Chapter 7
The Wrist and Hand Joints

Manual of Structural Kinesiology

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The Wrist & Hand Joints

- Many sports require precise functioning of wrist & hand
- Archery, bowling, golf, baseball, tennis, etc. require combined use of wrist & hand joints
- Relate functional anatomy to joint actions

– flexion, extension, abduction, & adduction of wrist & hand

– 29 bones

– More than 25 joints

– More than 30 muscles

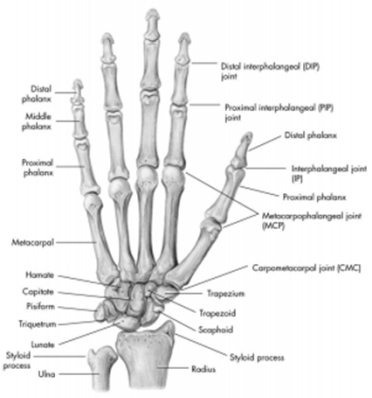
- 18 are intrinsic

Bones

- 29 bones, including radius & ulna
– 8 carpal bones in 2 rows of 4 bones form wrist
– 5 metacarpal bones, numbered 1 to 5 from thumb to little finger, join the wrist bones
– 14 phalanges (digits), 3 for each phalange except the thumb, which has only 2
• Proximal, middle, & distal
– Thumb has a sesamoid bone in its flexor tendon
– Other sesamoids may occur in joints of fingers

Bones

- Eight carpal bones
- Proximal row from radial to ulnar side
– scaphoid (boat-shaped) or navicular
– lunate (moon-shaped)
– triquetrum (three-cornered)
– pisiform (pea-shaped)



Bones

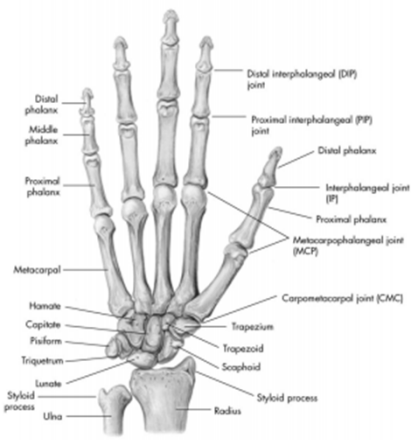
- Eight carpal bones
- Distal row, from the radial to ulnar side

– trapezium (greater multangular)

– trapezoid (lesser multangular)

– capitate (head-shaped)

– hamate (hooked)



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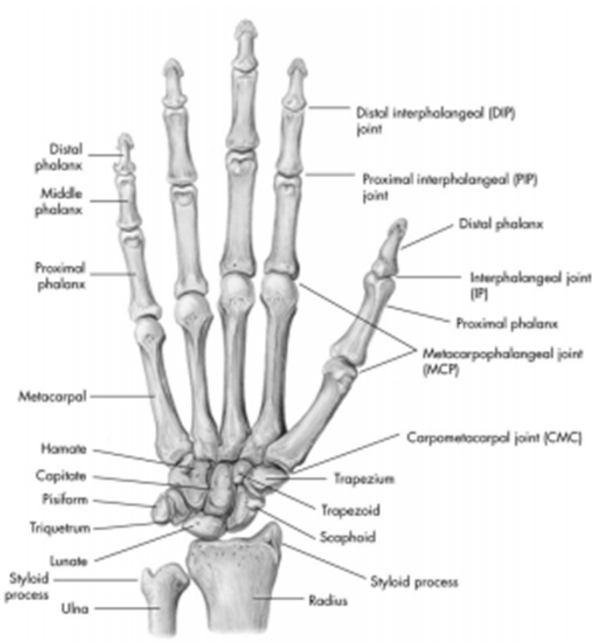
Bones



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Bones

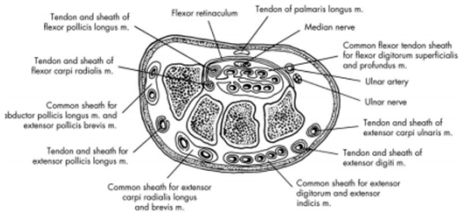
- Carpal bones form a three-sided arch

– concave on palmar side

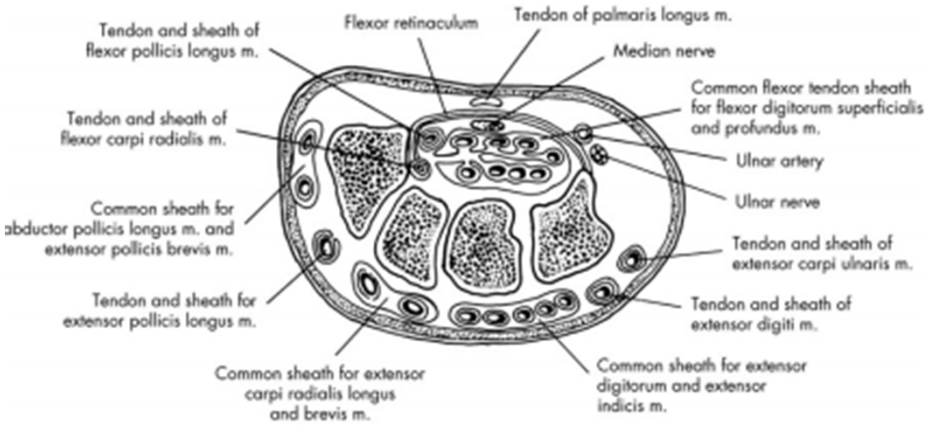
– bony arch is spanned by transverse carpal & volar carpal ligaments

– creates the carpal tunnel

– frequently a source of problems known as carpal tunnel syndrome

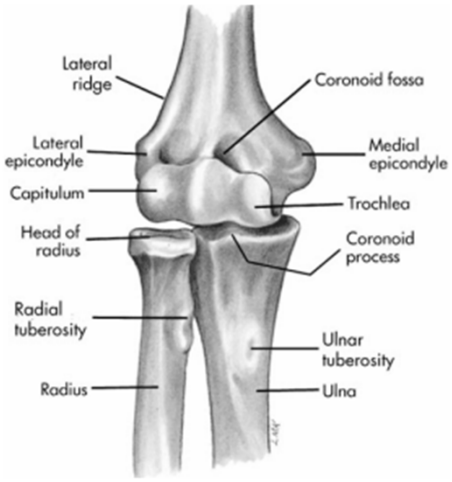


Bones



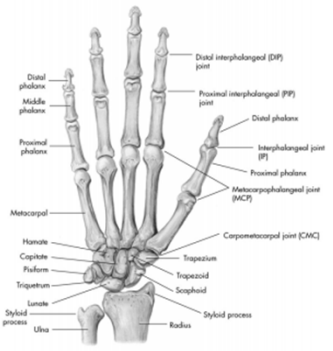
Bones

- Medial epicondyle, medial condyloid ridge, & coranoid process -origin for many wrist & finger flexors
- Lateral epicondyle & lateral supracondylar ridge - origin for many wrist & finger extensors

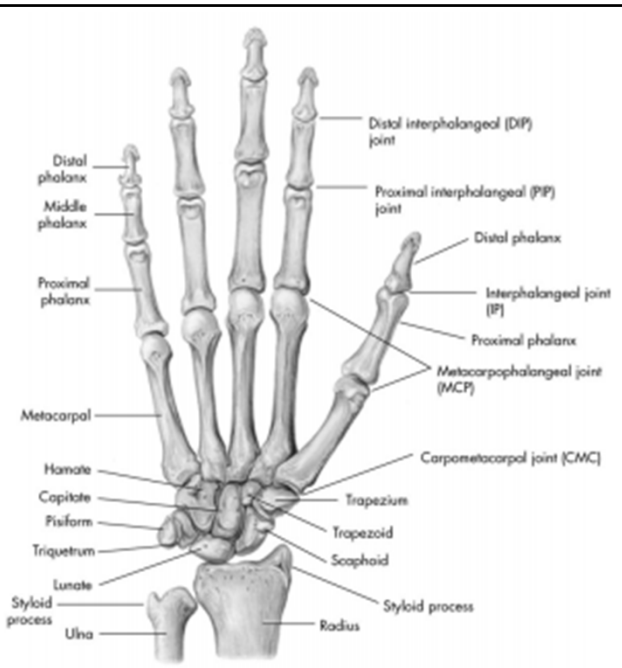


Bones

- Key distal bony landmarks for muscles involved in wrist motion
  - base of 2nd, 3rd, & 5th metacarpals, pisiform, & hamate
- Key bony landmarks for finger muscles
  - base of proximal, middle, & distal phalanxes
  - base of 1st metacarpal, proximal & distal phalanxes of thumb



Bones



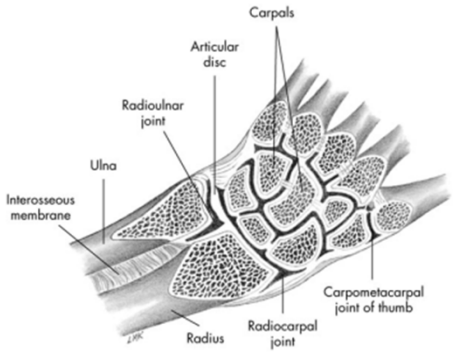
Joints

- Wrist joint

– condyloid-type joint

– allows flexion, extension, abduction, & adduction

– motion occurs primarily between distal radius & proximal carpal row (scaphoid, lunate, & triquetrum)



Joints

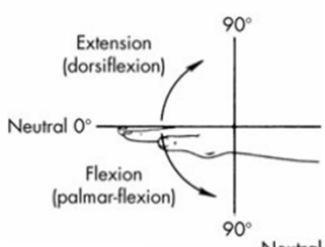
- Wrist joint

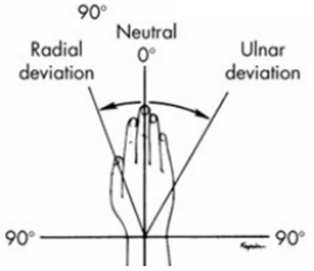
– 70 to 90 degrees of flexion

– 65 to 85 degrees of extension

– 15 to 25 degrees of abduction

– 25 to 40 degrees of adduction





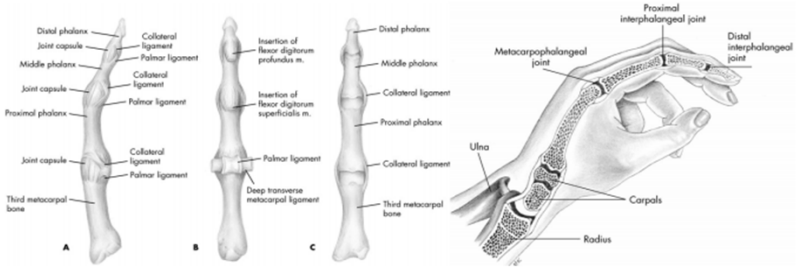
Joints

- Each finger has 3 joints

– Metacarpophalangeal (MCP) joints

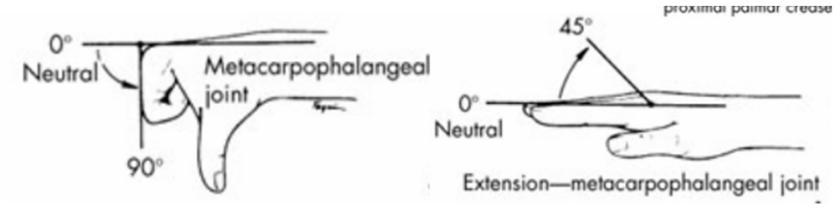
– Proximal interphalangeal (PIP) joints

– Distal interphalangeal (DIP) joints



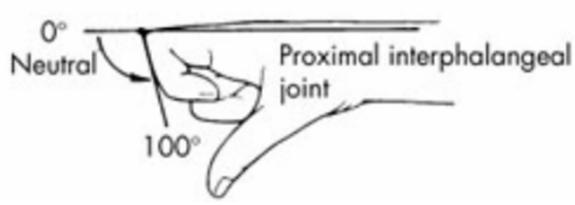
Joints

- Each finger has 3 joints
– Metacarpophalangeal (MCP) joints
- Condyloid
- 0 to 40 degrees of extension
- 85 to 100 degrees of flexion



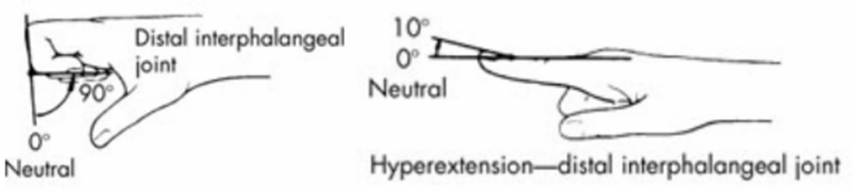
Joints

- Each finger has 3 joints
– Proximal interphalangeal (PIP) joints
- Ginglymus
- Full extension to 90 to 120 degrees of flexion



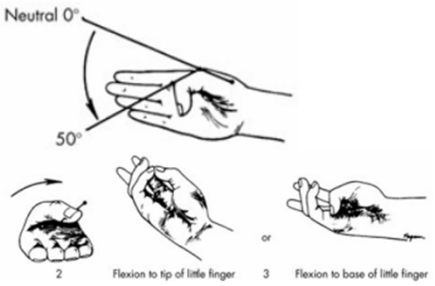
Joints

- Each finger has 3 joints
– Distal interphalangeal (DIP) joints
- Ginglymus
- Flex 80 to 90 degrees from full extension



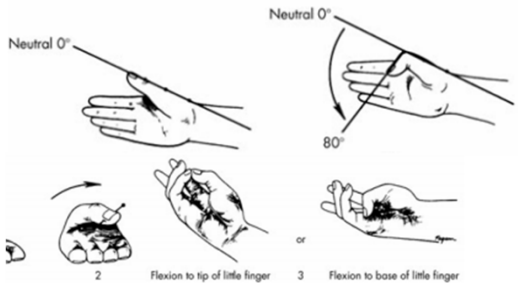
Joints

- Thumb has 2 joints
– Metacarpophalangeal (MCP) joint
- Full extension into 40 to 90 degrees of flexion
- Ginglymus



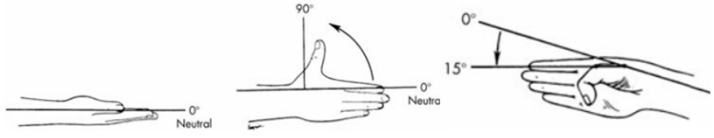
Joints

- Thumb has 2 joints
– Interphalangeal (IP) joint
- Flex 80 to 90 degrees
- Ginglymus



Joints

- Thumb has 2 joints
– Carpometacarpal (CMC) joint of thumb
- Unique saddle-type joint
- 50 to 70 degrees of abduction
- Flex 15 to 45 degrees & extend 0 to 20 degrees

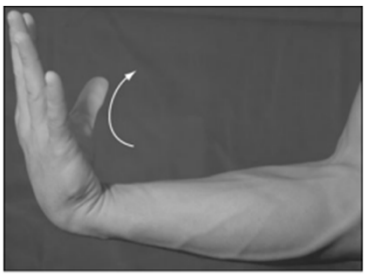


Movements

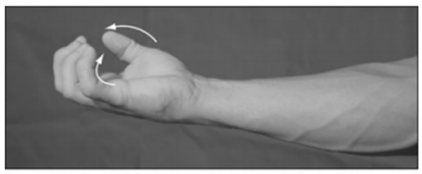
- Wrist
– Flexion & extension
– Abduction & adduction
- Fingers
– Flex & extend
– MCP joints also abduct & adduct

Movements

- Flexion
– movement of palm of hand and/or phalanges toward anterior or volar aspect of forearm



Wrist flexion

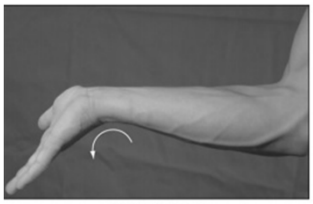


Flexion of fingers and thumb, opposition

Movements

- Extension

– movement of back of hand and/or phalanges toward posterior or dorsal aspect of forearm



Wrist extension

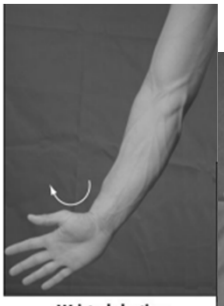
Extension of fingers and thumb, reposition

Movements

- Abduction (radial flexion)

– movement of thumb side of hand toward lateral aspect or radial side of forearm

– Also, movement of fingers away from middle finger



Wrist abduction (radial deviation)

Abduction of metacarpophalangeal joints

Movements

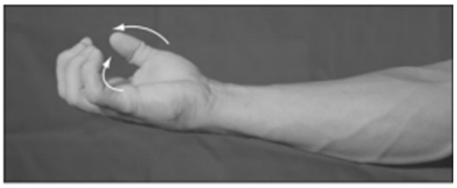
- Adduction (ulnar flexion)
– movement of little finger side of hand toward medial aspect or ulnar side of forearm
– Also, movement of fingers toward middle finger

Wrist adduction (ulnar deviation)

Adduction of metacarpophalangeal joints

Movements

- Opposition
– movement of thumb across palmar aspect to oppose any or all of the phalanges
- Reposition
– movement of thumb as it returns to anatomical position from opposition with hand and/or fingers



Flexion of fingers and thumb, opposition

Extension of fingers and thumb, reposition

Muscles

- Extrinsic muscles of wrist & hand grouped according to function & location
- 6 muscles move wrist but not fingers & thumb
  - 3 wrist flexors
    - flexor carpi radialis
    - flexor carpi ulnaris
    - palmaris longus
  - 3 wrist extensors
    - extensor carpi radialis longus
    - extensor carpi radialis brevis
    - extensor carpi ulnaris

Muscles

- 9 muscles primary movers of phalanges
  - Also involved in wrist joint actions
  - Generally weaker in their wrist actions
  - Flexors
    - Flexor digitorum superficialis
    - Flexor digitorum profundus
    - Flexor pollicis longus (thumb flexor)

Muscles

- Extensors
- Extensor digitorum
- Extensor indicis
- Extensor digiti minimi
- Extensor pollicis longus (thumb extensor)
- Extensor pollicis brevis (thumb extensor)
  - Abductor of thumb & wrist
  - Abductor pollicis longus

Muscles

- All wrist flexors generally have their origins on anteromedial aspect of proximal forearm and medial epicondyle of humerus with insertions on anterior aspect of wrist & hand
- Median nerve & all flexor tendons except flexor carpi ulnaris & palmaris longus pass through carpal tunnel
- Swelling & inflammation can cause increased pressure in carpal tunnel resulting in decreased function of median nerve leading to reduced motor & sensation function in its distribution

Muscles

- Wrist extensors generally have their origins on posterolateral aspect of proximal forearm & lateral humeral epicondyle with insertions located on posterior aspect of wrist & hand
- Flexor & extensor tendons immediately proximal to wrist are held in place on palmar& dorsal aspects by transverse bands of tissue known as flexor & extensor retinaculum to prevent the tendons from bowstringing during flexion & extension

Muscles

- Wrist abductors

– Generally cross wrist joint anterolaterally & posterolaterally to insert on radial side of hand

- Flexor carpi radialis
- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Abductor pollicis longus
- Extensor pollicis longus
- Extensor pollicis brevis

Muscles

- Wrist adductors

– cross wrist joint anteromedially &

- posteromedially to insert on ulnar side of hand
- Flexor carpi ulnaris
- Extensor carpi ulnaris

Muscles

- Intrinsic hand muscles have origins & insertions on bones of hand

– Radial side - four muscles of thumb

- opponens pollicis
- abductor pollicis brevis
- flexor pollicis brevis
- adductor pollicis

– Ulnar side - three muscles of little finger

- opponens digiti minimi
- abductor digiti minimi
- flexor digiti minimi brevis

Muscles

- Intrinsic hand muscles

– Remainder of hand - 11 different muscles

- 4 lumbricals
- 3 palmar interossei
- 4 dorsal interossei

Muscles

- Anteromedially at elbow

& forearm and anterior at hand

– Primarily wrist flexion

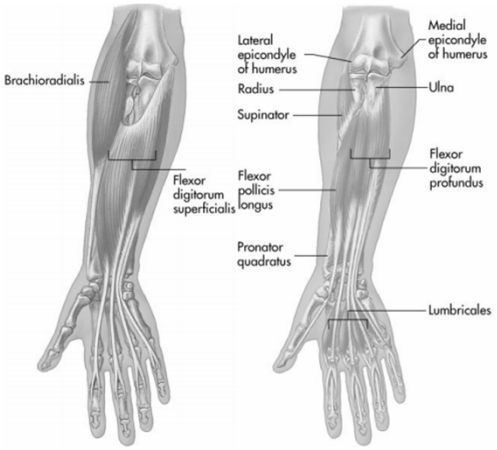
- Flexor carpi radialis
- Flexor carpi ulnaris
- Palmaris longus

Muscles

- Anteromedially at elbow & forearm and anterior at hand

– Primarily wrist & phalangeal flexion

- Flexor digitorum superficialis
- Flexor digitorum profundus
- Flexor pollicis longus

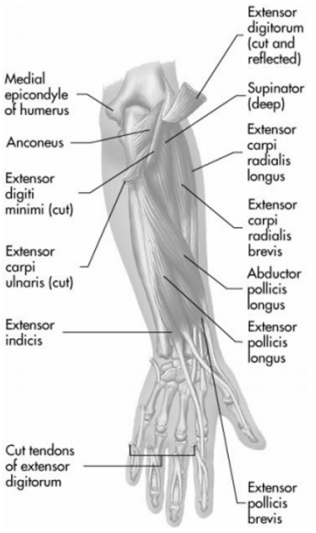


Muscles

- Posterolaterally at elbow & forearm and posterior at hand

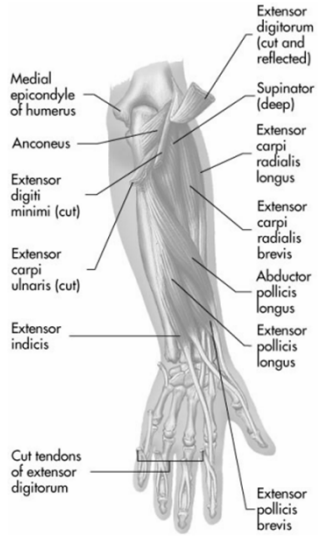
– Primarily wrist extension

- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Extensor carpi ulnaris



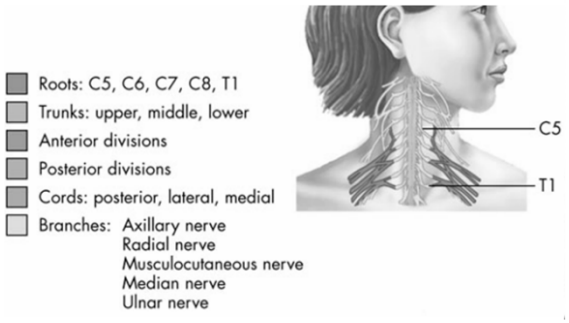
Muscles

- Primarily wrist & phalangeal extension
- Extensor digitorum
- Extensor indicis
- Extensor digiti minimi
- Extensor pollicis longus
- Extensor pollicis brevis
- Abductor pollicis longus



Nerves

- All wrist & hand muscles are innervated from the radial, median, & ulnar nerves of the brachial plexus



Nerves

- Radial nerve from C6, C7, & C8
  - Extensor carpi radialis brevis
  - Extensor carpi radialis longus
- Posterior interosseous nerve from radial nerve
  - Extensor carpi ulnaris
  - Extensor digitorum
  - Extensor digiti minimi
  - Abductor pollicis longus
  - Extensor pollicis longus
  - Extensor pollicis brevis
  - Extensor indicis

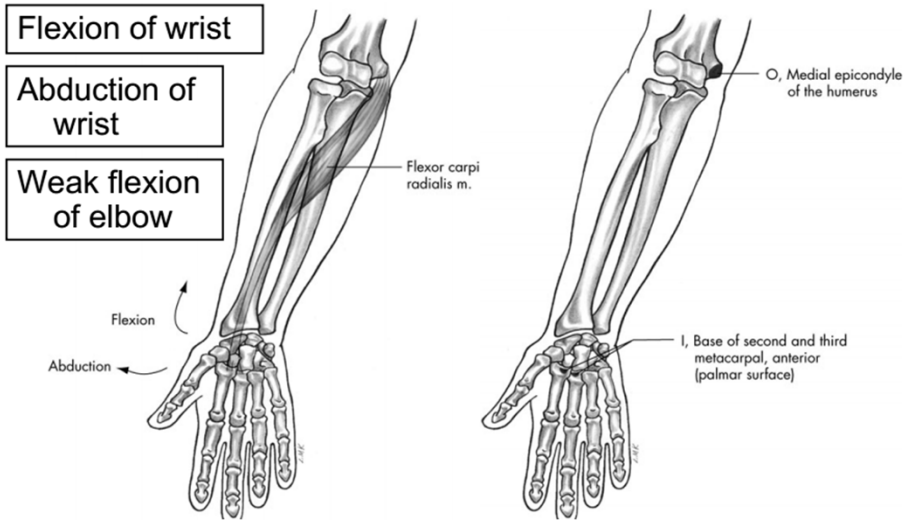
Nerves

- Median nerve - arising from C6, C7, C8, & T1
  - Flexor carpi radialis
  - Palmaris longus
  - Flexor digitorum superficialis
- Anterior interossseous nerve from median nerve
  - Flexor digitorum profundus for index & long finger
  - Flexor pollicis longus
  - Intrinsic muscles
- abductor pollicis brevis, flexor pollicis brevis
- (superficial head), opponens pollicis, and 1st & 2nd lumbrical

Nerves

- Ulnar nerve - branching from C8 & T1
  - Flexor digitorum profundus for 4th & 5th fingers
  - Flexor carpi ulnaris

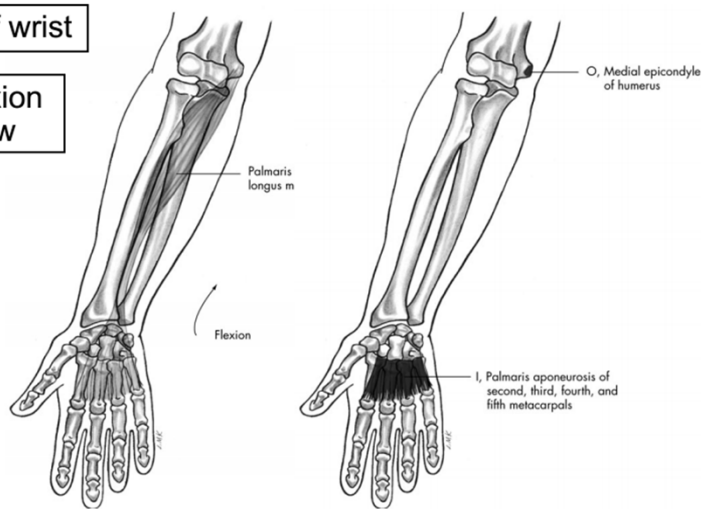
Flexor Carpi Radialis Muscle



Palmaris Longus Muscle

Flexion of wrist

Weak flexion of elbow



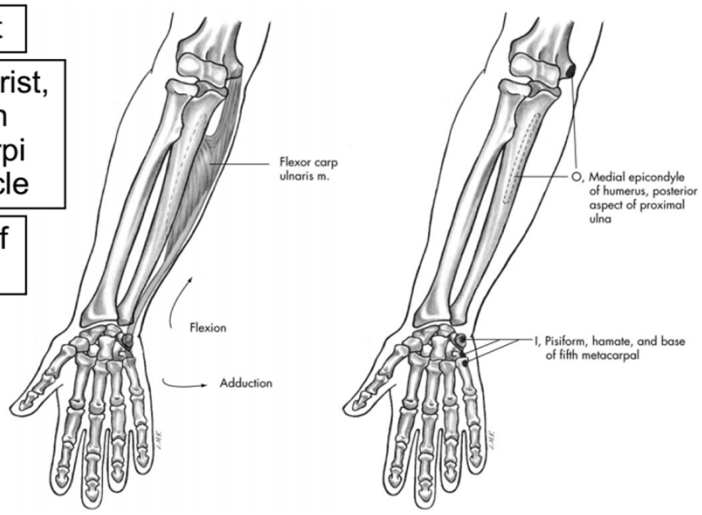
6-45

Flexor Carpi Ulnaris Muscle

Flexion of wrist

Adduction of wrist, together with extensor carpi ulnaris muscle

Weak flexion of elbow



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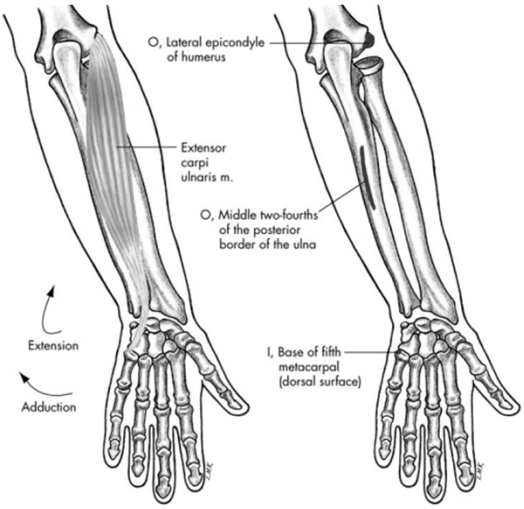
Extensor Carpi Ulnaris Muscle

Extension of wrist

Adduction of wrist together with flexor carpi ulnaris muscle

Weak extension of elbow



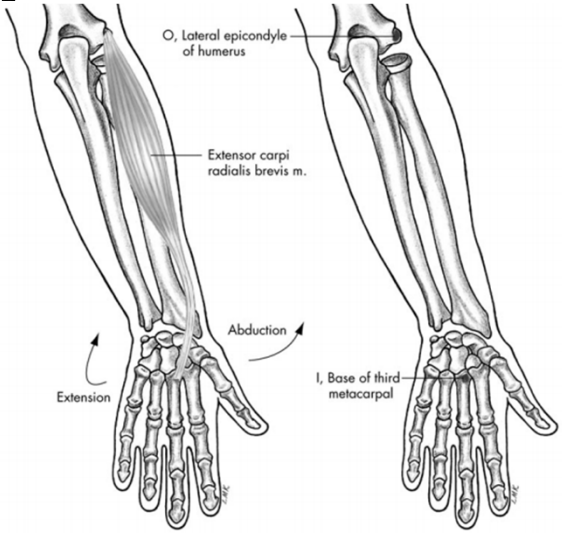
6-47

Extensor Carpi Radialis Brevis Muscle

Extension of wrist

Abduction of wrist

Weak extension of elbow



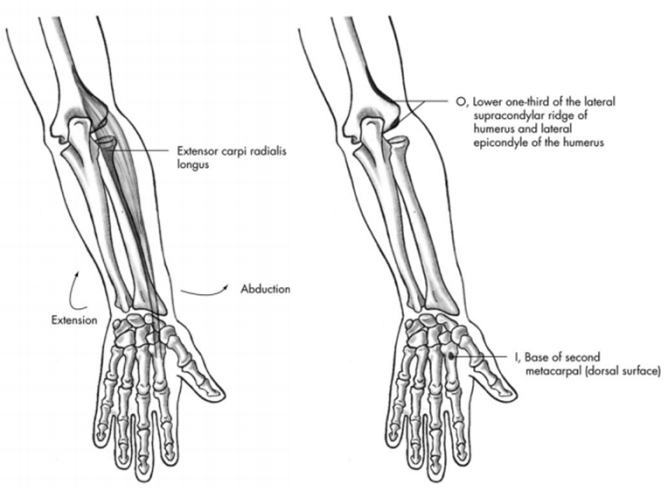
6-48

Extensor Carpi Radialis Longus Muscle

Extension of wrist

Abduction of wrist

Weak extension of elbow



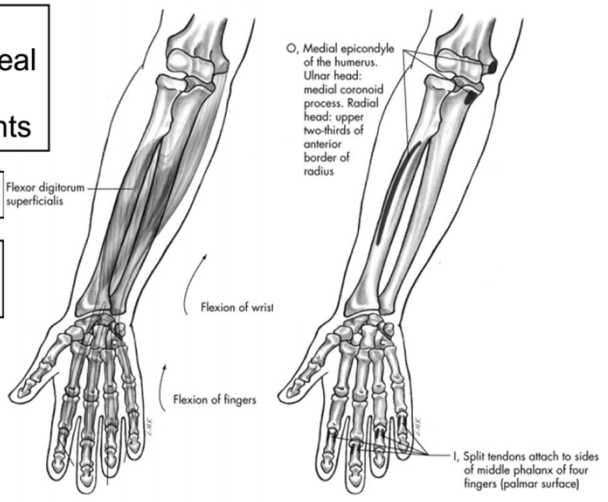
6-49

Flexor Digitorum Superficialis Muscle

Flexion of fingers at metacarpophalangeal & proximal interphalangeal joints

Flexion of wrist

Weak flexion of elbow

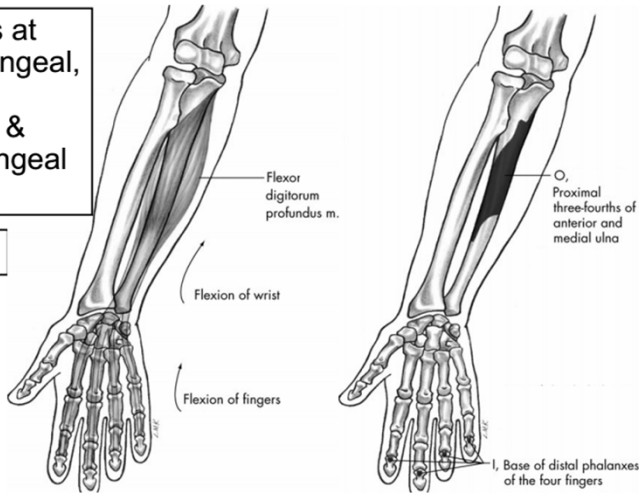


6-50

Flexor Digitorum Profundus Muscle

Flexion of 4 fingers at metacarpophalangeal, proximal interphalangeal, & distal interphalangeal joints

Flexion of wrist

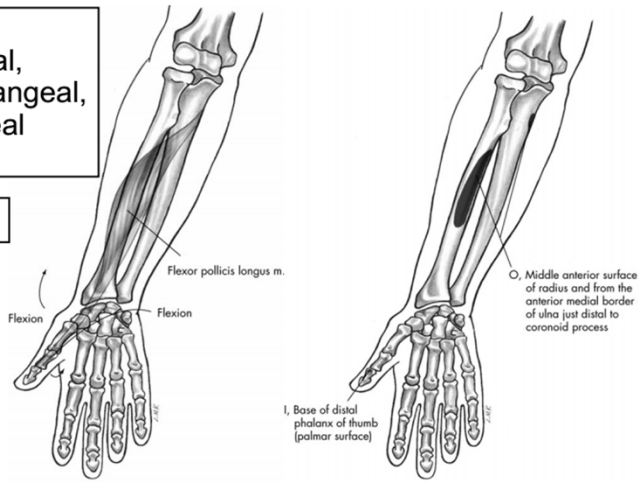


6-51

Flexor Pollicis Longus Muscle

Flexion of thumb carpometacarpal, metacarpophalangeal, & interphalangeal joints

Flexion of wrist



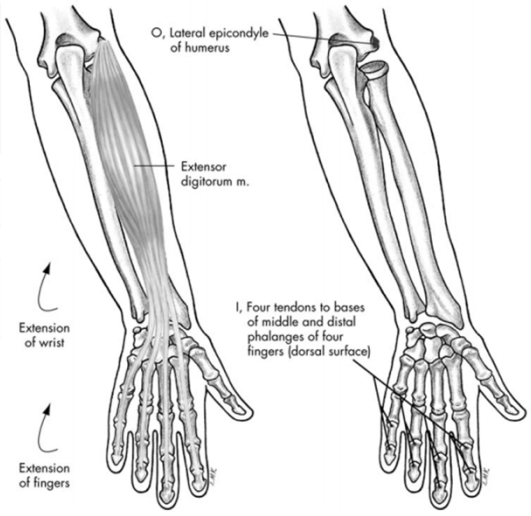
6-52

Extensor Digitorum Muscle

Extension of 2nd, 3rd, 4th, & 5th phalanges at metacarpophalangeal joints

Extension of wrist

Weak extension of elbow

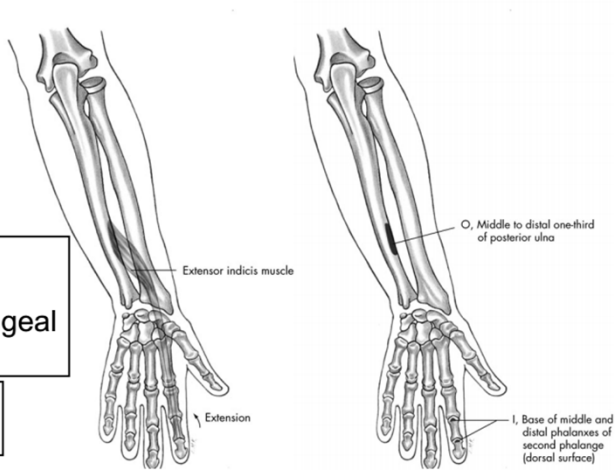


6-53

Extensor Indicis Muscle

Extension of index finger at metacarpophalangeal joint

Weak wrist extension

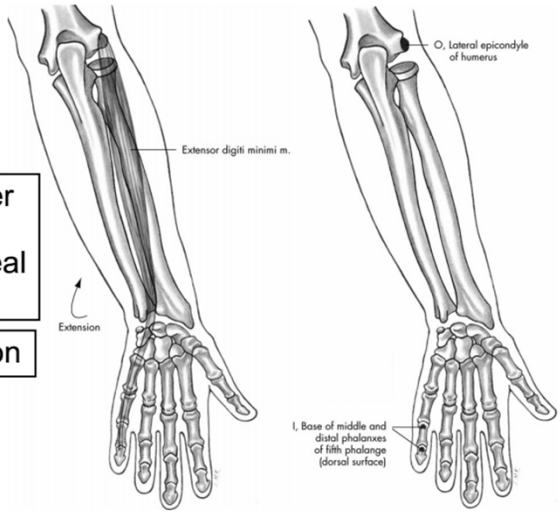


6-54

Extensor Digiti Minimi Muscle

Extension of little finger at metacarpophalangeal joint

Weak wrist extension



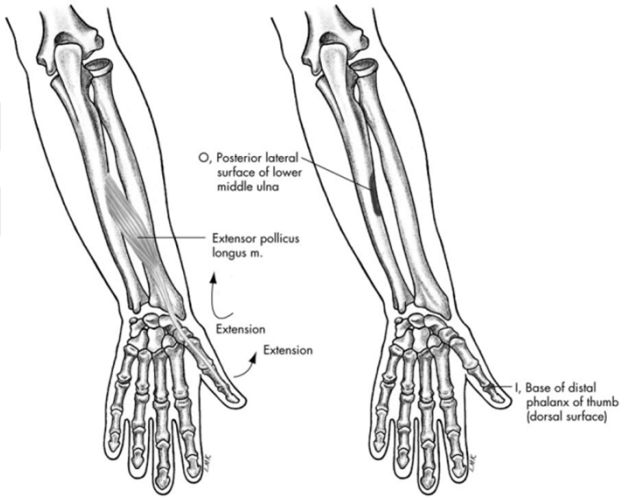
Manual of

6-55

Extensor Pollicis Longus Muscle

Extension of wrist

Extension of thumb

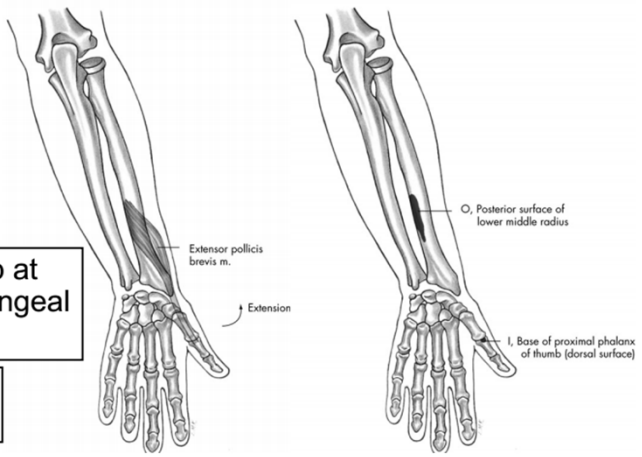


6-56

Extensor Pollicis Brevis Muscle

Extension of thumb at metacarpophalangeal joint

Weak wrist extension

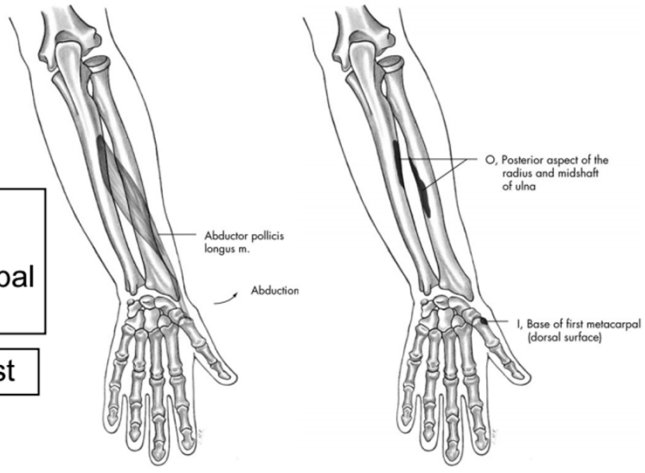


6-57

Abductor Pollicis Longus Muscle

Abduction of thumb at carpometacarpal joint

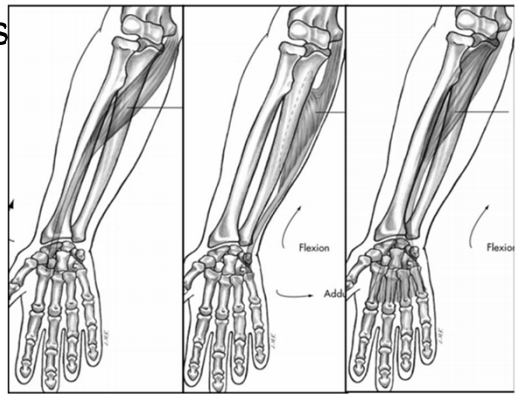
Abduction of wrist



6-58

Wrist Flexion

- Agonists
  - –Flexor carpi radialis
  - –Flexor carpi ulnaris
  - –Palmaris longus
  - – Flexor digitorum superficialis
  - – Flexor digitorum profundus
  - – Flexor pollicis longus



Wrist Extension

- Agonists
  - – Extensor carpi radialis longus
  - – Extensor carpi radialis brevis
  - – Extensor carpi ulnaris
  - – Extensor digitorum
  - – Extensor indicis
  - – Extensor digiti minimi
  - – Extensor pollicis longus
  - – Extensor pollicis brevis

Wrist Abduction

- Agonists
  - –Flexor carpi radialis
  - –Extensor carpi radialis longus
  - –Extensor carpi radialis brevis
  - – Abductor pollicis longus
  - – Extensor pollicis longus
  - – Extensor pollicis brevis

Wrist Adduction

- Agonists
- Flexor carpi ulnaris
- Extensor carpi ulnaris