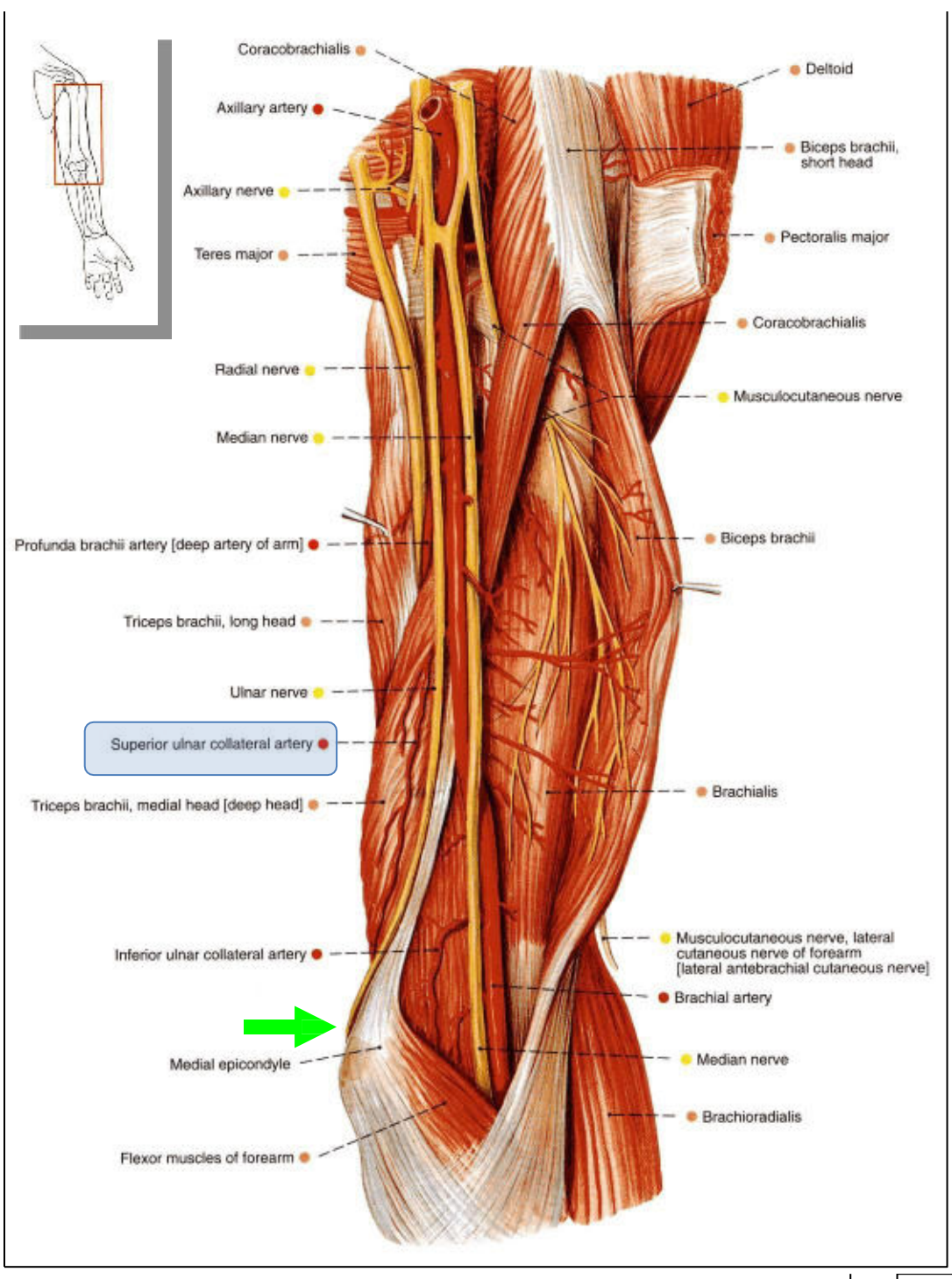
ULNAR NERVE ANATOMY & Its LESIONS

Dr Mukesh Singla

Learning Objectives

1. Ulnar nerve formation , root value and important relations
2. Motor and sensory supply
3. Important sites of injuries/entrapment of nerve
4. Effects of injury of ulnar nerve
5. How to clinically test ulnar nerve injury



Ulnar nerve C8T1

Origin : medial cord of brachial plexus , runs *medial to brachial artery*- middle of arm.

At **coracobrachialis insertion**, - ***pierces medial intermuscular septum***, is accompanied by superior ulnar collateral artery –and *enter posterior compartment of arm.*

At elbow - *posterior to medial epicondyle.*

No *branches* in arm.

Ulnar nerve in forearm

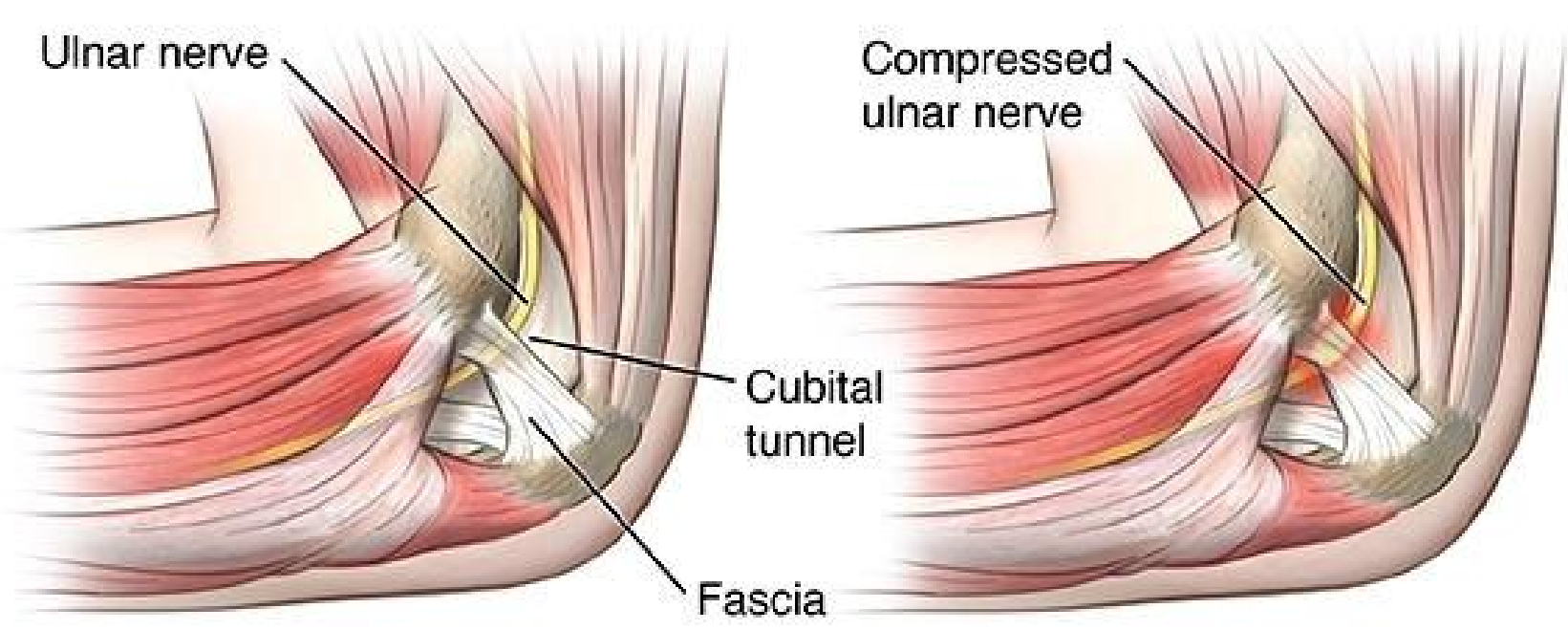
- It continues downward to enter in forearm
- b/w two heads of **flexor carpi ulnaris.** **Passes through <u>CUBITAL TUNNEL</u>**
- It runs down forearm **between FCU and FDP.**
- In lower half of forearm it lies **medial to ulnar artery.**

Cubital Tunnel

Cubital tunnel is a space of dorsal medial elbow which allows passage of the ulnar nerve around the elbow.

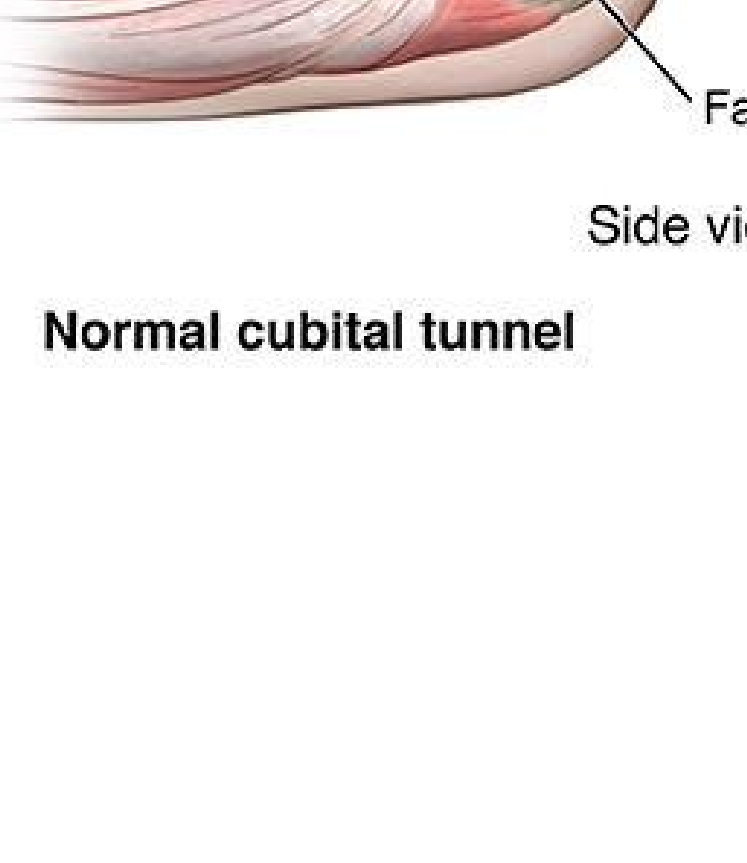
It is bordered
Medially - medial epicondyle of the humerus,
laterally -olecranon process of the ulna and tendinous arch joining the humeral and ulnar heads of the flexor carpi ulnaris.

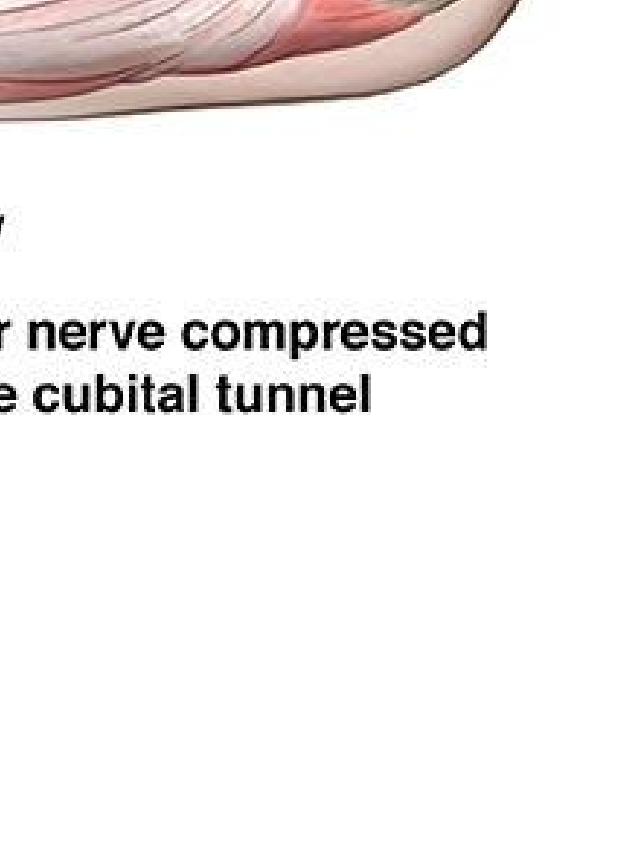
Cubital Tunnel



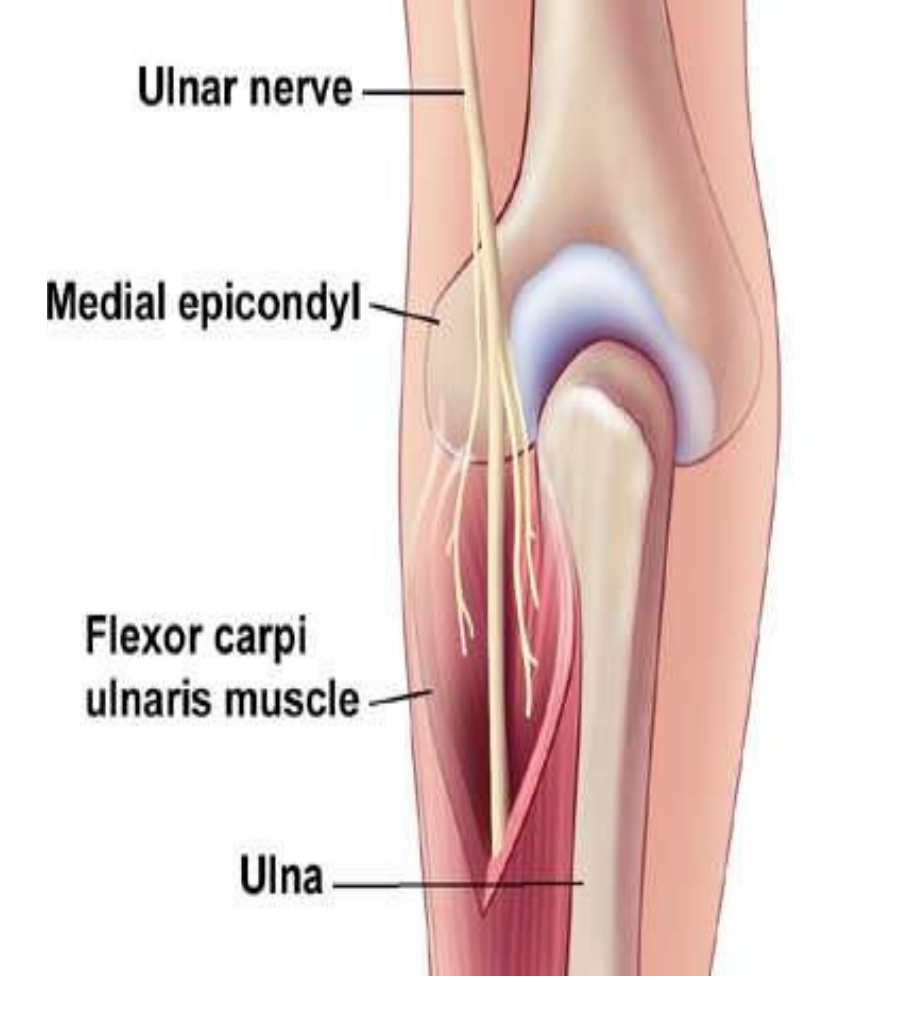
Side view of elbow

Normal cubital tunnel **Ulnar nerve compressed in the cubital tunnel**



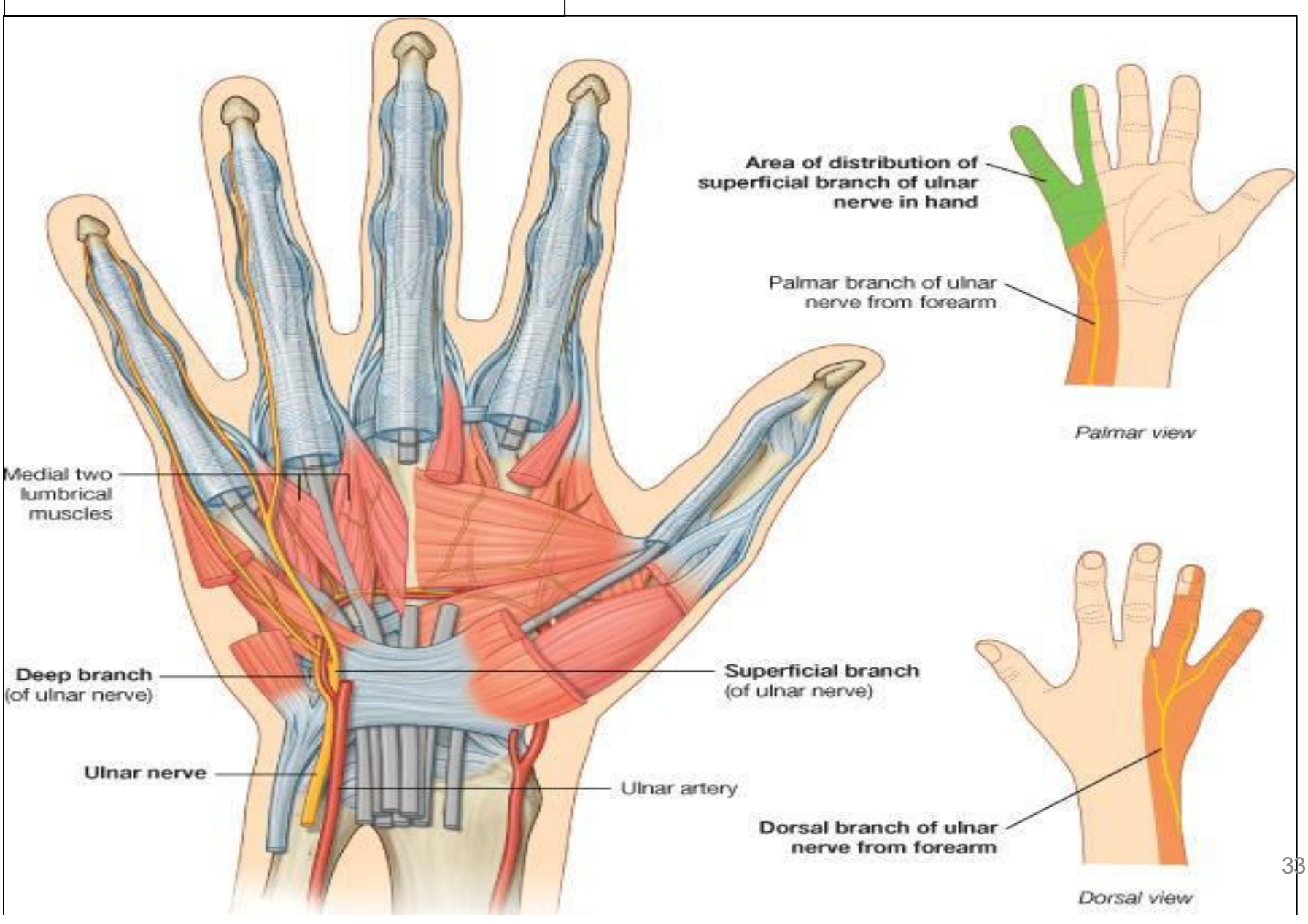


Ulnar nerve in Forearm



- Flexor carpi ulnaris.
- Medial ½of FDP
- **Articular:** elbow joint.
- **Dorsal or posterior cutaneous branch:**
- Dorsal surface - **medial 1/3rd** of **hand 1½ fingers.**
- **Palmar cutaneous branch :** to supply skin of palm of hand and medial **1½ fingers.**

Ulnar nerve in Hand



Ulnar nerve in Hand

After it travels down the ulna, ulnar nerve enters the palm of the hand.

At the wrist, the ulnar nerve and artery lie in a canal formed by the pisiform bone medially and the hook of hamate laterally (Guyon's canal).

- In this region the nerve divides into two branches.
- The Superficial sensory Branch
- The Deep Motor Branch

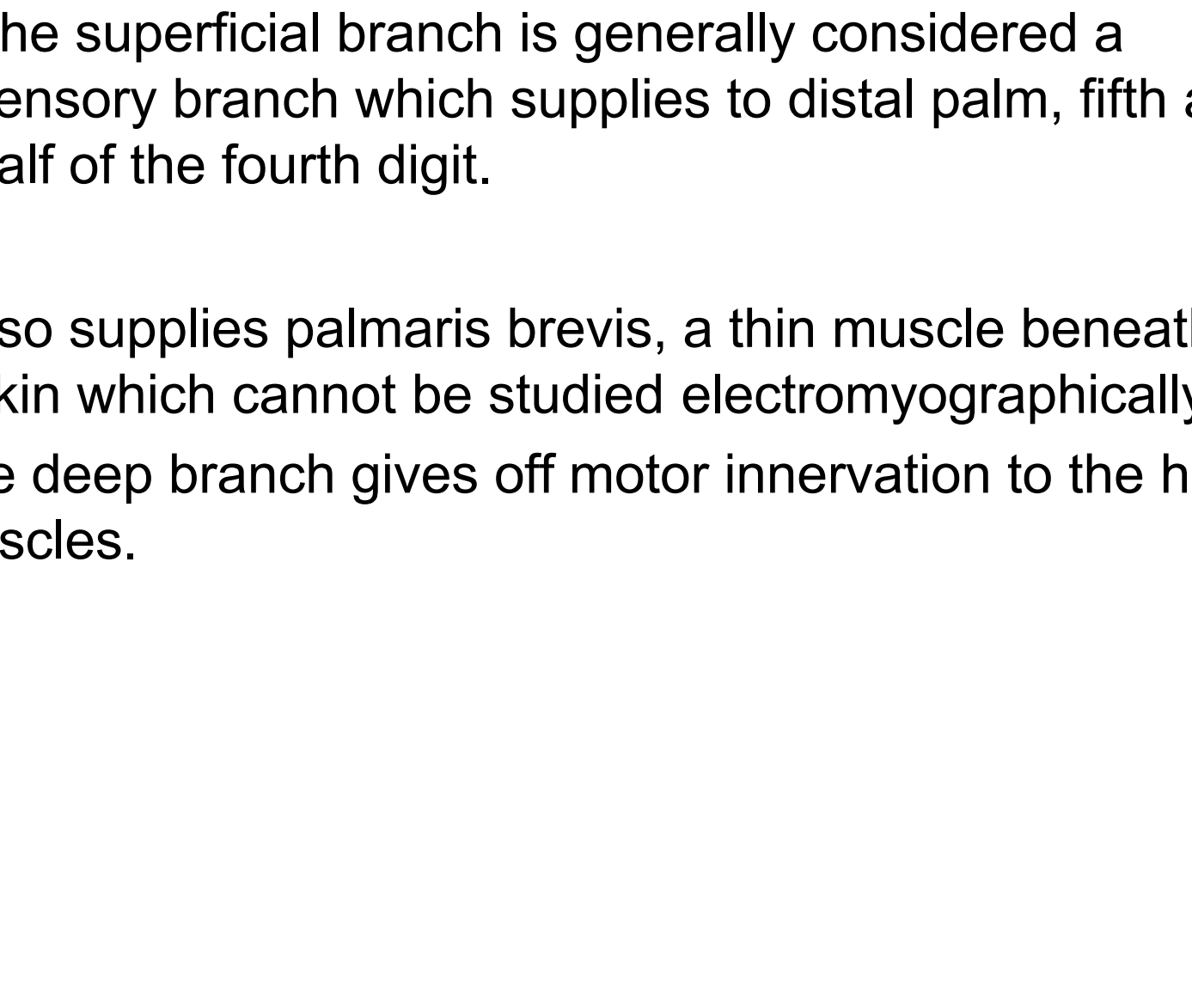
Ulnar nerve in Hand

The superficial branch is generally considered a sensory branch which supplies to distal palm, fifth and half of the fourth digit.

- It also supplies palmaris brevis, a thin muscle beneath the skin which cannot be studied electromyographically.

The deep branch gives off motor innervation to the hand muscles.

Wrist to (Medial) Hand



Ulnar nerve in Hand

Deep branch:

- Runs b/w abductor digiti minimi & flexor digiti minimi.
- pierces opponens digiti minimi.
- Then passes laterally <u>within</u> concavity of **deep palmar arch.**
- lies <u>deep</u> to flexor tendons.
- **It supplies 14 muscles :**
- **Three hypothenar muscles**.
- ***Adductor pollicis.***
- **All dorsal & palmar interossei.**
- **Medial 2 lumbricals.**

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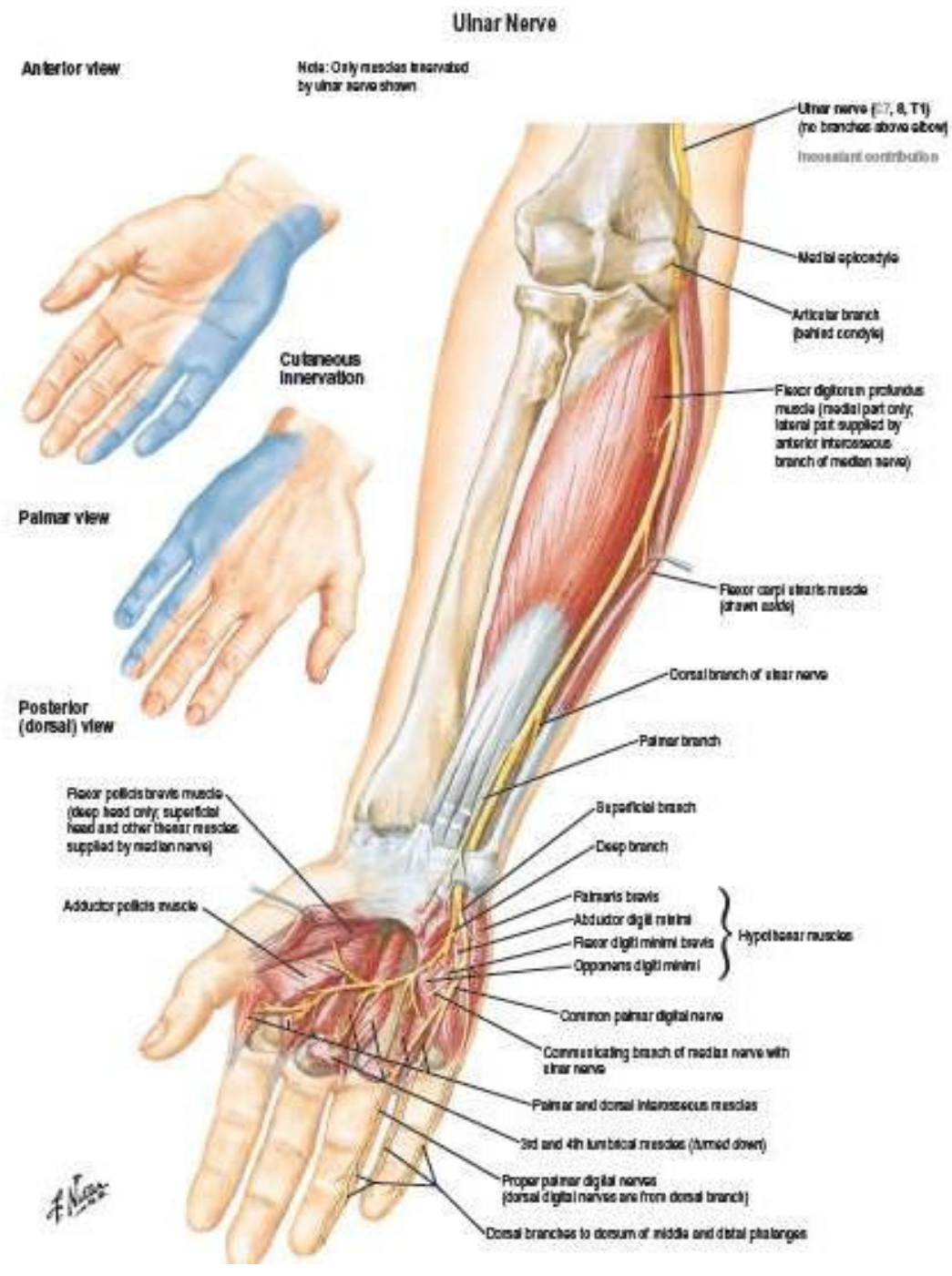


- BRANCHES: <u>Muscular</u>

  FCU, FDP (medial half), palmaris brevis, hypothenar muscles, medial 2 lumbricals, all palmar & dorsal interossei , thumb intrinsics medial to FPL {adductor pollicis , flexor pollicis brevis (deep head)}

<u>Cutaneous</u>

- palmar cutaneous supply to hypothenar eminence
- Dorsal cutaneous supply dorsum of hand (medial part), dorsum of little finger , part of dorsum of ring finger.

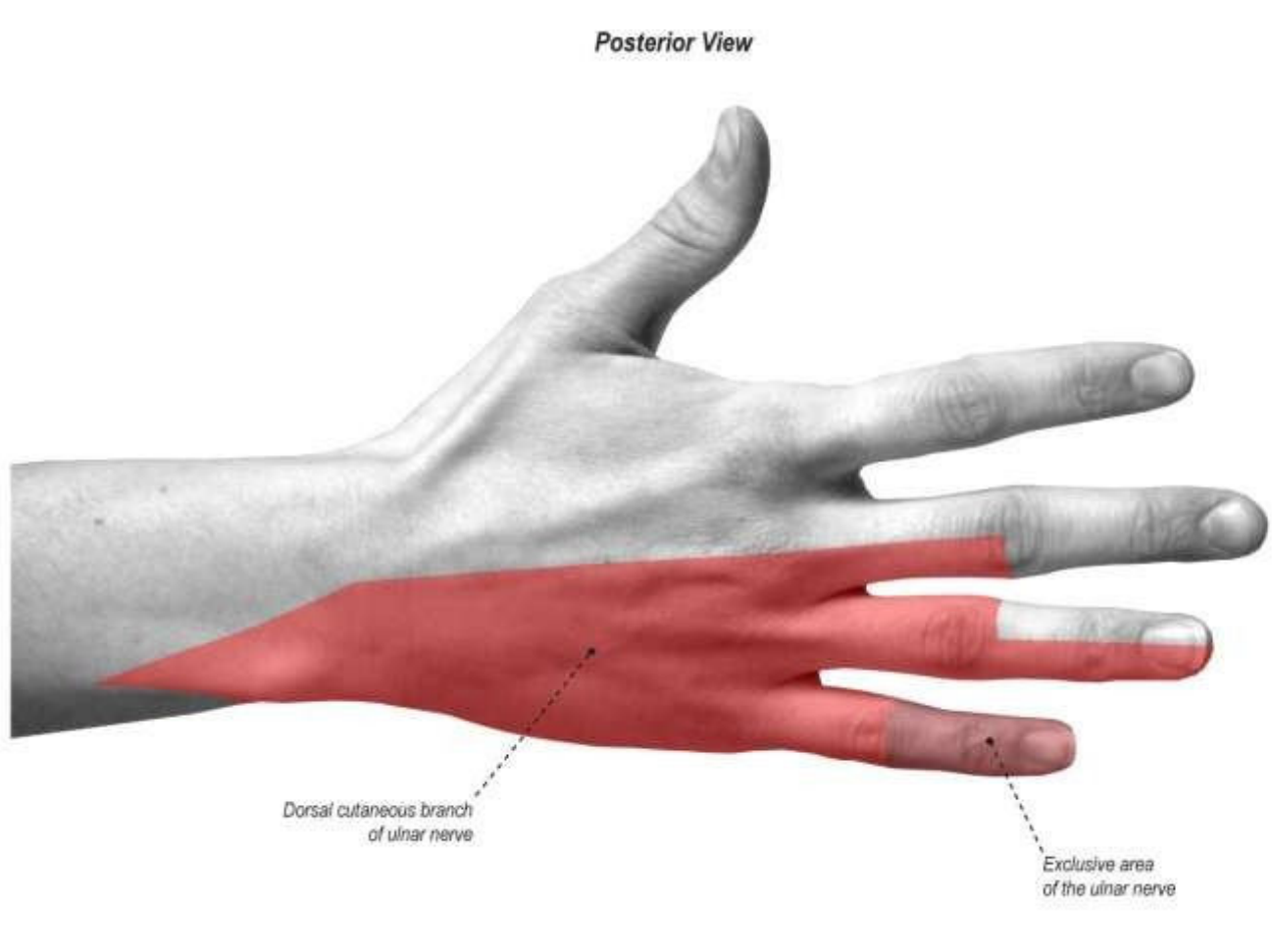
<u>Digital</u>

- forms the main sensory branches to the ring and little finger

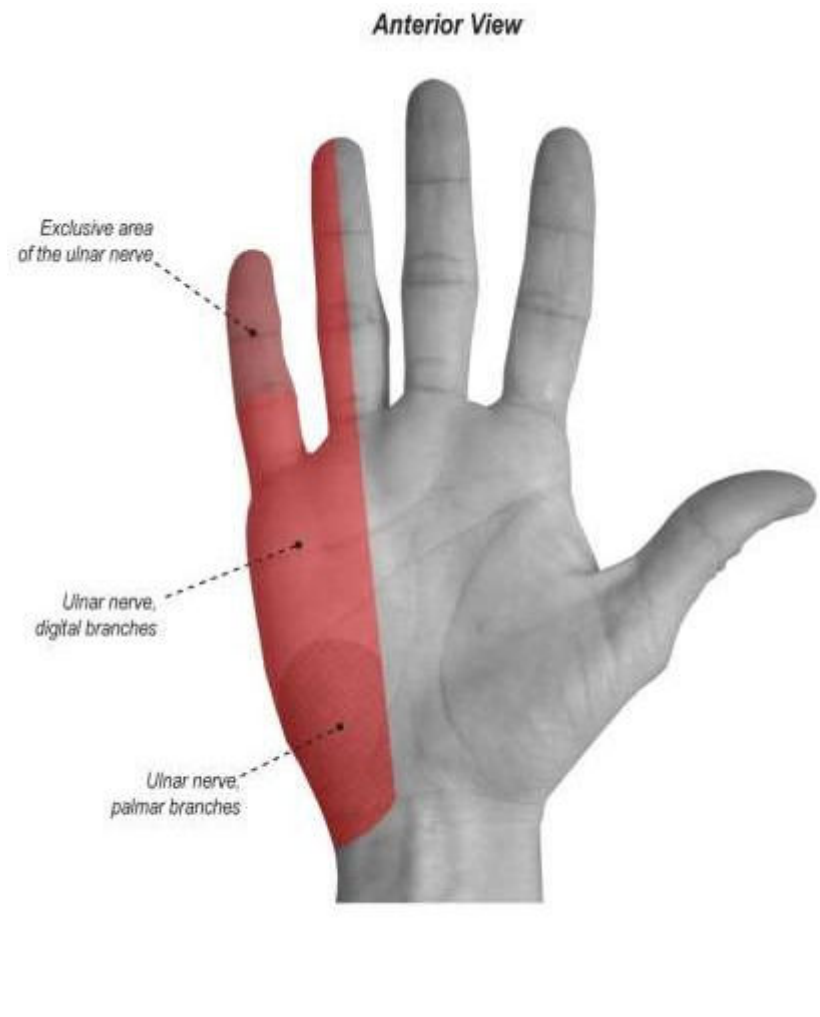
<u>Vascular & Articular</u>

No branches above elbow

DORSAL CUTANEOUS BRANCH



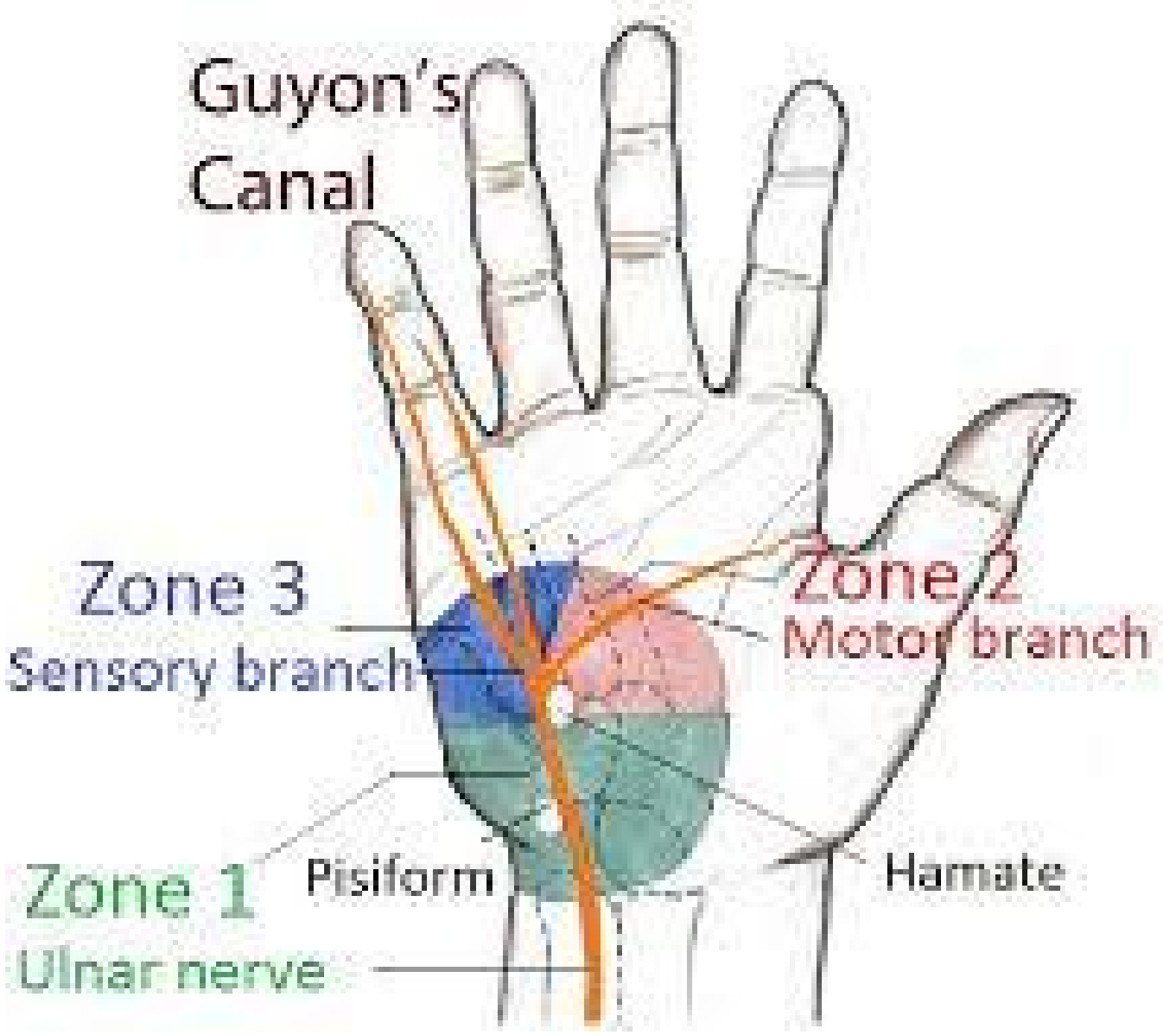
PALMAR CUTANEOUS BRANCH



Guyon Canal or Tunnel

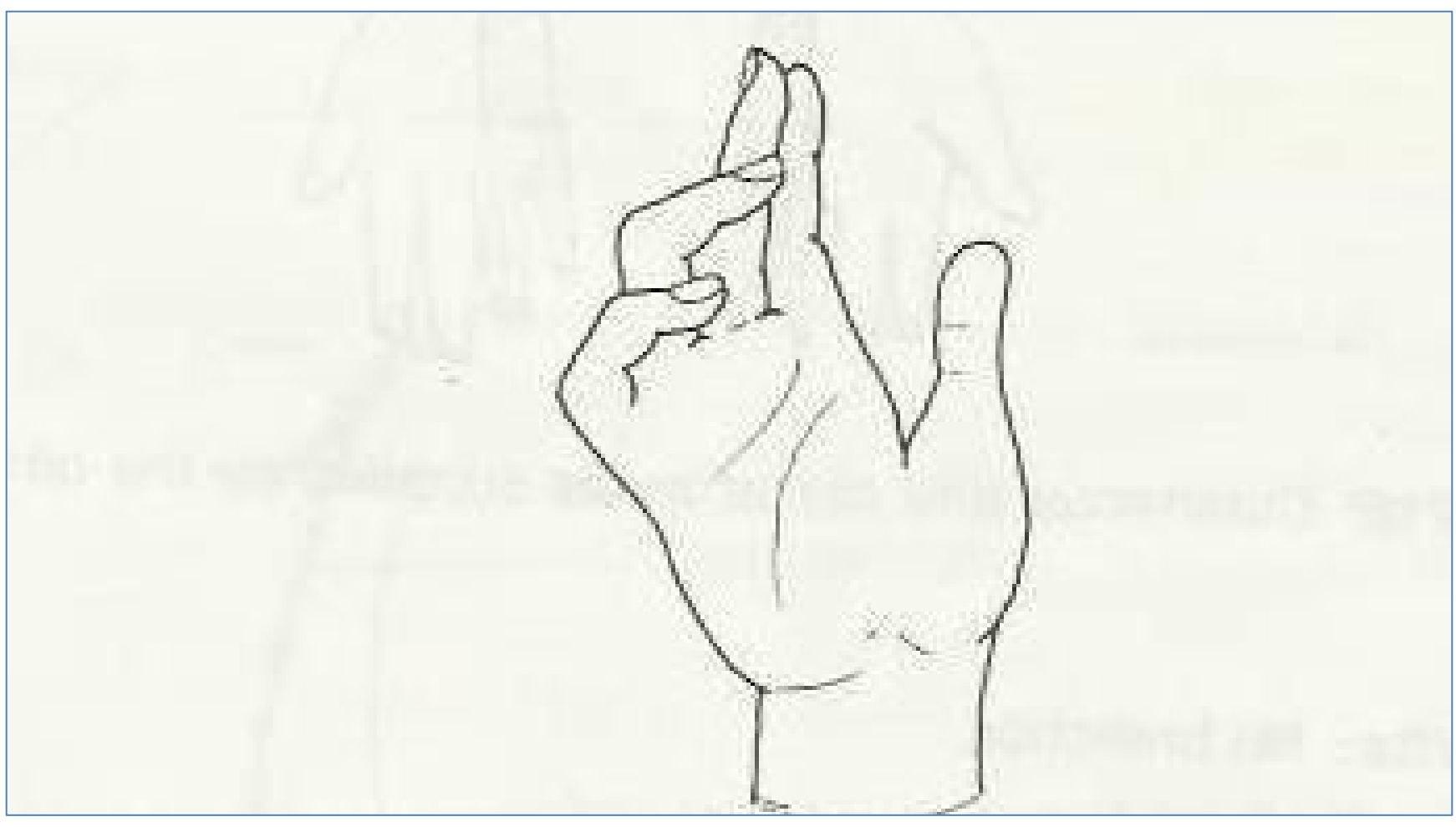
Semi-rigid longitudinal canal in the wrist that allows passage of the ulnar artery and ulnar nerve into the hand.

Roof of the canal -superficial palmar carpal ligament, deeper flexor retinaculum and hypothenar muscles comprise the floor.
The space is medially bounded by the pisiform and pisohamate ligament more proximally, and laterally bounded by the hook of the hamate more distally.It is approximately 4 cm long, beginning proximally at the transverse carpal ligament and ending at the aponeurotic arch of the hypothenar muscles.



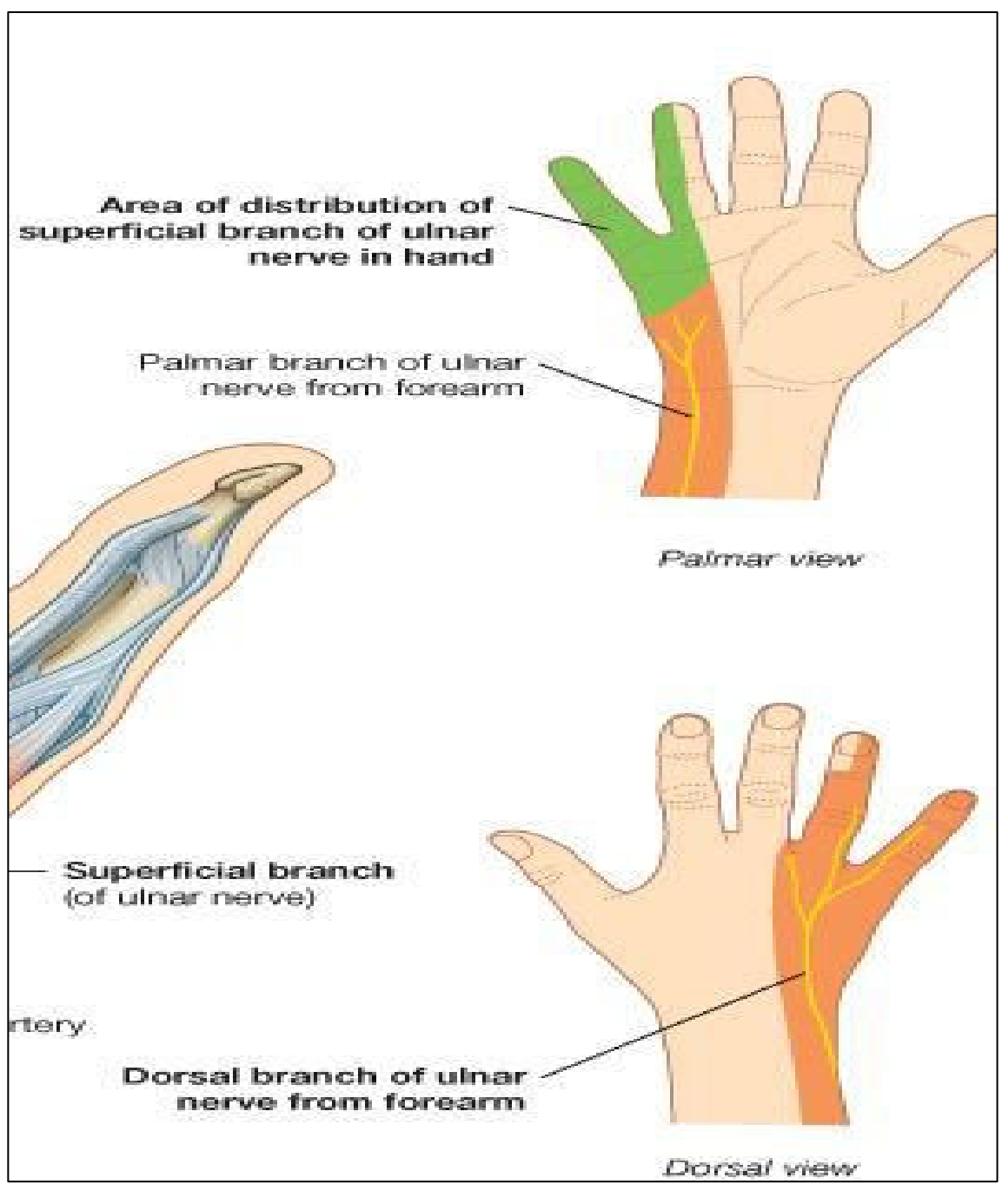
- Martin-Gruber anastomosis: a median-ulnar communication.
  - the crossing of fibers from the median to the ulnar nerve usually occurs 3 to 10 cm distal to the medial humeral epicondyle.
  - median fibers ultimately innervate the intrinsic hand muscles.
  - The overall incidence of Martin-Gruber anastomoses is approximately 17%.

Lesion of ulnar nerve above elbow - atrophy of hypothenar muscles



Lesion of ulnar nerve above elbow

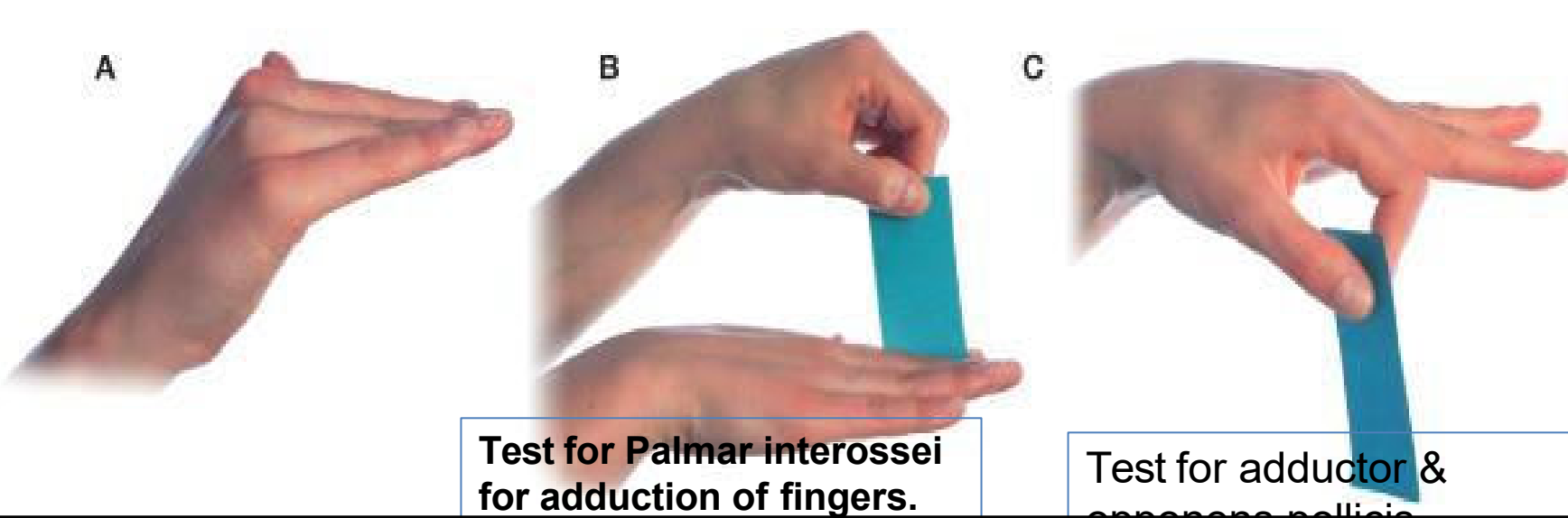
- Weakness of flexion at wrist → paralysis of FCU
- Loss of flexion of terminal phalanges of ring & little fingers → paralysis of medial ½ of FDP
- Paralysis of all interossei & medial 2 lumbricals (3rd & 4th).
- Characteristic deformity is - partial claw hand.
- Atrophy of hypothenar muscles.
- Fingers - hyperextended at metacarpophalangeal joints & flexed at interphalangeal joints - ring & little finger.
- Loss of adduction of hand & thumb due to paralysis of flexor carpi ulnaris & adductor pollicis.



Lesion of ulnar nerve above elbow - Loss of cutaneous sensations on front & dorsum of medial 1/3 of hand+ medial 1 ½ fingers.

Lesion of ulnar nerve above wrist

- **It leads to paralysis of intrinsic muscles of hand as described above.**
- **deformity 'claw hand'**
- **Loss of cutaneous sensations of medial 1 ½ fingers.**



Test for Palmar interossei for adduction of fingers.

Test for adductor & opponens pollicis.

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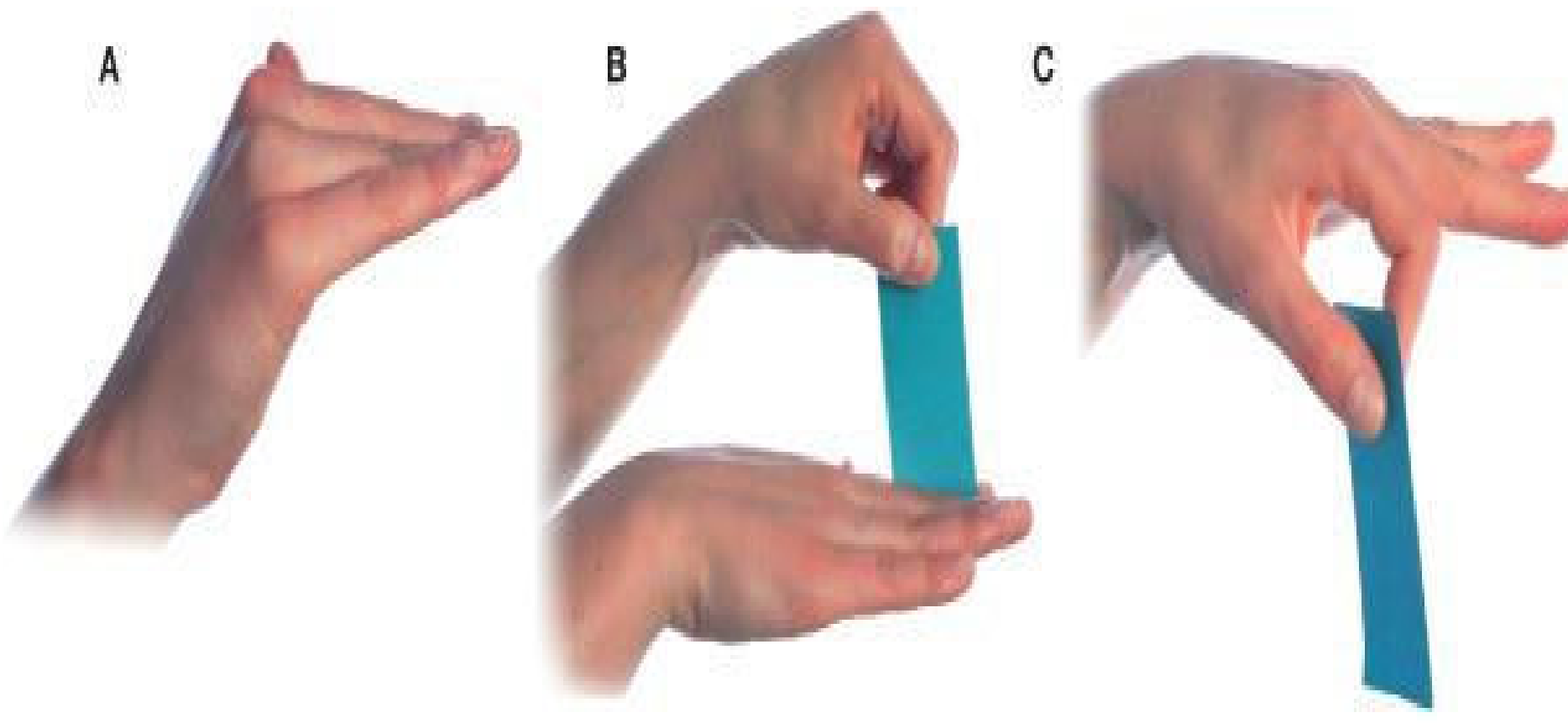
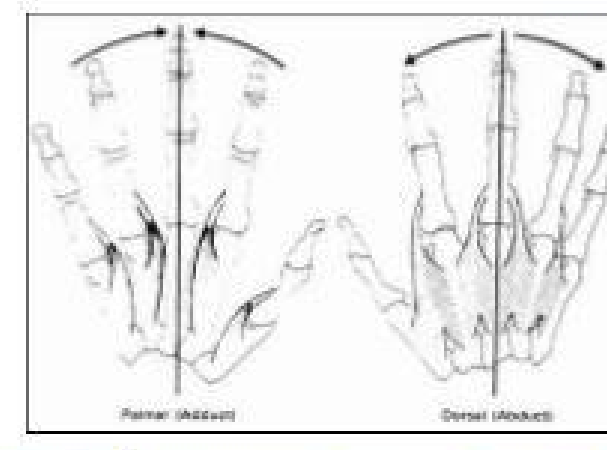


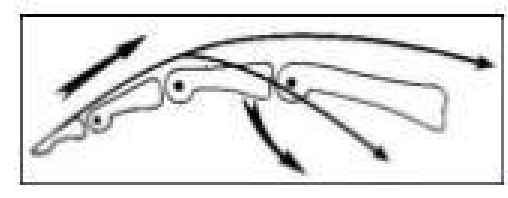
Ulnar nerve

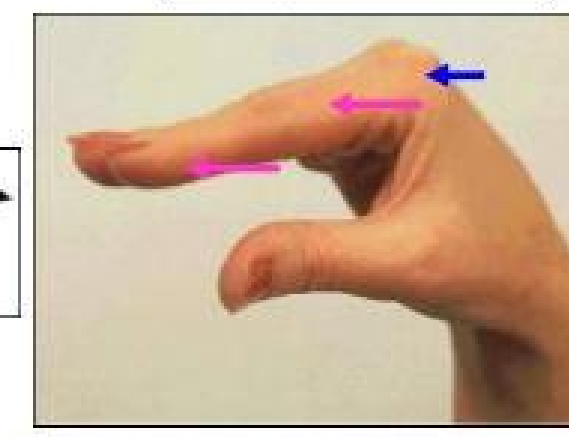
- **Action of interossei**
- Palmar ADduct – Dorsal Abduct (PAD & DAB)
- **Testing**:
  - Palmar interossei: adducting the fingers against a piece of paper
  - Dorsal interossei: Resisted abduction of fingers.
- **Action of interossei and lumbricals:**
  - Flexion of metacarpo-phalangeal joints and Extension of inter-phalangeal joints.
  - Act through the extensor expansion.



Testing palmar interossei

Testing dorsal interossei





Ulnar Nerve Injuries

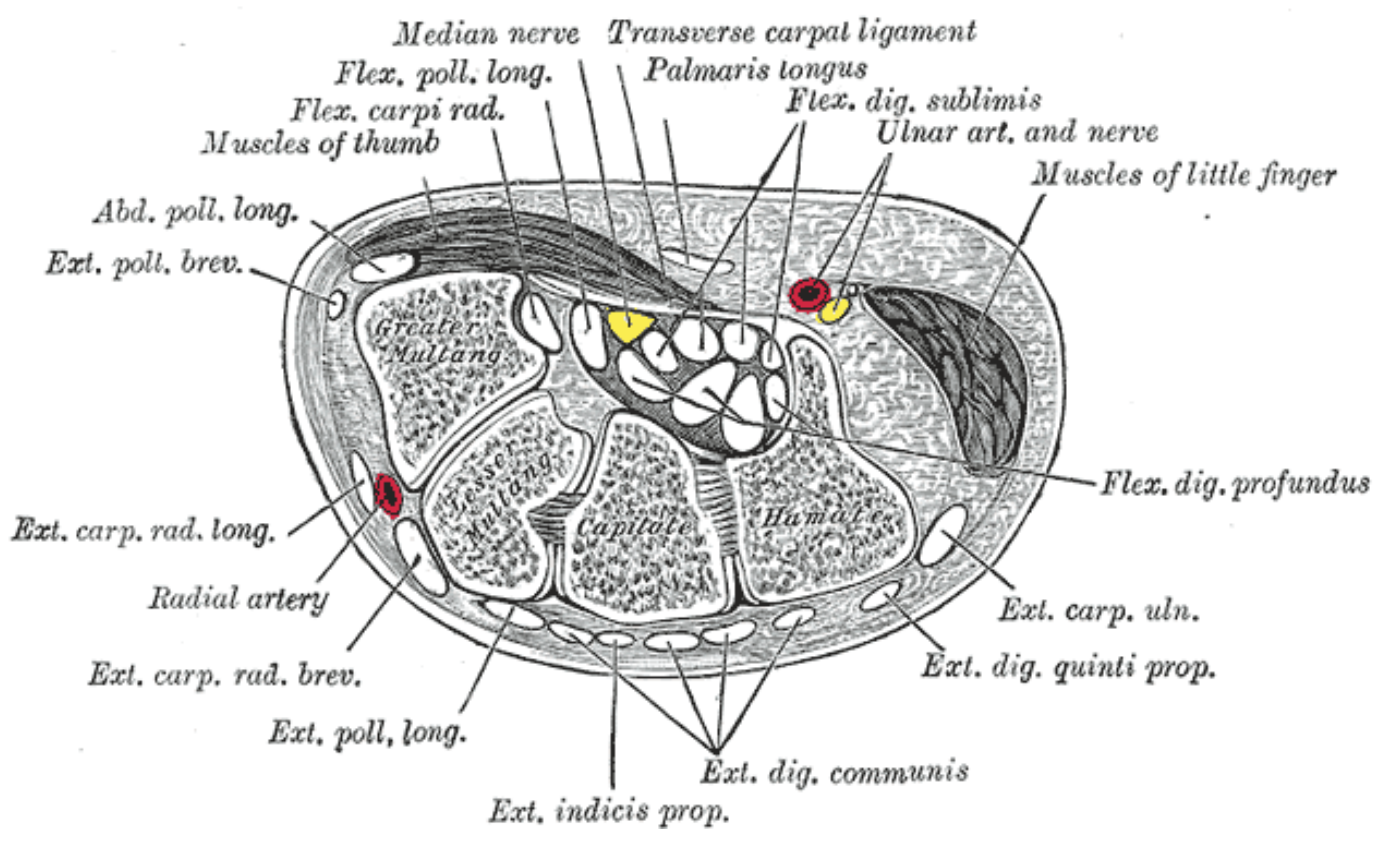
most commonly injured @

At elbow

where it lies behind the medial epicondyle usually associated with fracture

At wrist

where culum.



Injuries to the Ulnar Nerve at the Elbow

CUBITAL TUNNEL SYNDROME (2ND most common)

Motor

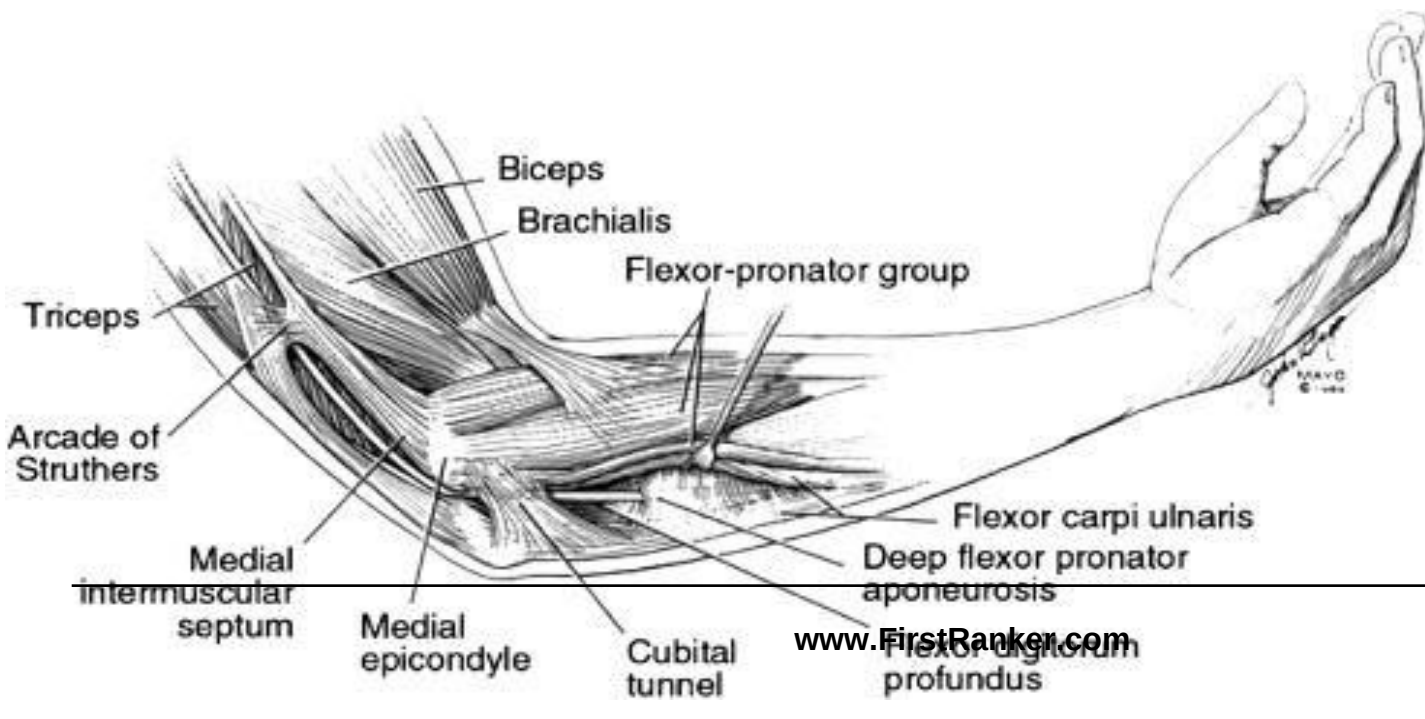
Flexor carpi ulnaris & medial half of flexor digitorum profundus ring & little fingers

No flexion of the terminal phalanges of the ring & little fingers

Flexion of wrist = abduction paralysis of flexor carpi ulnaris

medial border of the front of the forearm flattned/wasted

All the small muscles of the hand paralyzed EXCEPT ?



Injuries to the Ulnar Nerve @ the Elbow
Motor

Extensor digitorum can abduct the fingers to a small extent when metacarpophalangeal joints are hyperextended

Impossible to **adduct the thumb** adductor pollicis paralyzed

Froment's sign

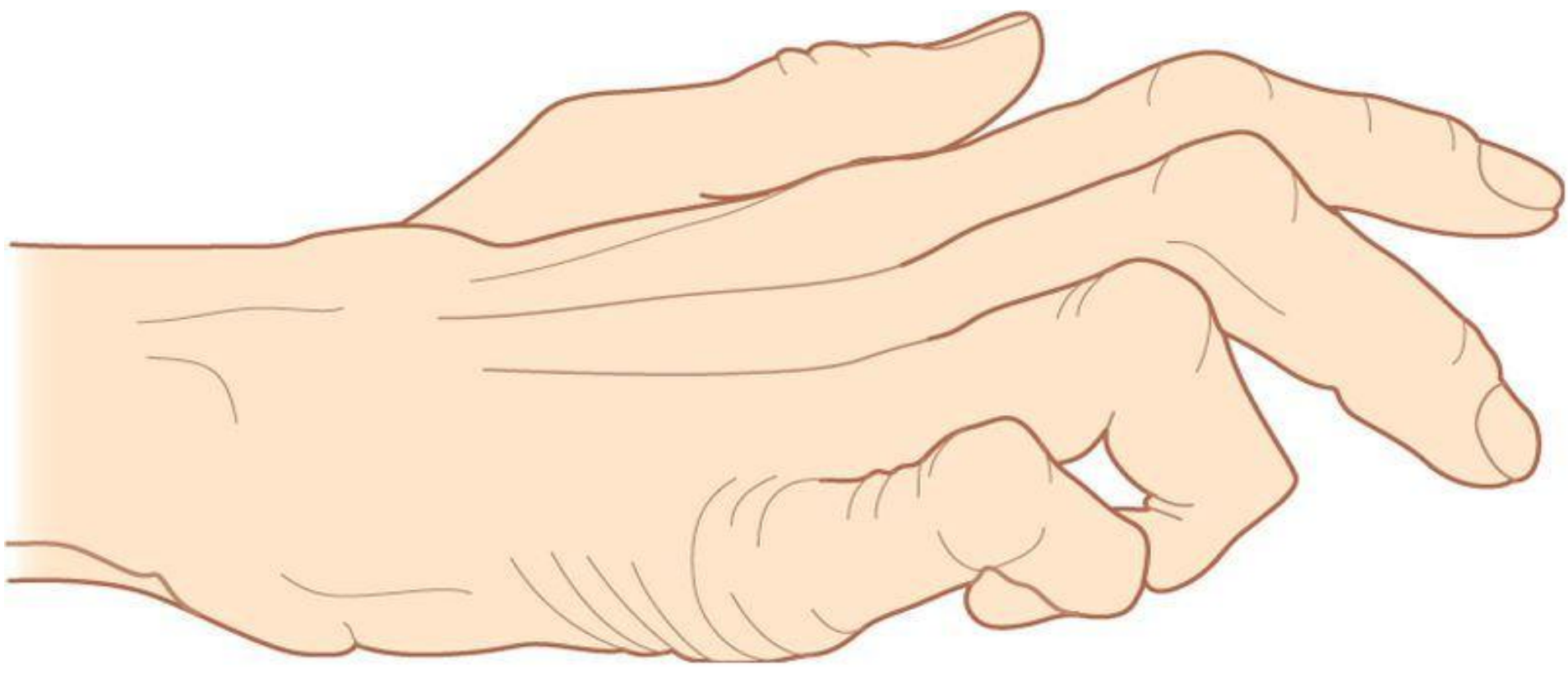
Grip a piece of paper between the thumb and index fingers

Froment sign: The patient is asked to hold the paper between the thumb and index finger. (*A*) With the intact ulnar nerve, the patient is able to make use of the adductor pollicis. (*B*) When the ulnar nerve is deficient, the patient compensates for the denervated adductor by using the flexor pollicis longus (median nerve innervated).

Injuries to the Ulnar Nerve @ the Elbow
Motor

2 medial lumbricals & interossei Hyperextended metacarpophalangeal joints
Flexed interphalangeal joints
fourth & fifth fingers

"claw" deformity main en griffe



Injuries to the Ulnar Nerve @ the Elbow
Motor

Flattening of hypothenar eminence

Loss of the convex curve to the medial border of the hand

Hollowing between metacarpal bones @ dorsum of the hand

wasting of dorsal interossei

Injuries to the Ulnar Nerve @ the Elbow
Sensory

Loss of skin sensation

anterior & posterior surfaces of medial 1/3 of the hand

medial 1 ½ fingers

Vasomotor Changes

warmer and drier skin area

arteriolar dilatation and absence of sweating /loss of sympathetic control

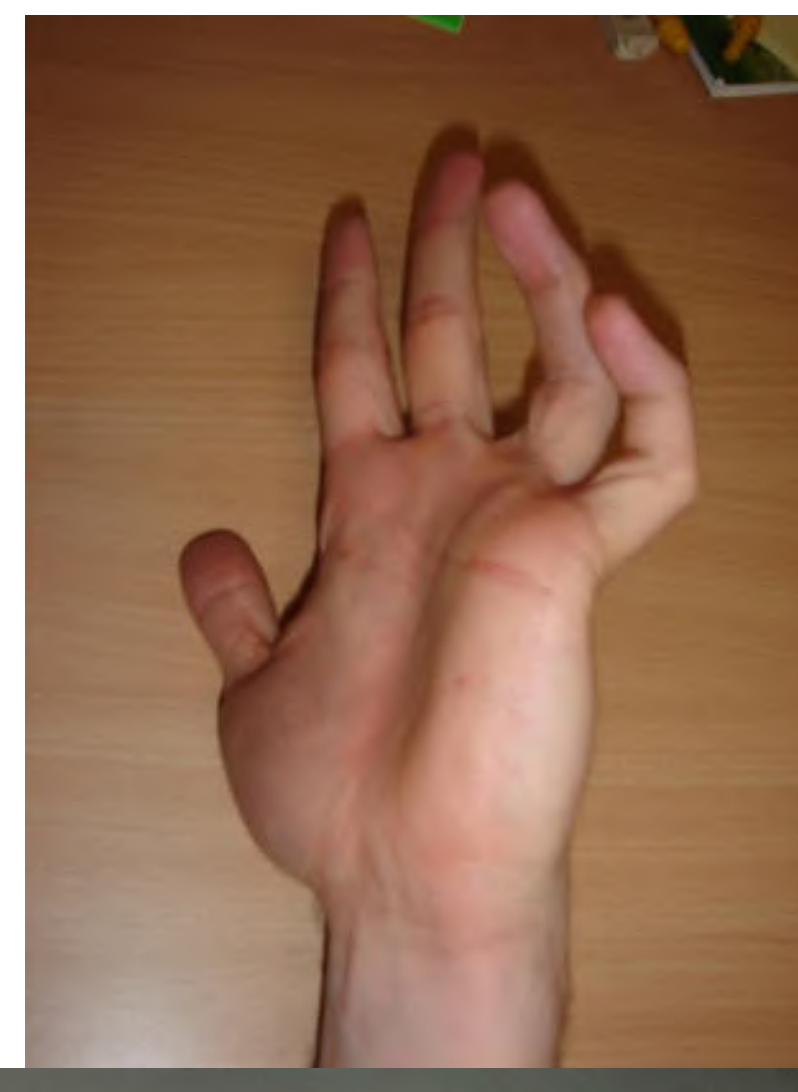
Injuries to the Ulnar Nerve @ the Wrist

Motor

Small hand muscles paralyzed, wasted – EXCEPT 3 thenar @ first 2 lumbricals

Claw hand

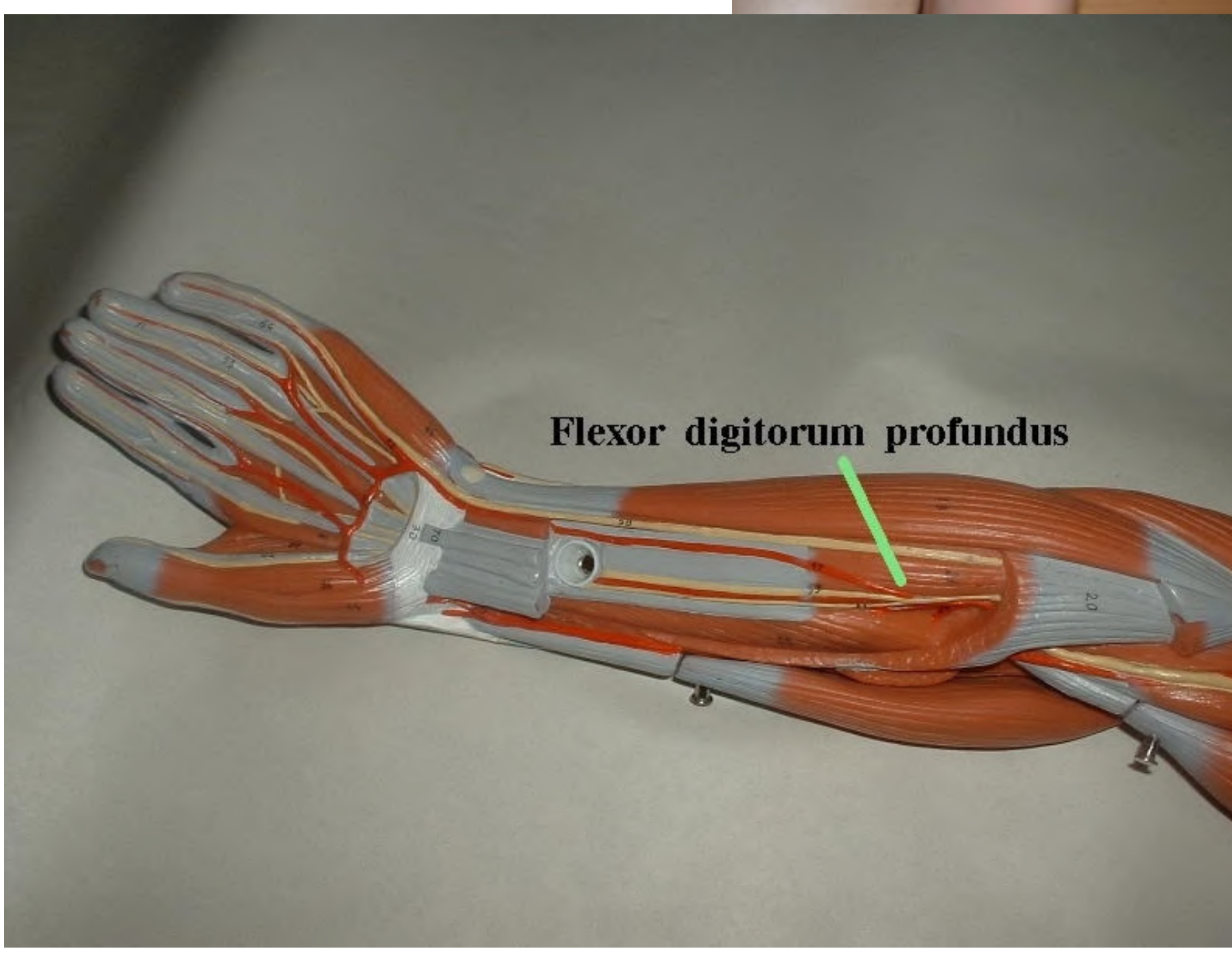
More obvious
Flexor digitorum profundus intact
Marked flexion of the terminal phalanges



Ulnar paradox

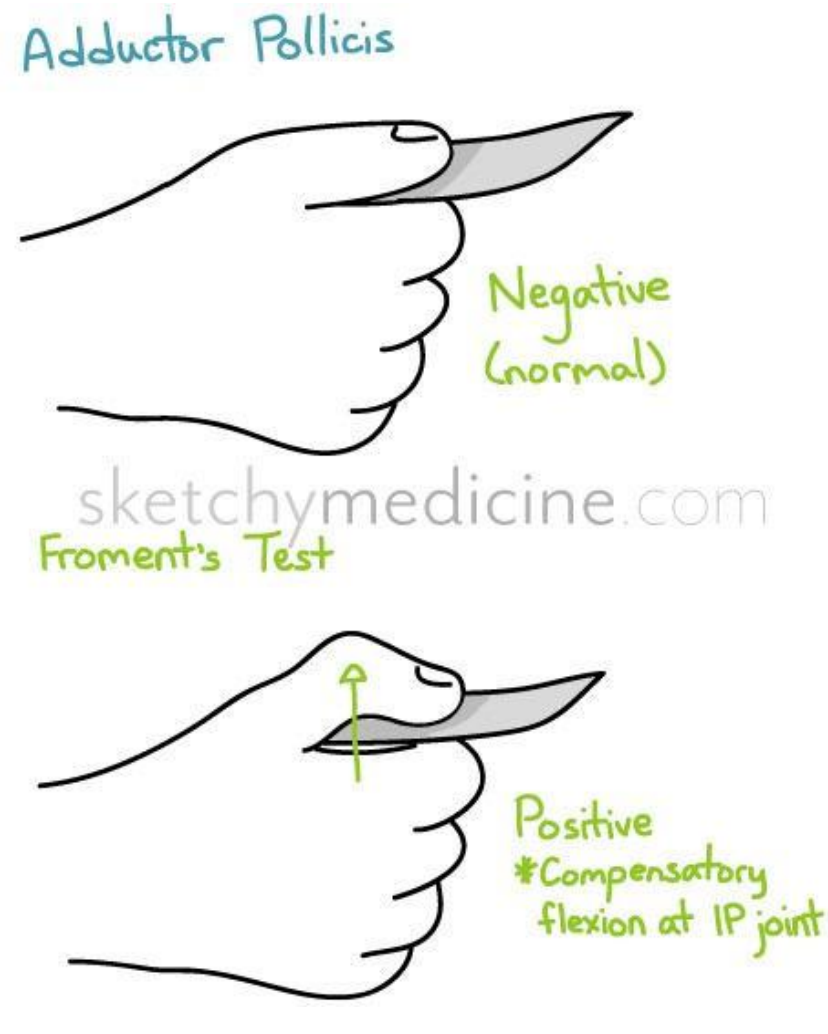
Higher lesion
Less obvious claw deformity

More proximal injury
Less claw



Froment's sign

To perform the test, a patient is asked to hold an object, usually a flat object such as a piece of paper, between their thumb and index finger (pinch grip). The examiner then attempts to pull the object out of the subject's hands.[2]



Froment's sign : hyperflexion of IP jt of thumb while attempting a lateral pinch(indicates paralysis of adductor pollicis, 1st DI , with replacement of pinch function by FPL)

Ulnar paradoxus

In proximal ulnar lesion (closer to the elbow), the Flexor Digitorum Profundus may also be denervated. As a result, flexion of the Interphalangeal joints is weakened, which reduces the claw-like appearance of the hand.

In distal lesion, at or below wrist
Condition of claw hand is worse because as FDP is spared ,there is active flexion of interphalangeal joint of medial two digits.This is called the **"ulnar paradox"** because one would normally expect a more debilitating injury to result in a more deformed appearance.

Cross your fingers test:

Inability to cross the middle finger dorsally over the index finger or vise versa.(1st PI & 2nd DI)

Some Facts

- At the back of medial epicondyle, ulnar nerve is lodged in a groove.
- Pressure on nerve at this site produce " funny bone ,symptoms with tingling along hypothenar eminence and little finger

Some Facts

- Deep branch of ulnar nerve is called "musician" nerve because it innervates all the small muscles of hand involved in fine movement
- Median nerve- eye of hand because it supply sensory receptors in the tips of medial three and half fingers of hand
- Median nerve – laborer's nerve because of motor supply to long flexor tendons

which of these symptoms is not caused by damage to the median nerve at the wrist?
A
ape/simian hand
B
loss of pronation
C
loss of sensation in most of thumb and digits 2 and 3.
D
thenar muscle paralysis

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- Injury to the ulnar nerve at the ____ causes _____, and at the ____ causes ____
- A
- elbow, radial deviation, wrist, wrist drop
- B
- elbow, radial wrist deviation, wrist, severe clawing of hand
- C
- elbow, severe clawing of hand, wrist, radial deviation
- D
- elbow, wrist drop, wrist, radial deviation

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- A patient after injury on hand presents with hand in claw position with 4th and 5th fingers extended at the metacarpophalangeal joints and flexed at the interphalangeal joints. Which nerve is involved in this injury
- Radial nerve
- Median nerve
- Ulnar nerve
- Anterior interosseous nerve

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2. Froment's sign is used to test the strength of which muscle
a) Abductor Pollicis longus
b) Adductor Pollicis
c) Flexor Pollicis longus
d) Extensor Pollicis Longus

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- A patient is asked by his physician to hold their wrist in complete and forced flexion (pushing the dorsal surfaces of both hands together) for 30–60 seconds. This maneuver compress the nerve within the carpal tunnel and characteristic symptoms (such as burning, tingling or numb sensation over the thumb, index, middle and ring fingers) conveys a positive test result and suggests carpal tunnel syndrome. What is the name of manoeuvre physician is performing
- Turning Circle maneure
- Phalen's Manoeuvre
- Collision Avoidance Manoeuvre
- Zig-zag Test Manoeuvre.

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- a. Pollock 's Sign
- b. Pointing Index
- c. Ape thumb deformity
- d. Andre- Thomas Sign

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The index finger is not flexed at the proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints. This clinical condition is called pointing index. This condition is due to lesion of

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b) Median nerve
c) Radial nerve
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Pen test in hand is performed to assess the neuromuscular status of:

a) Opponens pollicis
b) Flexor pollicis brevis
c) Abductor pollicis brevis
d) First palmar interossei

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In the phalen's test, the suspected compression of median nerve is elicited. Which of the following are the other structures passing through the carpal tunnel?

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- b. Superficial cutaneous branch
- c. Flexor digitorum profundud tendons
- d. Palmaris longus tendon

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THANK YOU