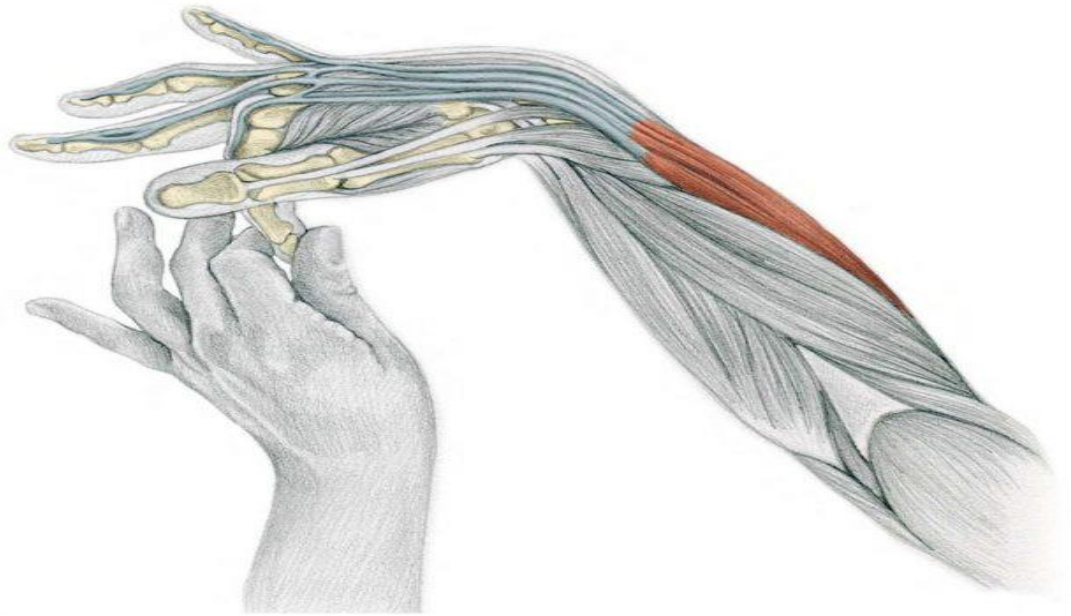
Department of Human Anatomy **College of Medicine**



Human Anatomy Practical Lectures(Upper limb) (Part 3)

BY

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For

First stage students in college of medicine

Surface Anatomy of the Hand Joint

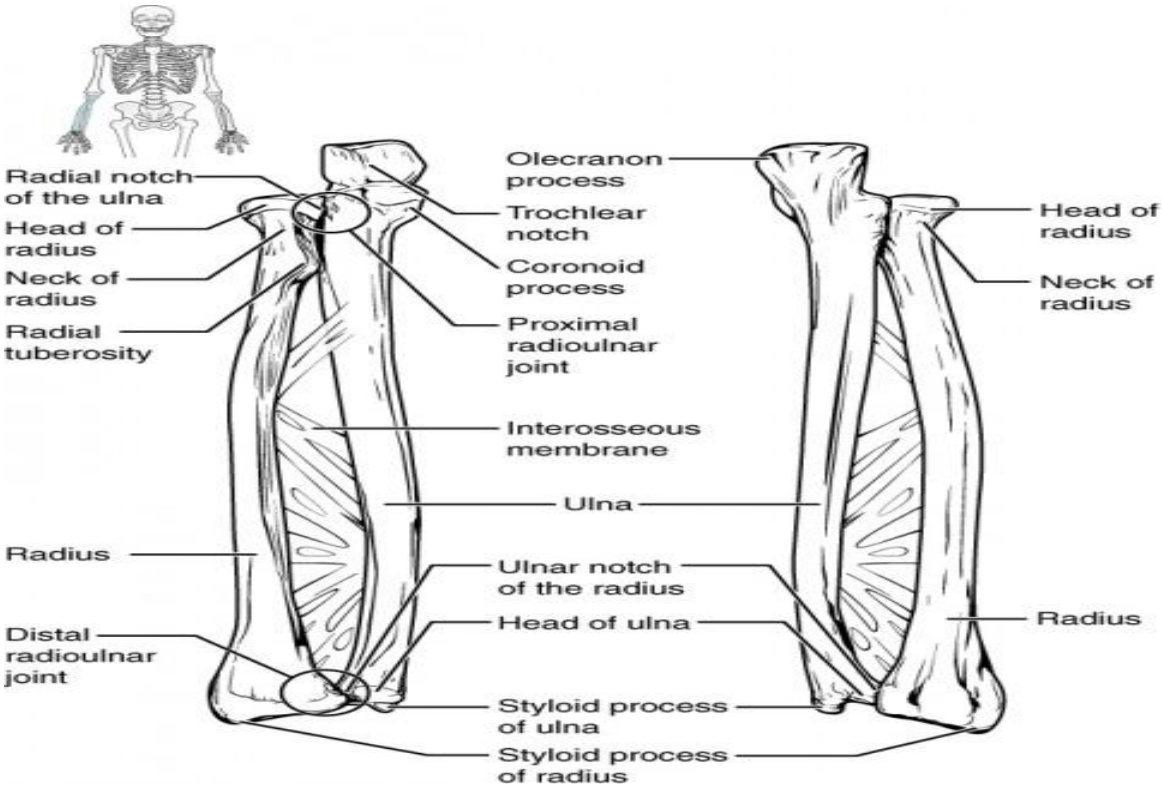
The hand joint is an extraordinarily mobile joint and moves along a horizontal and sagittal axis. The horizontal axis runs parallel to the slope of the radius and the caput ossis capitatum.

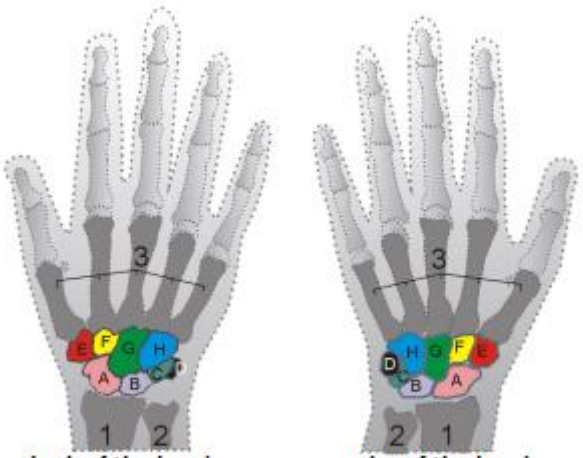
The average movements of the hand joint include:

- 80° of dorsal extension
- 80° of palmar flexion
- 20° of radial abduction
- 35° of ulnar abduction

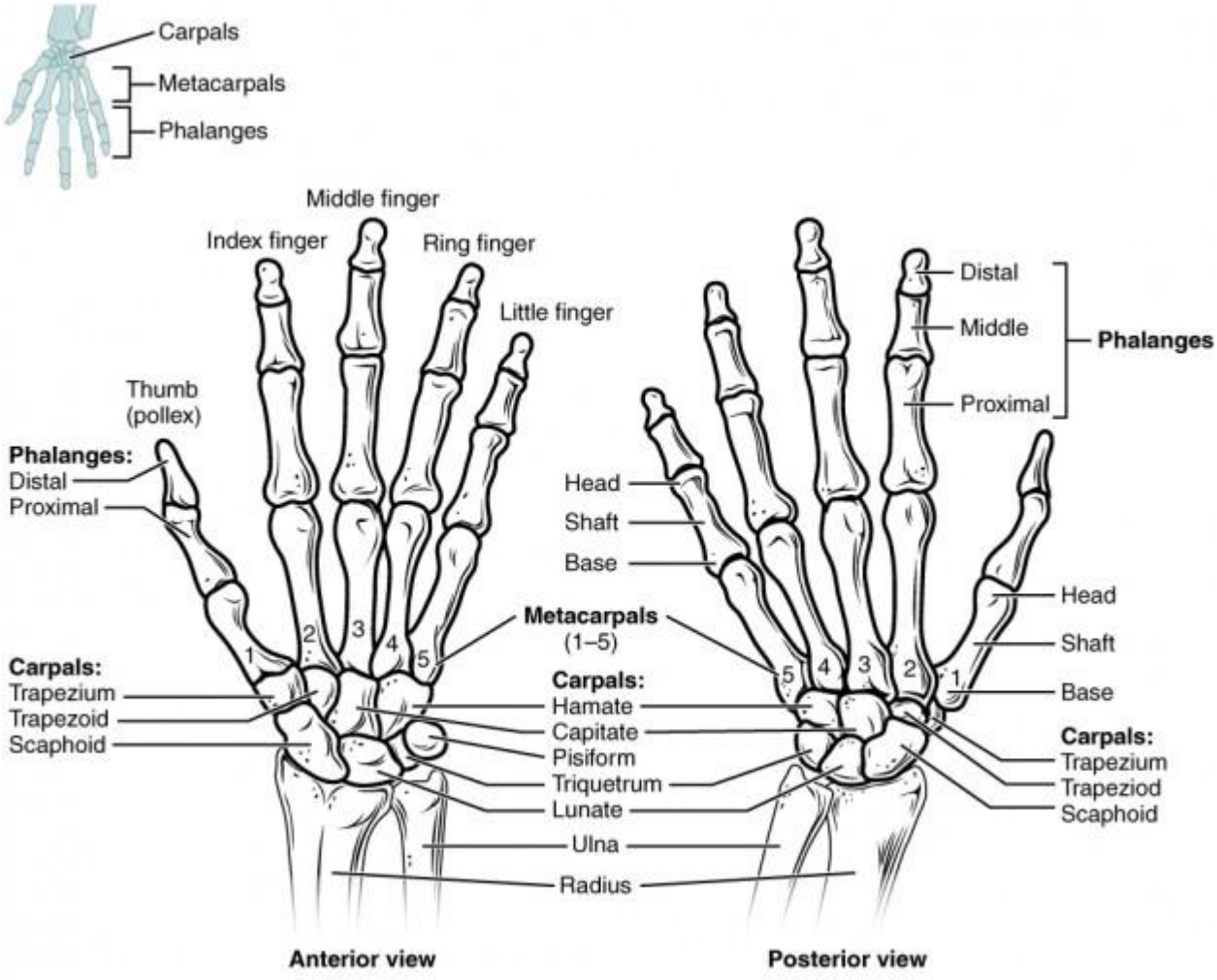
Articulation Radiocarpalis

The **radius** and the **discus ulnocarpalis** articulate with the proximal carpal Aseries and form the **art. radiocarpalis**, the proximal hand joint, which is an ellipsoidal joint.

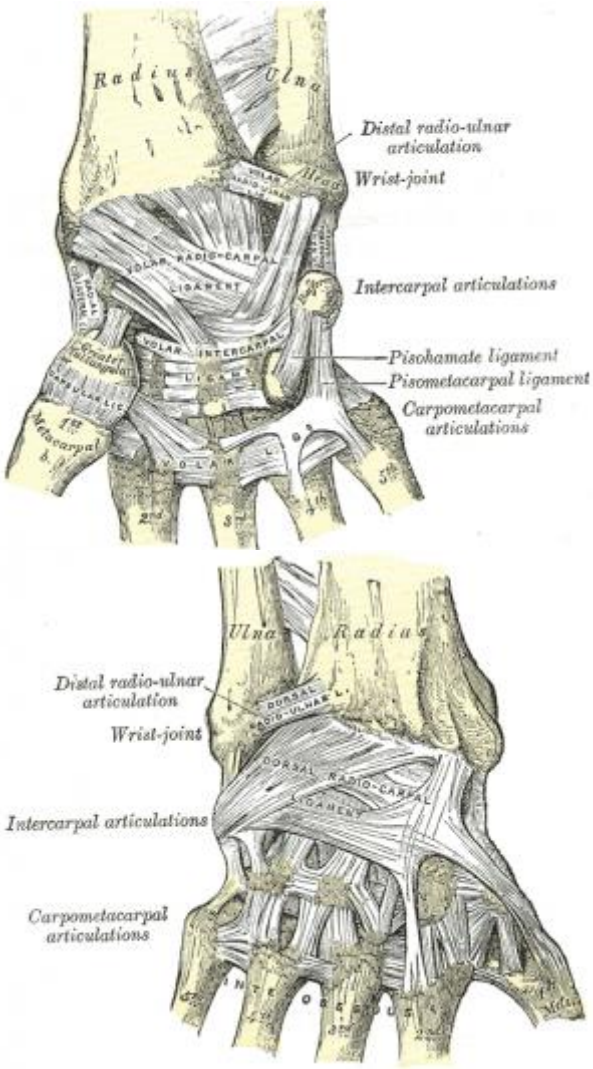




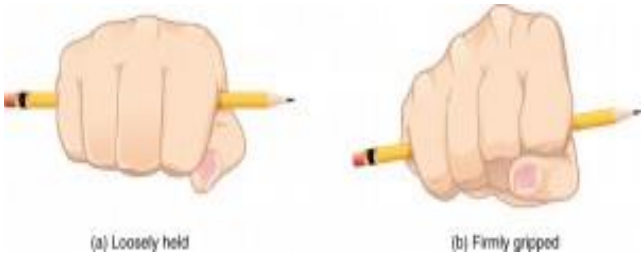
Articulation Mediocarpalis



Ligament Structures of the Hand Joint



Functional Anatomy of the Hand Joint



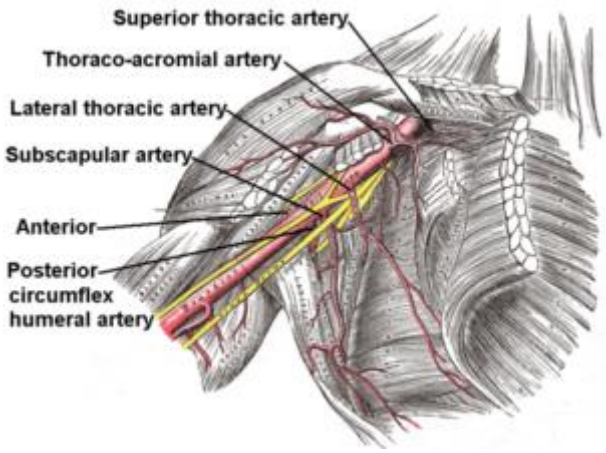
Due to the structure of the proximal hand joint, the socket of the radius is not perpendicular to the longitudinal axis of the forearm, but rather forms a **20°** angle referred to as the **radial joint surface angle**. Further, the socket of the radius is sloped **10°** sagittally as the **sagittal radial joint angle**. Both angles are essential for the smooth mobility of the proximal carpal series against the surface of the radius, to facilitate a complete and active range of motion in all possible directions.

Axillary Artery

As the subclavian artery crosses the lateral border of the first rib, it becomes the axillary artery. The **pectoralis minor muscle** runs in front of the axillary artery and divides it into three parts. The first part lies proximal to the muscle, the second part beneath it, and the third part distal to it (see image).

The first part of the artery gives rise to the **superior thoracic artery**, which supplies blood to the first and second intercostal muscles.

The **thoracoacromial artery**, which arises from the second part, nourishes the **pectoralis major, pectoralis minor, subclavius, and deltoid muscle**. It also supplies blood to the shoulder joint.

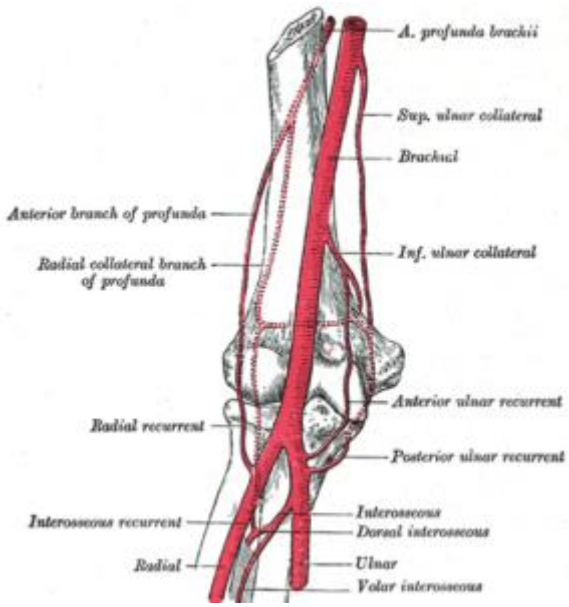


The **lateral thoracic artery**, which also arises from the second part of the axillary artery, supplies the **serratus anterior muscle** and the **skin and fascia of the anterolateral thoracic wall**.

The **anterior circumflex humeral artery** and the **posterior circumflex humeral artery**, both arising from the third part of the axillary artery, anastomose around the neck of the humerus. Both arteries supply the **deltoid muscle** and other muscles around the surgical neck of the humerus.

The **subscapular artery** is the largest branch of the axillary artery, arising from its third part. It further divides into the **scapular circumflex artery** and the **thoracodorsal artery**. The former supplies blood to the **teres major, teres minor, and infraspinatus muscle**. The latter supplies blood to the **latissimus dorsi muscle**.

Brachial Artery



As the axillary artery descends the lower border of **teres major muscle**, it becomes the brachial artery (see image). This also marks the **lower border of the axilla**.

The brachial artery runs down the arm, ending at the neck of the radius, where it divides into **radial and ulnar arteries**. It usually runs a superficial course in the arm, just below the deep fascia, where it branches out.

The **profunda brachii artery** is a deep branch of the brachial artery. It passes posterior to the **shaft of humerus** and supplies the posterior compartment of the arm. It terminates by dividing into **radial collateral and middle collateral arteries**. The former supplies the medial part of **triceps and anconeus muscles,** while the latter supplies the lower lateral part of the arm. Both arteries form a rich anastomotic network around the **elbow joint**.

The **superior and inferior ulnar collateral arteries** are branches of the brachial artery supplying the medial arm.

Radial Artery

The radial artery begins at the neck of the radius and passes laterally along the forearm. Proximally, it has only one branch, the **radial recurrent artery**. As noted, it anastomoses with the **radial collateral artery** and supplies the lateral side of the elbow. (See also "Palmar Arches," below.)

Ulnar Artery

The ulnar artery passes along the medial aspect of the forearm. The **anterior and posterior ulnar recurrent arteries** originate from the proximal part of the ulnar artery. They anastomose with the **superior and inferior ulnar collateral arteries**. Both arteries supply the medial side of the elbow and proximal portions of the **flexor muscles** of the forearm (see image).

As the body moves distally, the ulnar artery branches out into another branch called the **common interosseus artery**, which supplies the deep structures of the forearm and further divides into anterior and posterior branches.

The posterior branch branches out into the **interosseus recurrent artery**, which anastomoses with the **middle collateral artery** around the elbow joint.

The anterior interosseous artery supplies the following:

- Flexor pollicis longus
- Flexor digitorum profundus
- Pronator quadrates muscles
- Radius

- Ulna and carpal bones

The posterior interosseus artery supplies the following muscles of the posterior forearm compartment:

- Supinator
- Abductor pollicis longus
- Extensor pollicis longus
- Extensor pollicis brevis
- Extensor indicis muscles

Its interosseus recurrent branch nourishes the elbow joint and anconeus muscle. The ulnar artery, along with the radial artery, forms the **palmar arches**.

Palmar Arches

The radial and ulnar arteries branch out to form **superficial and deep palmar arches** (see image). The ulnar artery usually supplies the medial aspect of the index, third, fourth, and fifth fingers. The thumb and lateral half of the index finger are supplied by the branches of the radial artery.

The superficial palmar arch lies superficial to the **flexor tendons** and deep into the **palmar aponeurosis**. The deep palmar arch lies deep to the flexor tendons and above the **metacarpal bones**.

The **palmar carpal branch** of the ulnar artery anastomoses with the palmar carpal branch of the radial artery on the palmar surface of the hand.

The **dorsal carpal branch** of the ulnar artery anastomoses with the dorsal carpal branch of the radial artery on the dorsal surface of the hand and forms an arch. This arch branches into the **dorsal metacarpal arteries**, which further divide into **dorsal digital arteries**.

The deep palmar branch of the ulnar artery anastomoses with the continuation of the radial artery to form the **deep palmar arch**. It supplies the deep palm, including the carpal and metacarpal bones, adjacent muscles of the hand, and the metacarpophalangeal, proximal interphalangeal, and radioulnar joints. Its branches include the **palmar metacarpal arteries, recurrent branches, and perforating branches** (the connection between the deep and dorsal circulations of the hand).

The ulnar artery terminates by forming the **superficial palmar arch**. Here, it anastomoses with the superficial palmar branch of the radial artery. It supplies the superficial palm, palmar surface of the digits (excluding the thumb), and the dorsum of the distal phalangeal segments of digits two to five.

Common palmar digital arteries arise from the superficial palmar arch to supply the palmar aspect of two adjacent digits. These further divide into proper palmar digital arteries to supply the palmar aspect of each digit. These arteries also anastomose with the palmar metacarpal arteries, arising from the deep palmar arch.

The radial artery, after branching out into the superficial palmar branch, enters the dorsal surface of the hand, passes over the floor of the **anatomical snuff box**, branches out into the dorsal first metacarpal artery, and, finally, passes between the **heads of the first interosseus muscles** to re-enter the palmar aspect of the hand. It then branches out into the deep palmar branch, forming a deep palmar arch and two other branches called the **princeps pollicis** and **radialis indicis**.

The other muscles of the hand are divided into 4 groups: **the lumbricals, interossei, thenars, and hypothenars**.

Lumbricals

Muscles	Origin	Insertion	Nerve supply	Function
Lumbricals (I-II)	Lateral 2 tendons of flexor digitorum profundus (FDP) (unipennate)	Lateral surfaces of extensor expansions of digits 2–5	Median nerve (T1)	Flex metacarpophalangeal and extend interphalangeal joints of digits 2–5
Lumbricals (III-IV)	Medial 2 tendons of FDP (bipennate)		Deep branch of the ulnar nerve (T1)	

The lumbricals are 4 narrow muscle bellies that have no direct bony anchors. They also stabilize the metacarpophalangeal joints and prevent ulnar deviation.

Interossei Muscles

Muscle	Origin	Insertion	Nerve supply	Function
Dorsal interossei	Dorsal sides of all metacarpals (bipennate)	Base of proximal phalanges and extensor expansions (digits 2–4, dorsal; digits 2, 4 and 5, palmar)	Deep branch of the ulnar nerve (T1)	Abduct digits 2–4 away from the axial line
Palmar interossei	Palmar sides of metacarpals 2, 4 and 5			Adduct digits 2, 4 and 5 toward the axial line

Thenar Muscles

Muscles	Origin	Insertion	Nerve supply	Function
Opponens pollicis	Flexor retinaculum and tubercles of scaphoid and trapezium	Lateral side of the 1st metacarpal	Recurrent branch of the median nerve (C8)	Oppose thumb
Abductor pollicis brevis		Lateral side of proximal phalanx of digit 1		Abducts thumb; supports the opposition
Flexor pollicis brevis				Flexes thumb
Adductor pollicis	**Oblique head:** Base of 2nd and 3rd metacarpals and capitate **Transverse**	Medial side of proximal phalanx of thumb	Deep branch of the ulnar nerve (C8)	Adducts thumb

	head: anterior surface of the 3rd metacarpal			

Hypothenar Muscles

Muscles	Origin	Insertion	Nerve supply	Function
Palmaris brevis	Transverse carpal ligament and palmar aponeurosis	Ulnar palm	Ulnar nerve	Wrinkles the skin of the medial palm
Abductor digiti minimi	Pisiform	Medial side of proximal phalanx of the 5th digit	Deep branch of the ulnar nerve (T1)	Abducts the 5th digit
Flexor digiti minimi brevis	Hook of hamate and flexor retinaculum			Flexes proximal phalanx of the 5th digit
Opponens digiti minimi		Medial border of the 5th metacarpal		Rotates and draws the 5th metacarpal anteriorly

Surface Anatomy and Osteology: Phalanges

Any discussion of finger joints in human anatomy requires differentiation of:

- Metacarpophalangeal joints (MCP)
- Proximal interphalangeal joints (PIP)
- Distal interphalangeal joints (DIP)

Individual motor skills are attributed to the distinct mobility of the finger joints facilitated by the 3-movement axes.

Metacarpophalangeal articulations: The horizontal axis lies in the 3rd metacarpal and runs in a radial-ulnar direction to facilitate extension and

flexion, although the degree of extension is not equal for all fingers. The sagittal axis lies in the middle of the 3rd metacarpal and runs in a dorsal-palmar direction, which enables abduction and adduction. The rotation occurs via a longitudinal axis, which is equal to the long axis of the 1st metacarpal.

Proximal and distal interphalangeal articulations: The PIP and DIP joints merely move via the horizontal axis during flexion and extension. They lie in the convex head of the proximal phalanx of both the proximal and middle phalanges in a radial-ulnar direction. The average active degrees of mobility are:

PIP	DIP
• 110° of flexion • 0° of extension	• 70–80° of flexion • 5° of extension

Metacarpophalangeal Articulations

Metacarpophalangeal articulations: Osseous structures and joint surfaces

The **metacarpal head (caput metacarpale)** articulates with the **base of the proximal phalanx** (**basis phalangis proximalis) via** the metacarpophalangeal joints.

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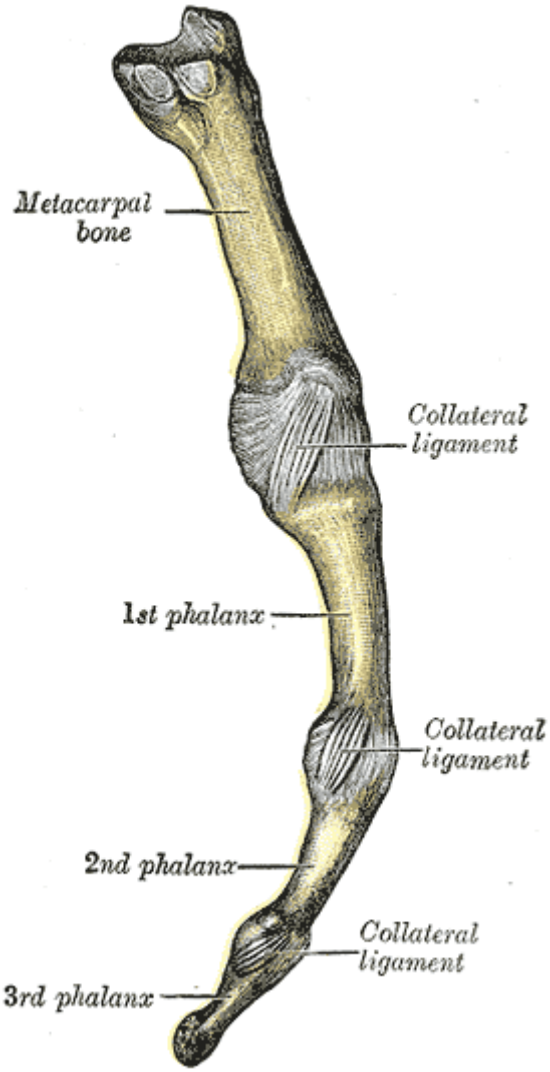
Metacarpal articulations: Ligaments



The metacarpophalangeal joints are connected with ligaments. Along with the **radial and ulnar collateral ligaments, collateral accessory ligament** and the **phalangeoglenoidal ligaments** ensure sufficient protection of the osseous structures. They neutralize palmar pulling forces during flexion, which primarily target the ligament bands.