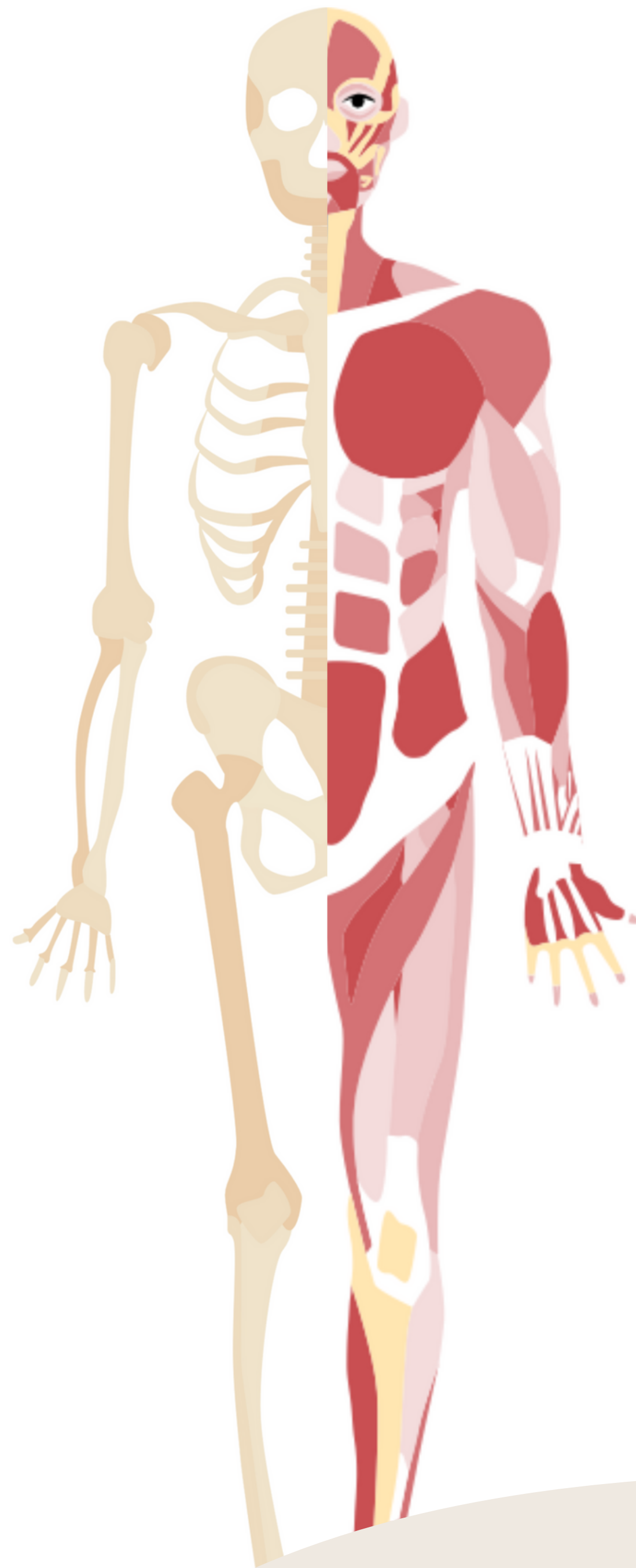


Lecture 9

HAND & WRIST

OBJECTIVES

- Describe the anatomy of the deep fascia of the wrist & hand (flexor & extensor retinaculae & palmar aponeurosis)
- List the structures passing superficial & deep to flexor retinaculum.
- Describe the anatomy of the insertion of long flexor & extensor tendons.
- Describe the anatomy of the small muscles of the hand (origin, insertion action & nerve supply)



Color Index:

- Main text
- Boys' Slides
- Girls' Slides
- Important
- Dr's Notes
- Extra



[Editing File](#)

Retinacula



intro from 0:00 to 2:53
 carpal tunnel syndrome from 2:54 to 4:23
 flexor retinaculum from 4:24 to 6:35
 carpal tunnel structure from 6:36 to the end

Helpful Video

Flexor and Extensor Retinacula :

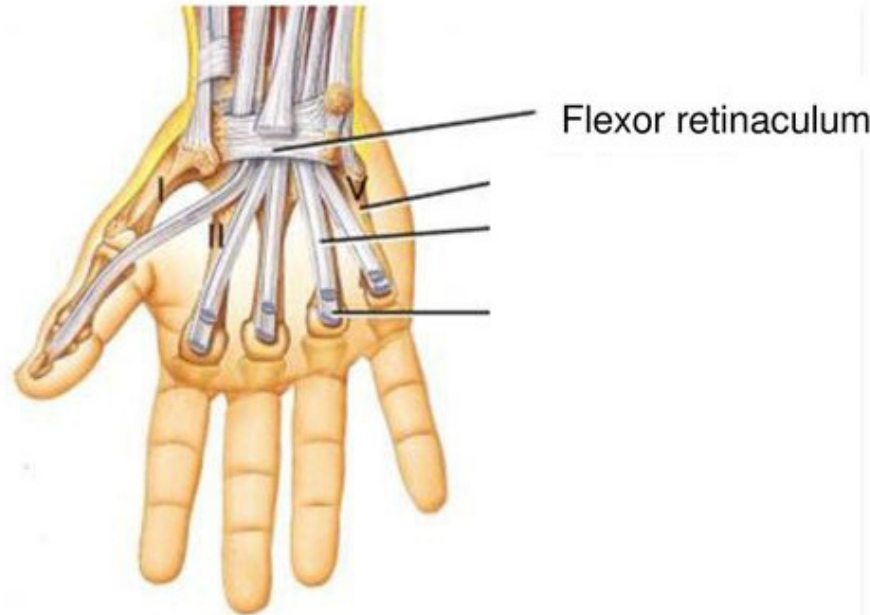
Bands of Deep Fascia at the Wrist

Function :

Hold the long flexor and extensor tendons at the wrist in position

Flexor retinaculum

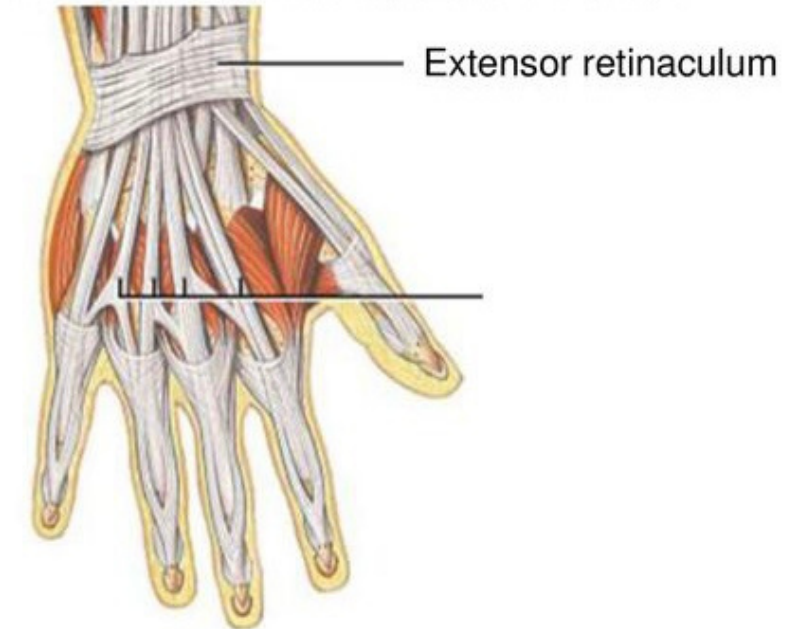
- Holds down tendons of anterior muscles



(a) Anterior superficial view

Extensor retinaculum

- Holds down tendons of posterior muscles



(b) Posterior superficial view

Attachment

Flexor retinaculum

Extensor retinaculum

Medially

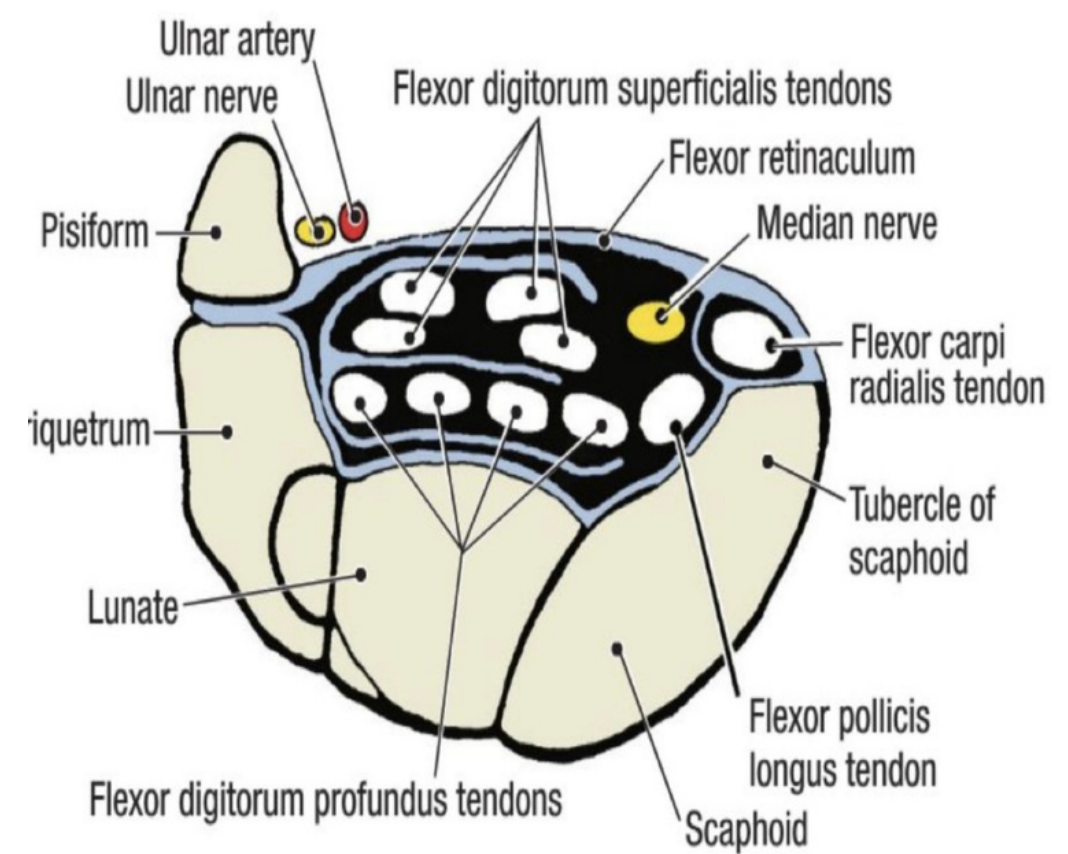
Both attach to Pisiform & Hook of Hamate

Laterally

Tubercle of Scaphoid & Trapezium

Distal end of Radius

CARPAL TUNNEL WITH CONTENTS



Flexor Retinacula:

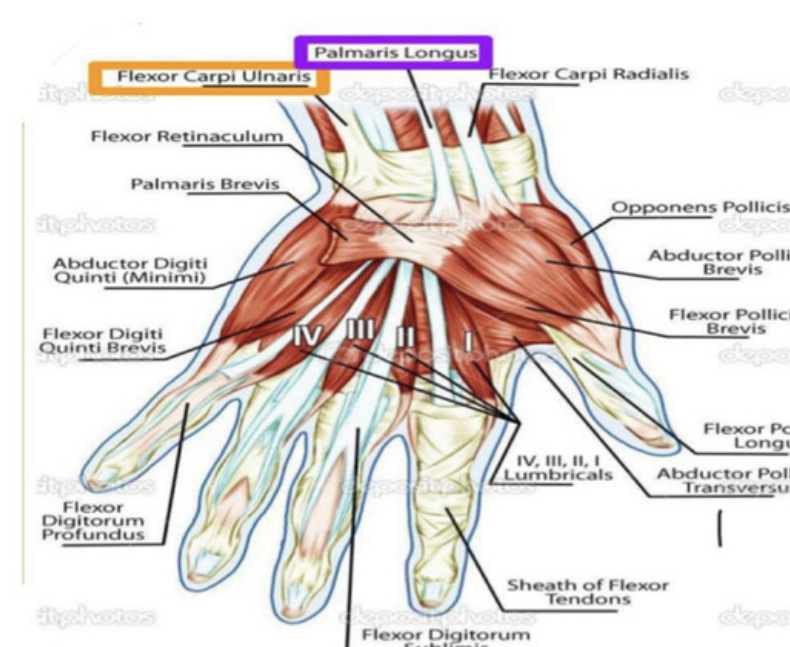
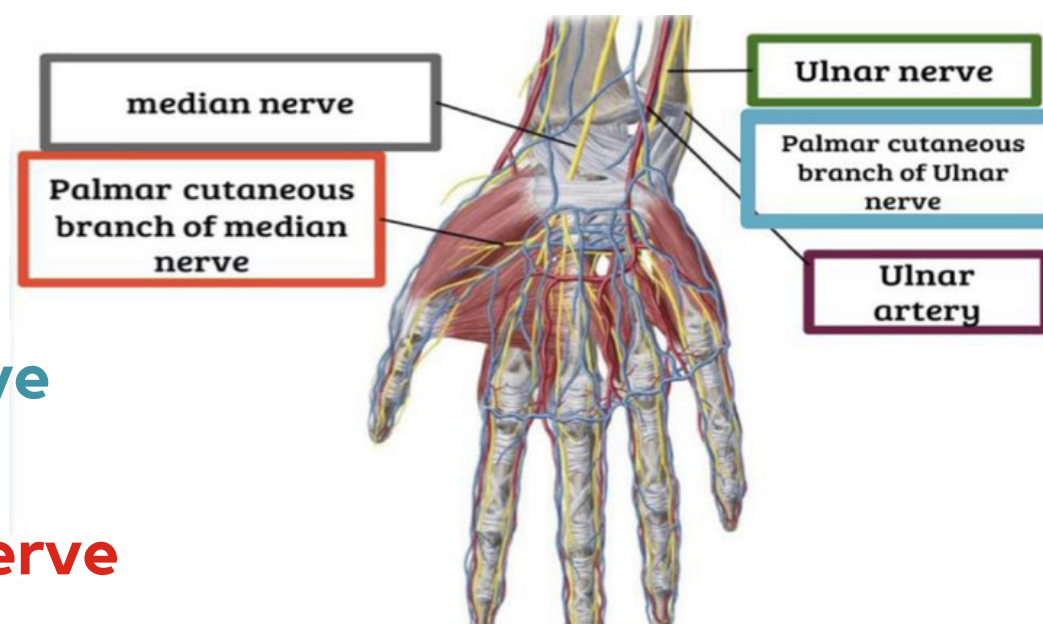
Is a thickening of deep fascia,

- 2–3 cm square
- crosses the concavity of the carpus to form an osseofascial carpal tunnel to convey the long flexor tendons.
- Thenar and hypothenar muscles arise from its superficial surface

Structures superficial to Flexor Retinaculum:

From medial to lateral:

1. Tendon of Flexor Carpi Ulnari
2. Ulnar nerve
3. Ulnar artery
4. Palmar cutaneous branch of ulnar nerve
5. Palmaris longus tendon
6. Palmar cutaneous branch of median nerve



Carpal Tunnel

(Structures **Beneath** Flexor Retinaculum)

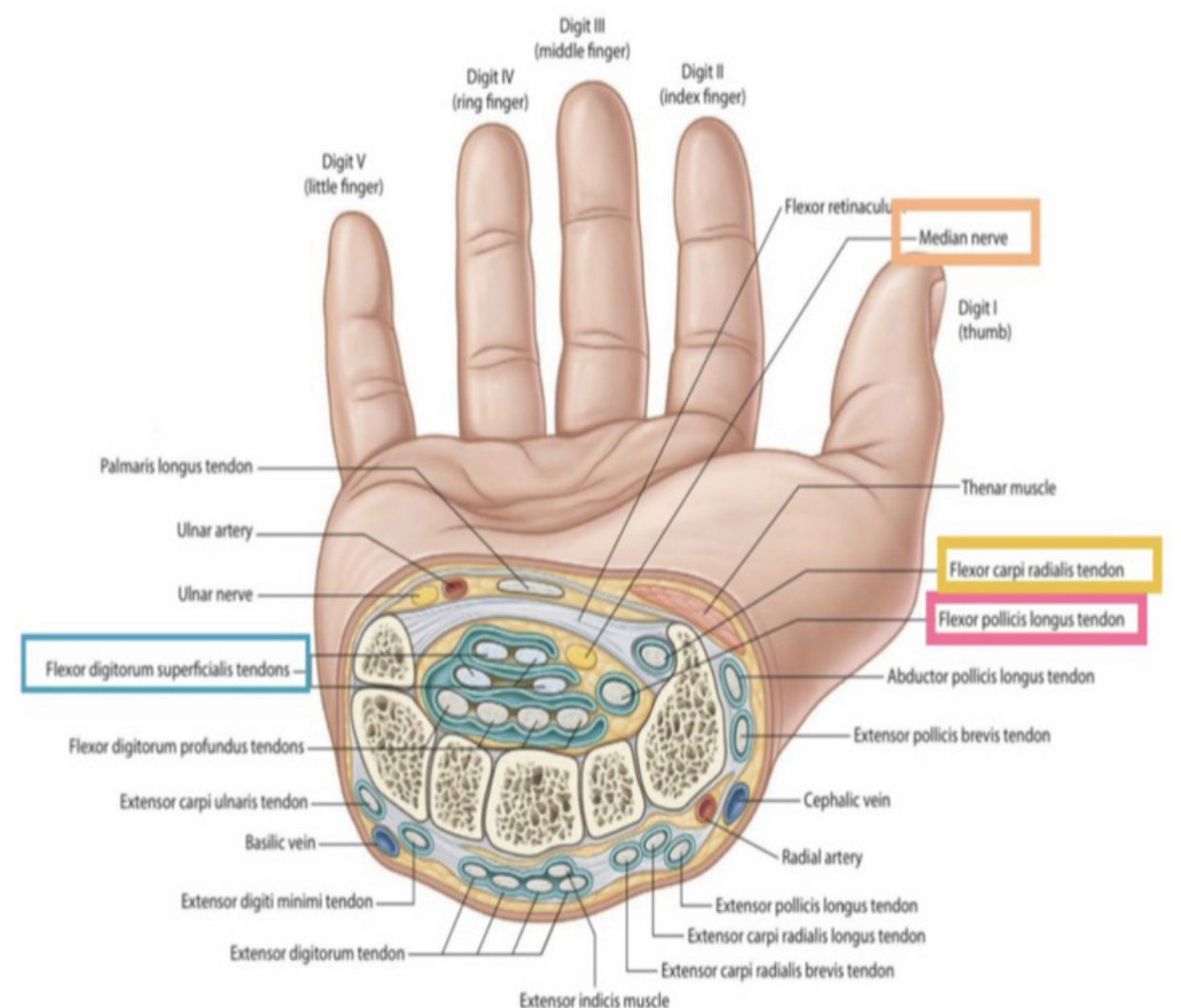
Formed from: Concave anterior surface of the Carpus (carpal bones) covered by Flexor Retinaculum.

Contents

From Medial to Lateral:

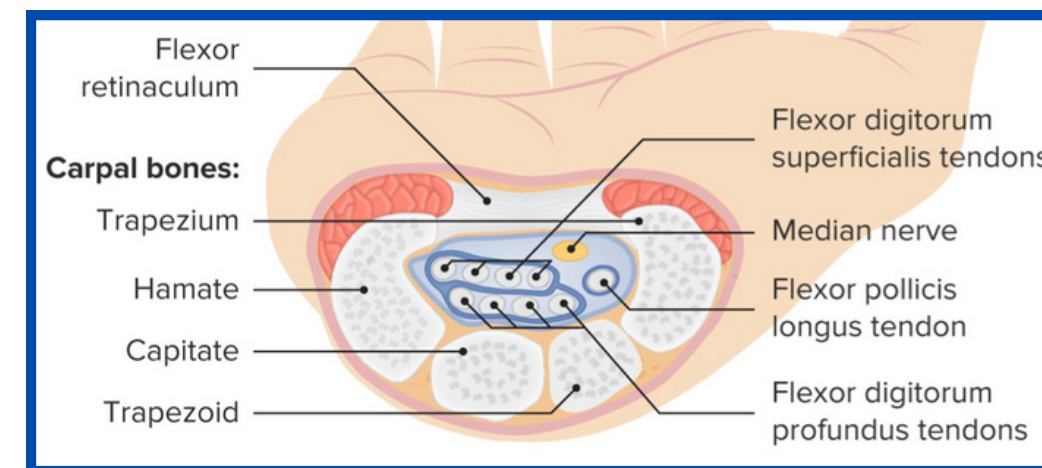
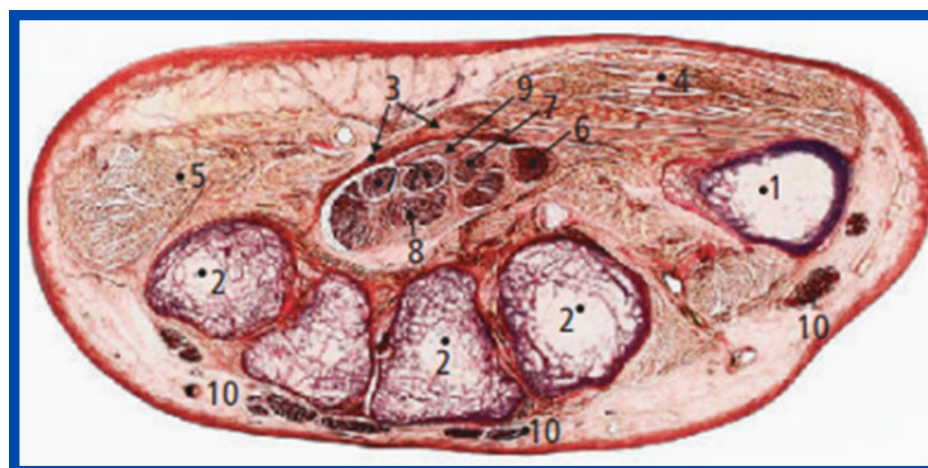
1. **Tendons of flexor digitorum superficialis & profundus**
2. **Median nerve**
3. **Tendon of Flexor Pollicis Longus**
4. **Tendon of Flexor carpi radialis**

Note: the flexor carpi radialis is in between brackets because it has a special compartment in the fascia



Carpal Tunnel

1. Base of 1 metacarpal
2. Row of carpal bones
3. Flexor retinaculum
4. Thenar eminence – ball of thumb
5. Hypothenar eminence
6. Flexor pollicis longus
7. Flexor digitorum superficialis
8. Flexor digitorum profundus
9. Median nerve
10. Extensor tendons



Carpal Tunnel syndrome



CAUSES (ETIOLOGY):

Compression of the median nerve within the carpal tunnel (**arthritis or diabetes**)

Reduced size of the osseofibrous carpal tunnel, resulting from

Inflammation of the flexor retinaculum

Arthritic changes in the carpal bones, or

Inflammation or thickening of the synovial sheaths of the flexor tendons

MANIFESTATION:

1. Burning pain (pins and needles) (**paresthesia : tingling, burning , and numbness**) **in the lateral three and half fingers.**

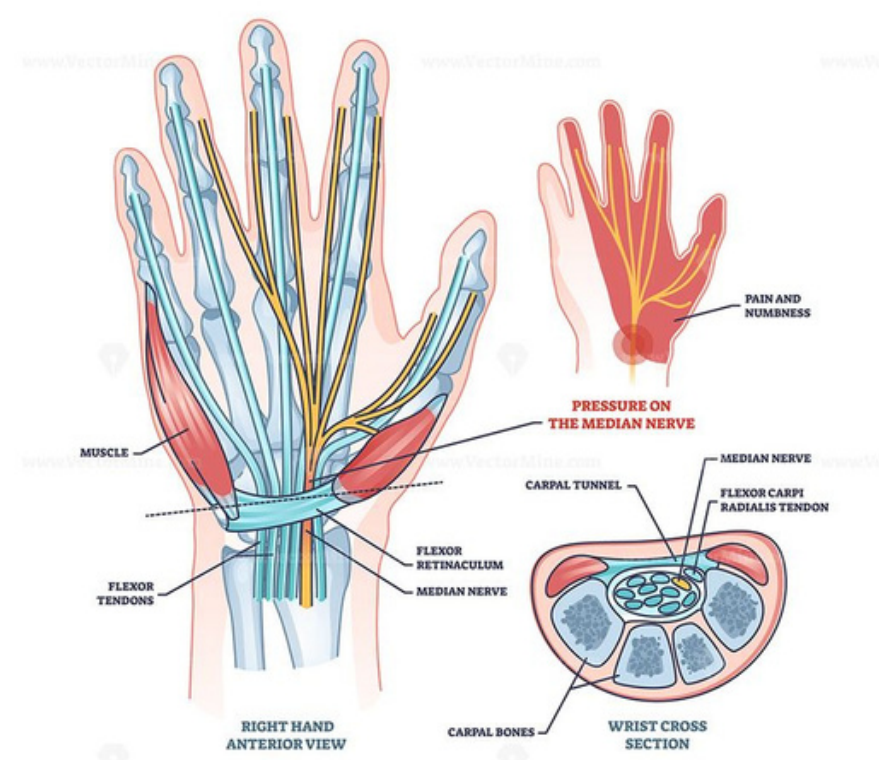
No paresthesia over thenar eminence:

Because no sensory changes over the Palm as the Palmer Cutaneous branch descends in front of Flexor Retinaculum to supply skin of Palm, so it doesn't enter the Carpal Tunnel.

2. Weakness or atrophy of the thenar muscles (Ape Hand):

Inability to **Oppose** the thumb (**due to paralysis of opponens pollicis supplied by median nerve**)

CARPAL TUNNEL SYNDROME



APE HAND



Median Nerve Injury

Palmar Aponeurosis

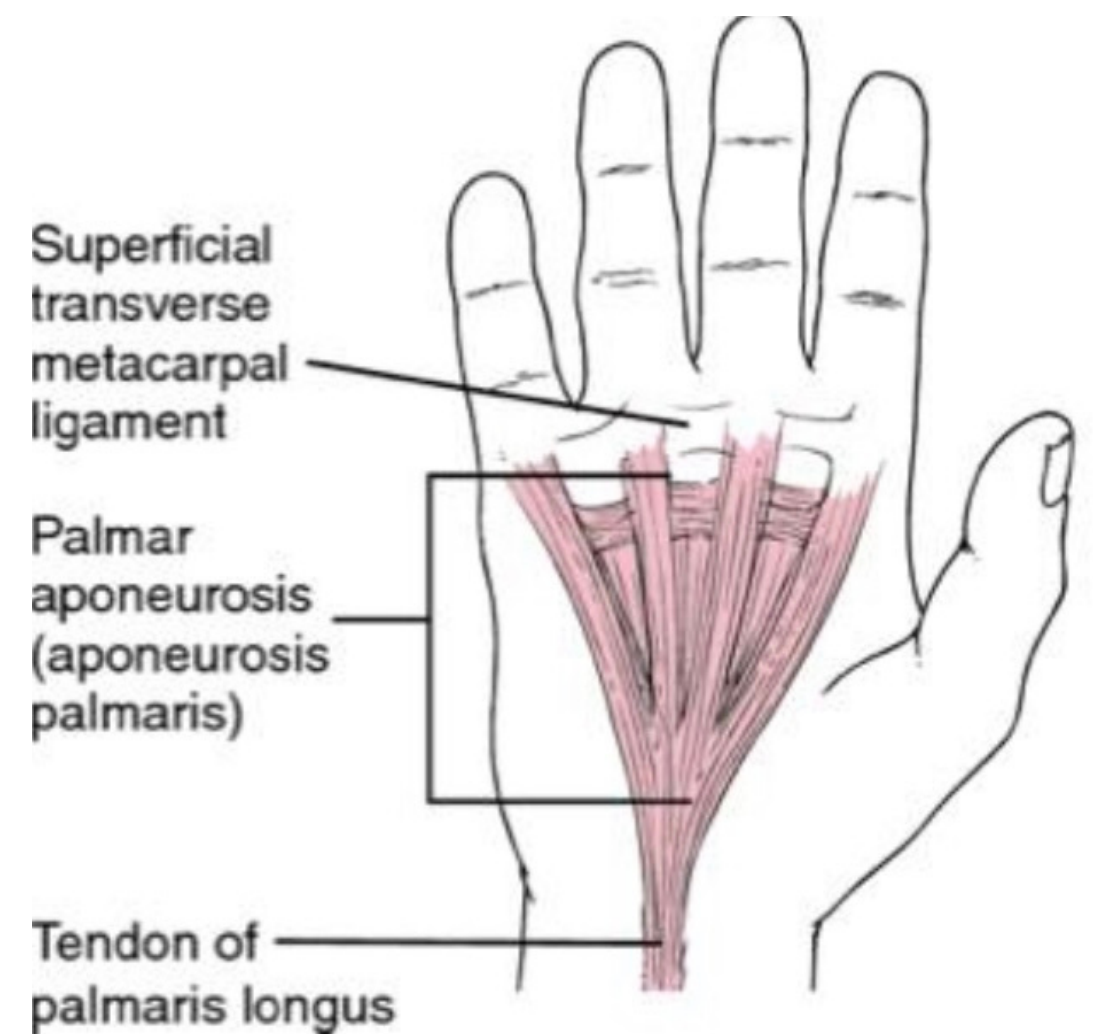
- The thickened deep fascia of the palm.
- It is triangular in shape, occupies the central area of the palm

It Has:

1. **Apex:** attached to the distal border of flexor retinaculum and receives the insertion of palmaris longus tendon
2. **Base:** divides at the bases of the fingers into 4 slips that pass into the fingers.

Function:

1. Firmly attached to the overlying skin and **improves the grip.**
2. **Protects** the underlying tendons, vessels & nerves.
3. Gives origin to **palmaris brevis muscle.**



• an abnormal thickening of the palmar aponeurosis.

• Cause is unknown

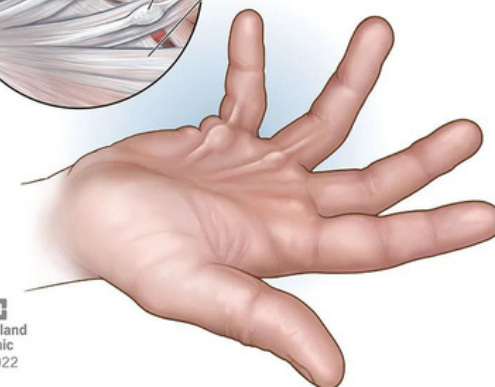
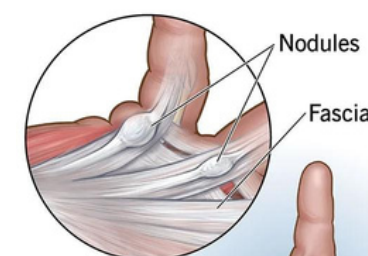
Dupuytren's contracture

• Results in shortening and thickening of the digital bands, which then pull the fingers into flexion, especially the ring and little fingers.

• is not uncommon in middle-aged and elderly individuals.



Dupuytren's Contracture



Cleveland Clinic ©2022



Helpful Video

Eventually, the metacarpophalangeal and proximal interphalangeal joints become permanently flexed. Surgical excision of the contracture is often effective.

Volkmann contracture

Ischemic muscular contracture (flexion deformity) of the fingers and sometimes of the wrist,

Resulting from ischemic necrosis of the forearm flexor muscles, caused by a pressure injury, such as compartment syndrome, or a tight cast.

The muscles are replaced by fibrous tissue, which contracts, producing the flexion deformity.

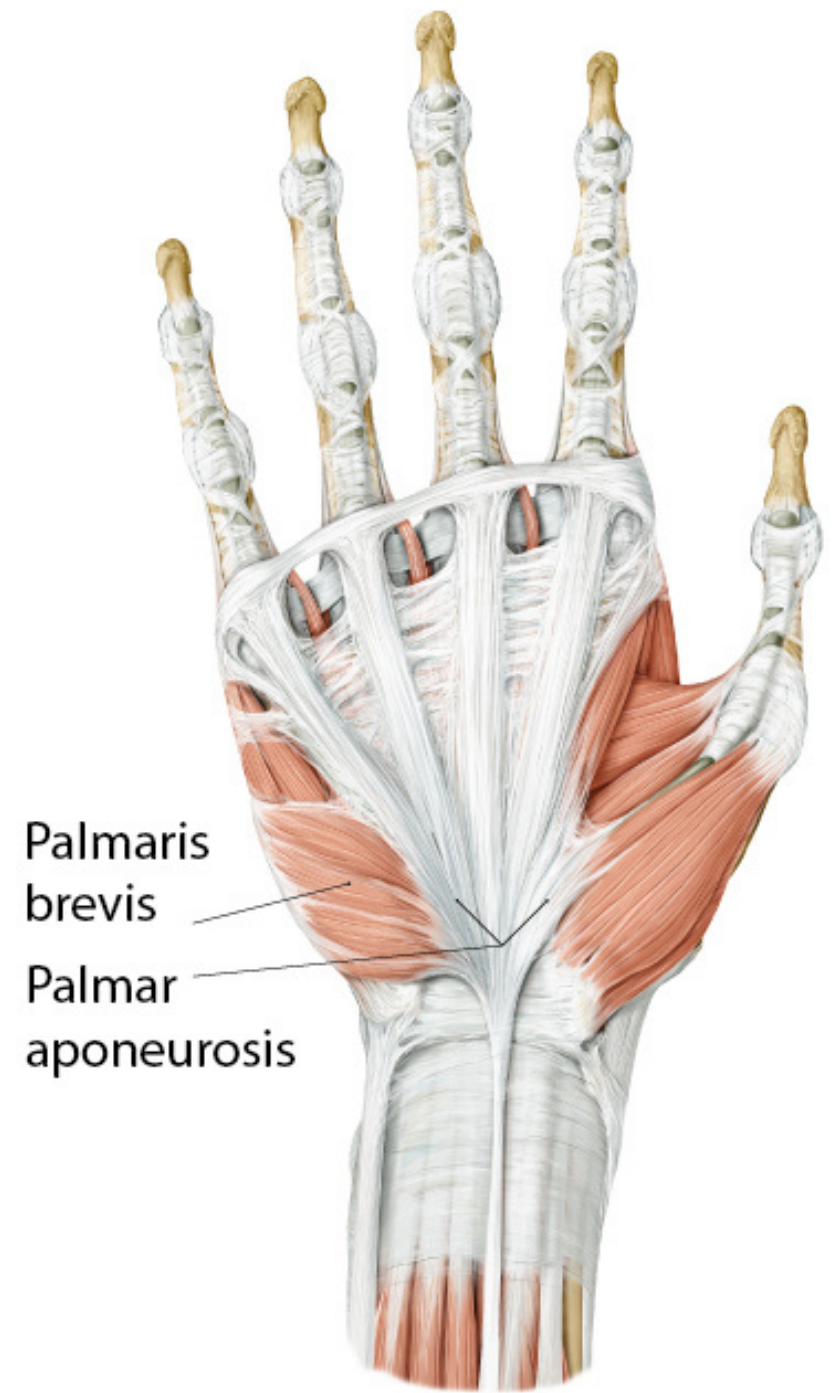


Palmaris Brevis

Girls' Slides

Origin:
Flexor retinaculum (FR) &
Palmar aponeurosis (PA)

Insertion:
Skin of the palm



Nerve supply:

Ulnar nerve (superficial branch) (the only muscle supplied by the superficial branch of ulnar nerve)

Action:

Prevent corrugation of skin to improve grip.

Short muscles of the hand (little finger)

they are a small mirror images of the thenar muscles.

And Their action is indicated by their names



Helpful Video

Hypothenar eminence (3 muscles)

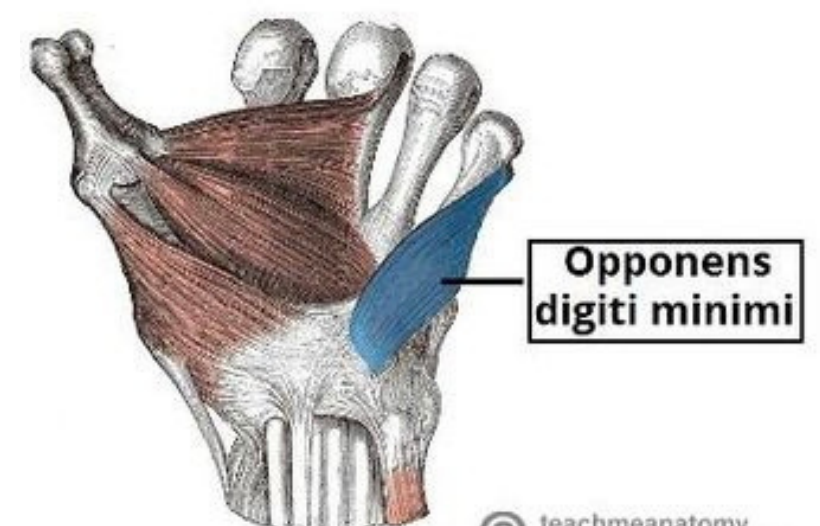
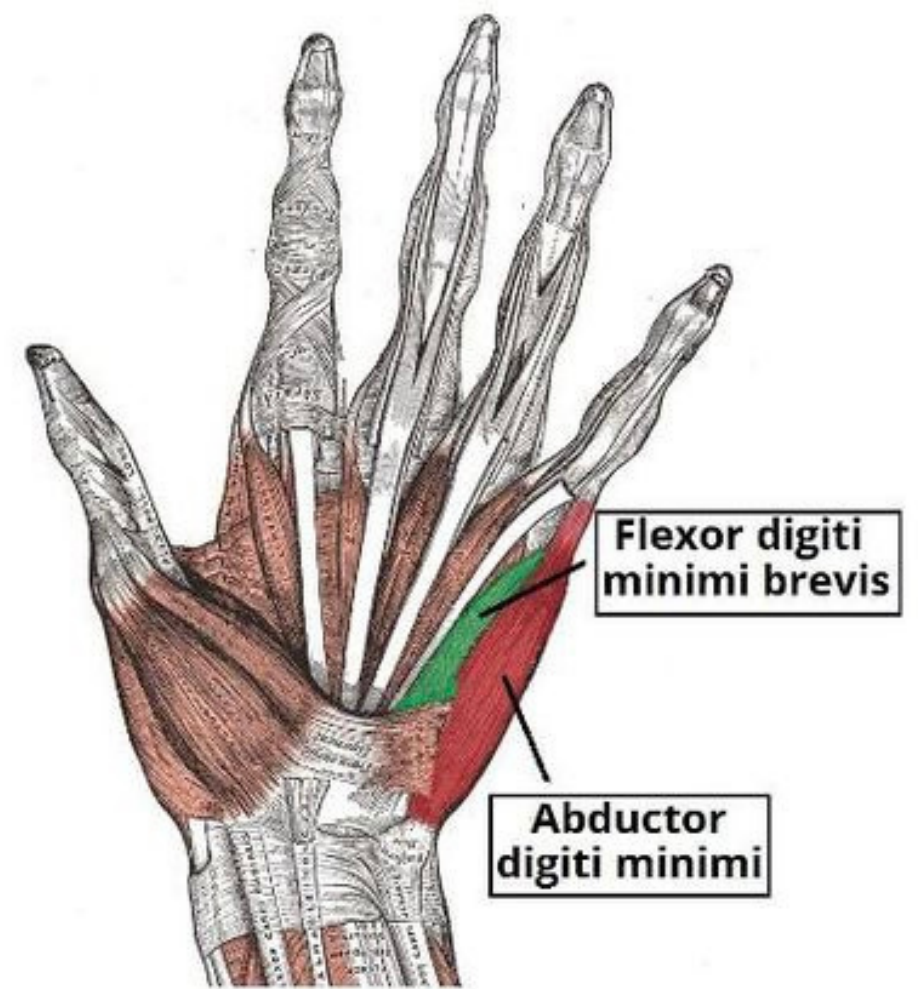
Extra Information: In anatomy, "digiti minimi" refers to the fifth digit or the smallest finger of the hand or foot.

	Abductor digit minimi	Flexor digit minimi	Opponens digit minimi
Origin	Pisiform	Flexor Retinaculum	Palmar surface of 5th metacarpal
Insertion	Base of proximal phalanx		Whole length of the ulnar margin of 5th metacarpal
Nerve supply	All by deep branch of ulnar nerve		
Action	Abduction	Flexion	Pulls the 5th metacarpal forward (cup the palm)



Extra Information:

- Abductor digiti minimi abduct the little finger away from the fourth.
- Flexor digiti minimi produces flexion of the little finger at its Hypothenar eminence (3 muscles) metacarpophalangeal joint.



Short muscle of the hand (Thumb)

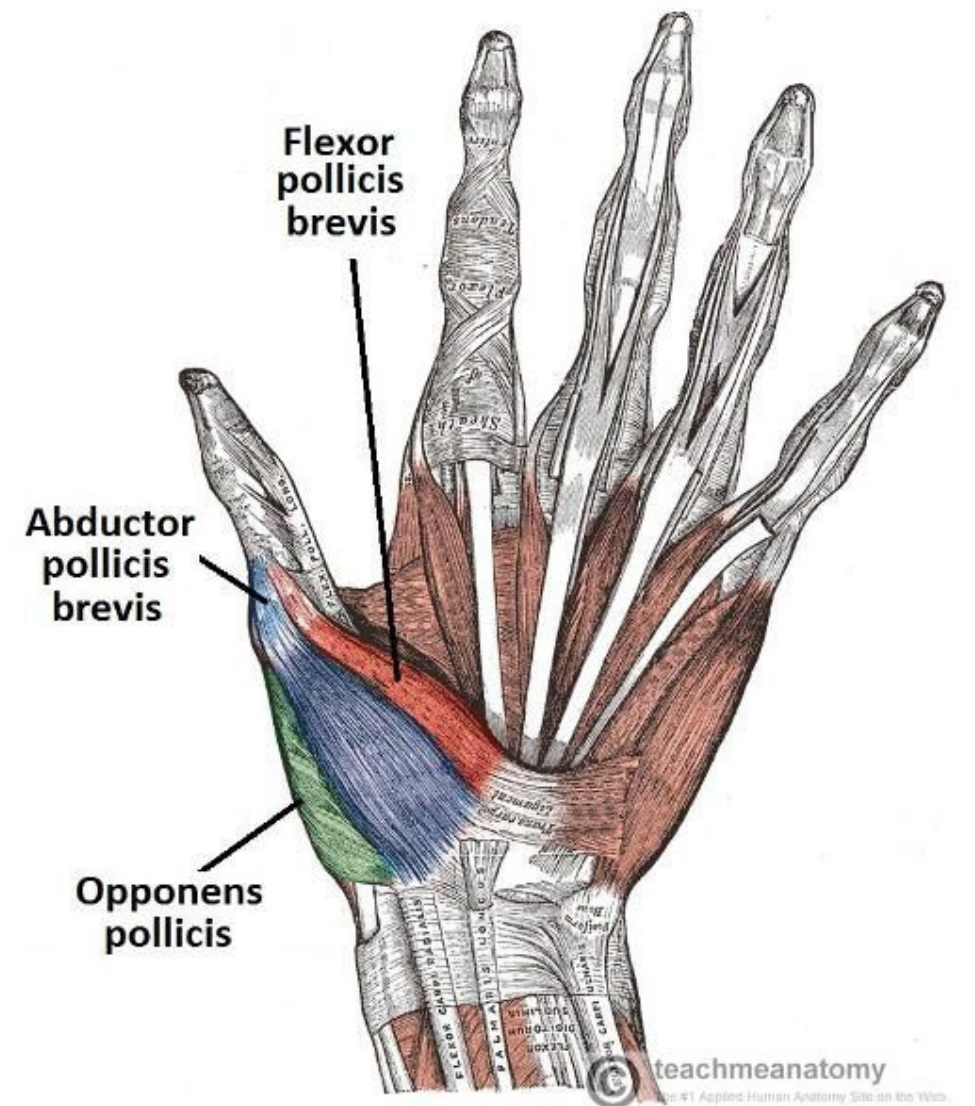


Thenar eminence (3 muscles)

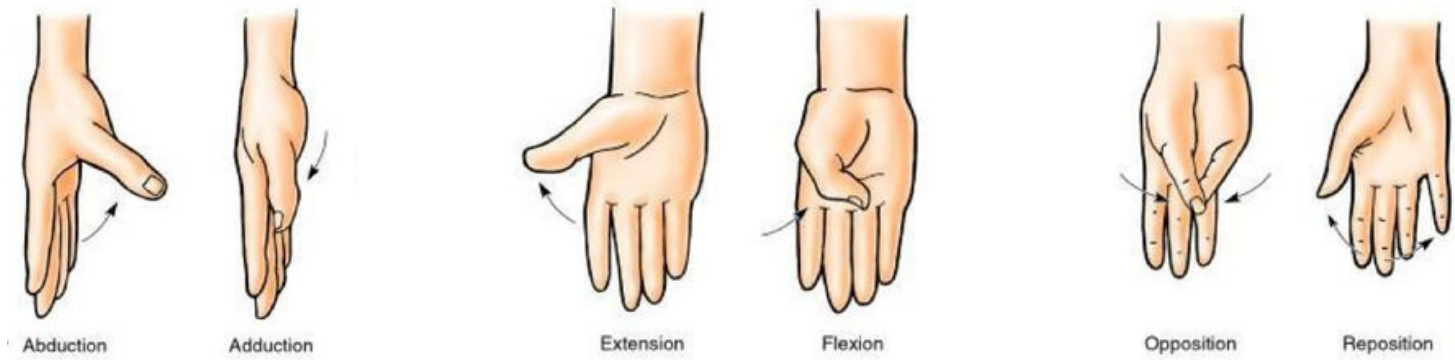
Extra Information: In anatomy, "pollicis" refers to the thumb or the first digit of the hand.

	Abductor pollicis brevis	Flexor pollicis brevis	Opponens pollicis
Origin	Flexor retinaculum, Scaphoid, & Trapezium	Flexor Retinaculum	
Insertion	Base of proximal phalanx		Lateral part of the 1st metacarpal
Nerve supply	All supplied by median nerve		
Action	Abduction	Flexion (It flexes the carpometacarpal and metacarpophalan geal joints of the thumb.)	Opposition

It flexes, adducts and medially rotates the thumb (otherwise known as opposing the thumb) to bring the pulp of the thumb tip into contact with the tips of the flexed fingers.



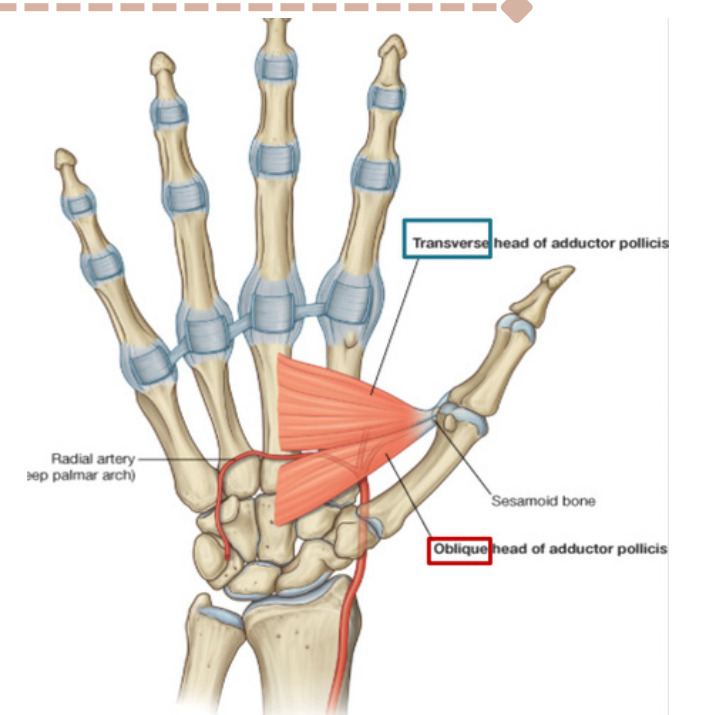
Movements of the thumb :



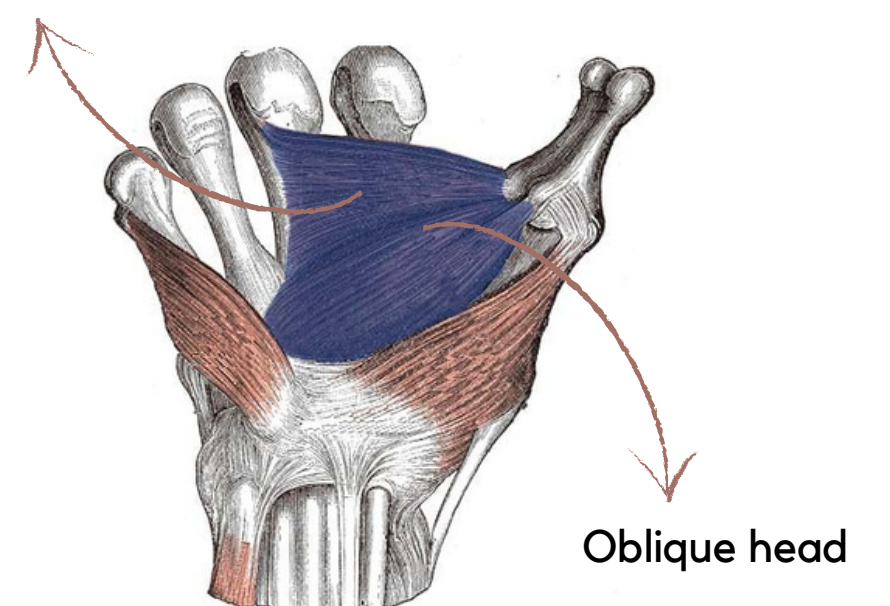
Short muscle of the hand (Thumb)

Adductor pollicis

origin	Oblique head: Anterior bases of 2nd& 3rd metacarpal Transverse head: 3rd metacarpal
insertion	Medial side of base of proximal phalanx of thumb
nerve supply	Deep branch of ulnar
action	Adduction , and assists in opposition of the thump



Transverse head



a) Adductor pollicis

Flexor digitorum Superficialis:



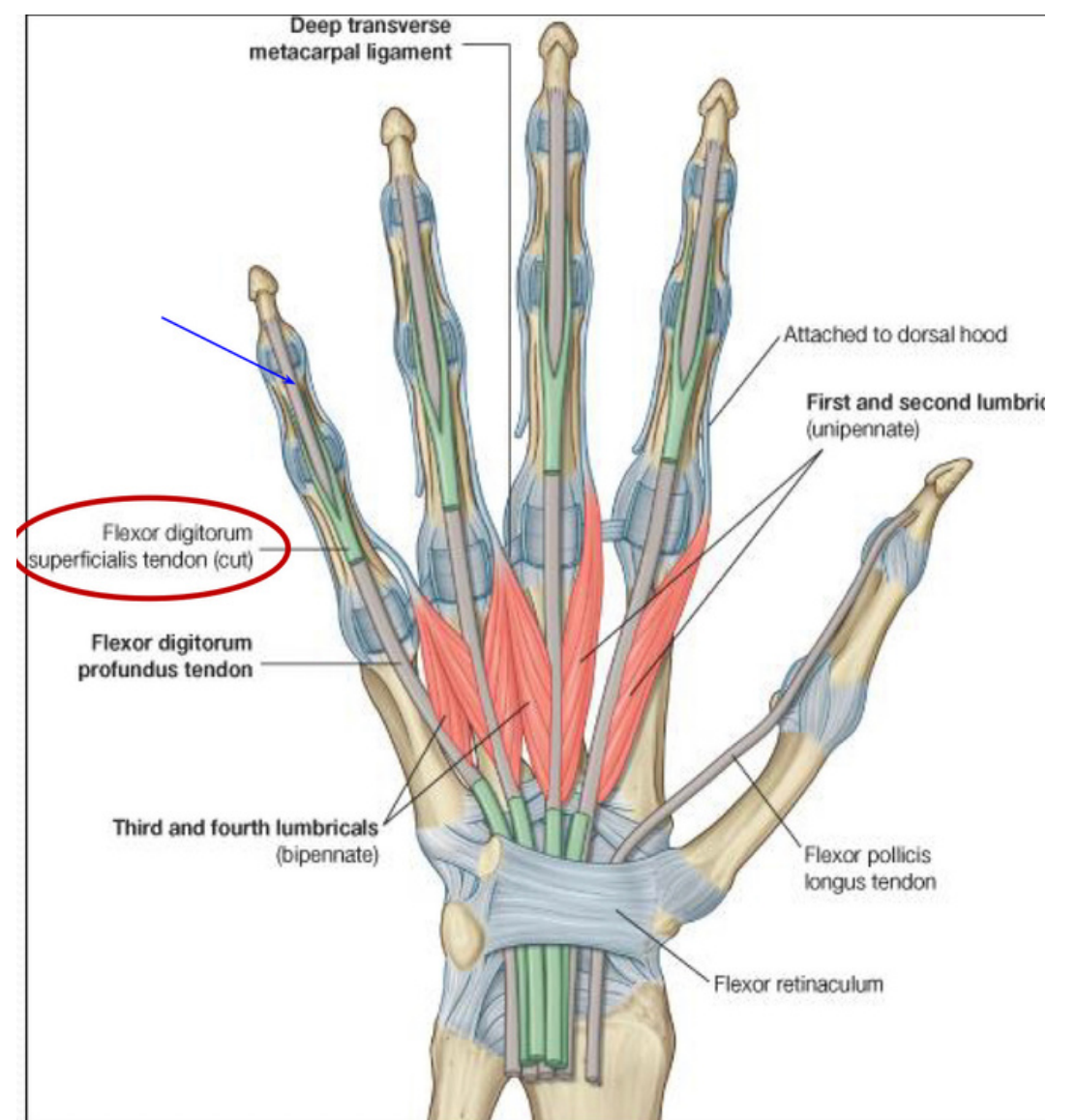
Inserted into Sides of Middle Phalanges of medial 4 fingers.

Each tendon:

- Divides into two halves & pass around the Profundus Tendon.
- The two halves Meet on the posterior aspect of Profundus tendon (partial decussation of fibers).
- Reunion of the two halves.
- Further Division into two slips attached to the Borders of Middle Phalanx.

Flexor digitorum Profundus:

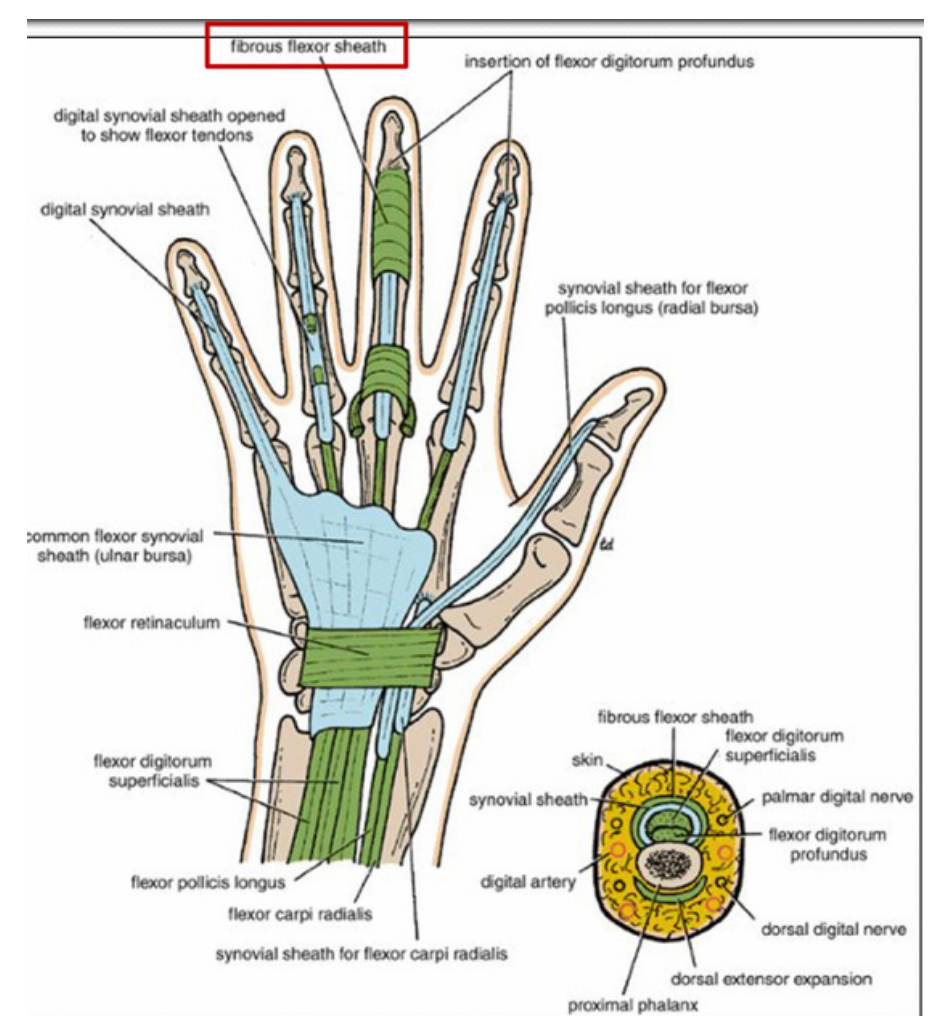
Inserted into the Base of the Distal Phalanges of medial 4 fingers .



Fibrous Flexors (digital) Sheath

A strong fibrous sheath, which covers the anterior surface of the fingers and attached to the sides of the phalanges.

- Its **Proximal** end is **opened**,
- Its **Distal** end is **closed**.
- The sheath with the anterior surfaces of the phalanges & the interphalangeal joints form an **Osteofibrous blind tunnel** for the long flexor tendons of the fingers covered by synovial sheaths.



Synovial Flexor Sheaths

A-Common synovial sheath (Ulnar bursa):

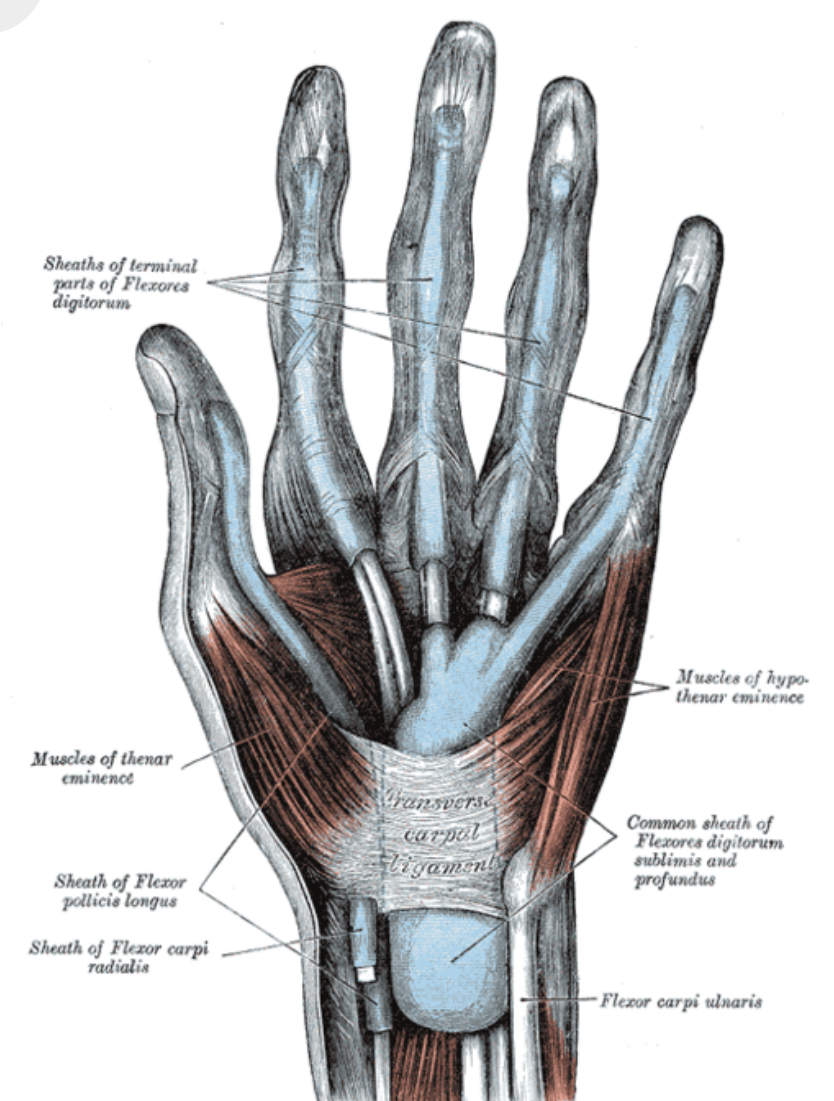
3 separate synovial sheaths surround the flexor tendons.

- 1st surround tendons of flexor digitorum superficialis & profundus
- The **medial** part of the sheaths **extend** distally (without interruption) on the tendon of the **little finger** .
- the **Lateral** part of the sheath **stops** on the middle of the palm
- 2nd separate synovial sheaths surround (the distal ends of) the long flexor tendons of (Index, middle & Ring) fingers acquire **Digital synovial sheaths**
- 3rd separate synovial sheath surround flexor pollicis longus




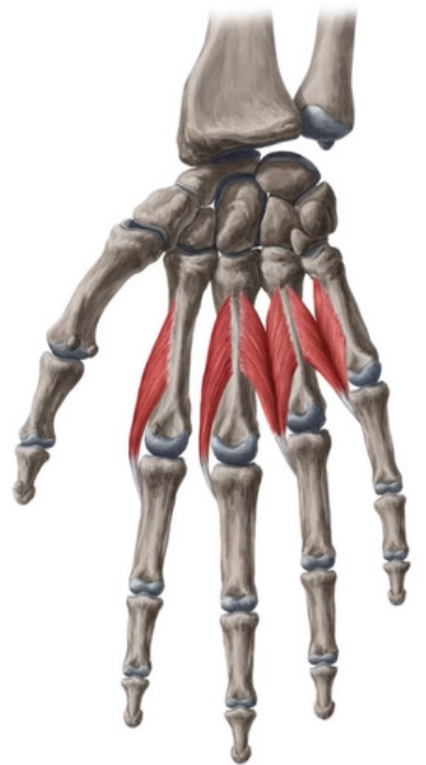

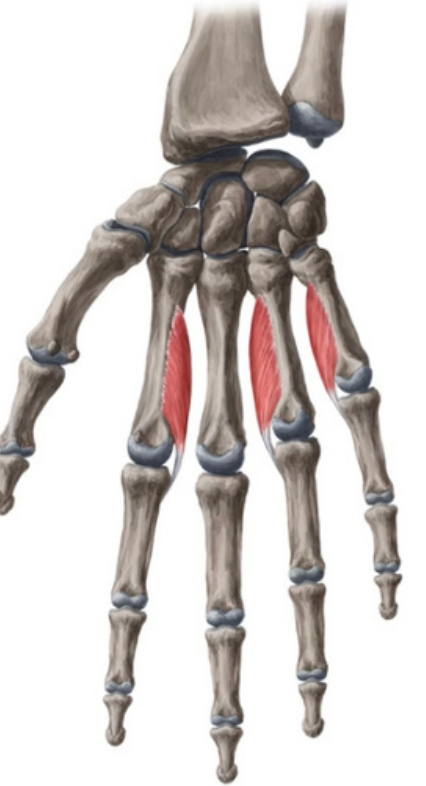

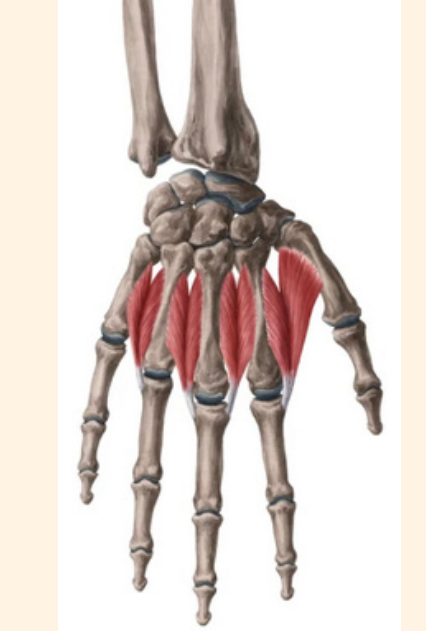
B- Flexor Pollicis Longus tendon has its own synovial sheath (Radial Bursa).

Function of synovial sheaths: Allow the long tendons to move smoothly with a minimum of friction beneath the flexor retinaculum and the fibrous flexor sheaths.

* Ulnar bursa is the synovial flexor sheath enclosing the tendons of medial 4 fingers flexors.



Thank you team 441!

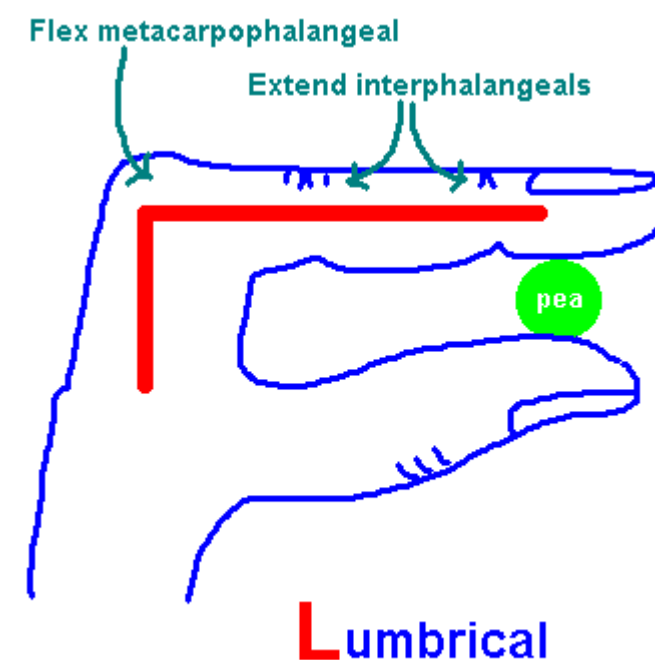
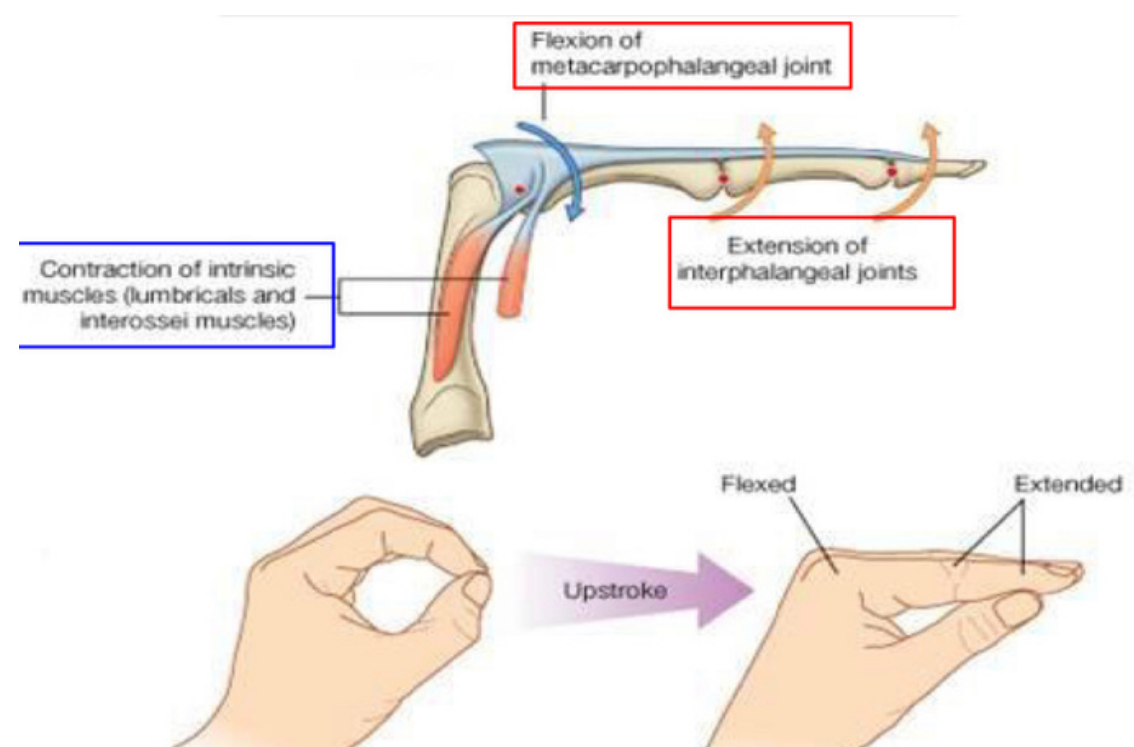
name of the muscle	origin	insertion	 nerve supply	 action	picture
 Lumerical muscles (4 muscles) (worm like)	Tendon of flexor digitorum Profundus	Extensor expansion of medial four fingers	1st & 2nd (Lateral two): Median Nerve. 3rd & 4th: Ulnar nerve (Deep branch).	Flexes: metacarpophalangeal joints. Extends: inter-phalangeal joints of finger. Except thumb	
 palmar interossei (4 muscles)	1st :Base of 1st metacarpal. Other three: Anterior Surface of Shafts of 2nd, 4th, & 5th metacarpals	Proximal phalanges of thumb, index, ring, & little fingers and Extensor expansion	Deep Branch of ulnar nerve	Adduction of fingers toward center of the 3rd one. (PAD: Palmar = adduction)	
 dorsal interossei (4 muscles)	Contiguous sides of Shafts of Metacarpals	Proximal Phalanx of index, ring, mid finger & EX		Abduction of fingers away from the 3rd one. (DAB: Dorsal= Abduction)	

1 **Interossei**
 Lie deep between the metacarpals
 Four dorsal and four palmar muscles.
 The palmar adduct 'Pad' and the dorsal abduct 'Dab' the fingers about the axis of the middle finger.

2 **Lumbricals**
 are slender, worm-like muscles, action is similar to that of the interossei, but it is in the finer control of the upstroke in writing that they are most important.

Action of lumbricals & interossei

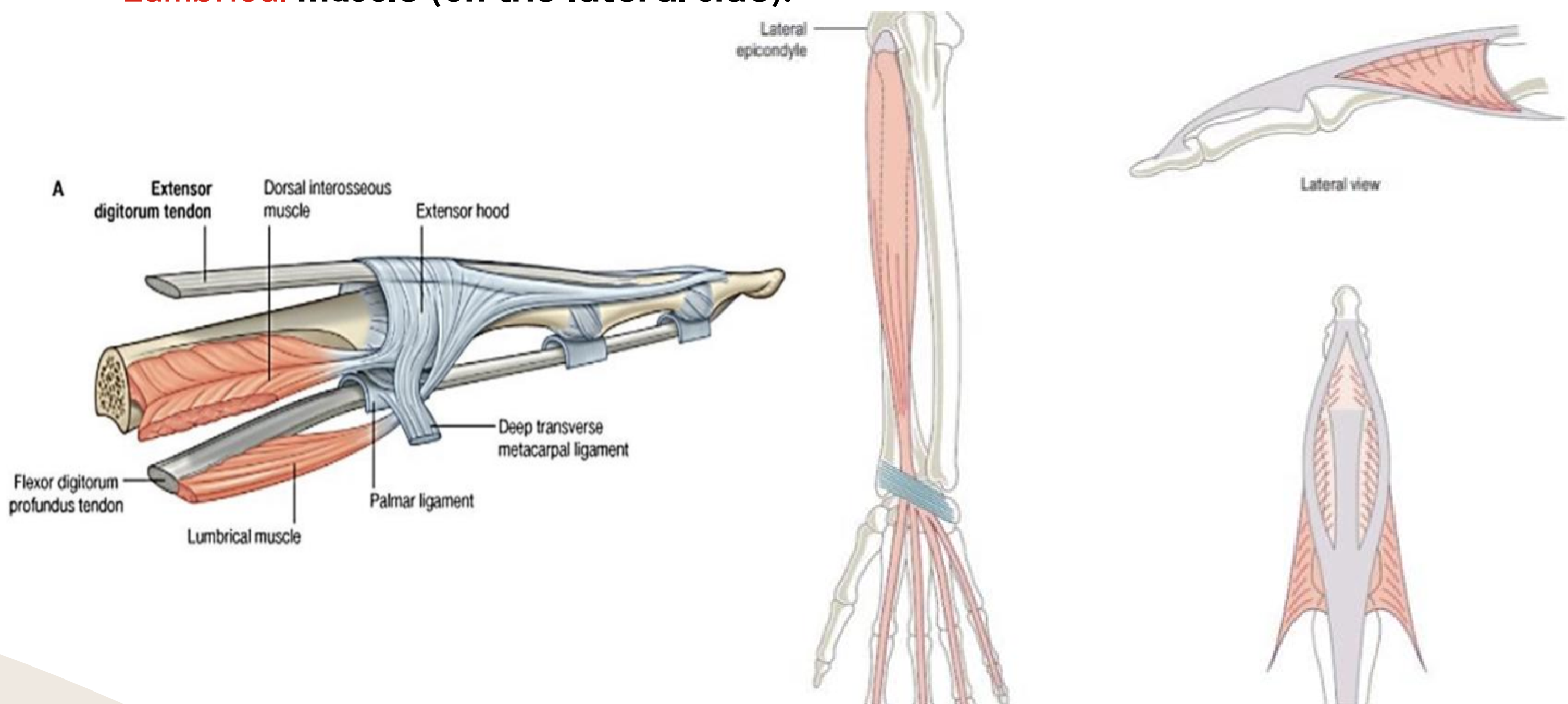
Action: Flex metacarpo-phalangeal joints and extend interphalangeal joints of fingers
Except thumb



Extensor Expansion

Formed from the expansion of the tendons of extensor digits at the PIJ (proximal interphalangeal joint).

- The tendon splits into three parts:
 - **One Central:** inserted into the **base** of **Middle phalanx**.
 - **Two laterals:** inserted into the **base** of the **Distal phalanx**.
- The Expansion Receives the insertions of:
 - Corresponding **Interosseous** muscle (on each side)
 - **Lumbrical** muscle (on the lateral side).



Muscles of the Hand



Muscle	Origin	Insertion	Nerve	Action
Abductor pollicis brevis	Flexor retinaculum, scaphoid, trapezium	Lateral side of base of proximal phalanx of thumb	Median	Abducts thumb
Flexor pollicis brevis	Flexor retinaculum and trapezium	Base of proximal phalanx of thumb	Median	Flexes thumb
Opponens pollicis	Flexor retinaculum and trapezium	Lateral side of first metacarpal	Median	Opposes thumb to other digits
Adductor pollicis	Capitate and bases of second and third metacarpals (oblique head); palmar surface of third metacarpal (transverse head)	Medial side of base of proximal phalanx of the thumb	Ulnar	Adducts thumb
Palmaris brevis	Medial side of flexor retinaculum, palmar aponeurosis	Skin of medial side of palm	Ulnar	Wrinkles skin on medial side of palm
Abductor digiti minimi	Pisiform and tendon of flexor carpi ulnaris	Medial side of base of proximal phalanx of little finger	Ulnar	Abducts little finger
Flexor digiti minimi brevis	Flexor retinaculum and hook of hamate	Medial side of base of proximal phalanx of little finger	Ulnar	Flexes proximal phalanx of little finger
Opponens digiti minimi	Flexor retinaculum and hook of hamate	Medial side of fifth metacarpal	Ulnar	Opposes little finger
Lumbricals (4)	Lateral side of tendons of flexor digitorum profundus	Lateral side of extensor expansion	Median (two lateral) and ulnar (two medial)	Flex metacarpophalangeal joints and extend interphalangeal joints
Dorsal interossei (4) (bipennate)	Adjacent sides of metacarpal bones	Lateral sides of bases of proximal phalanges, extensor expansion	Ulnar	Abduct fingers, flex metacarpophalangeal joints, extend interphalangeal joints
Palmar interossei (3) (unipennate)	Medial side of second metacarpal; lateral sides of fourth and fifth metacarpals	Bases of proximal phalanges in same sides as their origins, extensor expansion	Ulnar	Adduct fingers, flex metacarpophalangeal joints, extend interphalangeal joints



MCQs

1

Pathological condition caused by compression of the median nerve at osseofibrous carpal tunnel?

A-Rheumatoid arthritis

B-Tendonitis

C-Arthritis

D-Carpal tunnel syndrome

2

Each tendon of flexor digiti superficialis divides into _____ around the profundus tendon?

A-2

B-3

C-4

D-5

3

Which of the following is not a movement of thumb?

A-flexion

B-extension

C-adduction

D-Rotation

4

In Fibrous Flexor (Digital) Sheath the proximal end is _____ and the distal end is _____ ?

A-closed, opened

B-opened, closed

C-opened, opened

D-Closed, closed

5

Triangular fibrous layer continuous with the palmaris longus tendon and overly the tendons in the palm?

A-flexor retinaculum

B-Palmar Aponeurosis

C-Palmaris longus

D-Bicipital aponeurosis



1-D 2-A 3-D 4-B 5-B

MCQs

6

The palmar interossei receive nerve supply from?

A-radial nerve	B-Median nerve	C-Brachial nerve	D-Deep branch of ulnar nerve
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7

The lateral two lumbrical muscles are supplied by?

A-Deep branch of ulnar nerve	B-digital branches of the median nerve	C-Superficial branch of the ulnar nerve	D-axillary nerve
------------------------------	--	---	------------------

8

The function of synovial sheaths is?

A-protect the bone	B-Hold the tendons at the wrist in position.	C-minimize friction	D-flexion of the wrist
--------------------	--	---------------------	------------------------

9

A muscular bulge on the ulnar side of the palm?

A-Hypothenar Eminence	B-thenar eminence	C-Palmaris Brevis	D-Palmar Aponeurosis
-----------------------	-------------------	-------------------	----------------------

10

A band of thickened deep fascia around tendons that holds them in place?

A-Palmar Aponeurosis	B-Retinaculum	C-Ulnar tunnel	D-Tendon sheath
----------------------	---------------	----------------	-----------------



6-D 7-B 8-C 9-A 10-B

SAQs

1 List the manifestations of Carpal Tunnel syndrome

- 1. Burning pain (pins and needles) in the lateral three and half fingers.
- 2. Weakness or atrophy of the thenar muscles (Ape Hand)

2 What is the function of Retinacula?

- Hold the long flexor and extensor tendons at the wrist in position.

3 What is the Carpal Tunnel formed from?

- Concave anterior surface of the carpus (carpal bones) and the carpus is covered by Flexor Retinaculum.

4 What is the origin of Adductor pollicis?

- 1- Oblique head: Anterior bases of 2nd & 3rd metacarpal 2- Transverse head: 3rd metacarpal

SAQs

A 40-year old man complaining of severe "pins and needle" in his right hand and lateral fingers examined by the physician. There was no objective impairment of sensation found over the thenar eminence. There was wasting of the thenar eminence muscles compared with the activity of the left side muscles.

5

Which nerve is affected ?

 Median nerve.

6

Which syndrome is related to this patient?

 Carpal tunnel syndrome.

7

List the muscles of the thenar eminence ?

 Abductor pollicis brevis. Flexor pollicis brevis. Opponens pollicis.



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