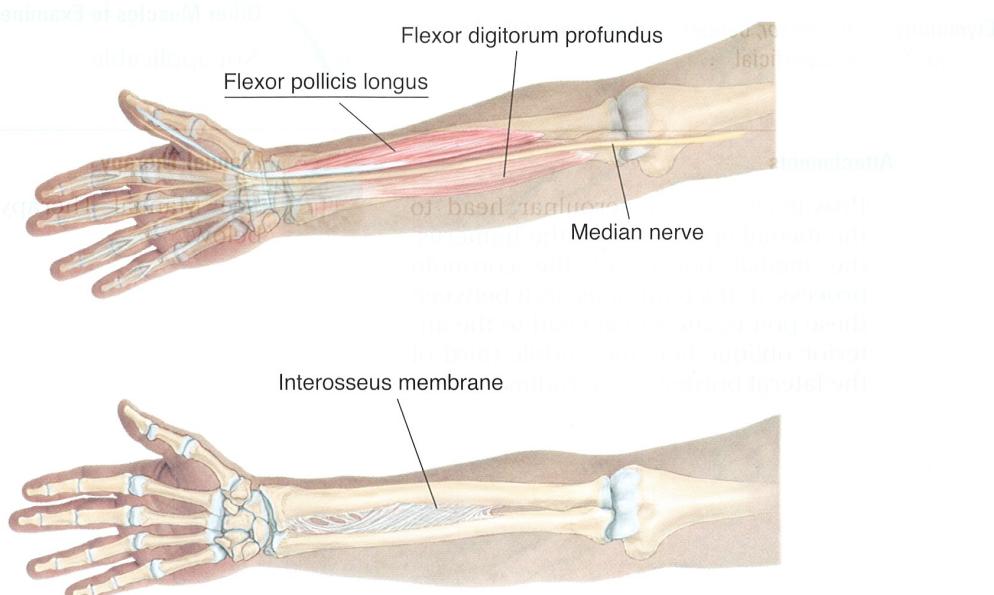


Figure 5-39 Anatomy of flexor pollicis longus, volar (anterior) view



Figure 5-40 Moving compression of the flexors and biceps brachii from distal to proximal. (From Porth M: Pathophysiology: concepts of Alimentary and Respiratory Disease, ed 6, Philadelphia, 1992, Lippincott.)



Figure 5-41 Stripping massage of the flexors using the thumb and the knuckles.



Manual Therapy for the Flexor Muscles of the Hand, Wrist, and Fingers

Stripping Massage of the Flexor Group

- The client lies supine.
- The therapist stands beside the client at the hip.
- With the non-treating hand, hold the client's hand to stabilize the arm.
- Place the knuckles or the heel of the hand on the volar wrist.
- Pressing firmly into the tissue, slide the knuckles or heel of the hand slowly along the muscle group (Fig. 5-40) across the elbow onto the distal end of biceps brachii.

Stripping Massage of Individual Extensor Muscles

- The client lies supine.
- The therapist stands beside the client at the hip.
- With the non-treating hand, hold the client's hand to stabilize the arm.
- Place the thumb, knuckles, or fingertips on the wrist just to the ulnar side of and proximal to the distal end of the radius.
- Pressing firmly into the tissue, slide the thumb, knuckles, or fingertips (Fig. 5-41) proximally along the radius to the volar aspect of the lateral epicondyle of the humerus.
- Beginning at a point slightly nearer the center of the wrist, repeat this movement, sliding along a line parallel to the last motion and ending at the base of biceps brachii.
- Repeat the same movement, following parallel lines, until the whole flexor (volar) aspect of the forearm has been covered (the last movement should be along the ulna).

MUSCLES IN THE HAND

Muscles of the Thumb

One of the distinguishing characteristics of homo sapiens is the opposable thumb, and we use it intensively, as every massage therapist certainly knows. Soreness, tender points, and trigger points in the thumb muscles due to overuse are quite common. Pain in the thumb area can also be a symptom of carpal tunnel syndrome, so careful examination and thorough treatment of both the thumb muscles and the muscles of the forearm are important.

The principal muscles of the thumb (abductor pollicis and opponens pollicis) comprise the **thenar eminence**, commonly called the ball of the thumb, the thick, muscular bundle of muscles at the base of the thumb just distal to the wrist.

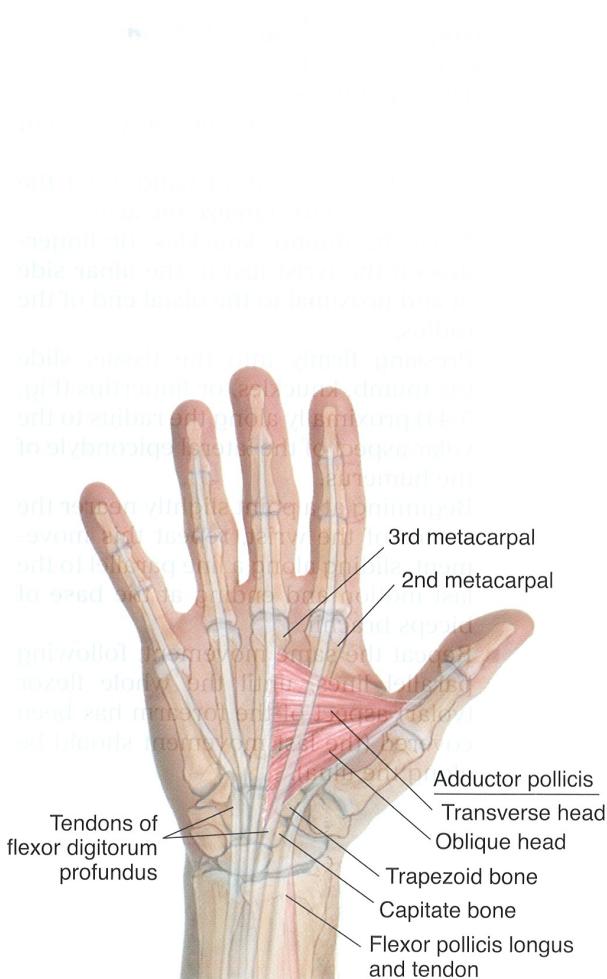


Figure 5-42 Anatomy of adductor pollicis

Adductor Pollicis (Fig. 5-42)

ad-DUCK-ter POL-ly-sis

Etymology Latin *adductor* (*ad*, to or toward + *ducere*, to lead), that which draws toward + *pollex*, thumb



Attachments

By two heads:

- The transverse head from the shaft of the third metacarpal
- The oblique head from the front of the base of the second metacarpal, the trapezoid and capitate bones
- Both heads to the ulnar side of base of proximal phalanx of thumb



Action

Adducts thumb at carpometacarpal joint



Referral Area

The base of the thumb on both the palmar and dorsal sides



Other Muscles to Examine

- Opponens pollicis
- Supinator
- Brachioradialis
- Brachialis
- Infraspinatus
- Subclavius
- Scalenus



Manual Therapy

See Manual Therapy for the Palmar Thumb Muscles, below

Flexor Pollicis Brevis (Fig. 5-43)

FLEX-er PAHL-isss-iss BREV-isss

Etymology Latin *flexor*, bender + *pollicis*, of the thumb + *brevis*, short



Attachments

- Proximally, superficial portion to the trapezium and the flexor retinaculum of the wrist, deep portion from ulnar side of first metacarpal bone
- Distally, to the base of the proximal phalanx of the thumb



Action

Flexes proximal phalanx of thumb



Referral Area

Not applicable



Other Muscles to Examine

Not applicable



Manual Therapy

See Manual Therapy for the Palmar Thumb Muscles, below.

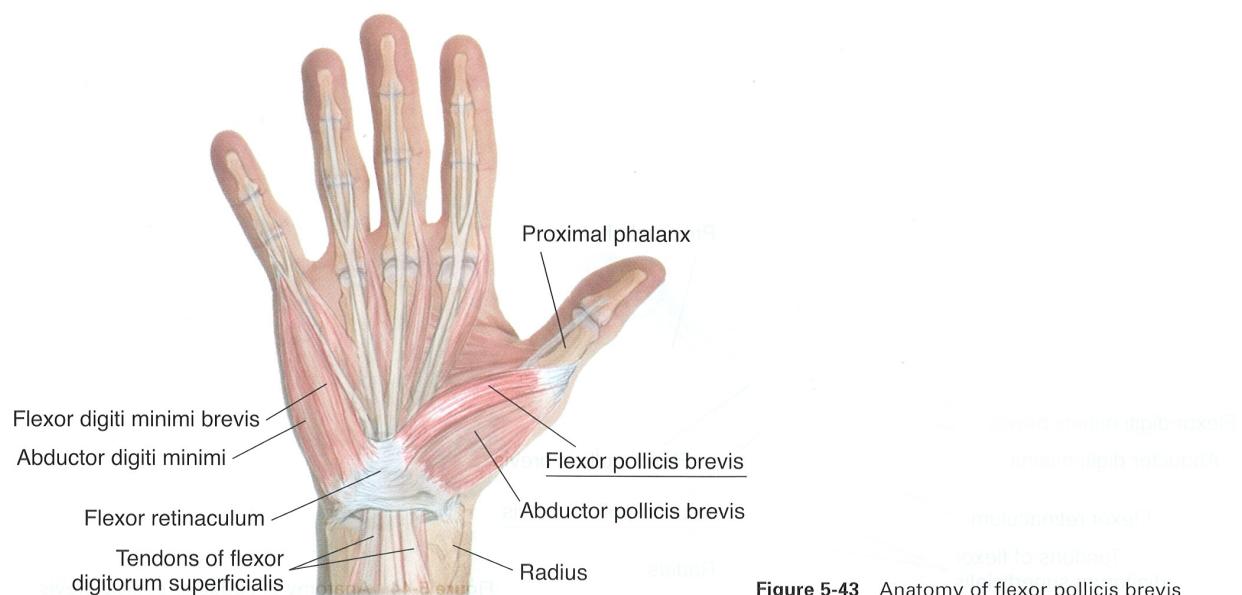


Figure 5-43 Anatomy of flexor pollicis brevis

Abductor Pollicis Brevis (Fig. 5-44)

ab-DUCK-ter POL-ly-sis BREV-iss

Etymology Latin *abductor* (*ab*, from + *ducere*, to lead), that which draws away from + *pollex*, thumb



Attachments

- Proximally, to the tubercle of the trapezium and flexor retinaculum
- Distally, to the base of the radial side of the proximal phalanx of the thumb



Action

Abducts thumb at the carpometacarpal joint



Referral Area

None



Other Muscles to Examine

Not applicable



Manual Therapy

None

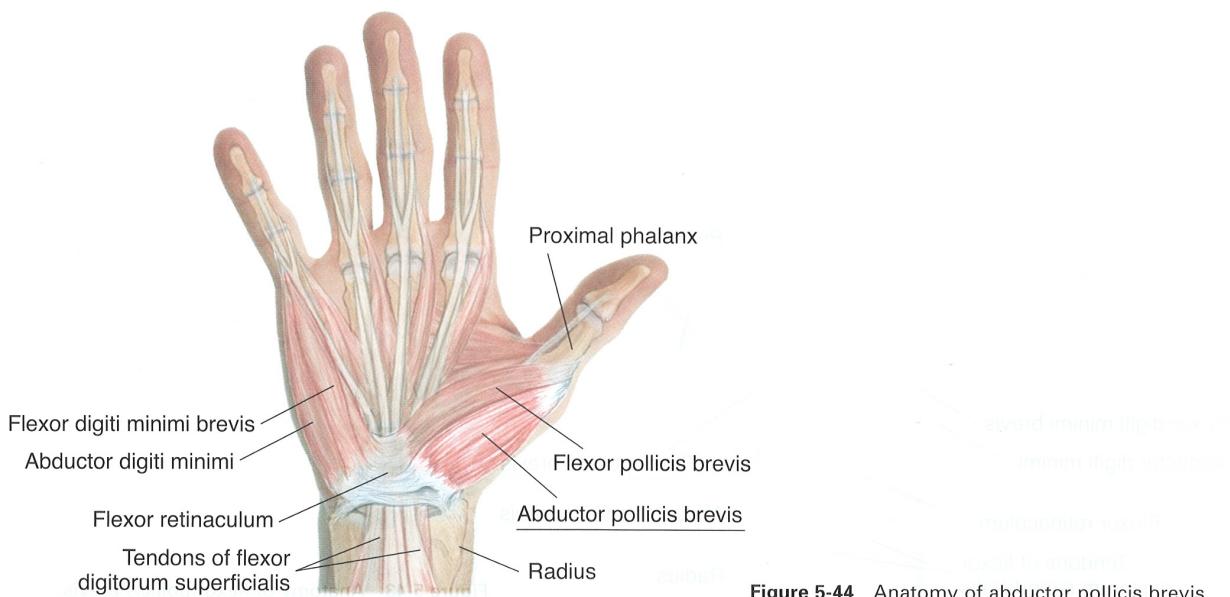


Figure 5-44 Anatomy of abductor pollicis brevis

Opponens Pollicis (Fig. 5-45)

op-POE-nens POL-ly-sis

Etymology Latin *opponere*, to place against, oppose

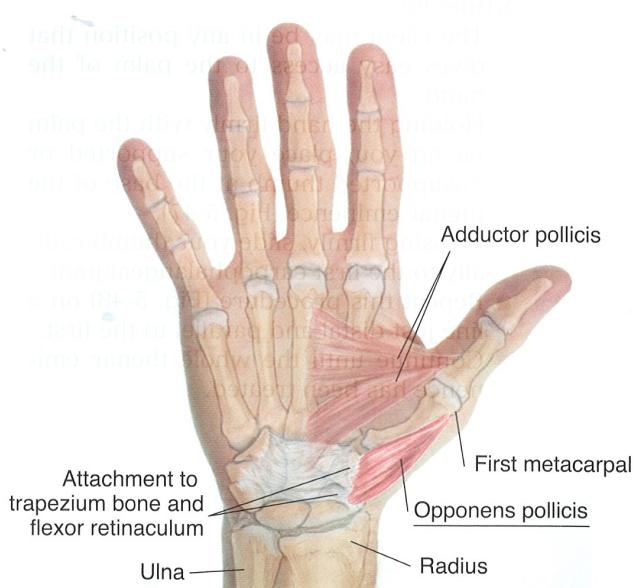


Figure 5-45 Anatomy of opponens pollicis



Attachments

- Proximally, to the ridge of the trapezium and flexor retinaculum
- Distally, to the radial side of the full length of the shaft of the first metacarpal bone



Action

Puts the thumb in opposition to the other fingers by drawing the base of the thumb toward the palm at the carpometacarpal joint



Referral Area

Lateral surface of thumb, wrist at the head of the radius



Other Muscles to Examine

- Adductor pollicis
- Infraspinatus
- Brachialis
- Subscapularis
- Subclavius
- Scalenes
- Serratus posterior superior



Figure 5-46 Compression of trigger point in opponens pollicis



Figure 5-47 Stripping massage of the thenar eminence beginning at opponens pollicis (with supported thumb)



Manual Therapy for the Palmar Thumb Muscles

TRIGGER POINT COMPRESSION

- Holding the client's hand with the palm up, use the other thumb to search for a trigger point on the thenar eminence near the base (Fig. 5-46).
- Compress with the thumb and hold for release.

STRIPPING

- The client may be in any position that gives easy access to the palm of the hand.
- Holding the hand firmly with the palm facing you, place your supported or unsupported thumb at the base of the thenar eminence (Fig. 5-47).
- Pressing firmly, slide your thumb radially to the first carpophalangeal joint.
- Repeat this procedure (Fig. 5-48) on a line just distal and parallel to the first.
- Continue until the whole thenar eminence has been treated.



Figure 5-48 Stripping massage of the muscles of the thenar eminence (with unsupported thumb)

Interosseous Muscles of the Hand

IN-ter-OSS-see-us

Etymology Latin *inter*, between + *os*, bone

Overview

The palmar interosseous muscles adduct the fingers toward the midline, the dorsal interosseous muscles abduct the fingers from the midline.

Attachments

Dorsal interosseous muscles (four) (Fig. 5-49):

- Proximally, to the sides of adjacent metacarpal bones
- Distally, to the base of the proximal phalanges and extensor expansion, first on radial side of second digit, second on radial side of third digit, third on ulnar side of third digit, fourth on ulnar side of fourth digit

Palmar interosseous muscles (three) (Fig. 5-50):

- Proximally, to the palmar surface of second, fourth, and fifth metacarpal bones
- Distally, the first palmar interosseous muscle into the base of the ulnar side of the second digit, the second and third palmar interosseous muscles into radial sides of fourth and fifth digits.



Action

Dorsal: abduct second and third digits from the axis of the third digit and adduct third and fourth digits

Palmar: adduct second, fourth, and fifth digits toward axis of the third digit



Referral Area

Edges of corresponding fingers

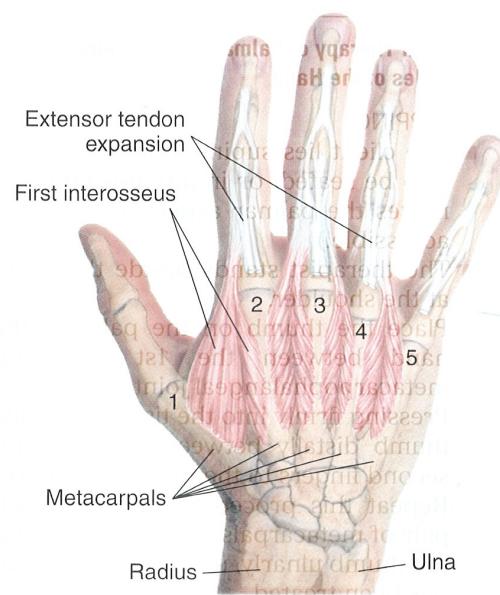


Figure 5-49 Anatomy of the dorsal interosseous muscles

Other Muscles to Examine

- Infraspinatus
- Scalenus
- Subclavius
- Pectoralis major
- Pectoralis minor
- Coracobrachialis
- Serratus anterior



Figure 5-50 Anatomy of the palmar interosseous muscles



Manual Therapy of Palmar Interosseous Muscles of the Hand

STRIPPING

- The client lies supine. (The client may also be seated, or in any position that makes the palmar aspect of the hand accessible.)
- The therapist stands beside the client at the shoulder.
- Place the thumb on the palm of the hand between the 1st and 2nd metacarpophalangeal joints.
- Pressing firmly into the tissue, slide the thumb distally between the first and second fingers to the thenar eminence.
- Repeat this procedure between each pair of metacarpals (Fig. 5-51), shifting the thumb ulnarily, until the entire hand has been treated.

Figure 5-51 Stripping massage of palmar interosseous muscles between 2nd and 3rd metacarpals.



Manual Therapy of Dorsal Interosseous Muscles of the Hand

STRIPPING

- The client lies supine. (The client may also be seated, or in any position that allows access to the dorsal aspect of the hand.)
- The therapist stands beside the client at the hips.
- Hold and stabilize the client's hand with your non-treating hand.
- Place the thumb on the dorsal aspect of the hand between the 1st and 2nd metacarpals (i.e., between the thumb and forefinger) just next to the metacarpophalangeal joint.
- Pressing firmly into the tissue, slide the thumb proximally between the thumb and forefinger (Fig. 5-52) to the end of the tissue.
- Repeat this procedure between each pair of metacarpals until the entire hand has been treated (Fig. 5-53).

Figure 5-52 Stripping massage of dorsal interosseous muscles between 1st and 2nd metacarpals.

Figure 5-51 Stripping massage of palmar interosseous muscles between 2nd and 3rd metacarpals.

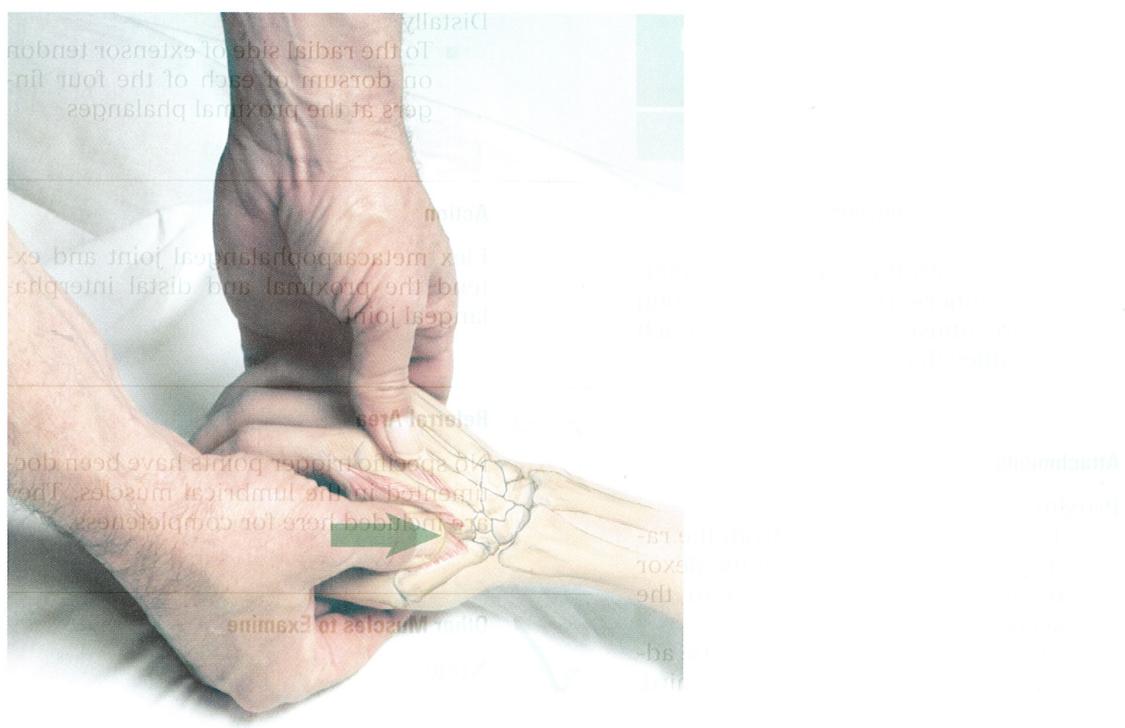


Figure 5-52 Stripping massage of first dorsal interosseous muscle



Figure 5-53 Stripping massage of dorsal interosseous muscles

Lumbrical Muscles of the Hand (Fig. 5-54)

LUM-bri-cal

Etymology Latin *lumbricus*, earthworm

The lumbricals work with the interossei in refining actions of the fingers, particularly in strong grasping. They are unusual in that they attach only to tendons, rather than bones.

Attachments

Proximally

- The two lateral (radial): from the radial side of the tendons of the flexor digitorum profundus going to the second and third digits
- The two medial (ulnar): from the adjacent sides of the second and third, and third and fourth tendons

From the palmar side of the second through fifth metacarpals. Solid arrows indicate the direction of pull; dashed arrows indicate the direction of the tendon.

Distally

- To the radial side of extensor tendon on dorsum of each of the four fingers at the proximal phalanges

Action

Flex metacarpophalangeal joint and extend the proximal and distal interphalangeal joint.

Referral Area

No specific trigger points have been documented in the lumbrical muscles. They are included here for completeness.

Other Muscles to Examine

None

Manual Therapy

These muscles are treated with the interossei, above.

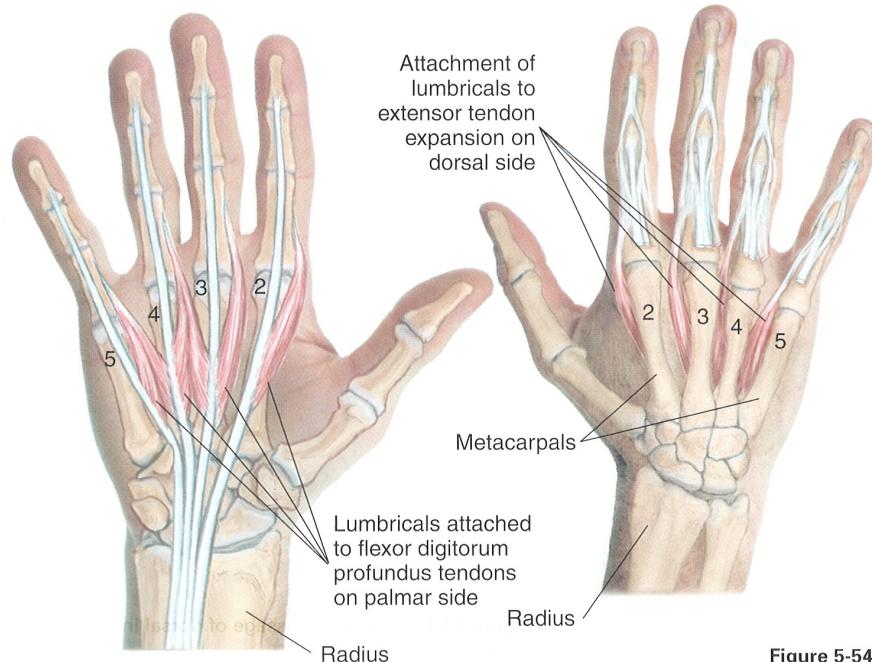


Figure 5-54 Anatomy of lumbricals

Flexor Digiti Minimi Brevis (Fig. 5-55)

FLEX-er DJJ-it-tea MIN-im-me
BREV-is

Etymology Latin *flexor*, flexor + *digiti*, of the finger + *minimi*, smallest + *brevis*, short

Small form to assist in pronouncing name



Attachments

- Proximally, to the hamulus of the hamate bone
- Distally, to the ulnar side of the proximal 5th phalanx



Action

Flexes the proximal phalanx of the fifth digit



Referral Area

No trigger points have been documented for this muscle.



Other Muscles to Examine

None



Manual Therapy

Not applicable

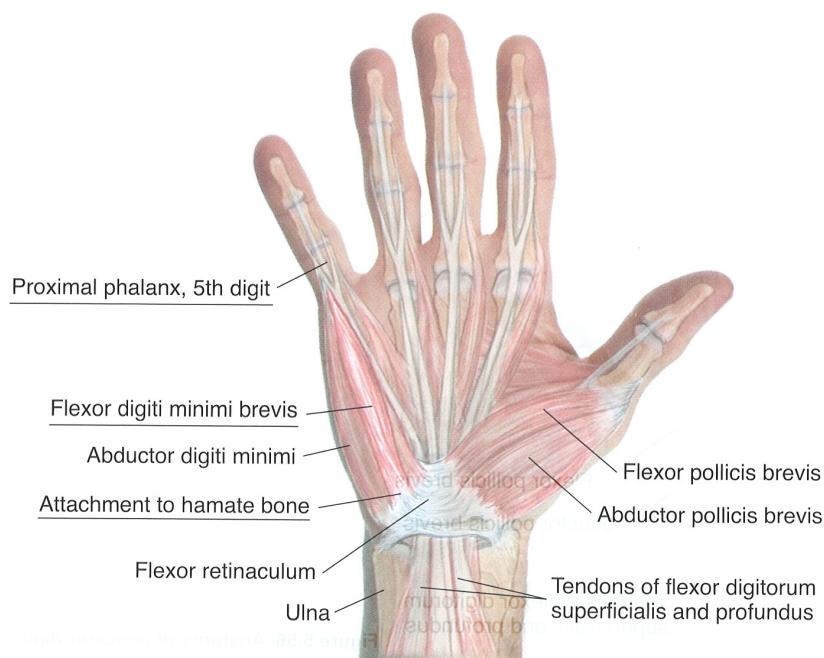


Figure 5-55 Anatomy of flexor digiti minimi brevis

Abductor Digiti Minimi noitoA

ab-DUCK-ter DIJ-it-tea MIN-im-me

Etymology Latin *abductor* (*ab*, away from + *ducere*, to lead), that which draws away + *digiti*, of the finger + *minimi*, smallest

Latin *abducere* = to draw away

Overview

If there were a sixth digit, abductor digiti minimi (Fig. 5.56) would be half of its dorsal interosseous muscle. It typically develops a trigger point at the center of the belly, palpable on the dorsal side.

Illustration by Michael H. Kinsman, © 2009 Lippincott Williams & Wilkins

Attachments

- Proximally, to the pisiform bone and pisohamate ligament
- Distally, to the ulnar side of the base of the proximal 5th phalanx

Action

Abducts proximal phalanx of and flexes the fifth digit

Referral Area

Lateral and dorsal aspects of the little finger

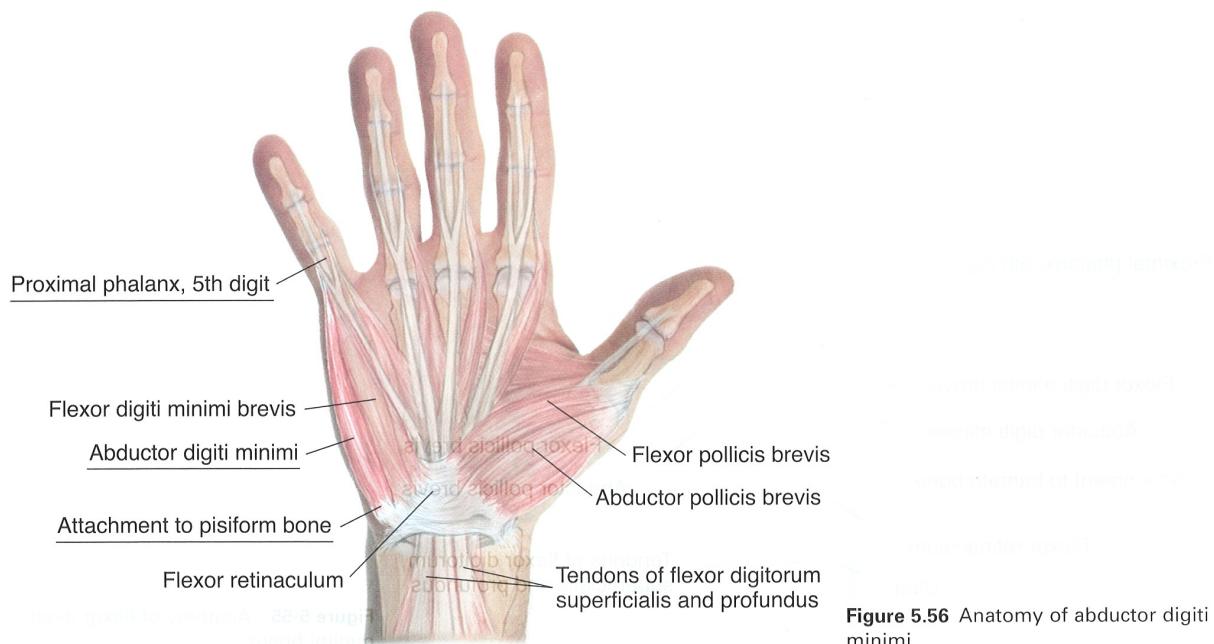


Figure 5.56 Anatomy of abductor digiti minimi



Other Muscles to Examine

- Pectoralis minor
- Serratus posterior superior
- Latissimus dorsi
- Triceps brachii
- Flexor digitorum



Manual Therapy

Pincer Compression

- The client is in any position that allows access to the ulnar edge of the hand.
- With the non-treating hand, hold and stabilize the client's hand.
- Using the thumb and index finger, explore the dorsal aspect of abductor digiti minimi looking for tender spots (Fig. 5-57).
- Hold for release.



Figure 5-57 Pincer compression of trigger point in abductor digiti minimi