

AAOS/AAPA 2022  
JUNE 25<sup>TH</sup>, 2022

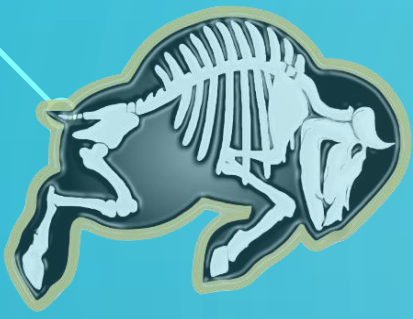
**Small Bones/Strange Joints/  
Scores of Problems: Hand and  
Wrist**



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# DISCLOSURES

- **Non-Declaration Statement:** I have no relevant relationships with ineligible companies to disclose within the past 24 months. (Note: Ineligible companies are defined as those whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients.)



# LEARNING OBJECTIVES

At the conclusion of this session, participants should be able to:

- Illustrate a basic understanding of radiographic principles regarding hand, wrist, forearm series
- Recognize important hand and wrist anatomy with physical exam tips and tricks
- Identify and treat ten of the most common upper extremity injuries including identifying/escalating emergent hand and wrist injuries
- Describe common hand and wrist infections with standardized treatment strategies
- Name general cast and splint principles for initial stabilization



Even when it's not pretty or perfect.  
Even when it's more real than you  
want it to be. Your story is what you  
have, what you will always have. It  
is something to own." – Michelle  
Obama



## QUICK CASE:

- 27M, fell three days ago while riding an electric scooter. Initial severe pain. Currently improved. No carpal tunnel symptoms Single view, PA, XR at urgent care shown. Dorsal wrist pain. What do you do next?
- 1) Wrist splint and follow up outpatient
- 2) Ibuprofen and a hug
- 3) Get a complete series of radiographs
- 4) MRI Stat!
- 5) Call nearest Hand Surgeon immediately
- 6) I have no idea what I'm looking at... why are there so many little bones?



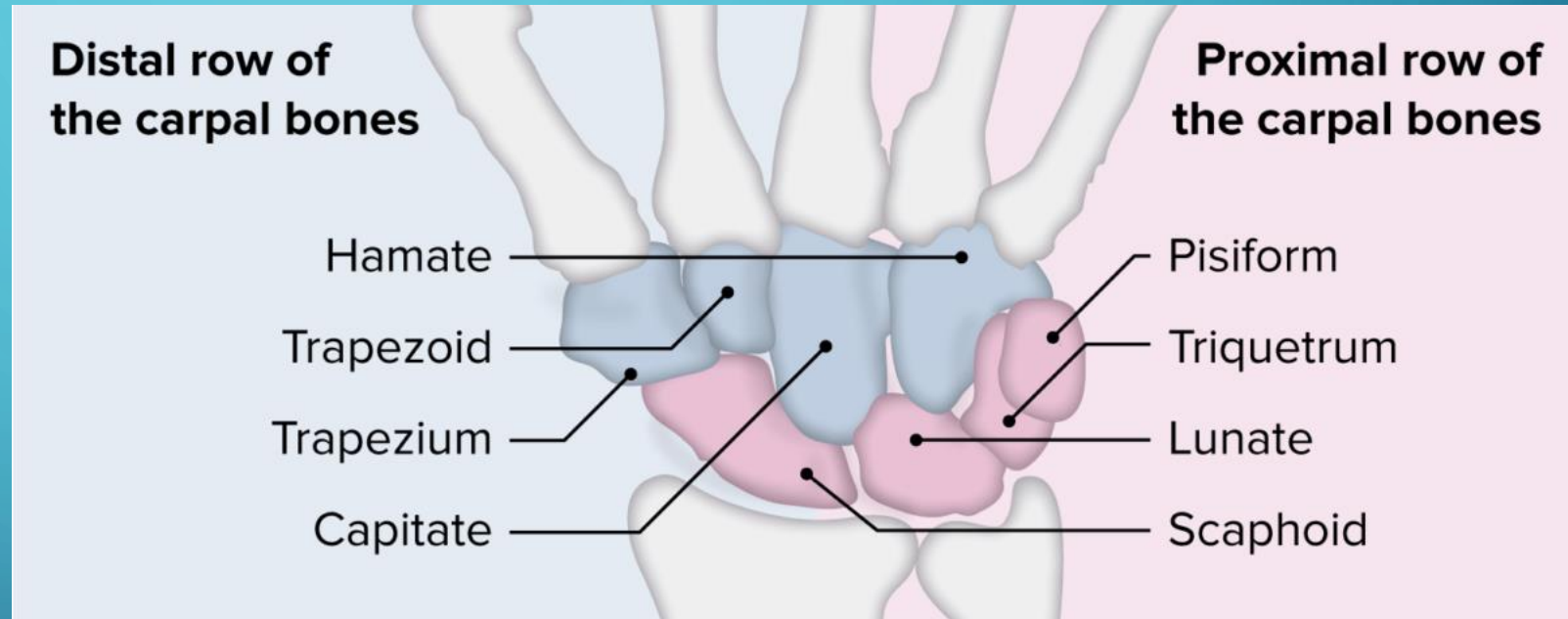
# HAND: OSTEOLOGY

- 29 Bones : Hand and Wrist
- Proximal, middle, and distal phalanx (P1, P2, P3)
- Thumb: prox and distal only
- MCPJ: Metacarpophalangeal joint
- PIJ: Proximal interphalangeal joint
- DIJ: Distal interphalangeal joint
- IP: Interphalangeal (Thumb)

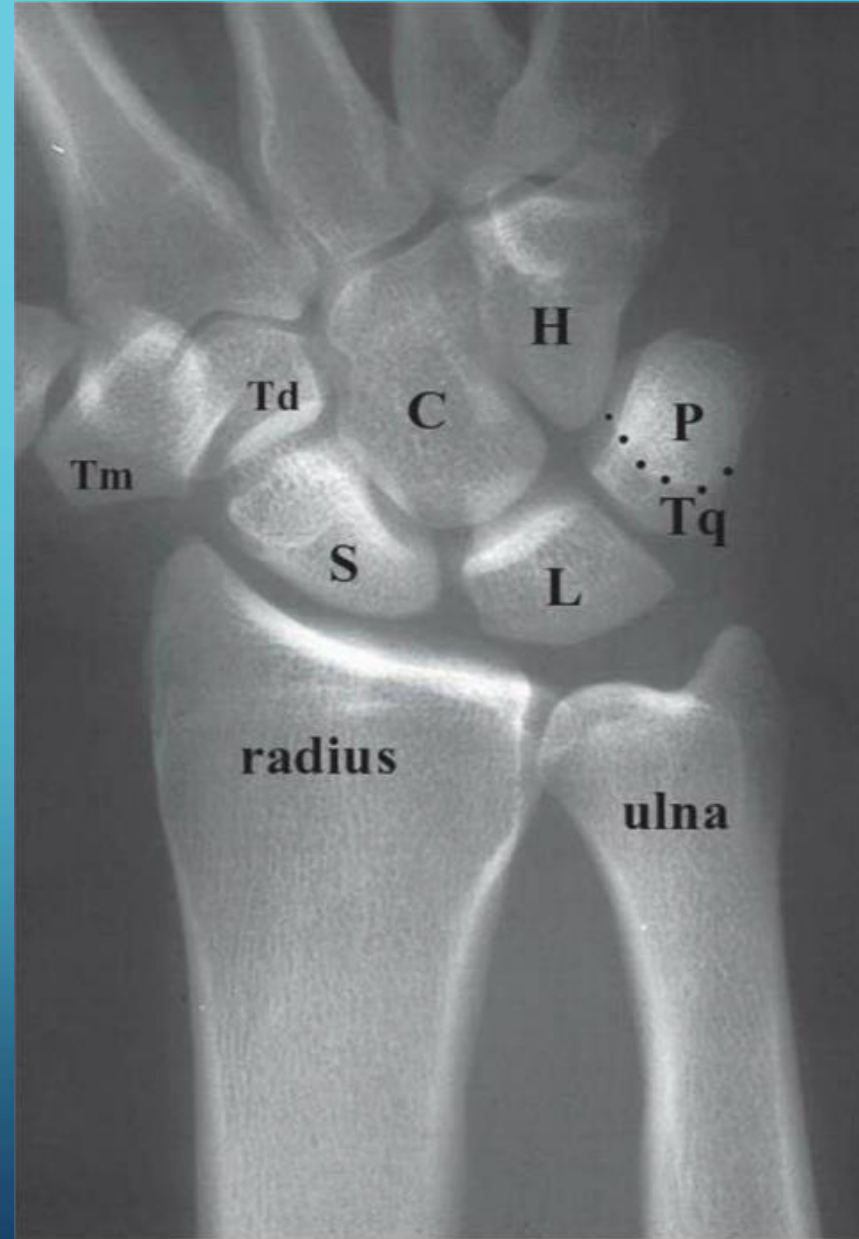


# WRIST: OSTEOLOGY

- 29 Bones : Hand and Wrist
- CMC: Carpometacarpal joint
- Mid Carpal Joint
  - Proximal/Distal Row
- Radiocarpal Joint
- DRUJ: Distal Radioulnar joint



# WRIST ANATOMY: OSTEOLOGY





# WRIST ANATOMY: XRS

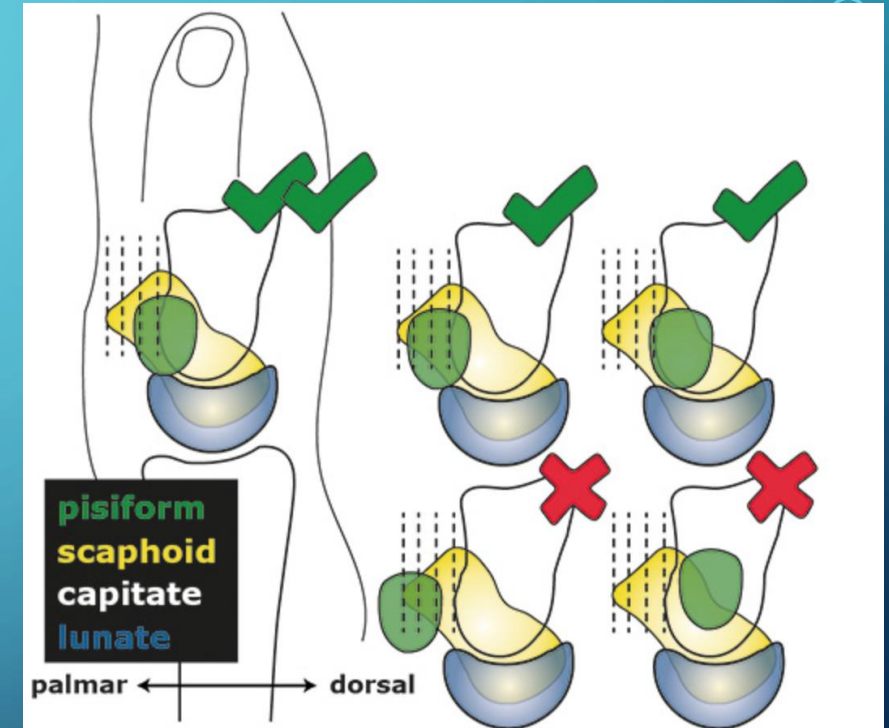
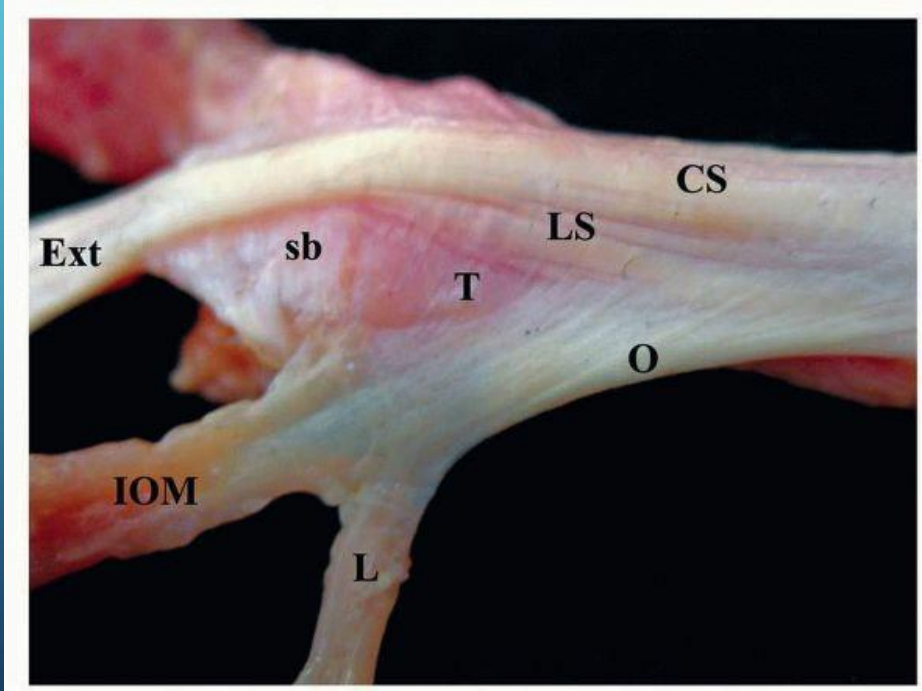
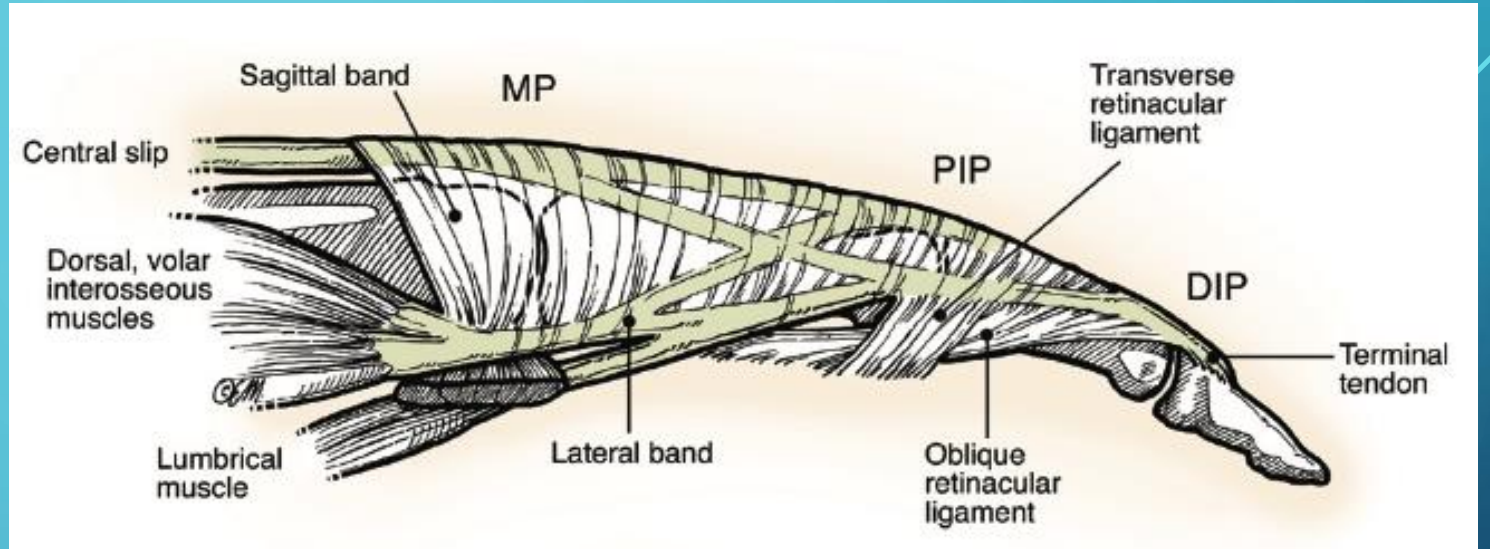
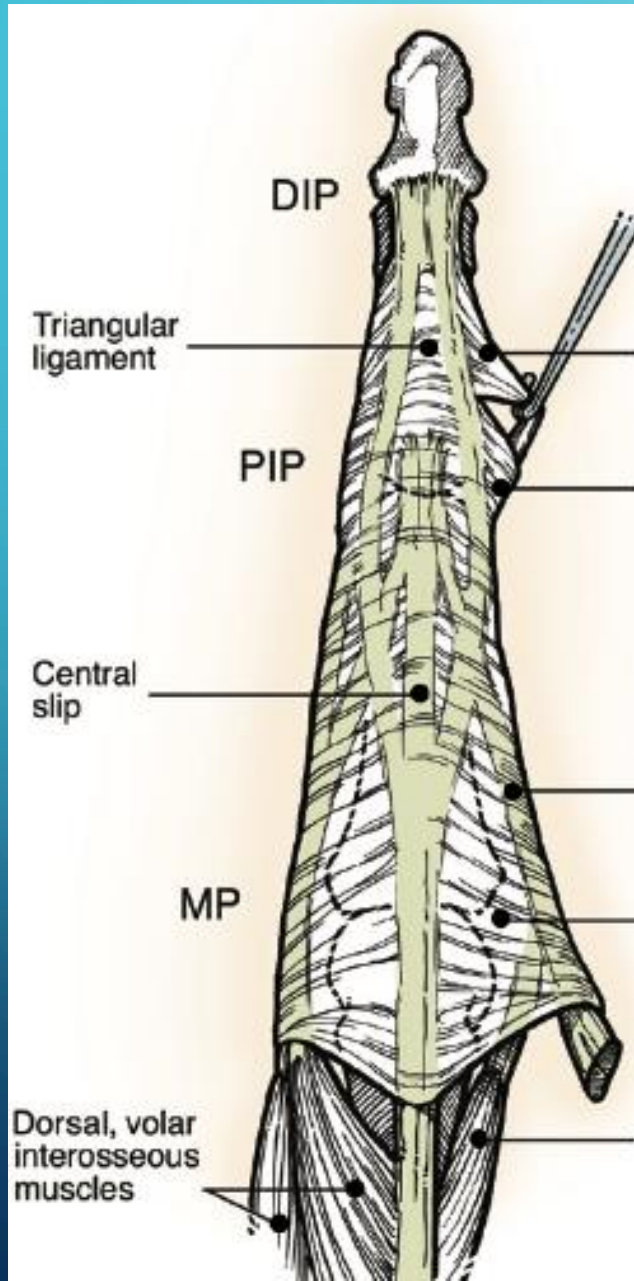
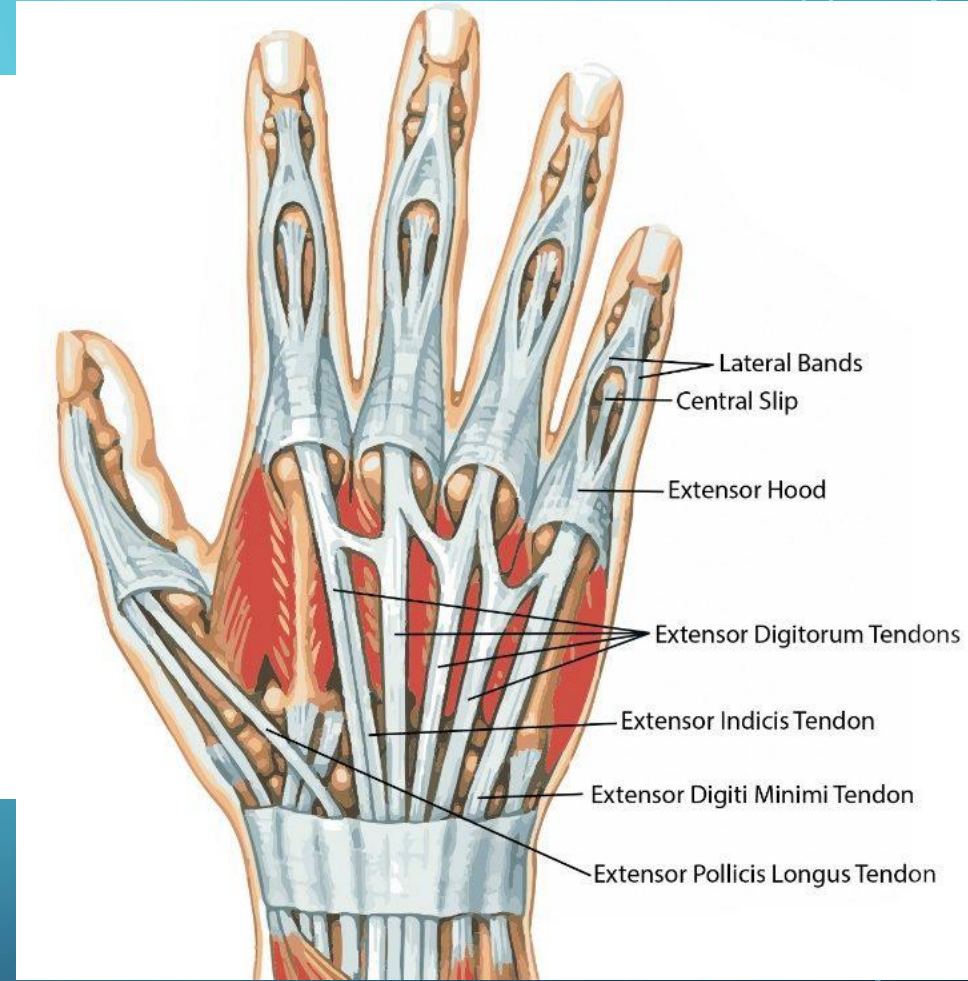
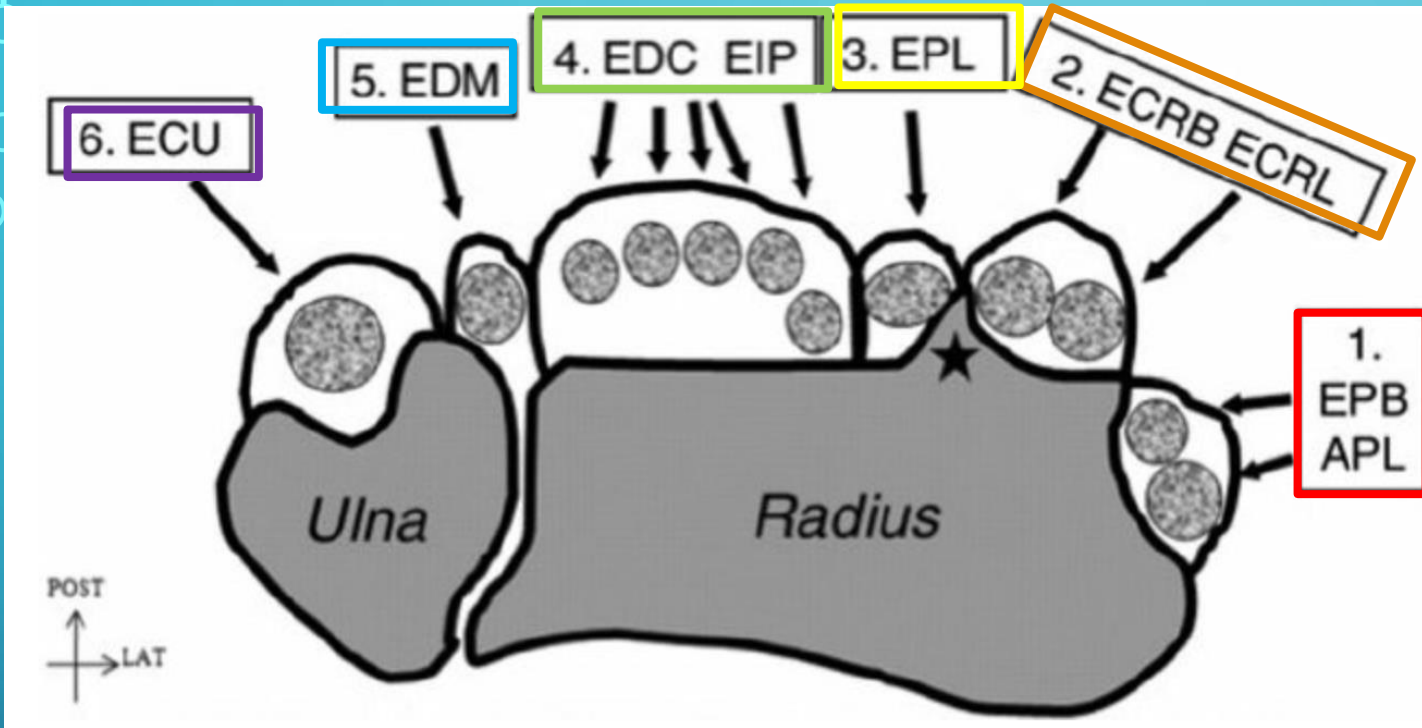


Figure 4. Technique for purely lateral image of the wrist. Ideally, the palmar cortex of the pisiform is located exactly between the palmar cortex of the capitate and the scaphoid (see top left). In the lower two positions, the image is not purely lateral.

# HAND: EXTENSOR TENDON APPARATUS



# HAND: EXTENSOR TENDONS



1. DeQuervain's tenosynovitis

5. Vaughn-Jackson Syndrome

2. Intersection syndrome

6. Snapping ECU

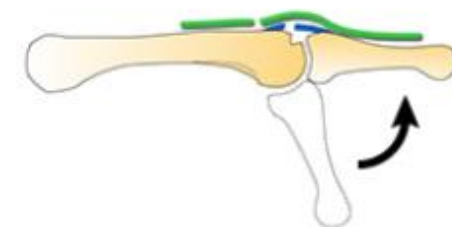
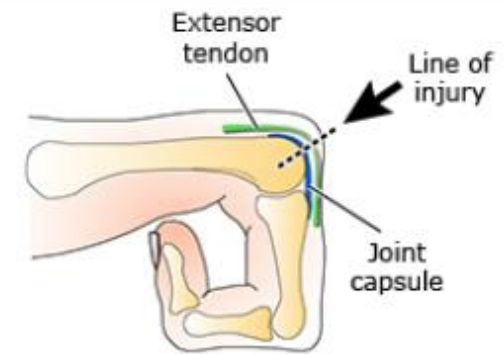
3. EPL rupture

4. Tenosynovitis

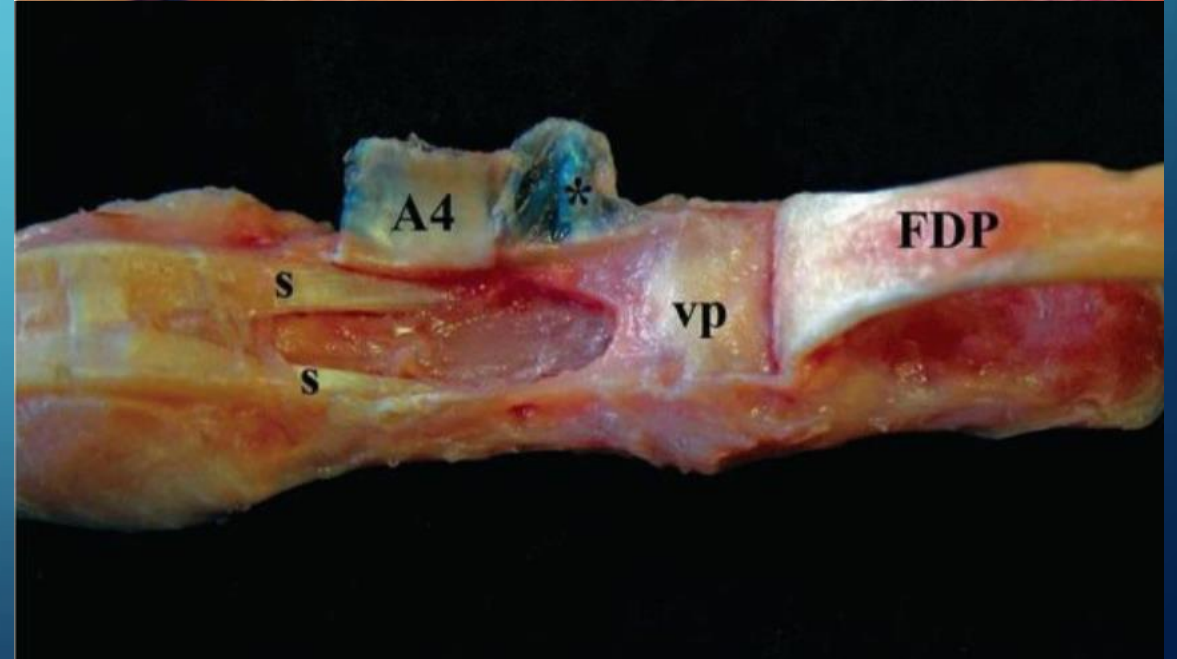
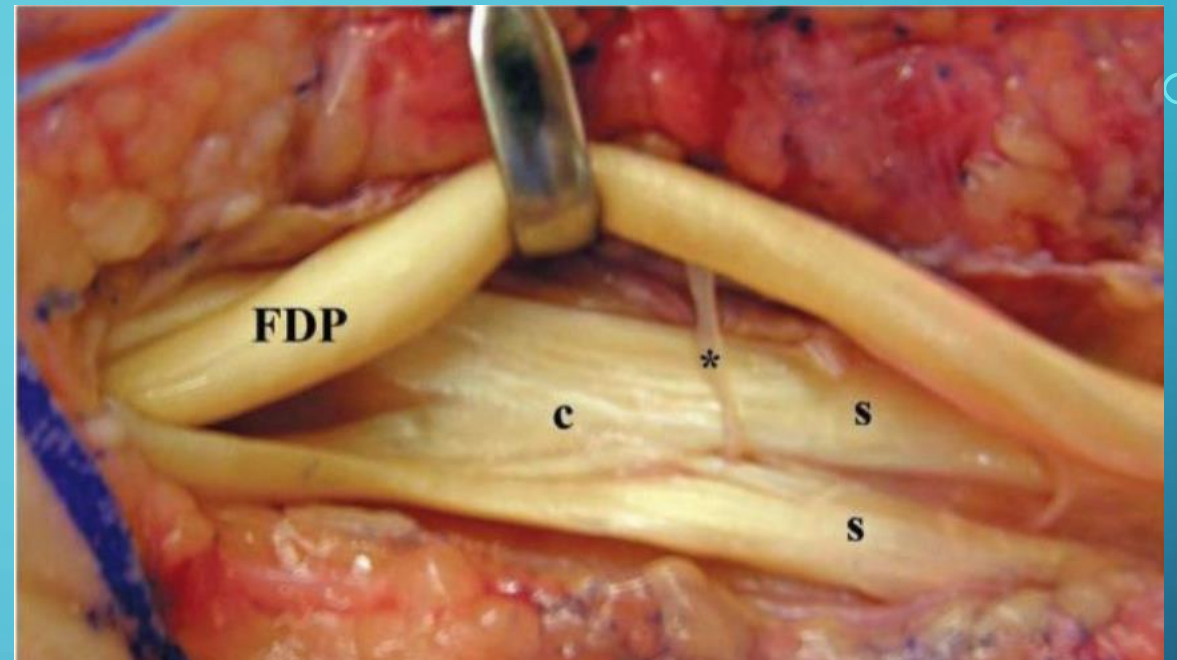
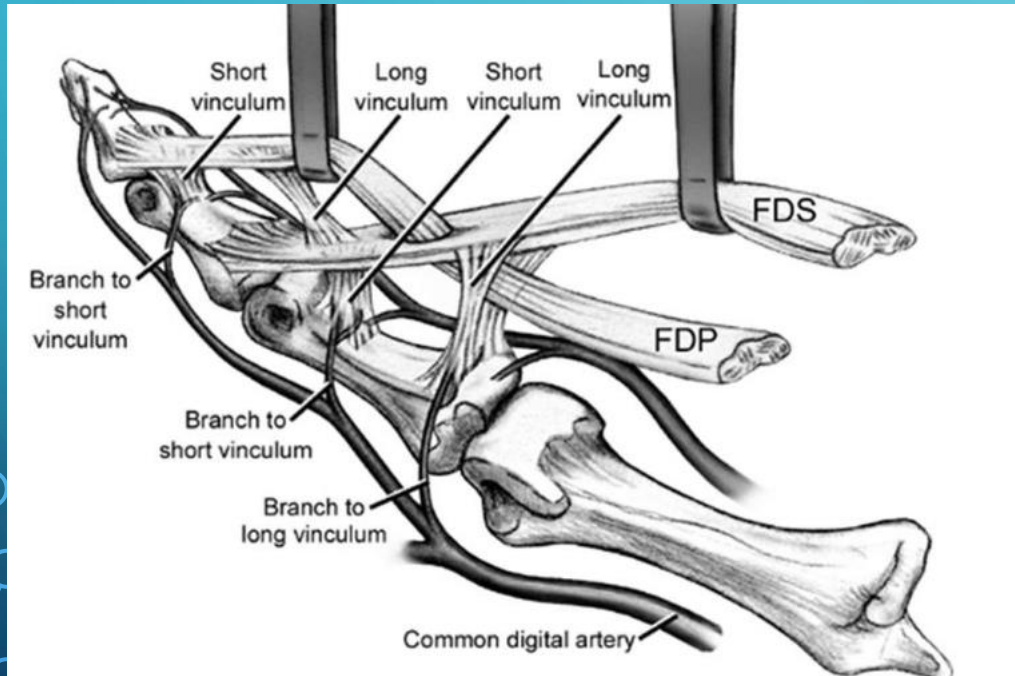


# COMMON CLINICAL SCENARIO #1: FIGHT BITE

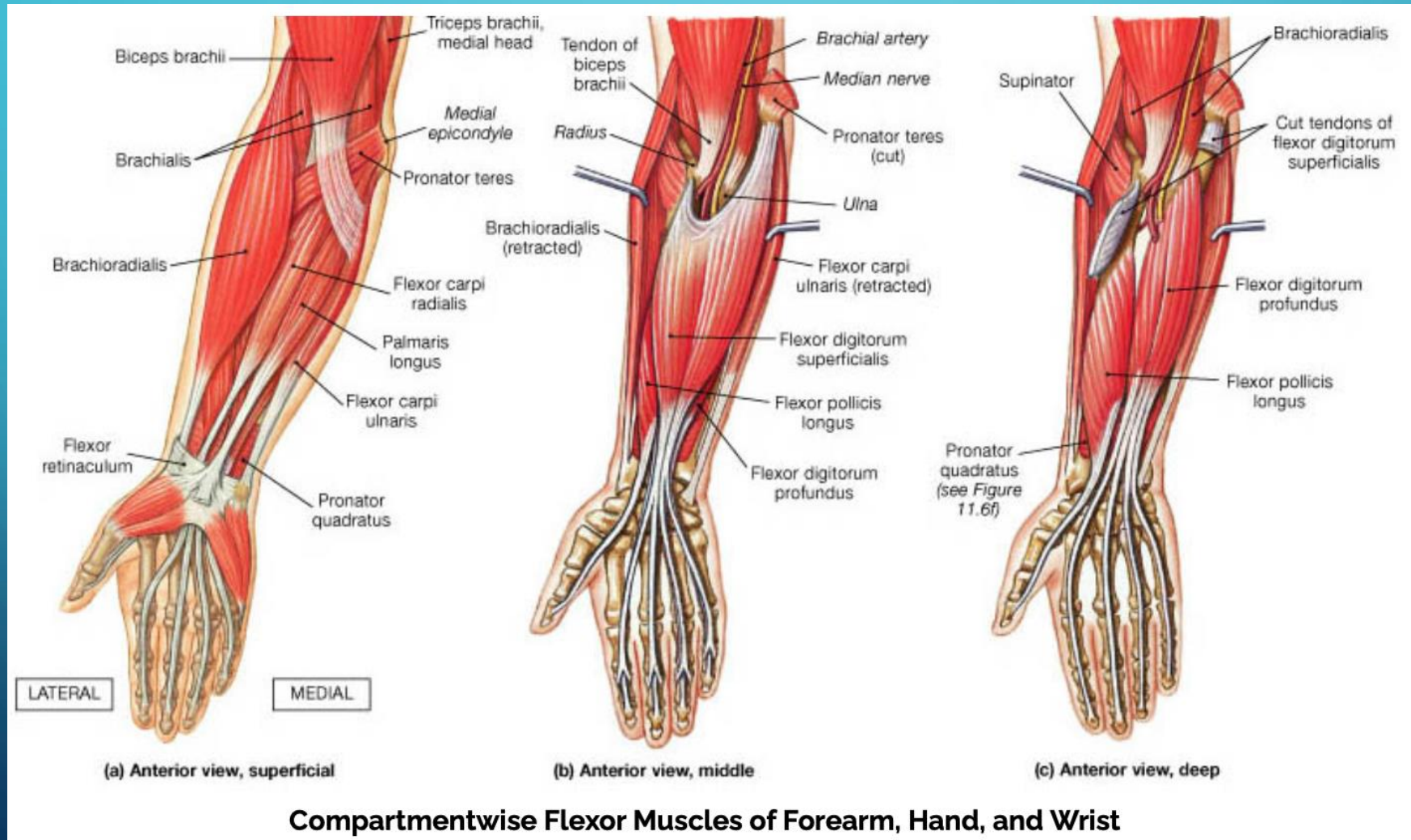
- 27F, Human bite over the MCPJ
  - 2-3 days prior
- May look superficial/benign, but with a closed fist injury, retraction of extensor hood can mask traumatic arthrotomy
- Oral flora (*Eikenella Corrodens*/GAS) + traumatic arthrotomy = extra bad
  - Saliva:  $10^8$  microbes/ml
- Tx:
  - Early Presentation: <24 hours
    - Unasyn IV → augmentin oral
  - Delayed Presentation: OR for I&D and and unasyn → augmentin for oral flora



# HAND: FLEXOR TENDONS



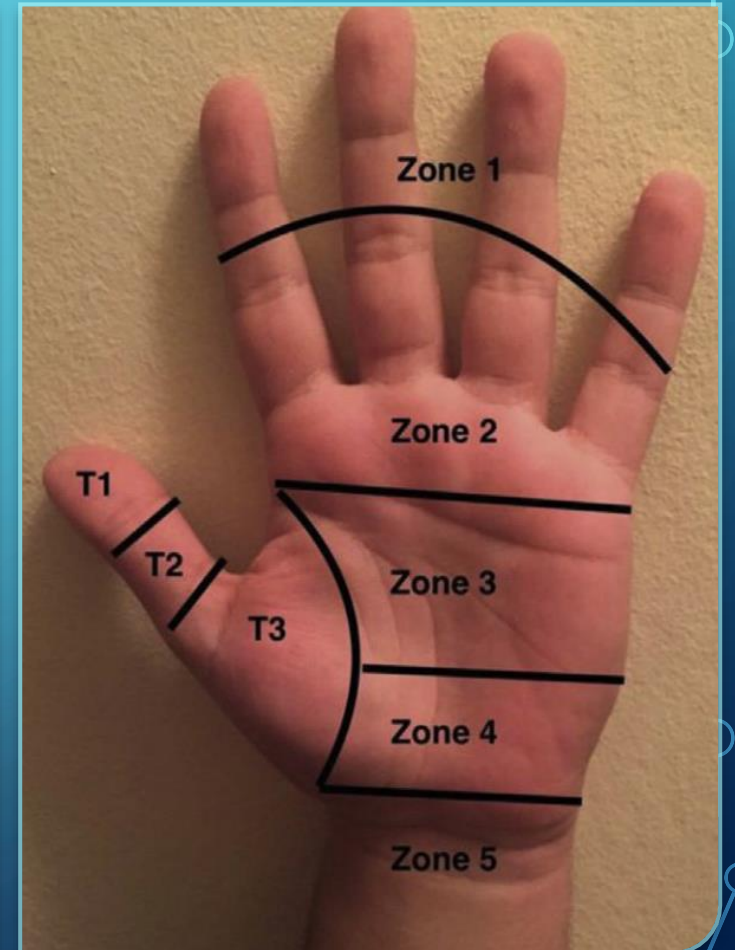
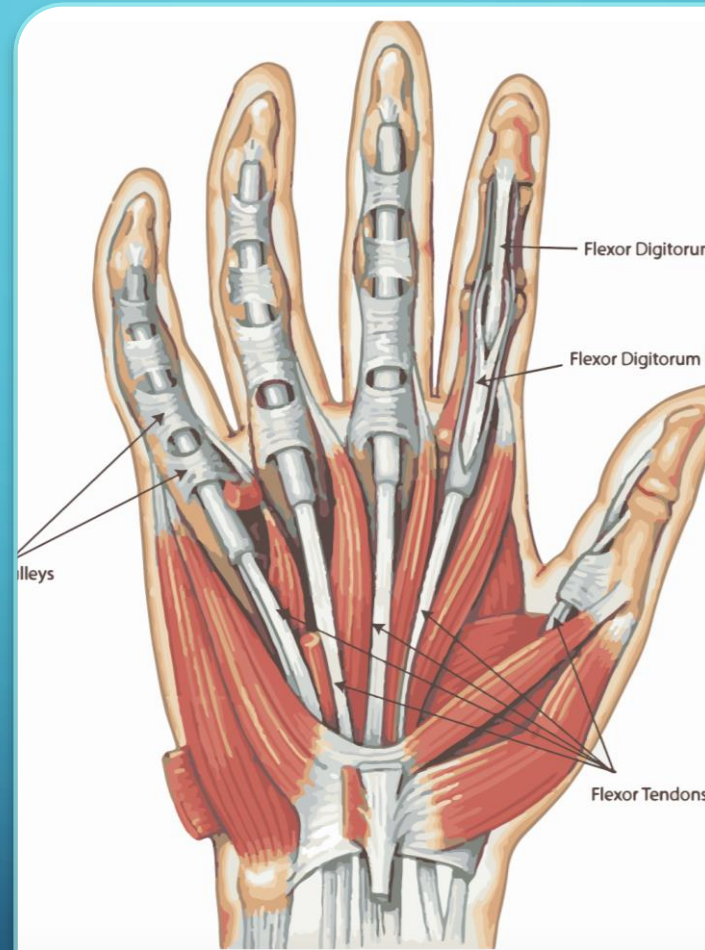
# HAND: FLEXOR TENDONS “EXTRINSIC FLEXORS”



# HAND: FLEXOR TENDON ZONES

- Verdan Zones:

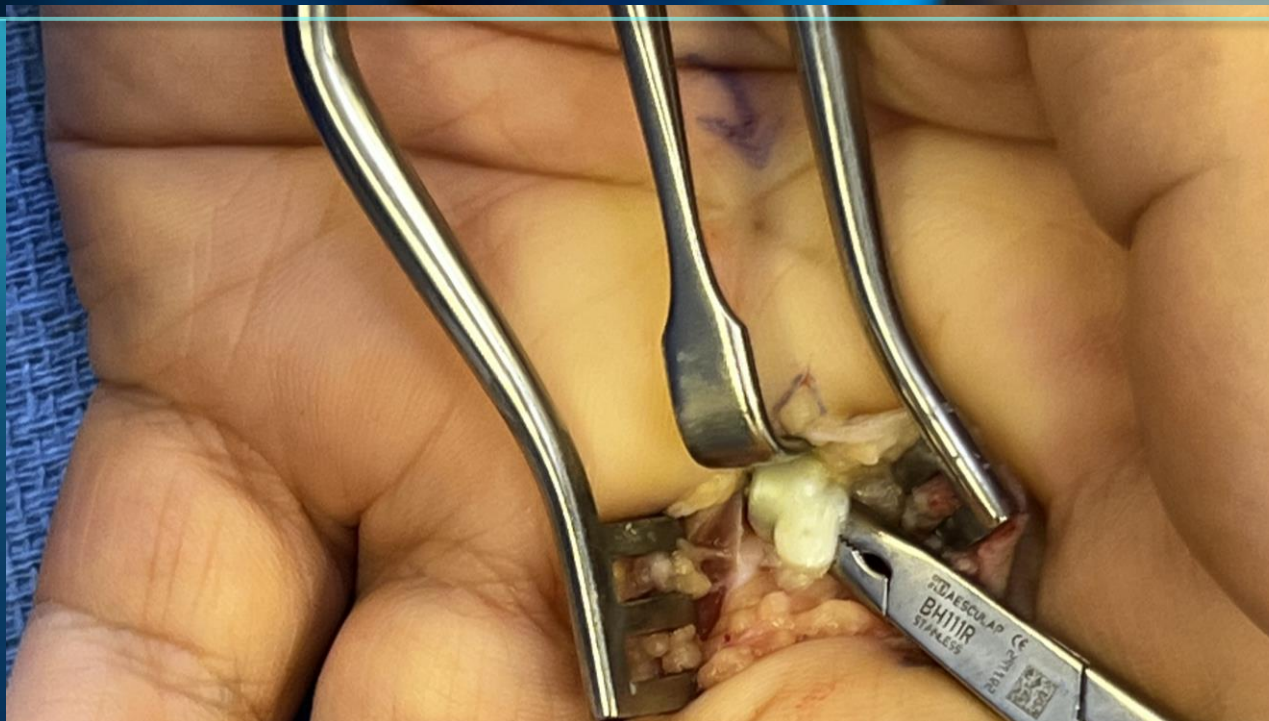
- Zone 1: Jersey Finger
  - FDP avulsion
- Zone 2: No Man's Land
  - FDP/FDS involvement
  - "Avocado Toast" injuries
- Zone 5: Spaghetti Wrist
  - Self-harm





## COMMON CLINICAL SCENARIO #2: AVOCADO TOAST

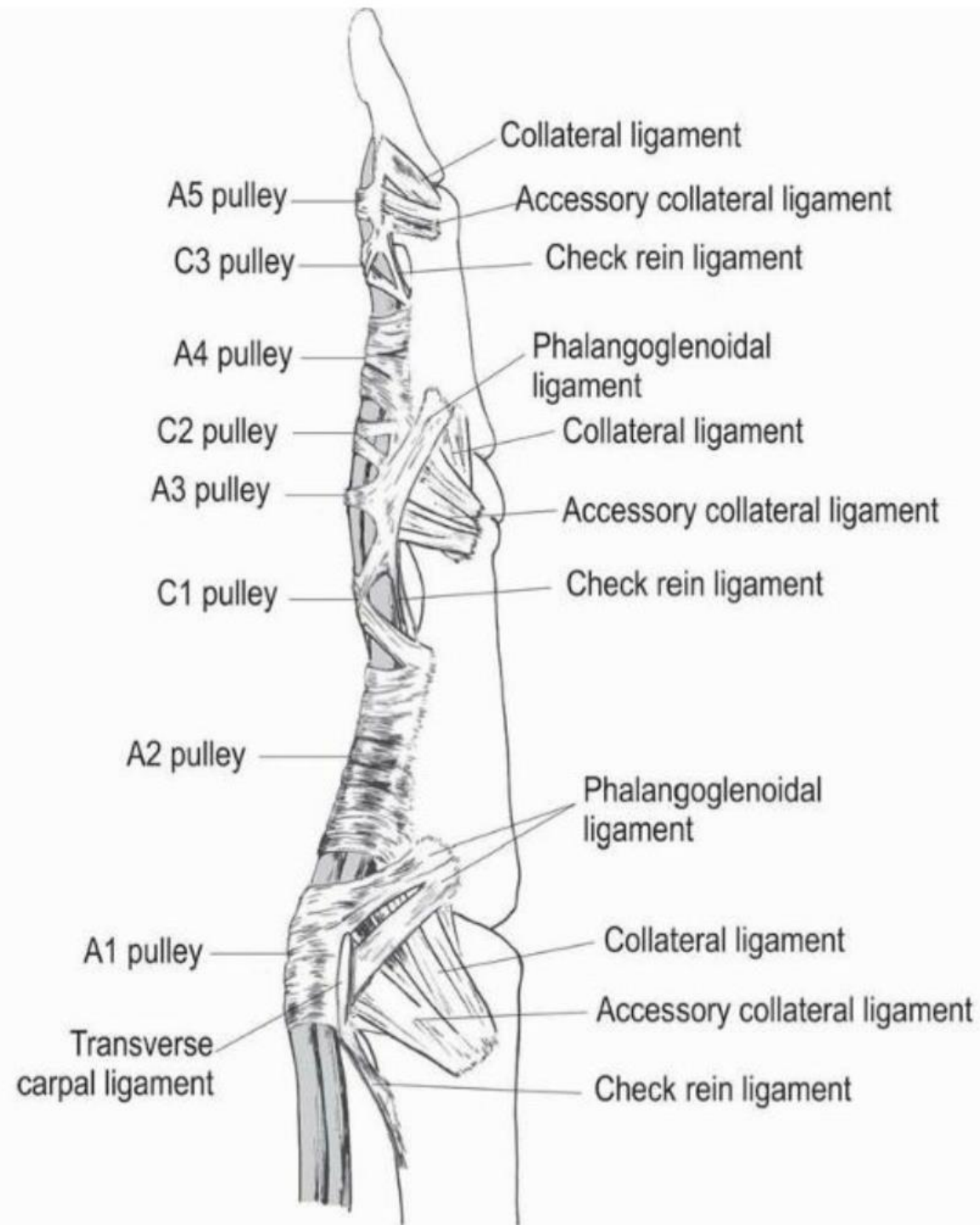
- 41F, Small laceration ZONE II Long
- Healed Laceration (3mm)
- Complains of clicking and catching with Flexion
- + digital swelling, mild dactylitis
- Full Isolated FDS/FDP intact
- Operative findings: Partial FDS laceration



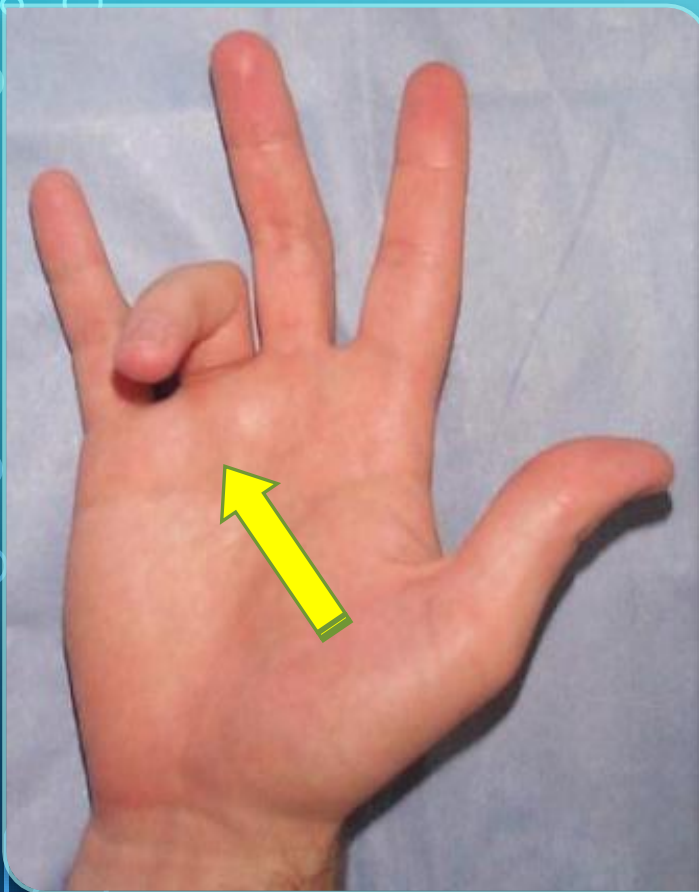


# HAND: PULLEY SYSTEM

- A=annular
- C=cruciate
- Purpose: keep the flexor tendons from bowstringing when the body of the flexor muscles contracts, flexing the finger
- Thickenings of the sheath where fibers run in circular (A) or crossed (C) patterns
  - A2 and A4 are the most important to keep intact



# COMMON CLINICAL SCENARIO #3: TRIGGER FINGER



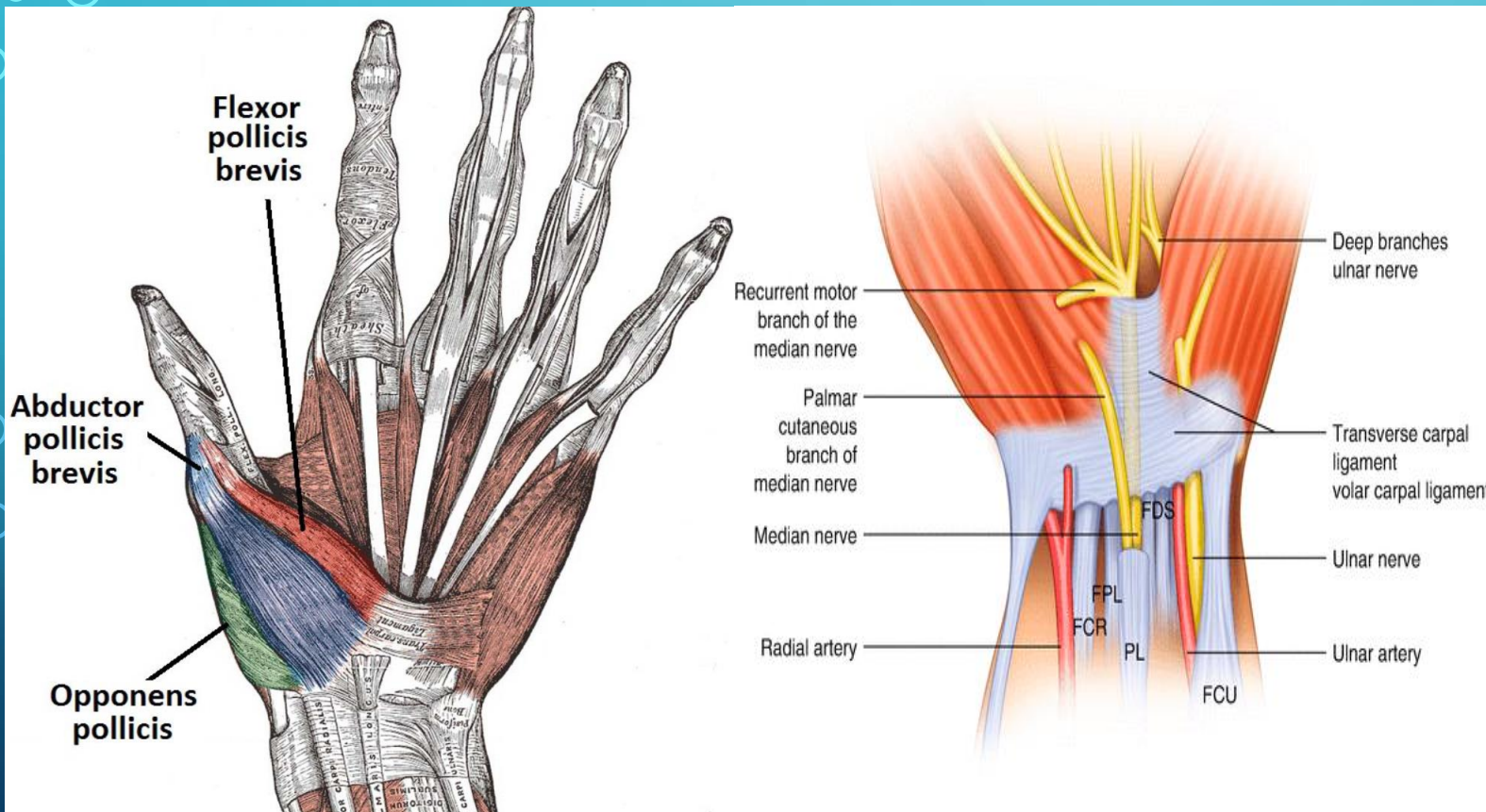
- 78M, gradual grinding with acute, painful locking of ring finger
- Dx: Stenosing tenosynovitis at level of A1 pulley
- Causes “locking” in flexion, called “triggering”
- **Exquisitely tender at A-1 pulley**
- Risk factors: DM/Hypothyroidism, female, age >50
  - Common in children < 5 yrs
- Treatment: CS injection, surgical release

# COMMON CLINICAL SCENARIO #4: FTS (PYOGENIC FLEXOR TENOSYNOVITIS)

- 27M, laborer
  - 2 day history of painful swelling in isolated finger, tracking to palm
  - 4/4 Kanavel Signs
    - Dactylitis
    - Finger flexion posturing
    - Pain with extension
    - Tenderness along flexor tendon sheath
- Technically, “pyogenic flexor tenosynovitis”
  - “FTS” or “flexor teno”
- Infection tracking along the flexor tendon sheath
- Intervention:
  - Immediate surgical debridement

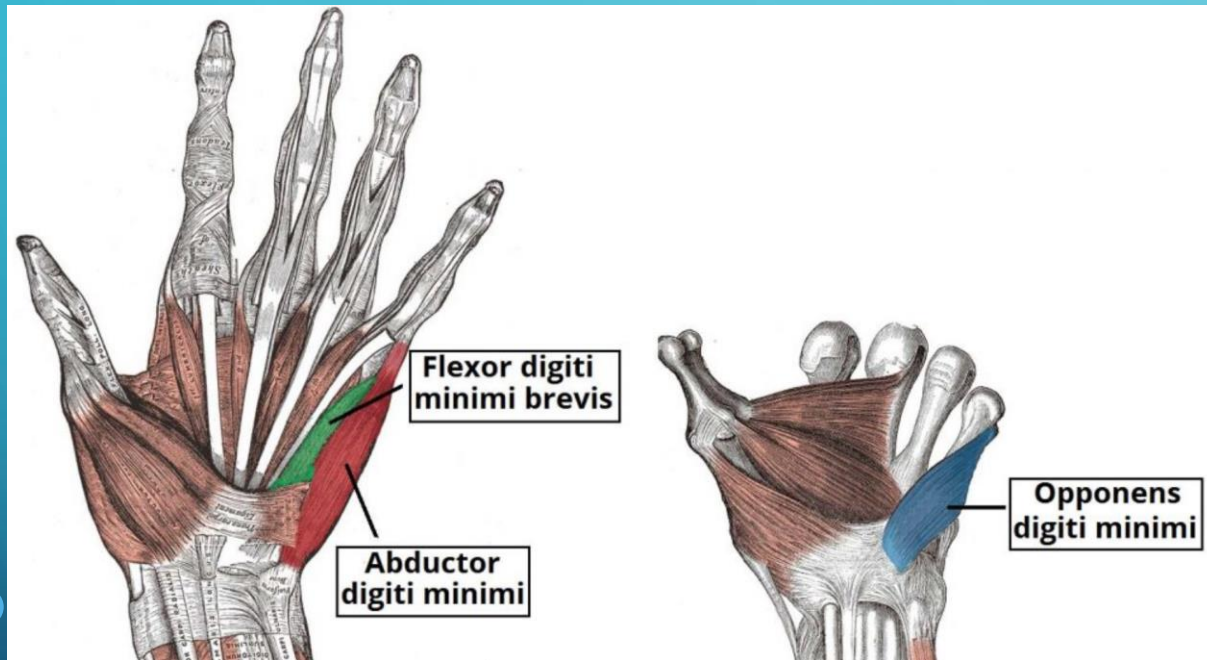


# INTRINSIC MUSCLES OF THE HAND: THENAR



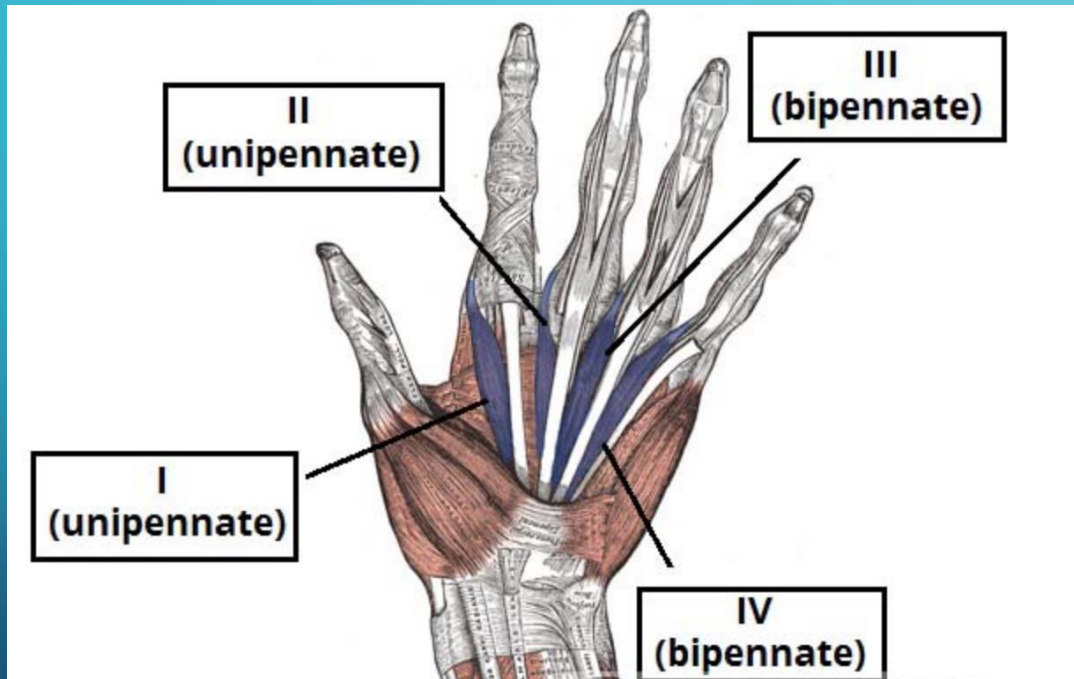
- Make up the thenar eminence
- For fine motor control of the thumb
- Innervated by recurrent branch of median nerve
  - Implications for Carpal tunnel syndrome
  - Zone V injuries

# INTRINSIC MUSCLES OF THE HAND: HYPOTHENAR



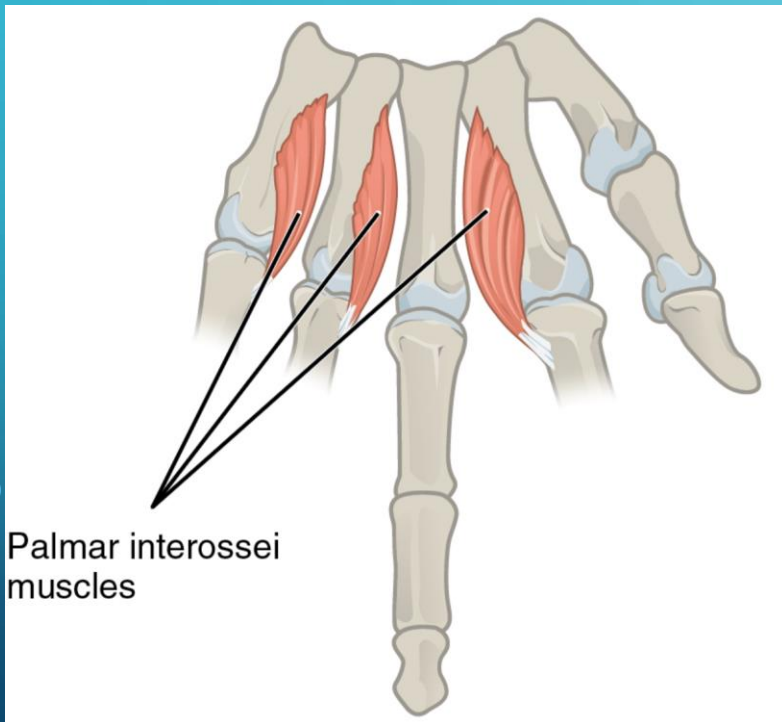
- Make up the hypothenar eminence
- Innervated by ulnar nerve
  - Implications for Cubital tunnel syndrome/Guyon's canal compression (i.e distal ulnar nerve compression )

# INTRINSIC MUSCLES OF THE HAND: LUMBRICALS

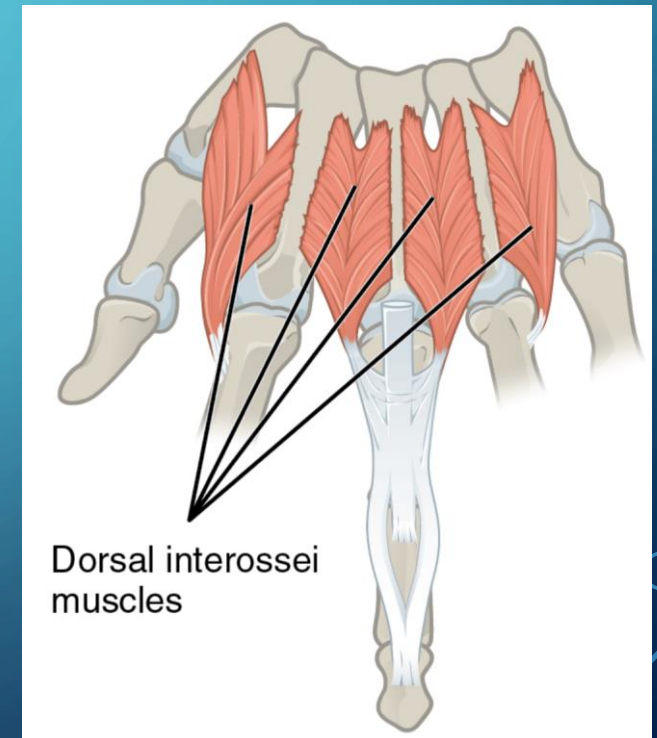


- Important for fine motor of fingers: links flexors to extensors
  - Originate on FDP tendons
  - Insert on extensor hood
- Flex MCP, extend IPJs
- Innervation
  - Index, long: median
  - Ring, small: ulnar

# INTRINSIC MUSCLES OF THE HAND: INTEROSSEI

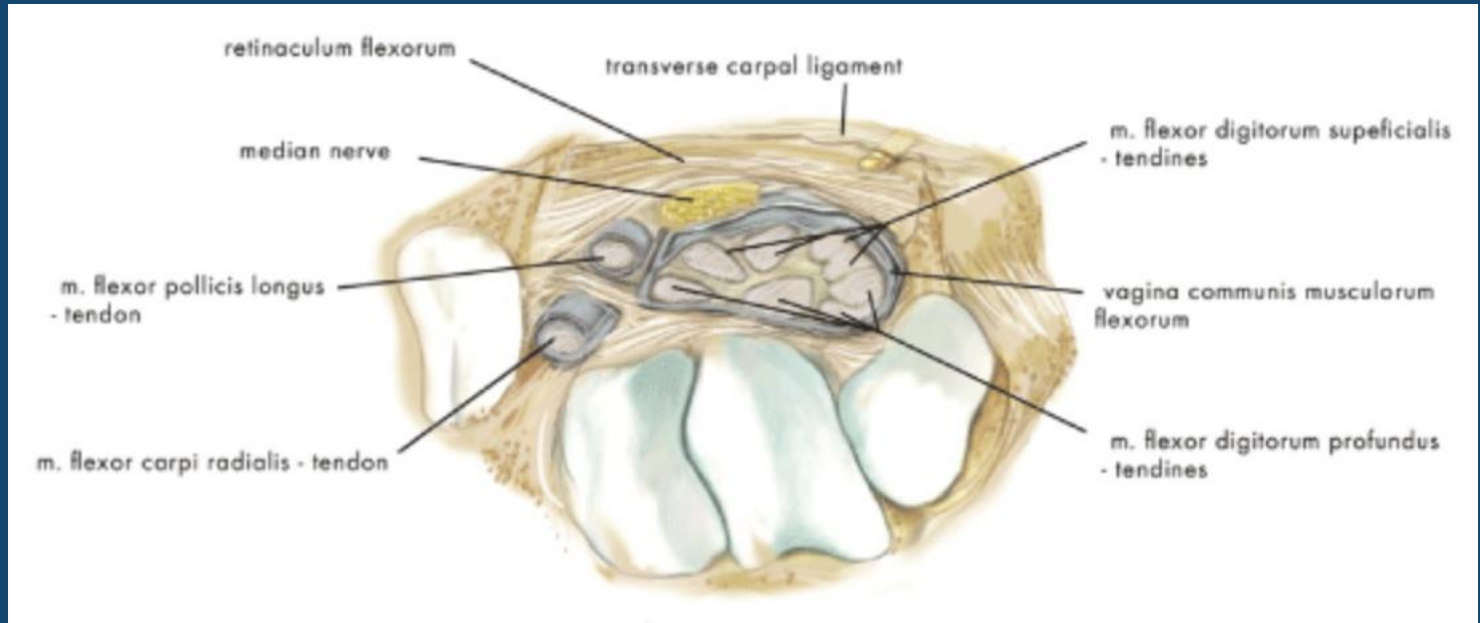


- Located between the metacarpals, assist lumbricals in MCP flex/IP extension
- Abduction and adduction of fingers at MCPJ
  - DAB
  - PAD
- Innervation: ulnar nerve
  - IO wasting in UN dysfunction



# COMMON CLINICAL SCENARIO #5: CARPAL TUNNEL SYNDROME

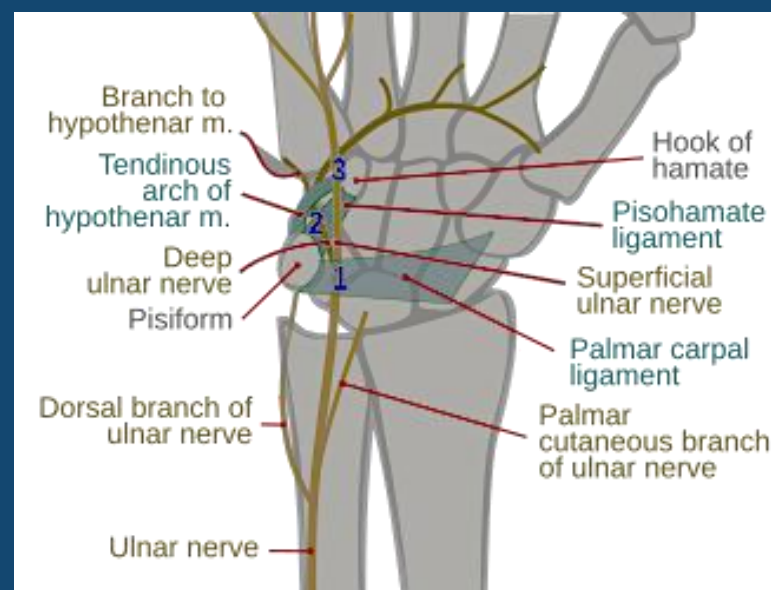
- 65F, n/t radial 3 digits, night symptoms
  - “Shaking out my hands”
- Compression of the median nerve through the carpal tunnel
  - 10 structures (9 tendons/1 nerve)
- Often chronic or rarely, acute (fracture)
- Exam: thenar wasting, Tinels, Phalen, Durkans compression test
  - EMG if suspicious
- Tx: night splinting, CS injections, surgical release of TCL





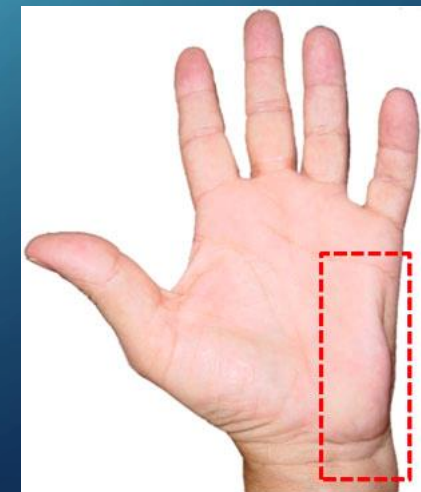
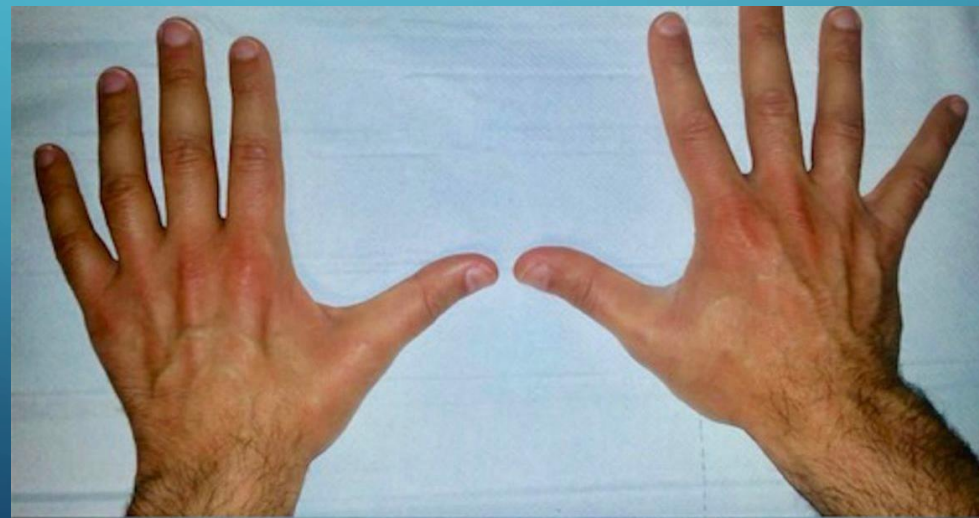
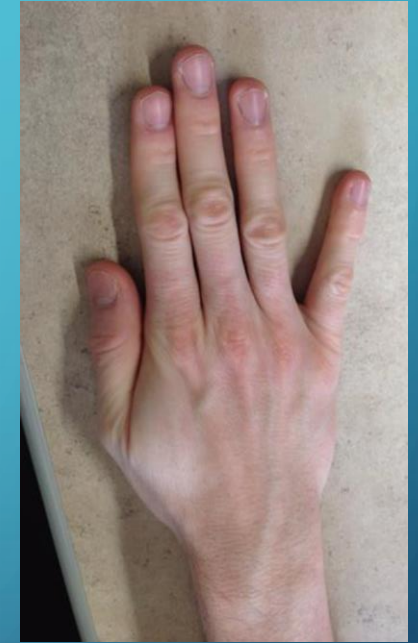
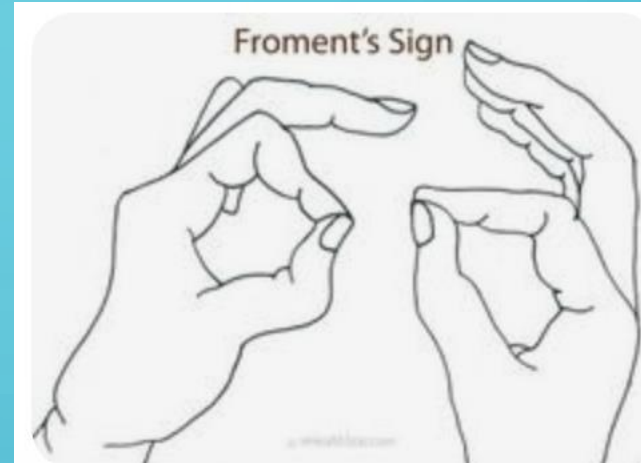
# COMMON CLINICAL SCENARIO #6: GUYON'S CANAL SYNDROME

- 55M, difficulty with fine motor movements of fingers/numbness and tingling in ulnar most digits.
- Cause: Compression of the ulnar nerve through the ulnar tunnel
  - Sxs depend on zone of compression
- Exam: weak grasp/pinch, indicative signs, clawing of ulnar 2 digits from loss of intrinsics
  - Guyon's canal compression test
  - Tinel's
  - Hypothenar wasting
- Dx: exam, EMG
- Tx: splinting, injections, surgical release of TCL



# DISTAL ULNAR NERVE COMPRESSION SIGNS/TESTS

- Froment's sign
  - With weak thumb adduction, FPL is recruited- causes thumb hyperflexion in attempt to pinch
- Wartenberg sign
  - SF held abnormally in abduction because of unopposed EDM (weak IO adduction)
- Hypothenar Wasting
- Intrinsic Wasting





# HAND FRACTURES: 60K FOOT VIEW

Is the digit PERFUSED?

Cap refill, color, temp, doppler, pulse ox

Is there a digital NERVE injury?

Mechanism, gross sensation, 2 pt discrimination

Is the fracture OPEN?

Abx and I&D needed in addition to regular reduction/splinting

If distal, is there a NAILBED injury?

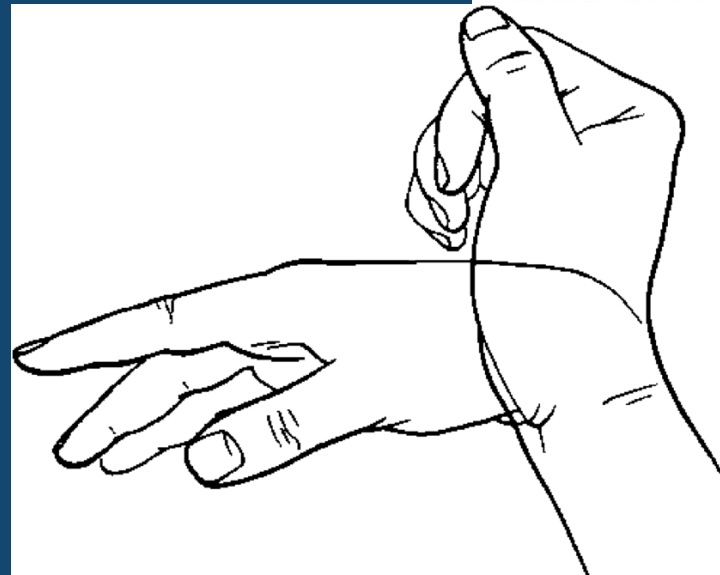
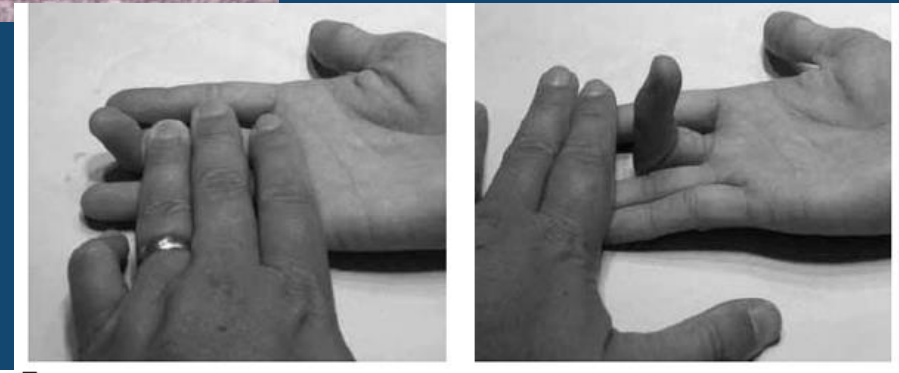
Nail removal, nailbed repair, advancement flap, revision amputation?

Is there a ROTATIONAL deformity?

Look at finger cascade/tenodesis

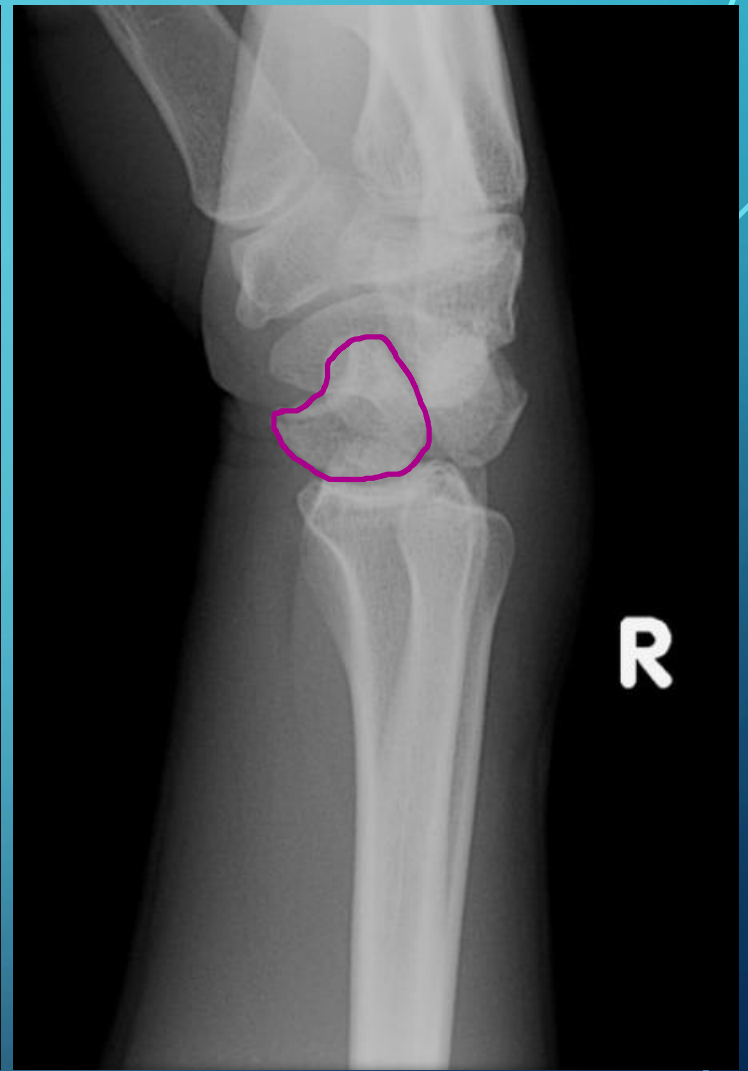
# CLINICAL PEARL: HAND EXAM

- How can you tell if sensation is *actually* intact (i.e. more specific than “can you feel this?”)
  - Warm water wrinkle test
  - 2 PD
- How can you test FDS and FDP independently?
  - FDP common muscle belly
- How do you assess a rotational deformity?
  - Tenodesis/PROM tensioning of flexor and extensors
- What labs do you need for every infection?
  - CBC/C-Reactive Protein/ESR



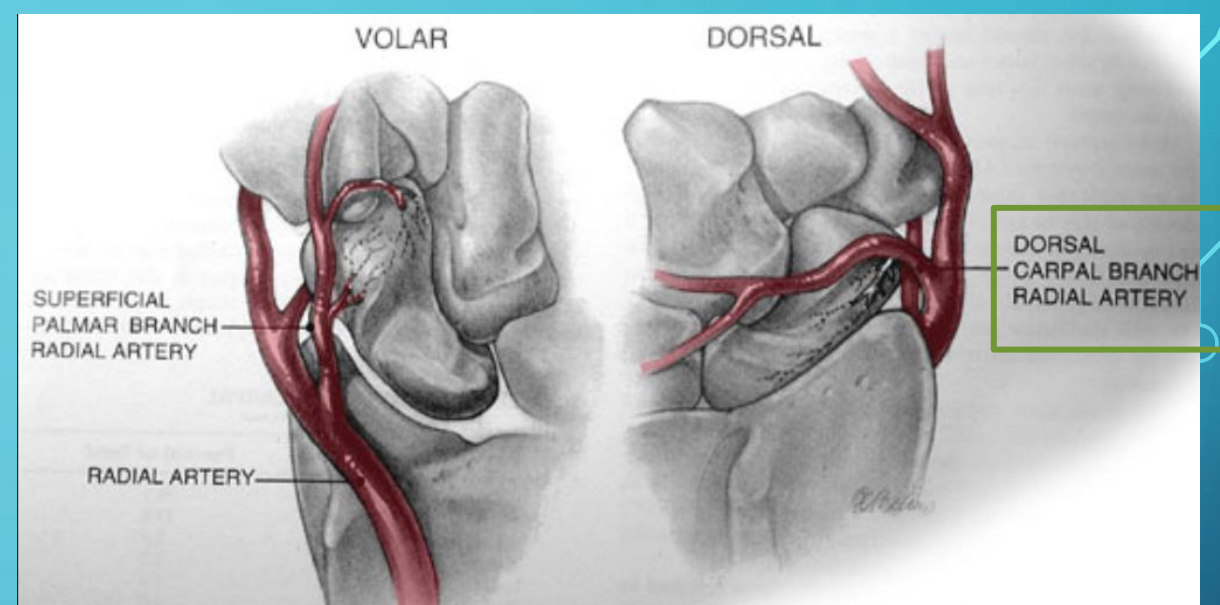
# COMMON CLINICAL SCENARIO #7: (PERI) LUNATE DISLOCATION

- 27M, fall while skateboarding 2 days prior
- Wrist pain
- Urgent care XR reading: neg
- Urgent reduction followed by urgent surgery
- “Pie in the sky” sign
- Cannot miss! High lawsuit rate



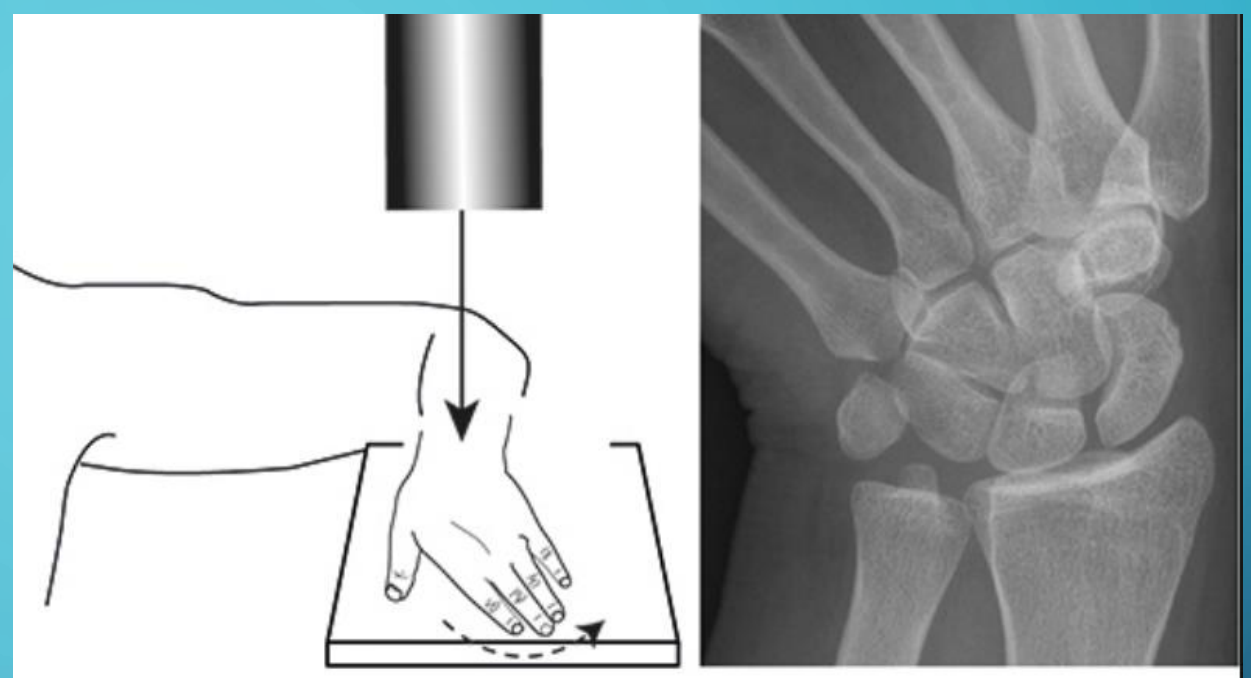
# SCAPHOID FRACTURES

- Most common carpal bone fracture
- Grouped into waist fractures, proximal pole, and distal pole fractures
- Based on the picture, which fracture location is *riskiest* for not healing or *nonunion*?



# COMMON CLINICAL SCENARIO #8: SCAPHOID FRACTURES

- 31F, fall on roller skates 2 months prior
- Insidious wrist pain
- Imaging:
  - XR: wrist views, scaphoid view, clenched fist
  - MRI scan: occult/suspected fracture
  - CT scan: nonunion/to assess healing
- Physical exam: snuffbox TTP, scaphoid tubercle pain
- Tx: SAC immobilization/surgery



# COMMON CLINICAL SCENARIO #9: METACARPAL FRACTURE

- 15M, RHD punching wall
- Sxs: pain, crossover deformity, "loss of knuckle"
- "Boxer's Fracture" vs Brawler fracture
- Injury: 5<sup>th</sup> Metacarpal neck fracture
- Tests:
  - Tenodesis: + crossover
  - Extensor lag?
- Treatment: Usually Non-op

Ulnar gutter

Buddy Tape

Reductions rarely useful







?

# YOUR MOST COMMON CONSULT!



# DISTAL RADIUS FRACTURES

- Most common: FOOSH with dorsal angulation of the distal segment (“Colles”, but injury mechanism affects injury pattern)



Volar Barton



Smith



Chaffeur's



Die Punch

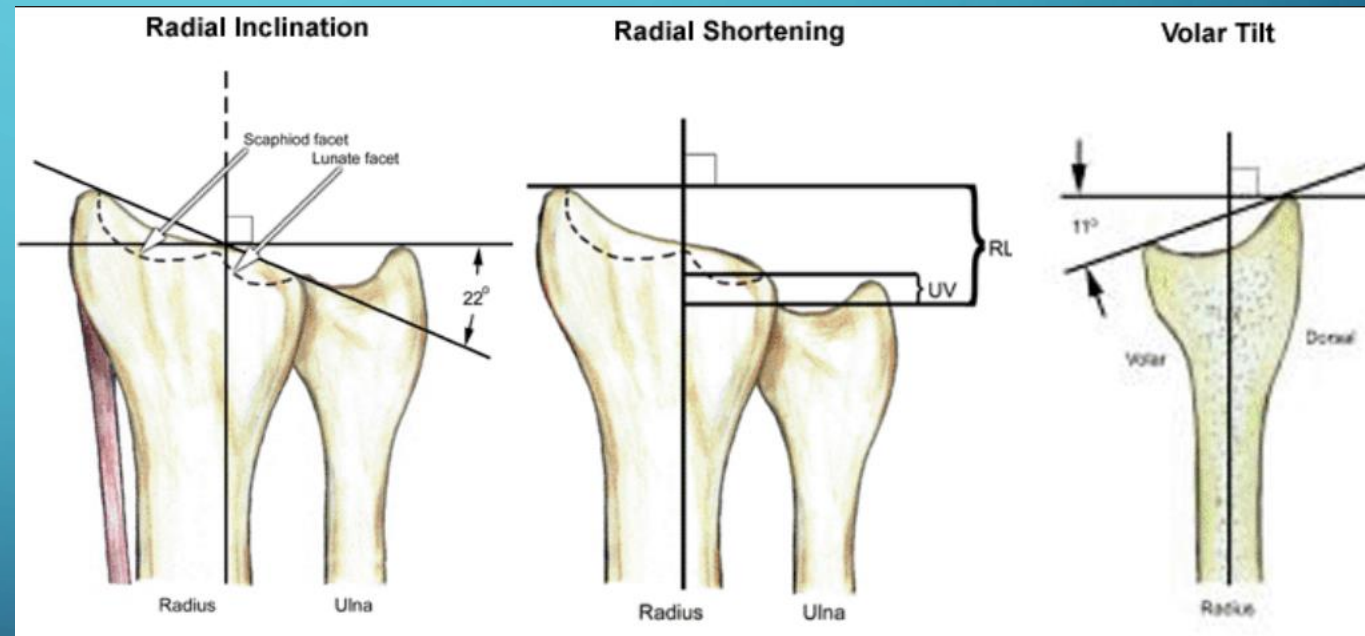
# DISTAL RADIUS FRACTURES

- Bimodal distribution:
  - Elderly low energy
    - Insufficiency Fracture
  - Young, high energy
    - Galeazzi fracture



# DISTAL RADIUS FRACTURES

Radiographic criteria		
Measurement	Normal	Acceptable criteria
Radial height (AP)	13mm	< 5mm shortening
Radial inclination (AP)	23°	Change < 5°
Articular stepoff (AP)	Congruous	< 2 mm stepoff
Volar tilt (Lateral)	11°	Dorsal angulation < 5° or within 20° of contralateral distal radius



IF NOT ACCEPTABLE IN SPLINT...

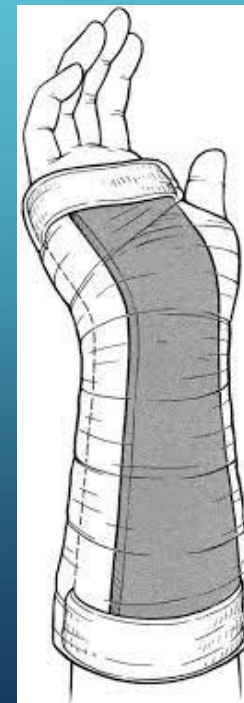


Approaches: volar henry, trans-FCR



# COMMON SPLINTS/CASTS

- Sugartong/Volar-Dorsal Splint:
  - Distal radius fractures
- Thumb spica splint/cast: scaphoid fracture, radial styloid fractures
- Ulnar gutter: 5<sup>th</sup> MC fractures
- Long arm cast/splint: elbow/forearm fractures
- Volar resting splint: soft tissue rest for infection
- Wrist brace: wrist sprain, ganglion cyst, carpal tunnel
- Intrinsic plus splint: Hand/finger fractures
  - Prevents stiffness



# TAKE HOME POINTS

- Hand and wrist anatomy is complex, but the patient will often times tell you exactly what the problem is.
- Obtain correct films to make diagnosis easier
- Don't miss Lunate dislocations or flexor tenosynovitis
- Immobilization is never a bad idea as long as they have appropriate follow up



# RESOURCES

- Orthobullets: Wikipedia of Orthopedics
- Handbook of Fractures
- Primus Manus
- Essential Anatomy 5
- AO Website
- Hand Podcasts:
  - Upper Hand with Drs. Chuck Goldfarb/Chris Dye



# THANK YOU!

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