



Wrist & Hand Arthrokinematics, Injuries and Manual Therapy Approaches

Tom Cresswell

BY DIABLO 665

Overview

Anatomy

Movements

Injuries

Manual therapy

Learning Objectives

To understand the arthrokinematics of the wrist and hand.

To review common injuries and conditions affecting the wrist and hand.

To prepare for practical manual therapy approaches to the wrist and hand.

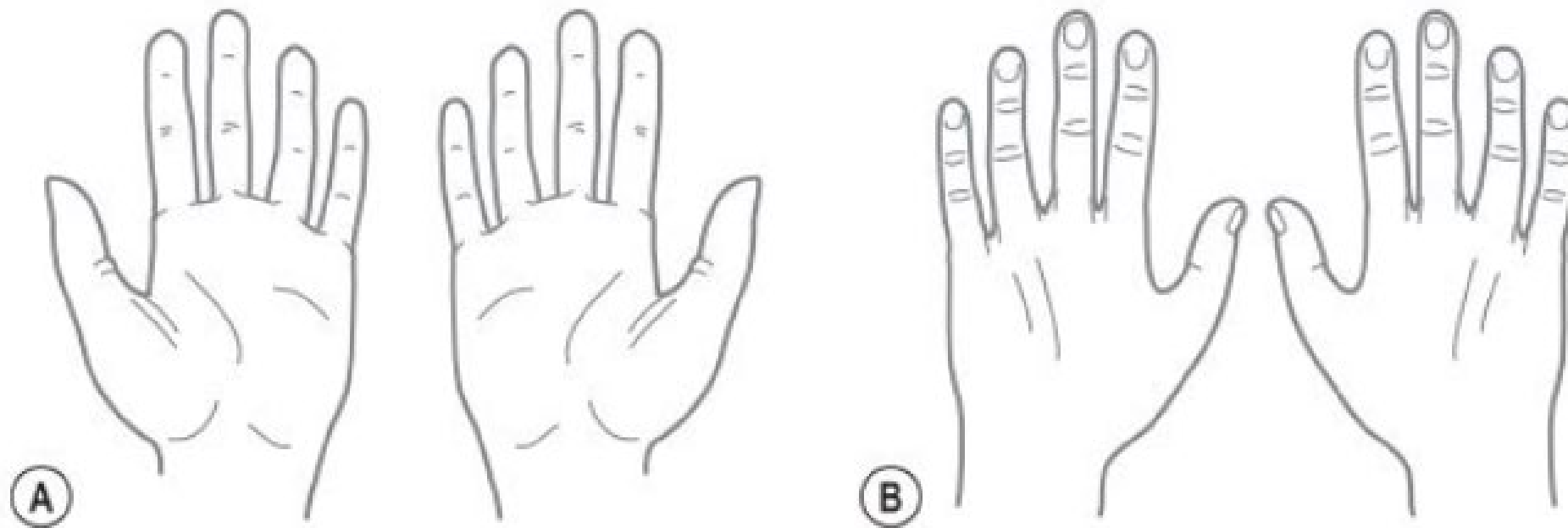


FIG. 11.1 ■ Body chart for wrist and hand. (A) Palmar surface. (B) Dorsal surface.

Arthrokinematics

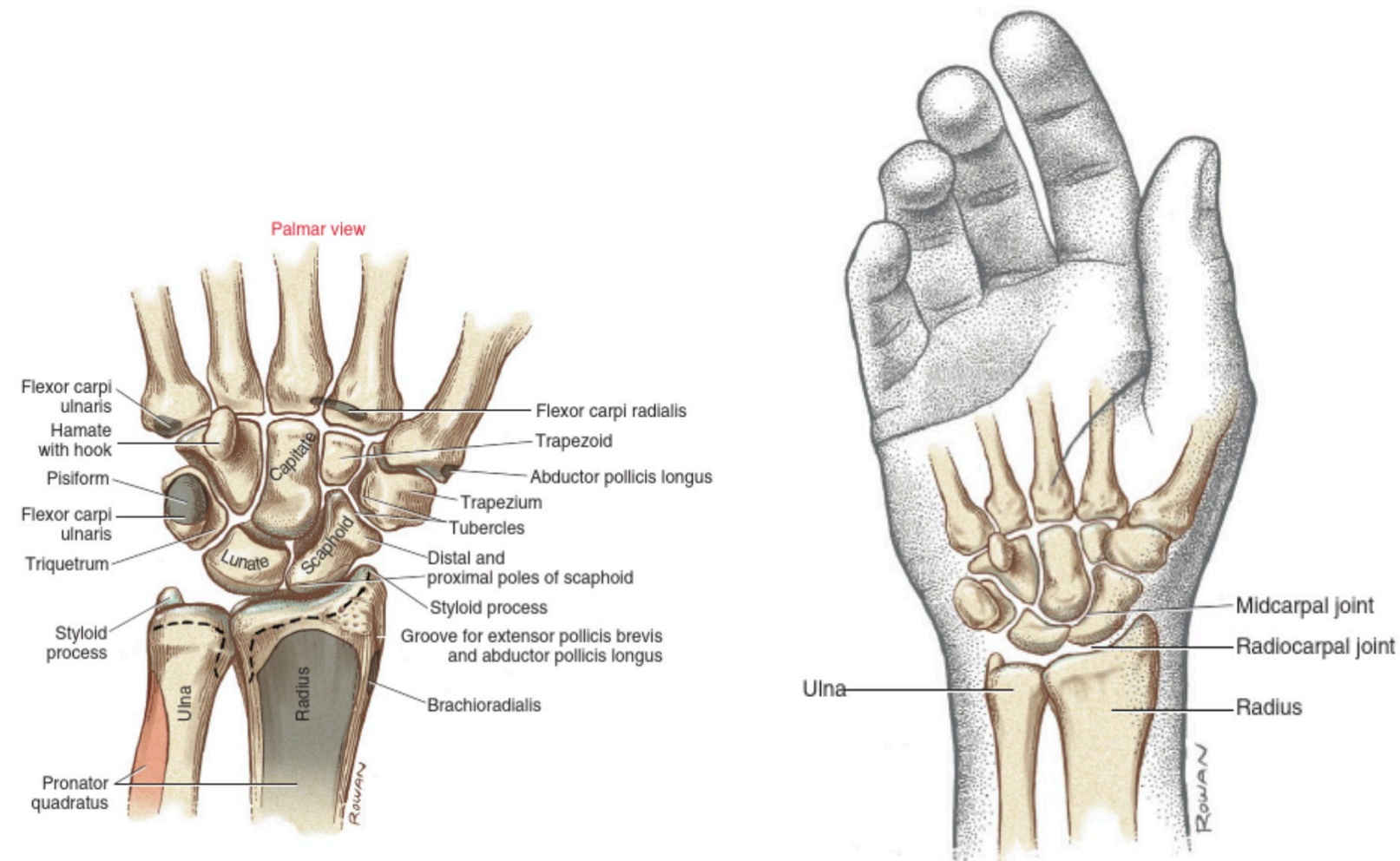


FIGURE 7-1. The bones and major articulations of the wrist.

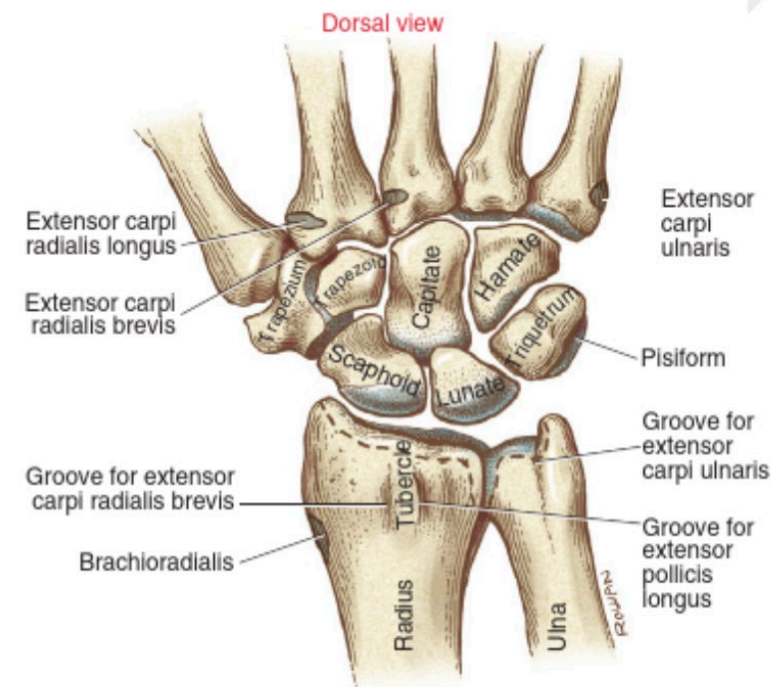
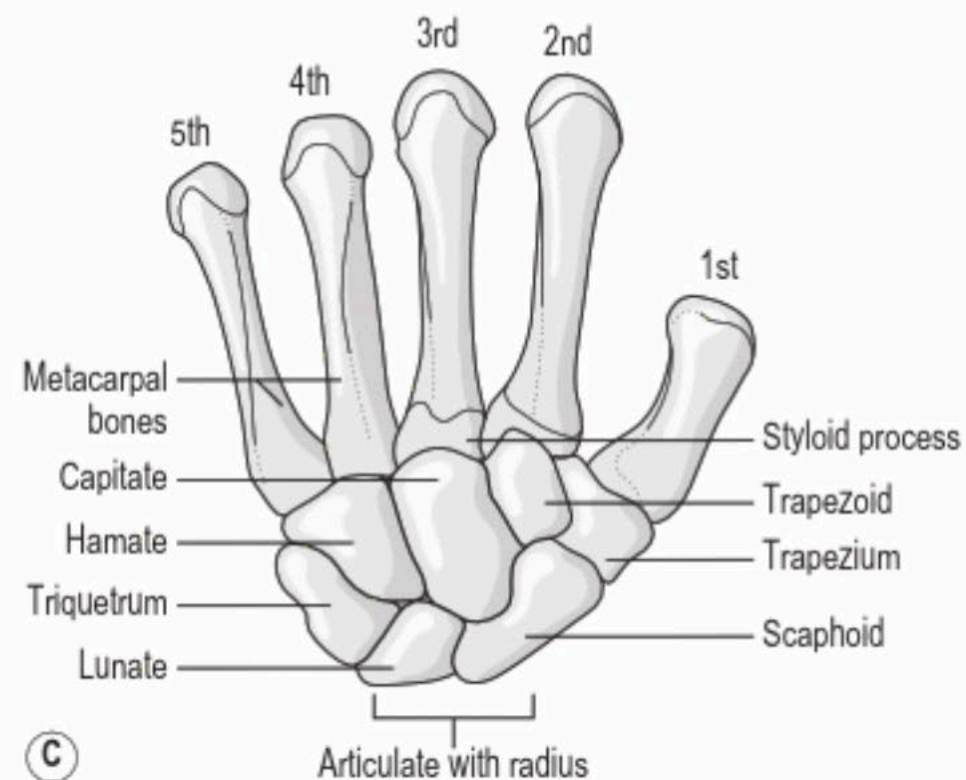
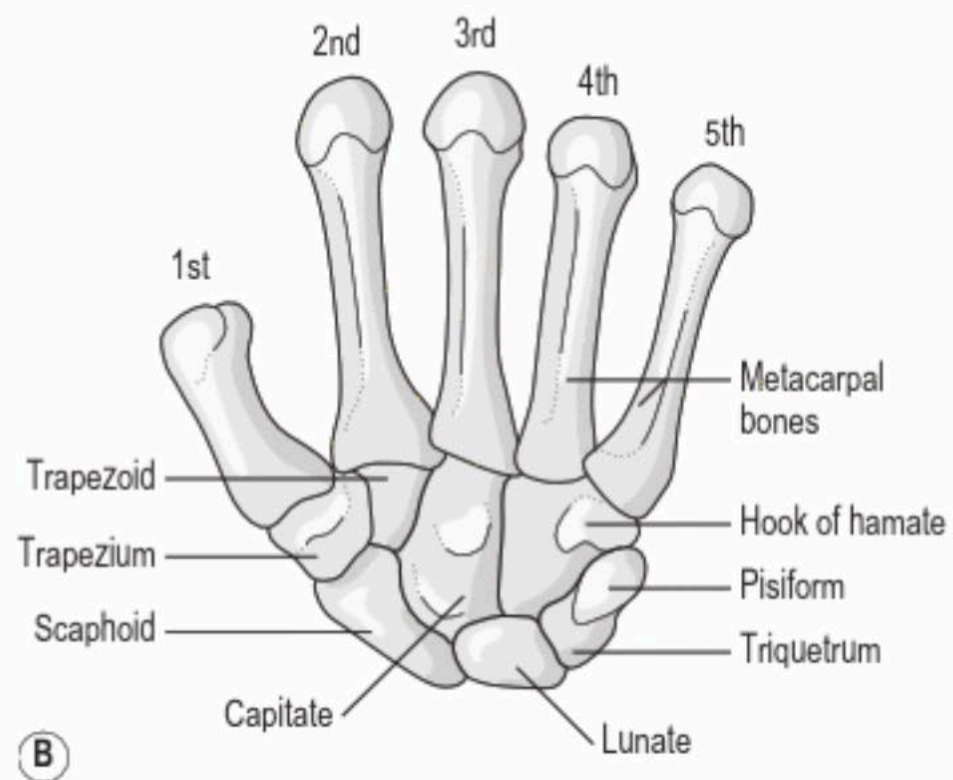


FIGURE 7-2. The dorsal aspect of the bones of the right wrist. The muscles' distal attachments are shown in gray. The dashed lines show the proximal attachment of the dorsal capsule of the wrist.



Movements of the wrist

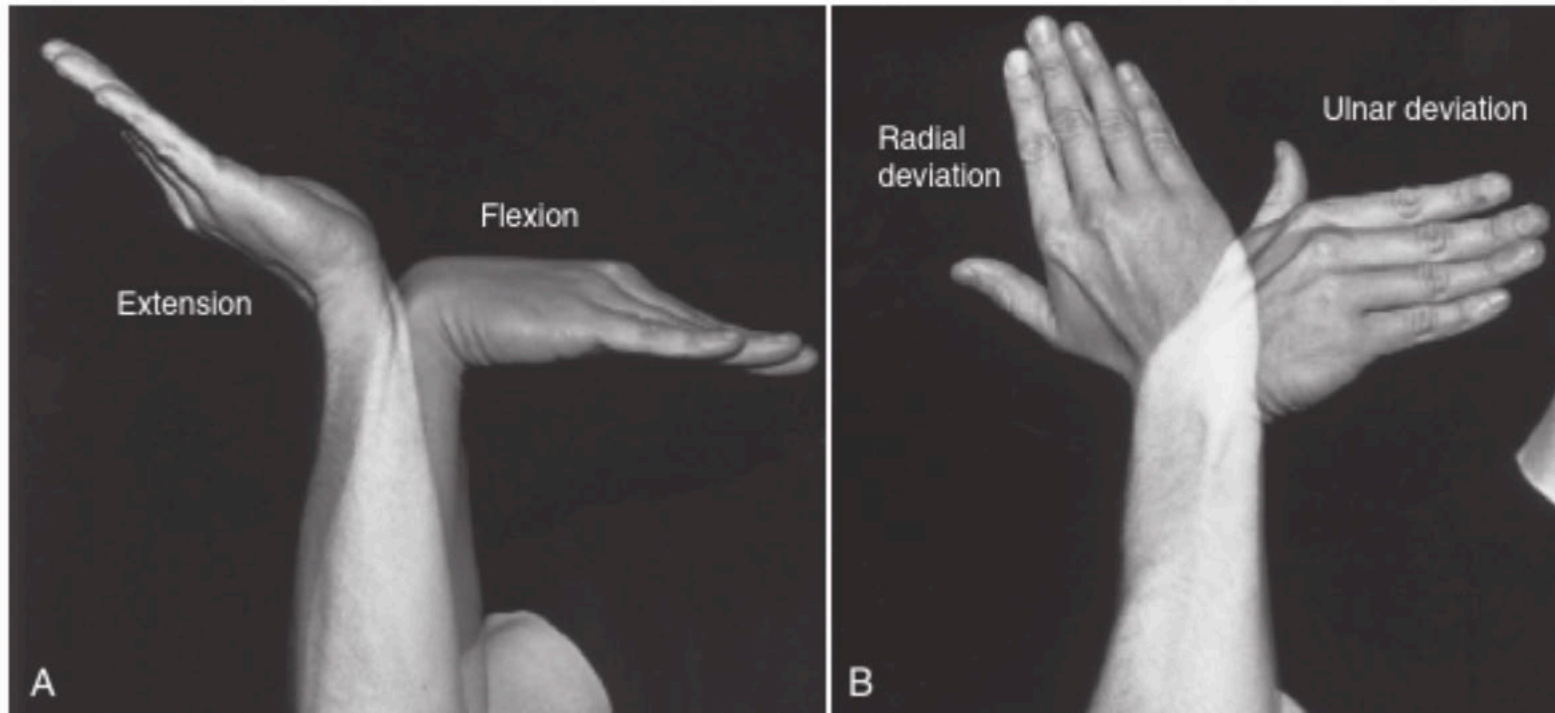


FIGURE 7-12. Osteokinematics of the wrist. **A**, Flexion and extension. **B**, Ulnar and radial deviation. Note that flexion exceeds extension and ulnar deviation exceeds radial deviation.

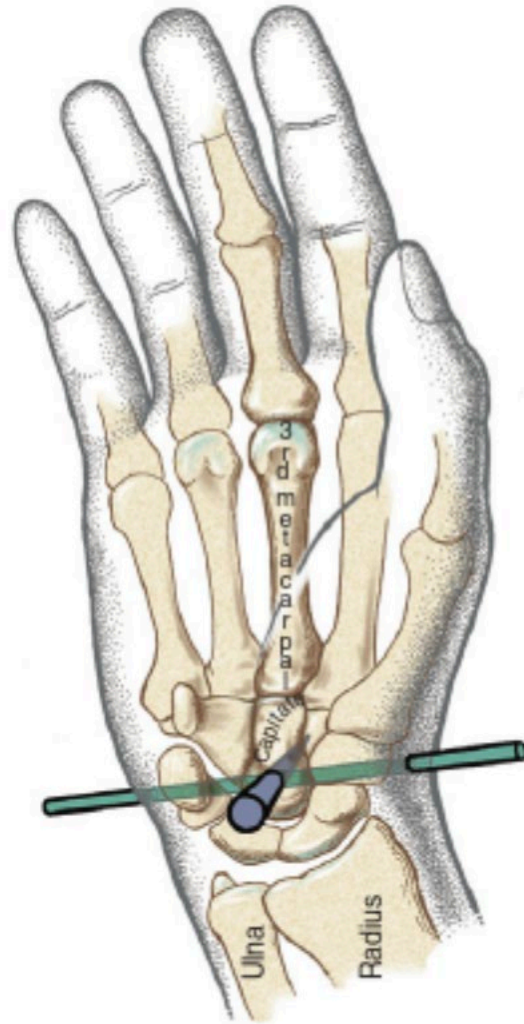


FIGURE 7-13. The medial-lateral (*green*) and anterior-posterior (*purple*) axes of rotation for wrist movement are shown piercing the head of the capitate bone.

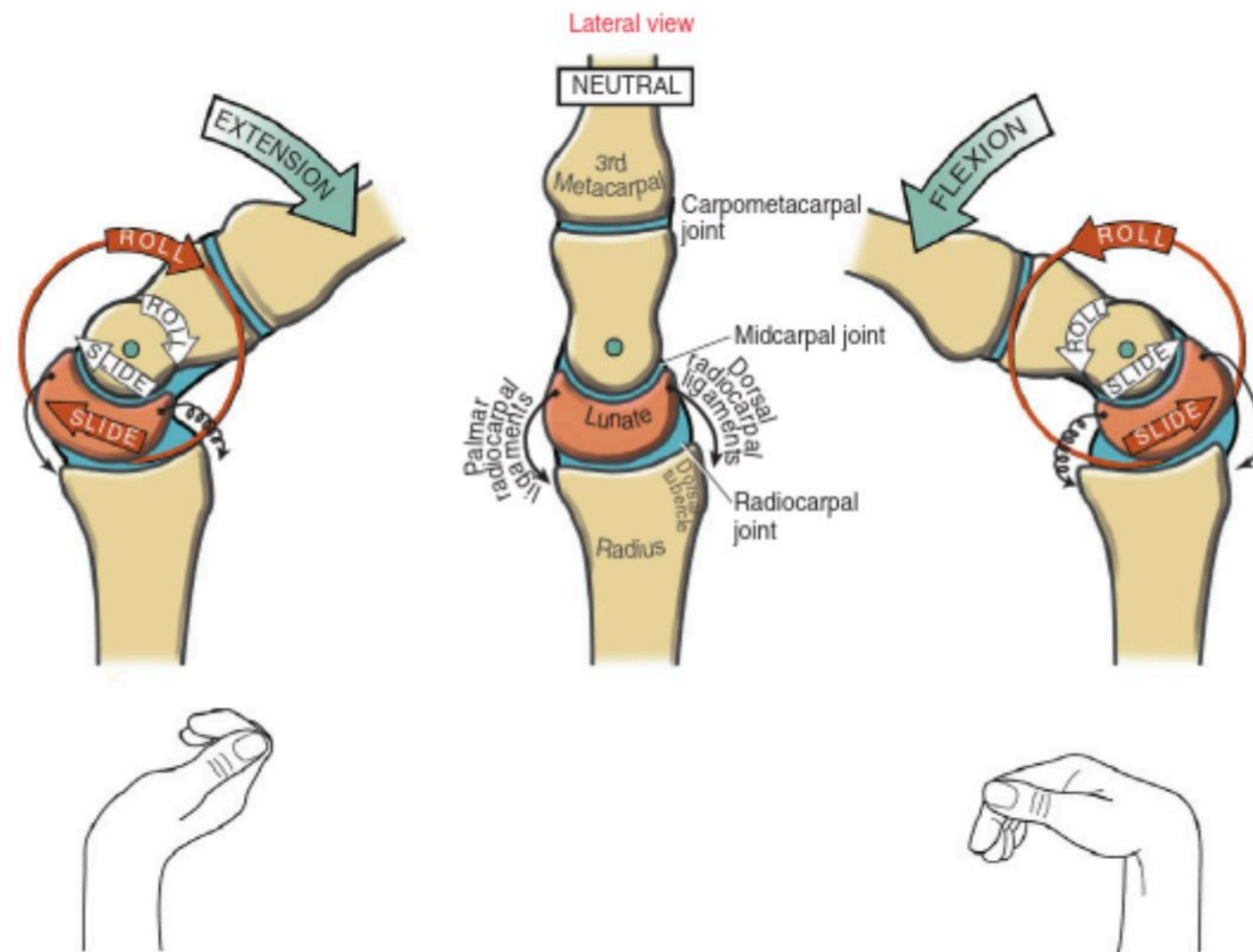


FIGURE 7-15. A model of the central column of the right wrist showing flexion and extension. The wrist in the center is shown at rest, in a neutral position. The roll-and-slide arthrokinematics are shown in red for the radiocarpal joint and in white for the midcarpal joint. During wrist extension (*left*), the dorsal radiocarpal ligaments become slackened and the palmar radiocarpal ligaments taut. The reverse arthrokinematics occur during wrist flexion (*right*).

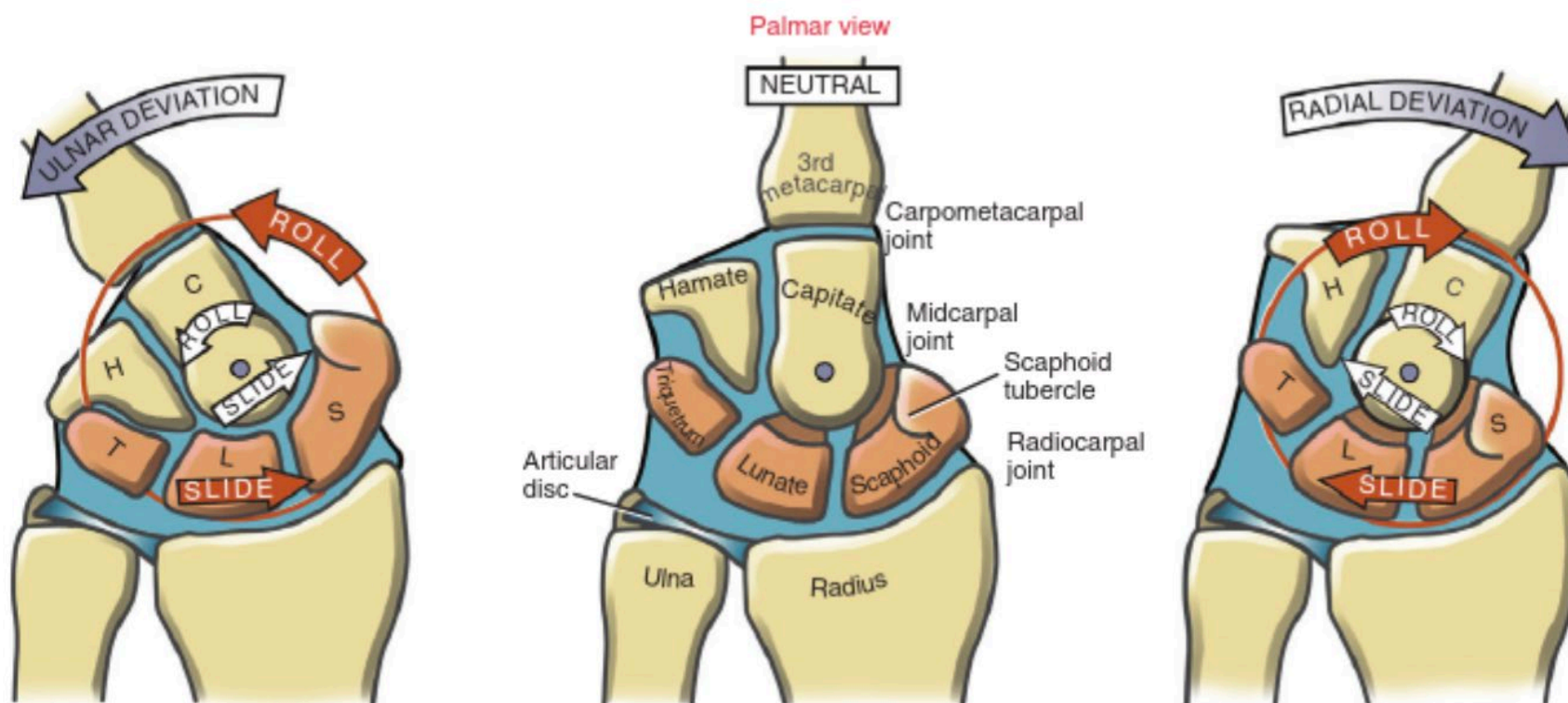


FIGURE 7-16. Radiographs and mechanical depiction of the arthrokinematics of ulnar and radial deviation for the right wrist. The roll-and-slide arthrokinematics are shown in red for the radiocarpal joint and in white for the midcarpal joint.

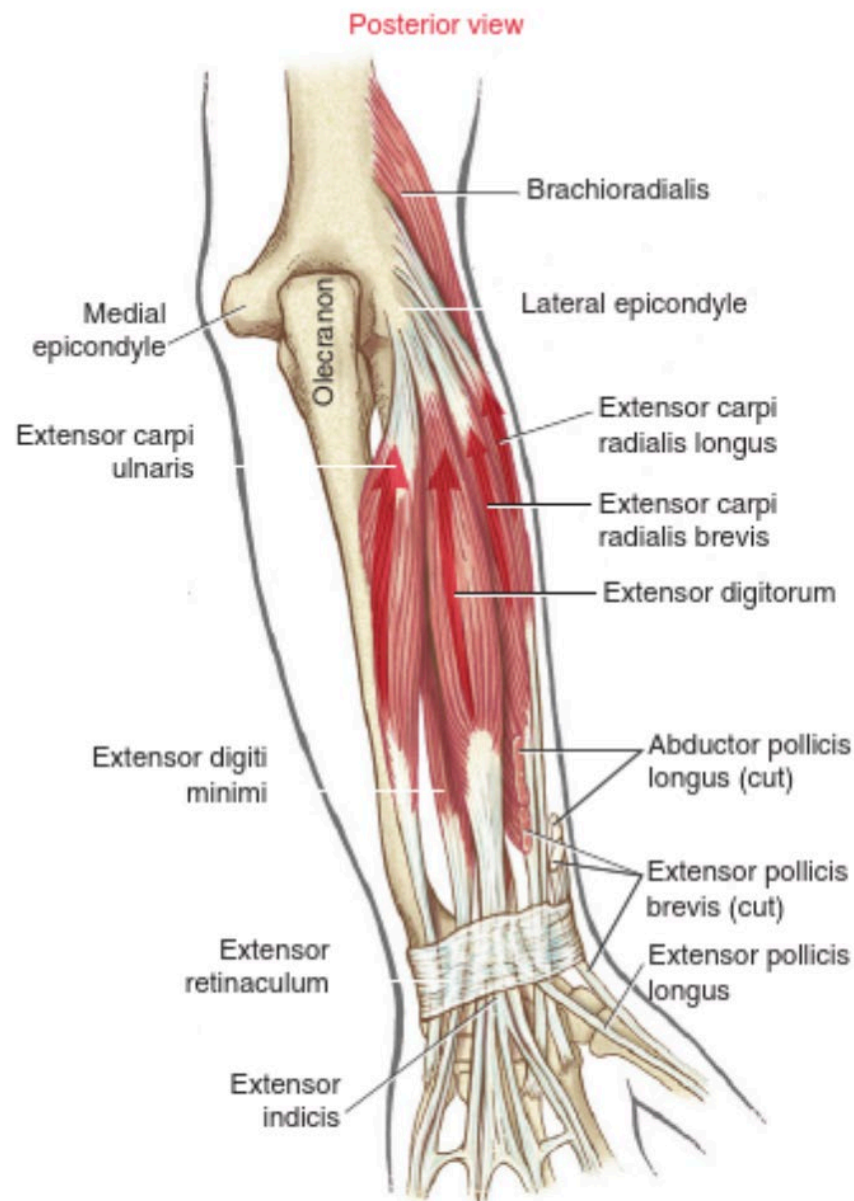


FIGURE 7-22. A posterior view of the right forearm showing the primary wrist extensors: extensor carpi radialis longus, extensor carpi radialis brevis, and extensor carpi ulnaris. The extensor digitorum and other secondary wrist extensors are also evident.

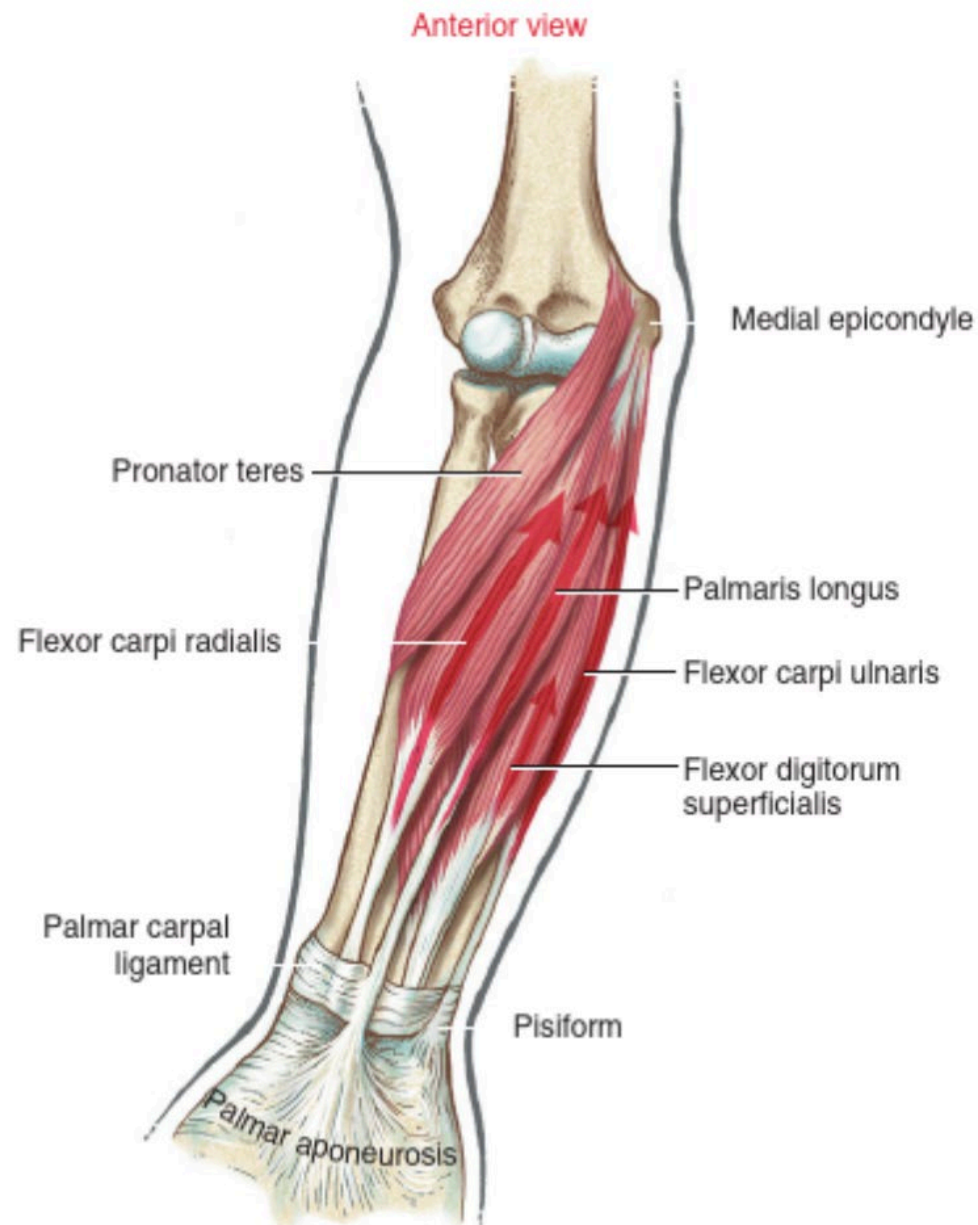


FIGURE 7-28. Anterior view of the right forearm showing the primary wrist flexor muscles: flexor carpi radialis, palmaris longus, and flexor carpi ulnaris. The flexor digitorum superficialis (a secondary wrist flexor) and pronator teres muscles are also shown.

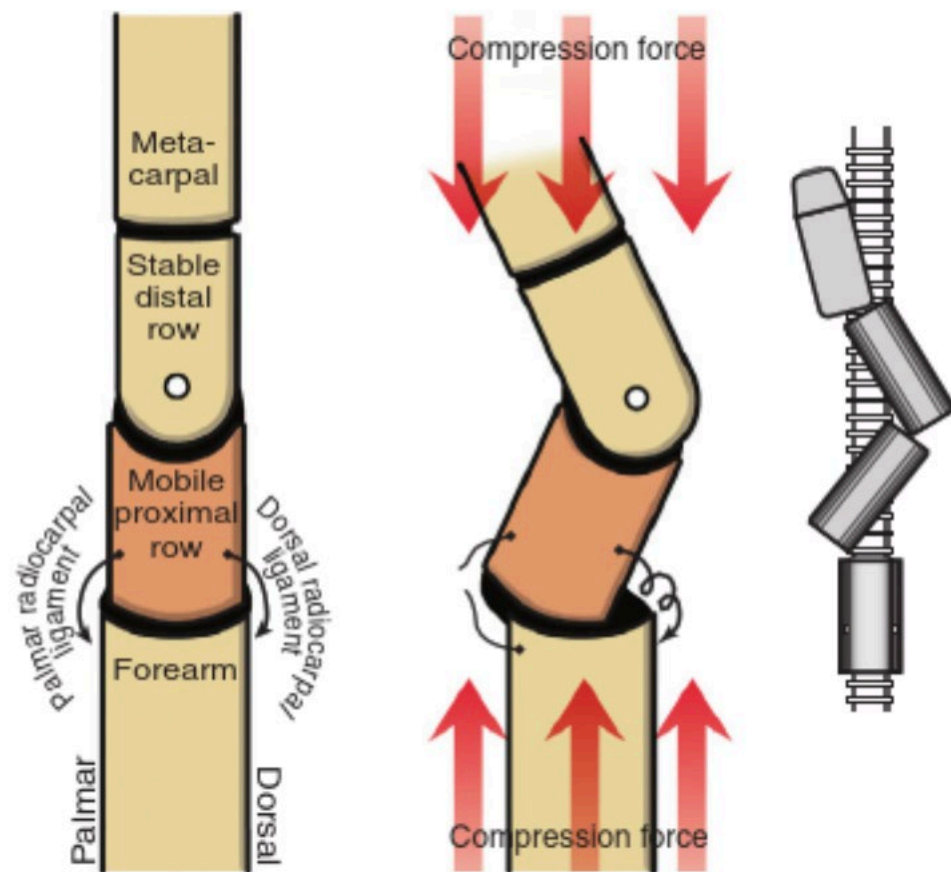


FIGURE 7-18. A highly diagrammatic depiction of a “zigzag” collapse of the central column of the wrist after a large compression force.

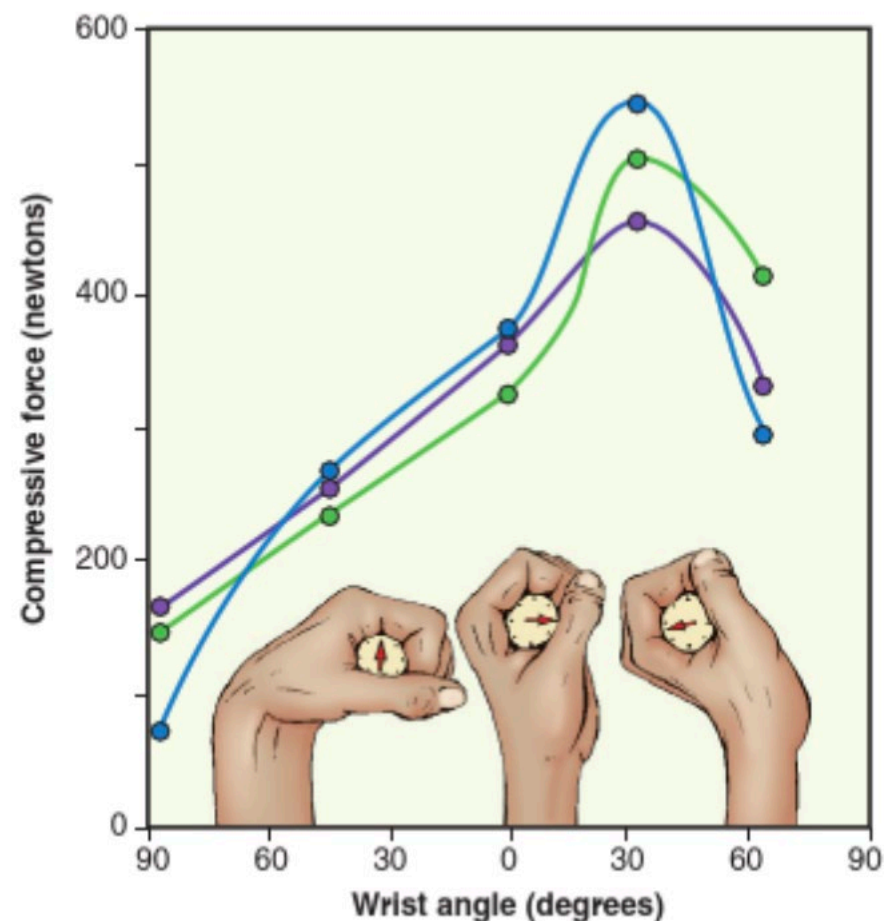


FIGURE 7-26. The compression forces produced by a maximal-effort grip are shown for three different wrist positions (for three subjects). Maximal grip force occurs at about 30 degrees of extension. (With permission from Inman VT, Ralston HJ, Todd F: *Human walking*, Baltimore, 1981, Williams & Wilkins.)



Wrist and Hand Injuries

Scaphoid Fracture

Figure: Mary Albury-Noyes

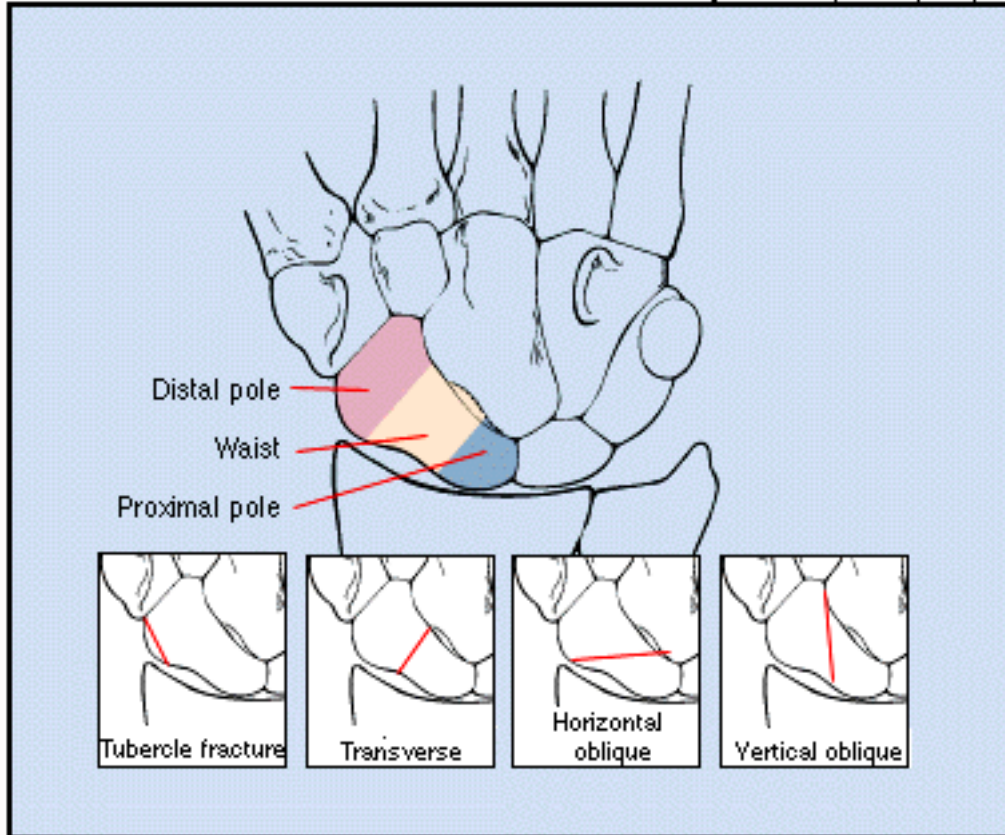
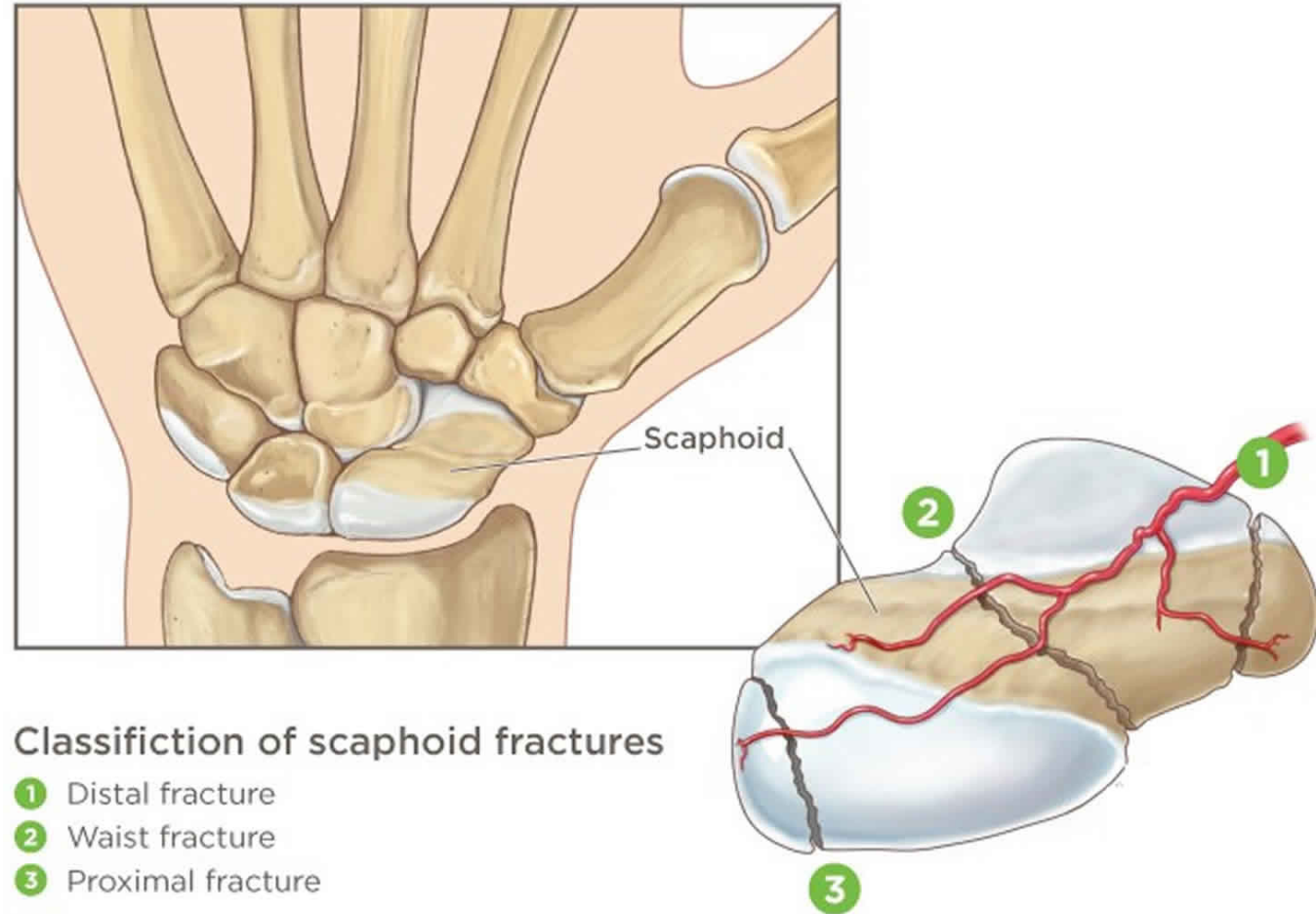


Figure 3. A dorsal view of the scaphoid bone demonstrates various fracture orientations. Determining the orientation on radiographs is important because the orientation helps guide treatment decisions.



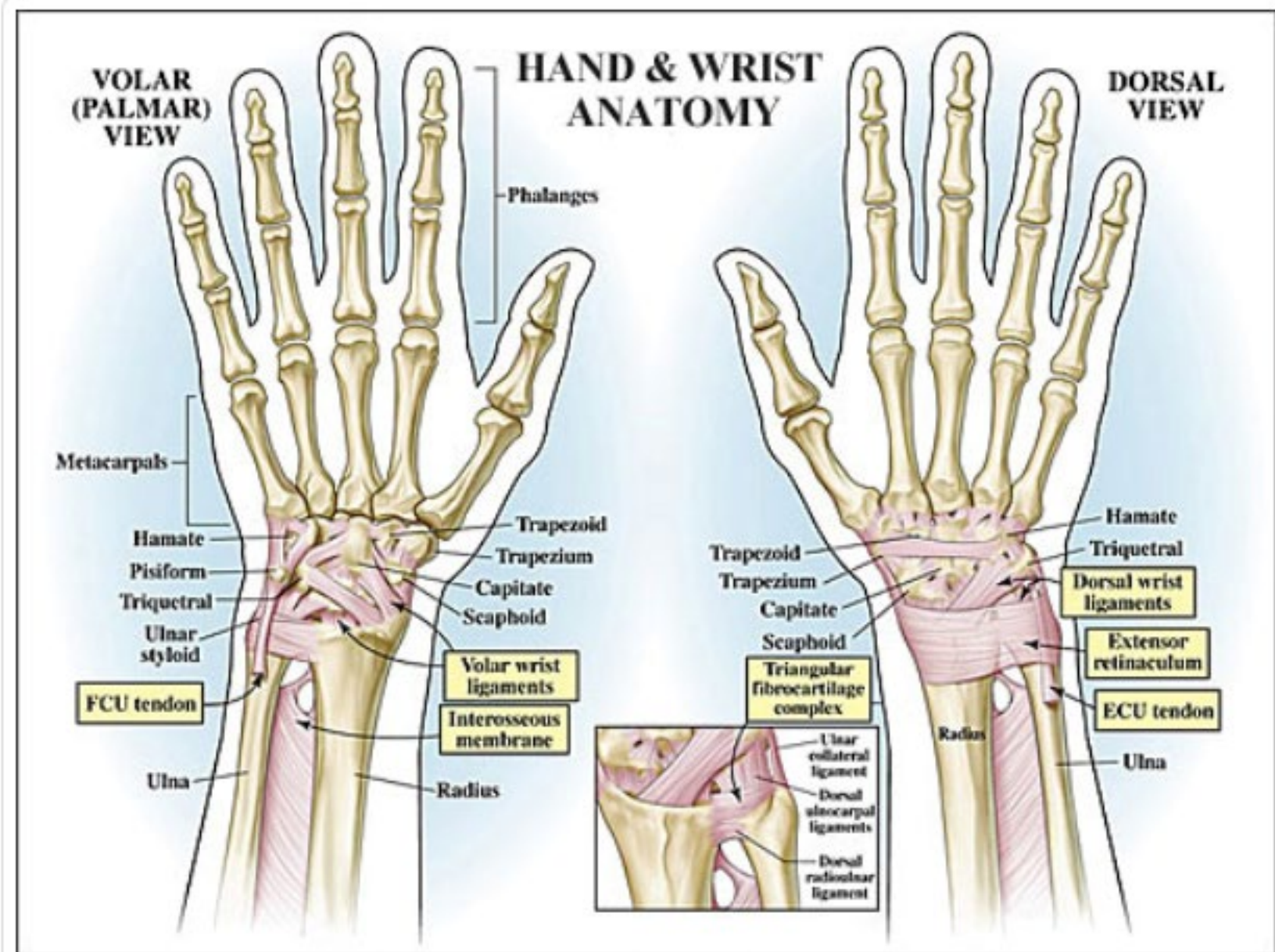
Scaphoid Fracture Cont

- Most common carpal fracture
- FOOA
- Tenderness in anatomical snuffbox
- Imaging
- Stable/Unstable
- Immob/Fix
- Blood supply < necrosis
- Delayed/Non-Union



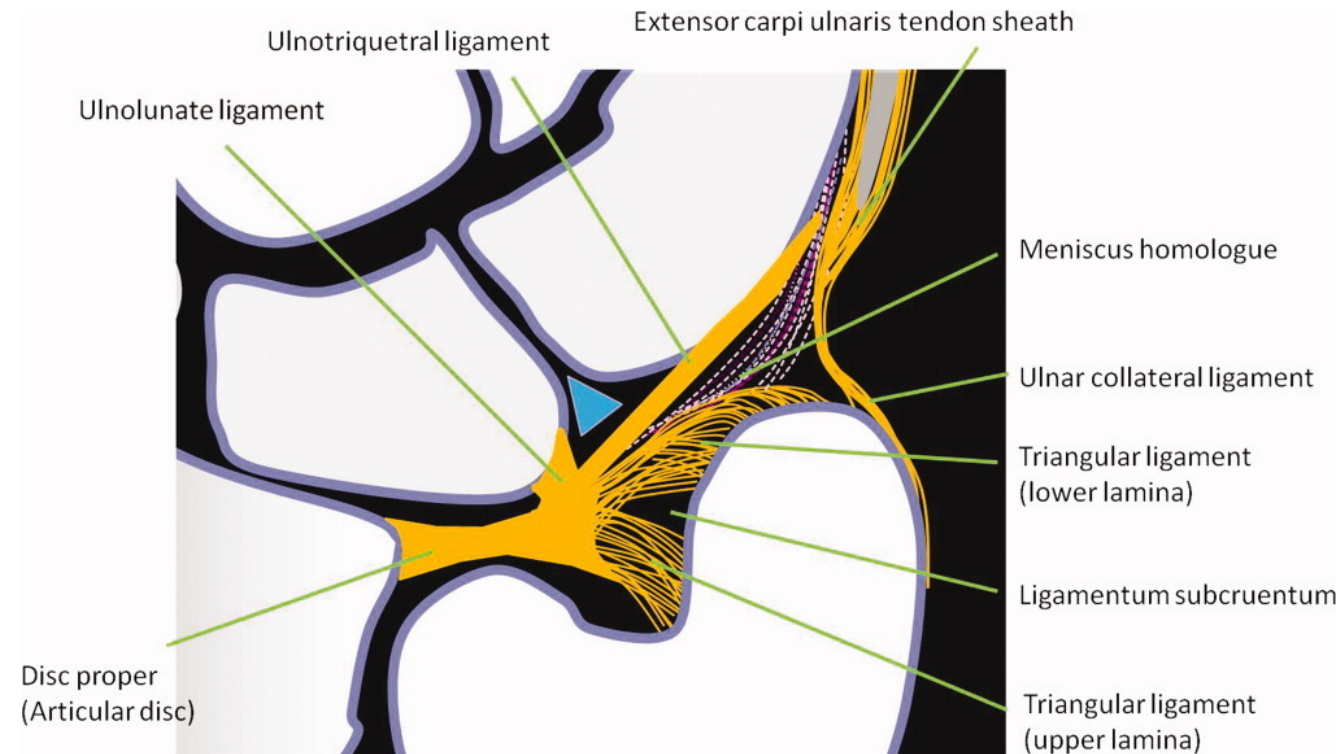
Wrist Sprains

- Radiocarpal
 - Intercarpal Lig
 - Scapholunate Lig
 - Lunotriquetral Lig
 - Carpal instability
-
- Palmer = FOOA
 - Dorsal = Punch



Triangular Fibro Cartilage Complex (TFCC) Tear

- Stabiliser of the distal radioulnar joint
- The "complex" consists of the triangular fibrocartilage, ulnar meniscus homolog, ulnar collateral ligament, numerous carpal ligaments and the extensor carpi ulnaris tendon sheath.
- MOI: Compression and ulnar deviation
- Ax: Clicking sensation, reduced grip strength, pain, chair push off.



Mallet Finger

- Flexion deformity
- **MOI:** Avulsion of the extensor insertion. Ball striking the fingertip during extension, forcing it into flexion.
- **Rx:** Must be splinted. X-Ray. May require surgery.

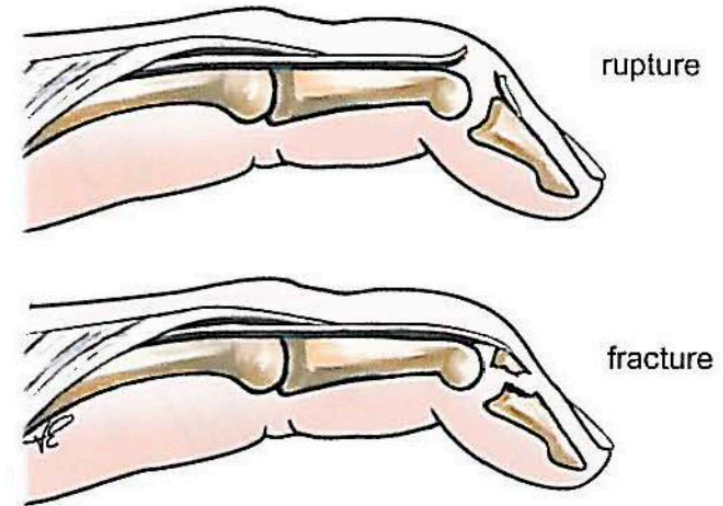


Figure 24.15 Mallet finger

(a) Mechanism of deformity—rupture or avulsion



(b) "Stack" splint. A dorsal splint can also be used

Table 23.3 Causes of subacute onset wrist pain according to location of pain. More common causes are listed first

Dorsal	Volar	Ulnar	Radial
Ganglion	Scaphoid aseptic necrosis	Triangular fibrocartilage complex tears	Scaphoid fracture (missed)
Intersection syndrome	Stenosing tendinopathies		Non-union of scaphoid fracture
Kienböck's disease	Flexor carpi ulnaris tendinopathy	Ulnar impaction syndrome	De Quervain's tenosynovitis
Dorsal pole of lunate and distal radius impingement (gymnasts)	Flexor carpi radialis tendinopathy	Distal radioulnar joint instability	Scaphoid impaction syndrome
Posterior interosseous nerve entrapment	Carpal tunnel syndrome	Carpal instability	Intersection syndrome
Inflammatory arthropathy	Ulnar tunnel syndrome	Scapholunate dissociation	Flexor carpi radialis tendinopathy
Degenerative joint disease	Pisotriquetral degenerative joint disease	Ulnar nerve compression (cyclists, golfers)	Dorsal pole of lunate impingement on distal radius (gymnasts)
Extensor carpi ulnaris tendinopathy	Avascular necrosis of the capitate (weightlifters)	Flexor carpi ulnaris tendinopathy	Scapholunate dissociation
Extensor carpi ulnaris subluxation	Extensor pollicis longus impingement/rupture (gymnasts)	Extensor carpi ulnaris tendinopathy	
Injuries to distal radial epiphysis (children)		Extensor carpi ulnaris subluxation	
Extensor pollicis longus impingement on Lister's tubercle (occasional rupture)		Distal radioulnar joint impaction syndromes (golfers)	
		Scaphoid impaction syndrome	

Dequervains Tenosynovitis

- Inflammation of the synovium of the abductor pollicis longus and extensor pollicis brevis tendons as they pass in their synovial sheath in a fibroosseous tunnel at the level of the radial styloid
- Most common radial-sided tendinopathy in sportspeople and occurs particularly with racquet sports, rowers and canoeists. The left thumb of a right-handed golfer is particularly at risk because of the hyperabduction required during a golf swing.

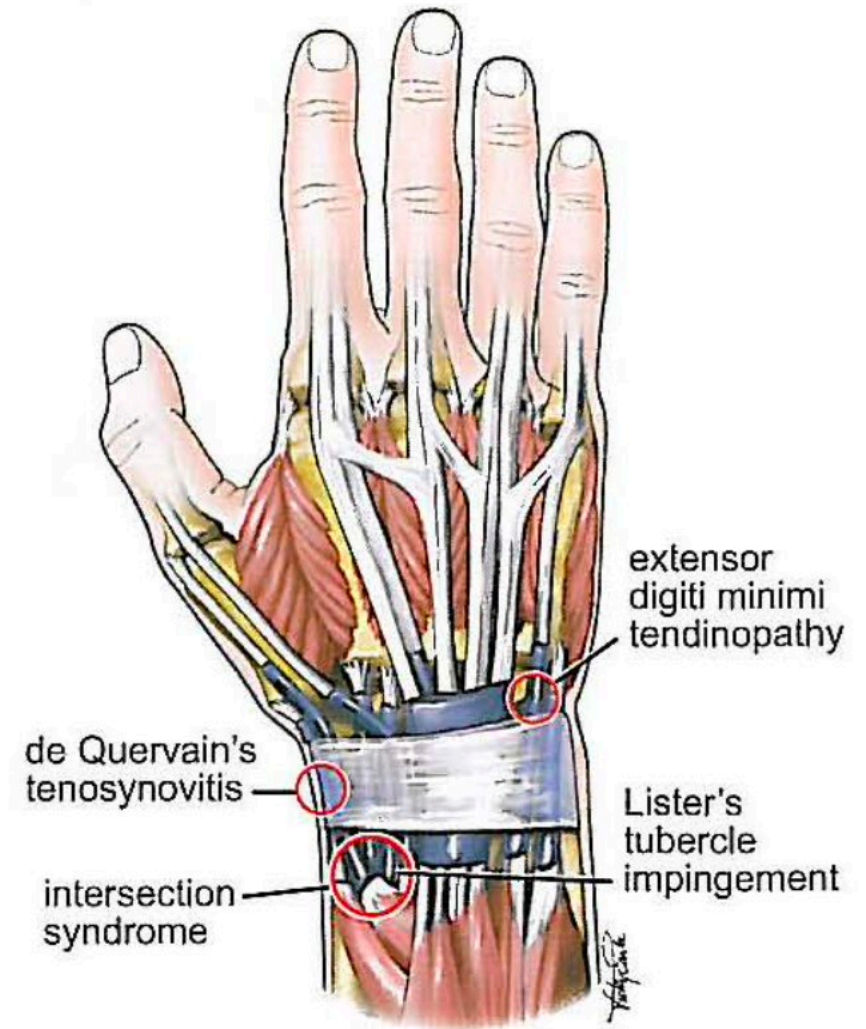


Figure 23.13 Some extra-articular causes of pain around the wrist

Impingement syndromes

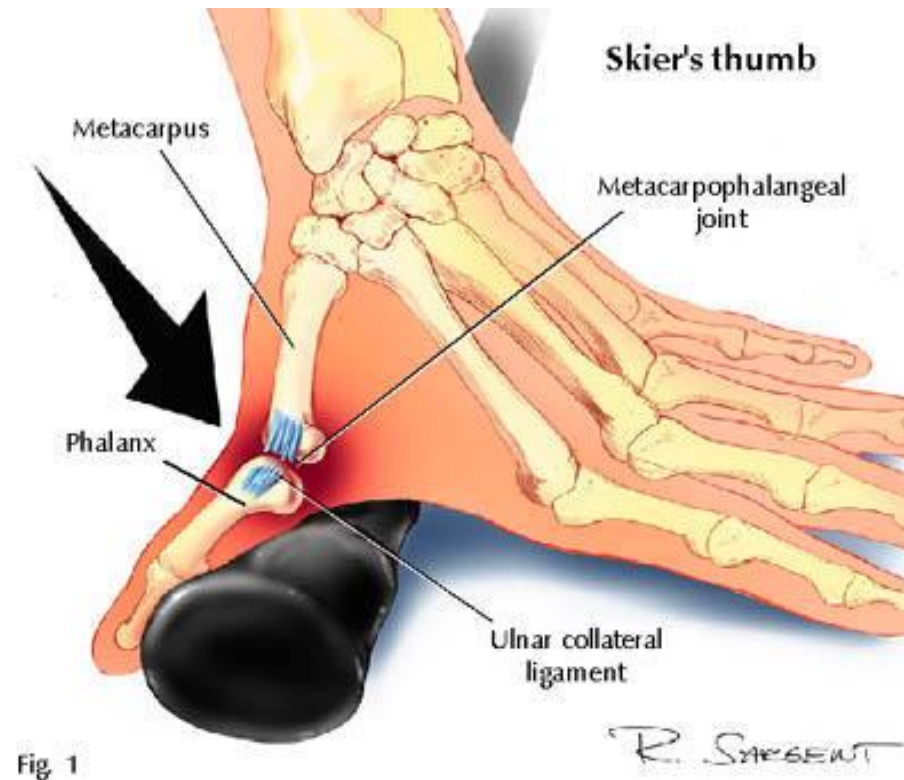
...a Tom Cresswell summary. Moooo!

MOI? Pain type?
Pattern?

Fracture, sprain,
impingement,
tendinopathy

1st MCP Sprain

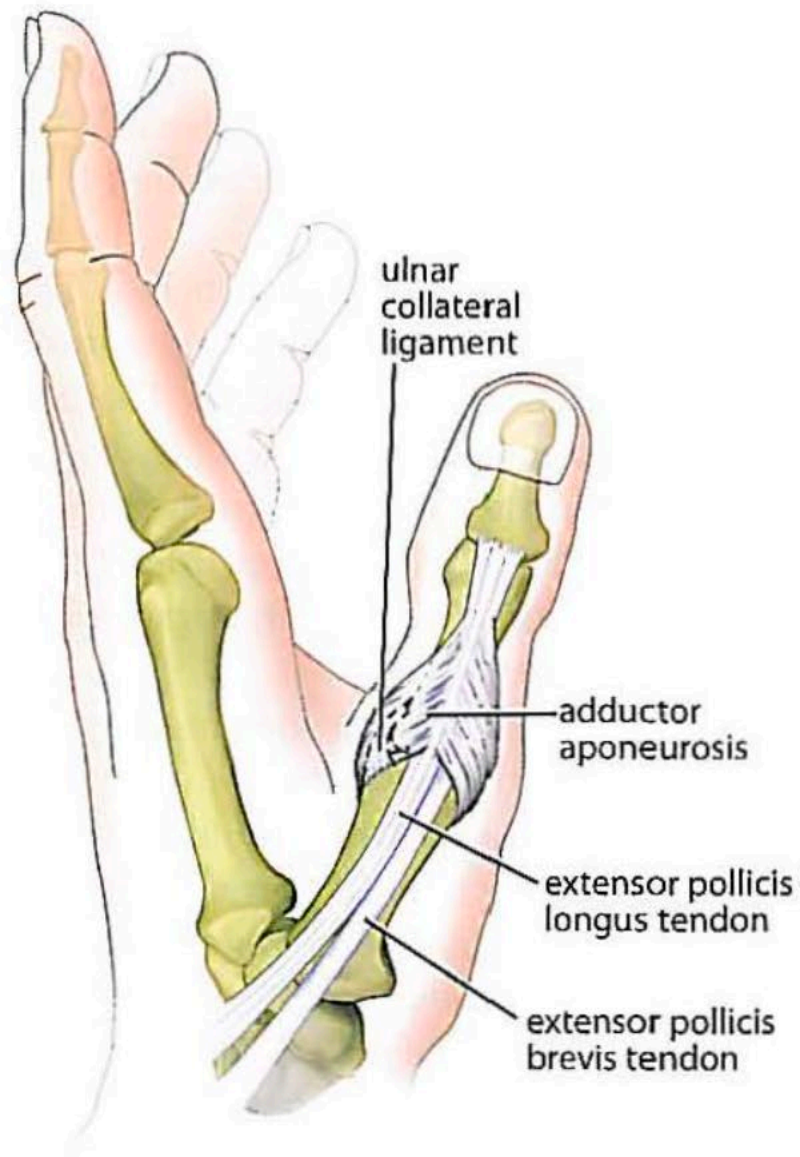
- One of the most common hand injury in sport.
- **MOI:** Skier's thumb? Forced abduction and hyperextension
- **Ax:** Deviation of 10-20deg on ulnar stress suggests grade 3.
- **Rx:** Immobilisation



Correct



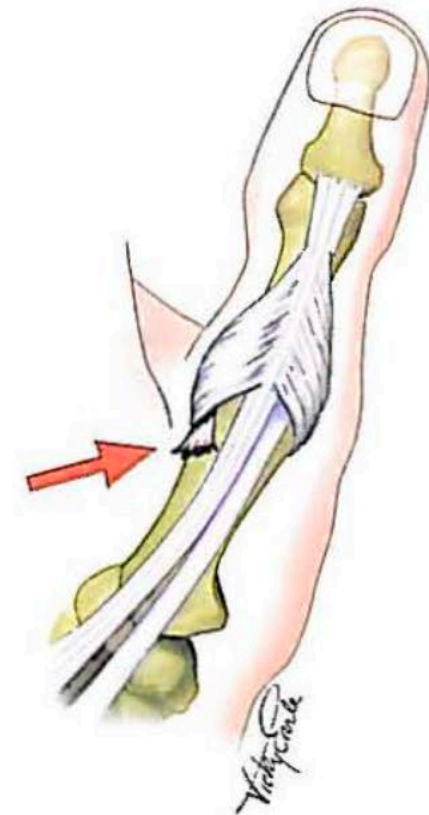
Incorrect



(a) Anatomy



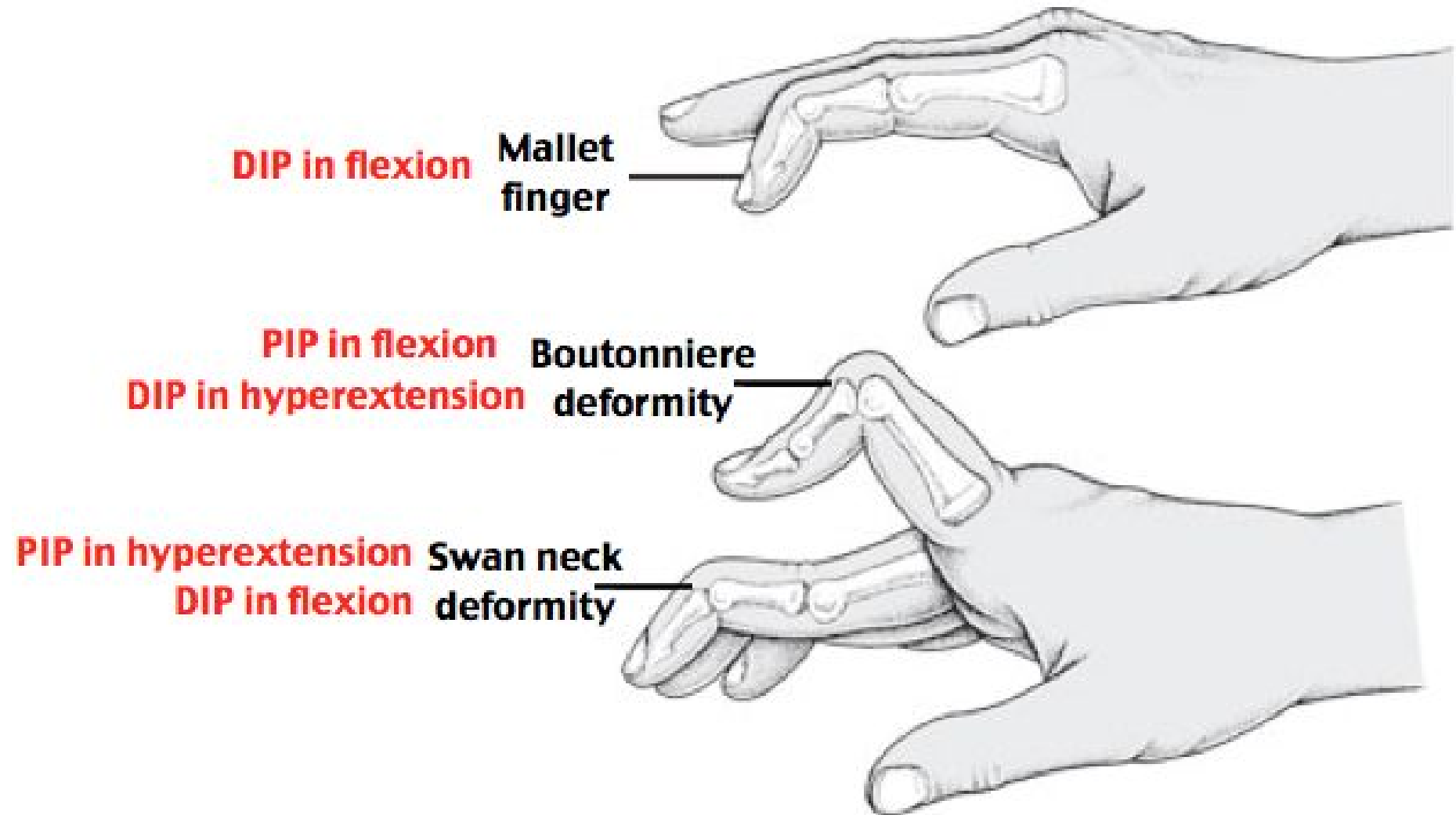
(b) Valgus stress opens up the joint and the adductor aponeurosis slips past the distal end of the proximal portion of the ruptured ulnar collateral ligament



(c) As alignment returns to normal, the adductor aponeurosis catches the proximal portion of the ulnar collateral ligament and flips it back proximally to form the Stener lesion

Figure 24.14 Mechanism of formation of a Stener lesion of the thumb

Funky fingers



Carpal Tunnel Syndrome



A blue ribbon graphic with a 3D effect, featuring a dark blue shadow on the left side. The ribbon is horizontal and has a folded appearance at the ends.

Manual Therapy

Improving Supination

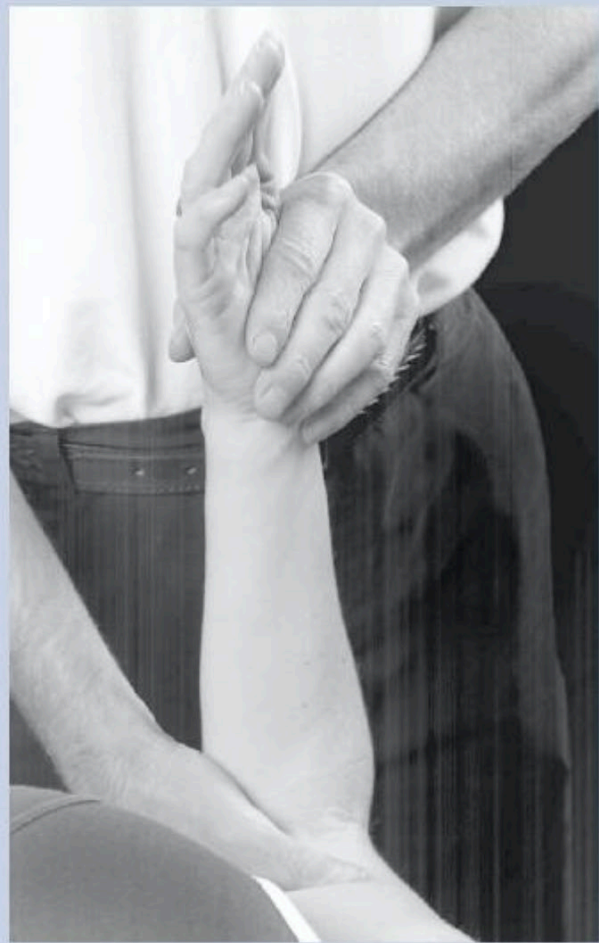


Figure 6.10 • Whole hand supination.



Figure 6.11 • Inferior radioulnar and radiocarpal supination.



Figure 6.17 • Inferior radioulnar joint: supination grade IV+.

Improving Pronation

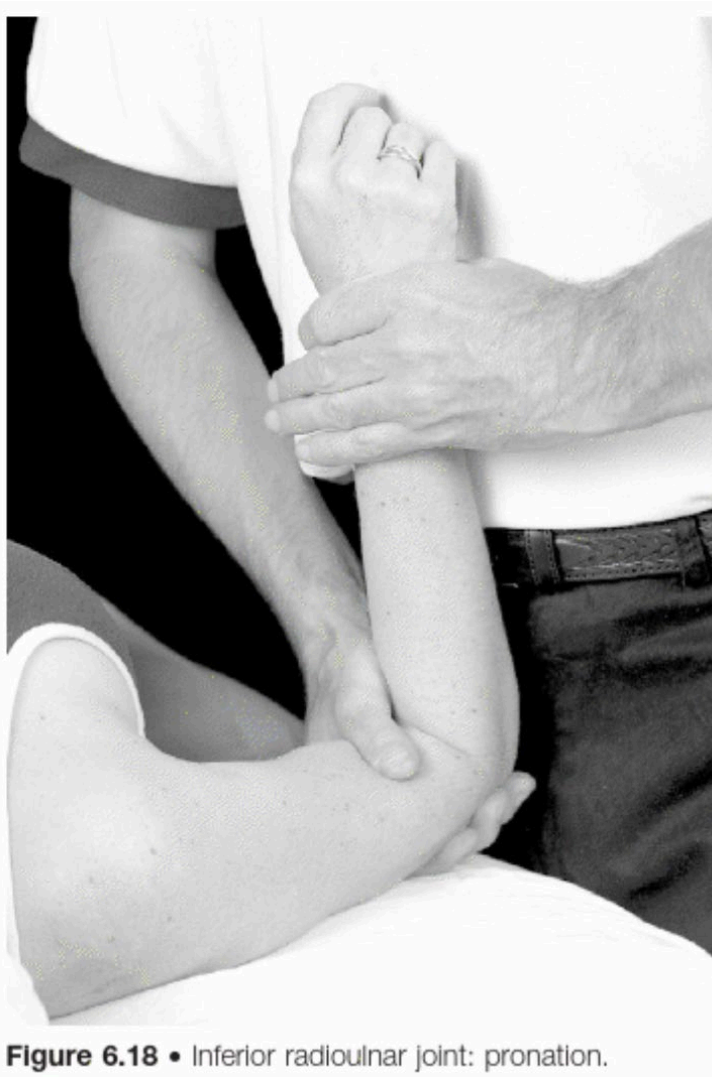


Figure 6.19 • Inferior radioulnar joint: pronation, grade IV+.

Radioulnar Accessory Movements



Figure 6.20 • Inferior radioulnar joint: posteroanterior and anteroposterior movements.



Figure 6.21 • Inferior radioulnar joint: compression.

Improving Flexion



Figure 6.23 • Wrist flexion (general).

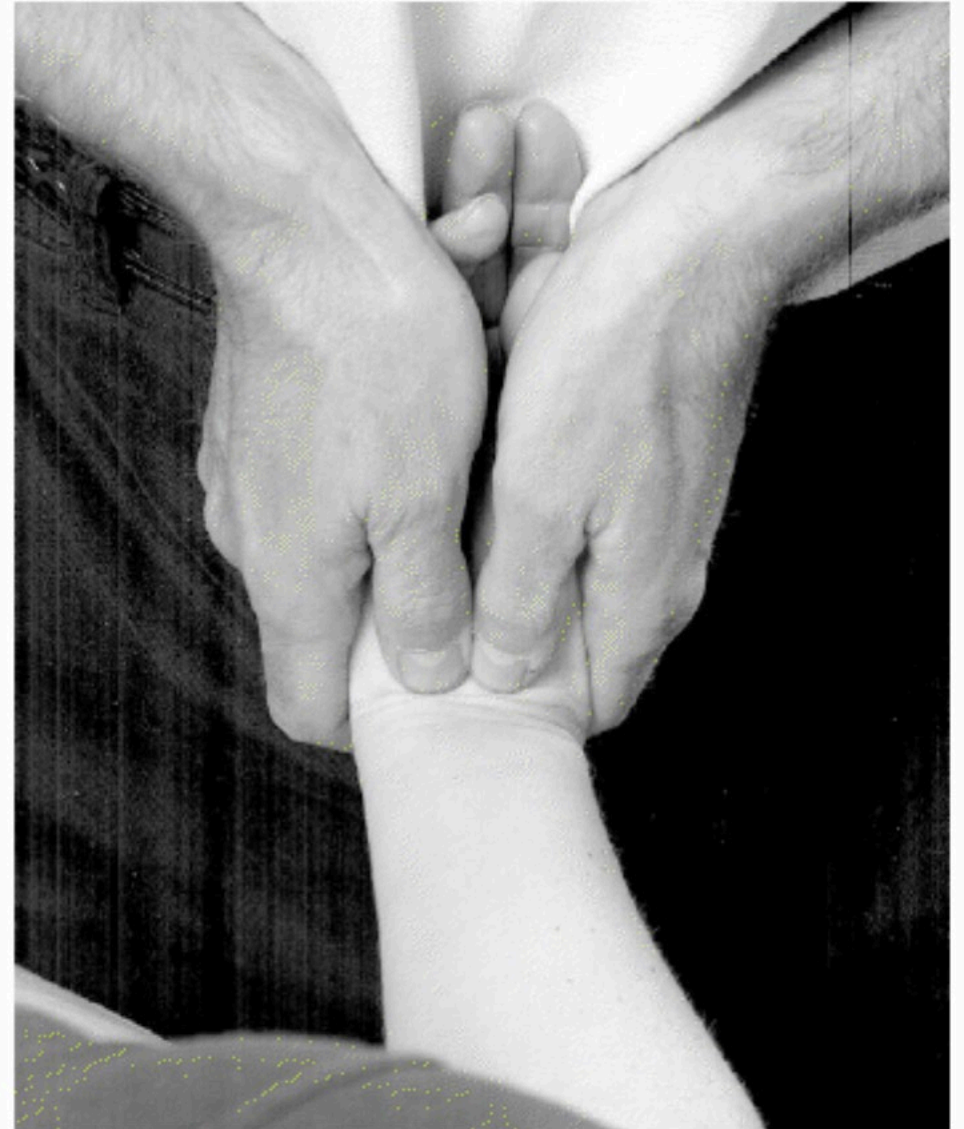


Figure 6.24 • Radiocarpal flexion.

Flexion Continued



Figure 6.25 • Midcarpal flexion.

Improving Extension



Figure 6.26 • Wrist extension (general).



Figure 6.27 • Radiocarpal extension.

Extension Continued

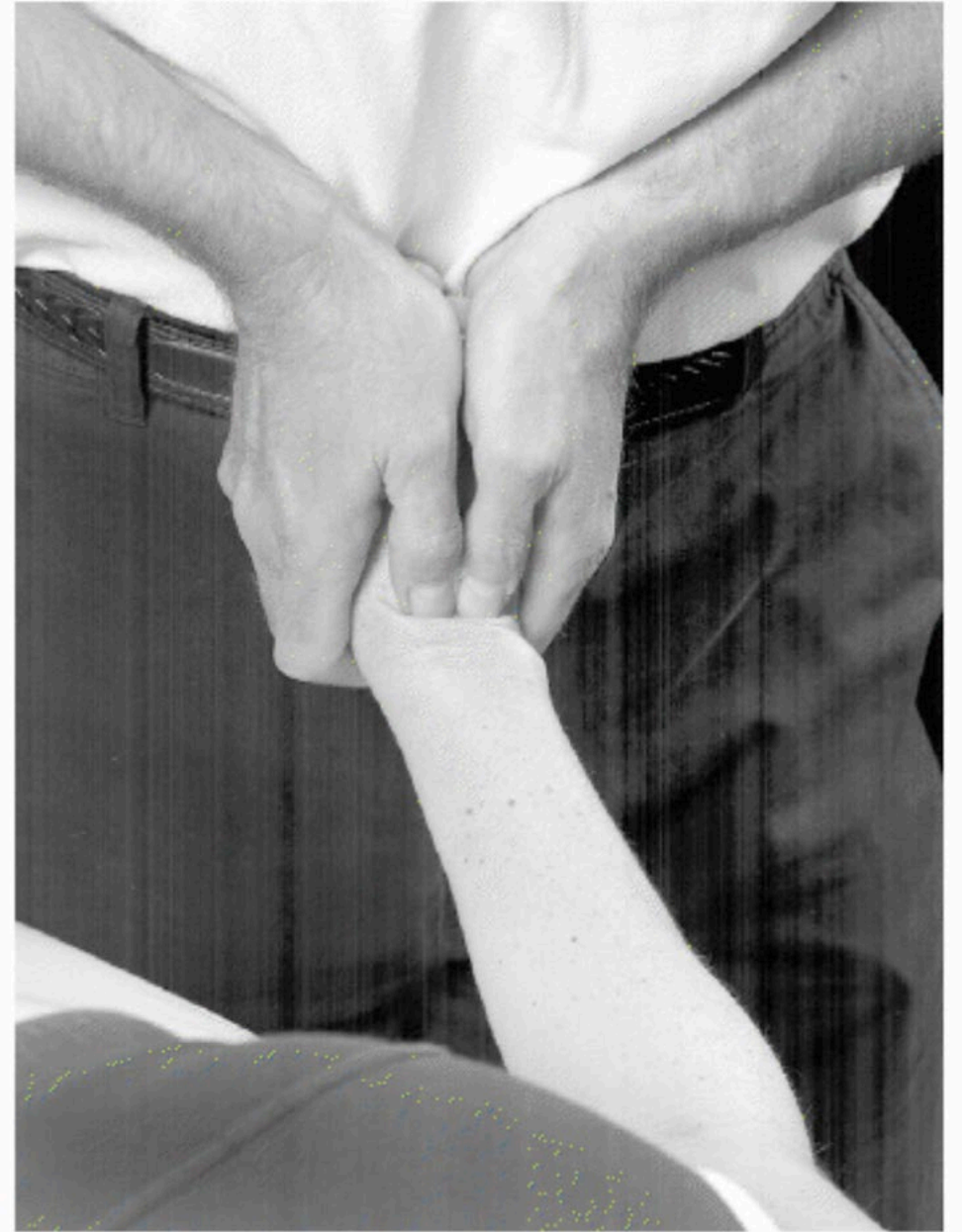


Figure 6.28 • Midcarpal extension.

Ulnar Deviation



Figure 6.29 • Wrist ulnar deviation (general).



Figure 6.30 • Wrist ulnar deviation (local).

Radiocarpal Movement

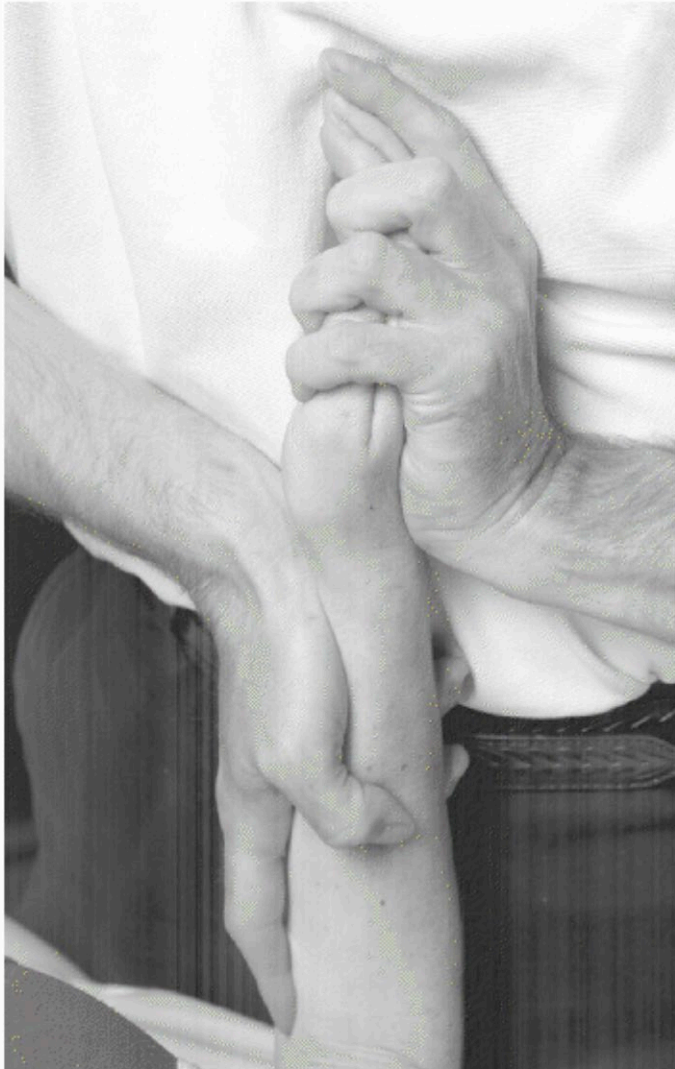


Figure 6.33 • Radiocarpal posteroanterior movement.

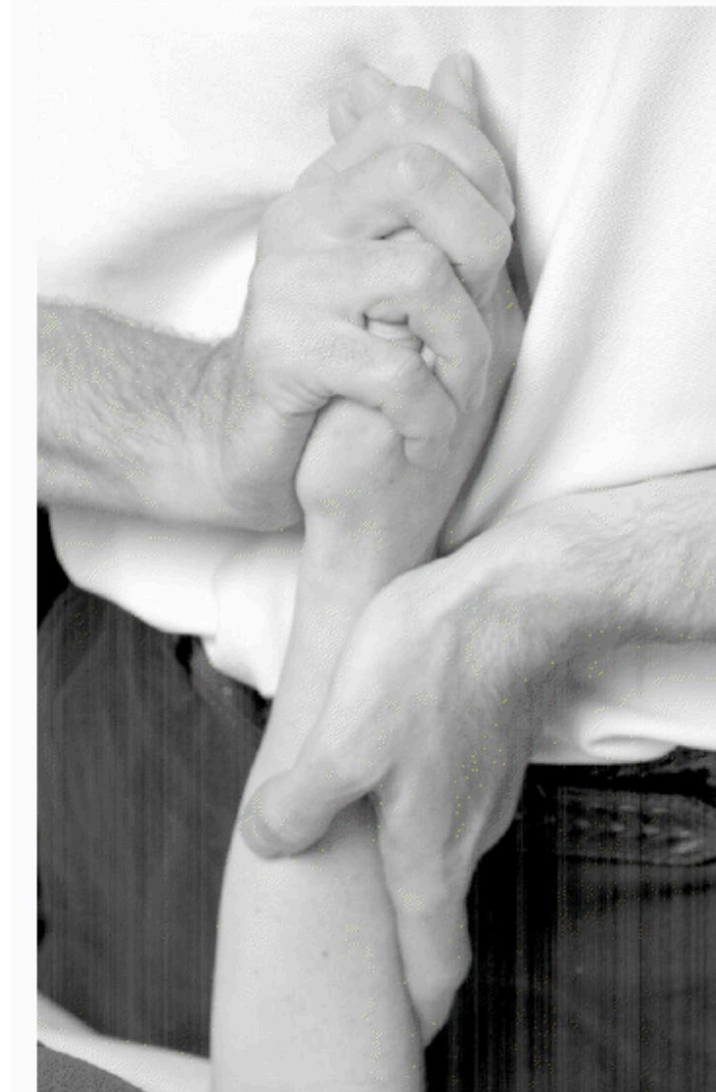


Figure 6.34 • Radiocarpal anteroposterior movement.

Radial Deviation

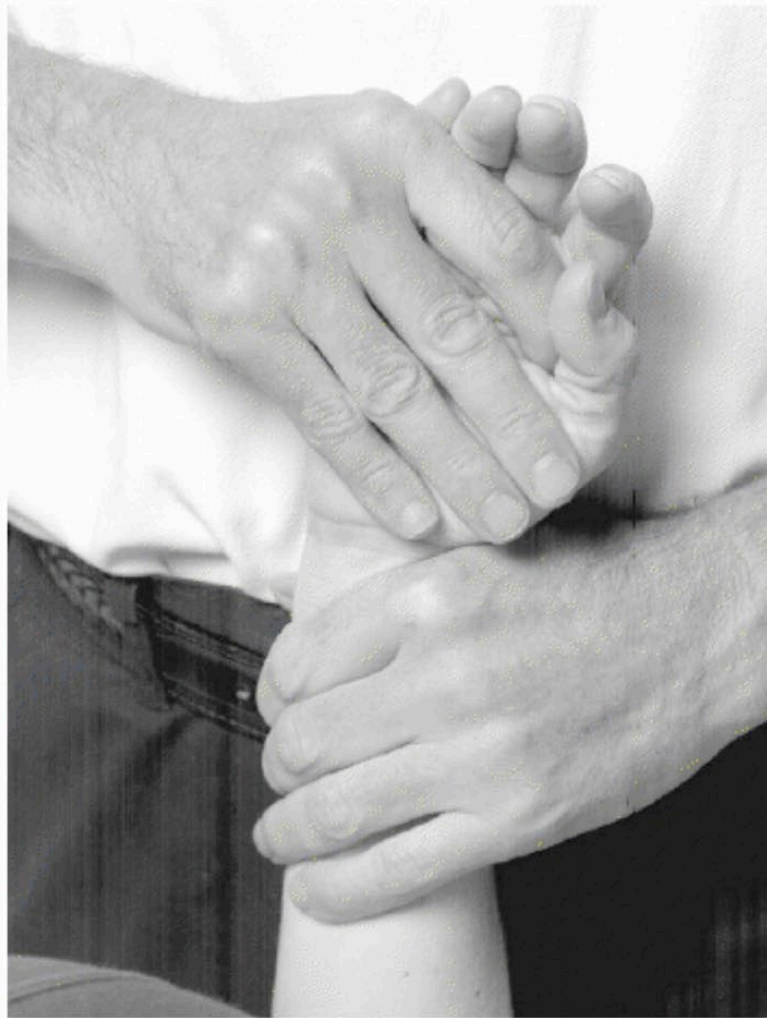


Figure 6.31 • Wrist radial deviation (general).

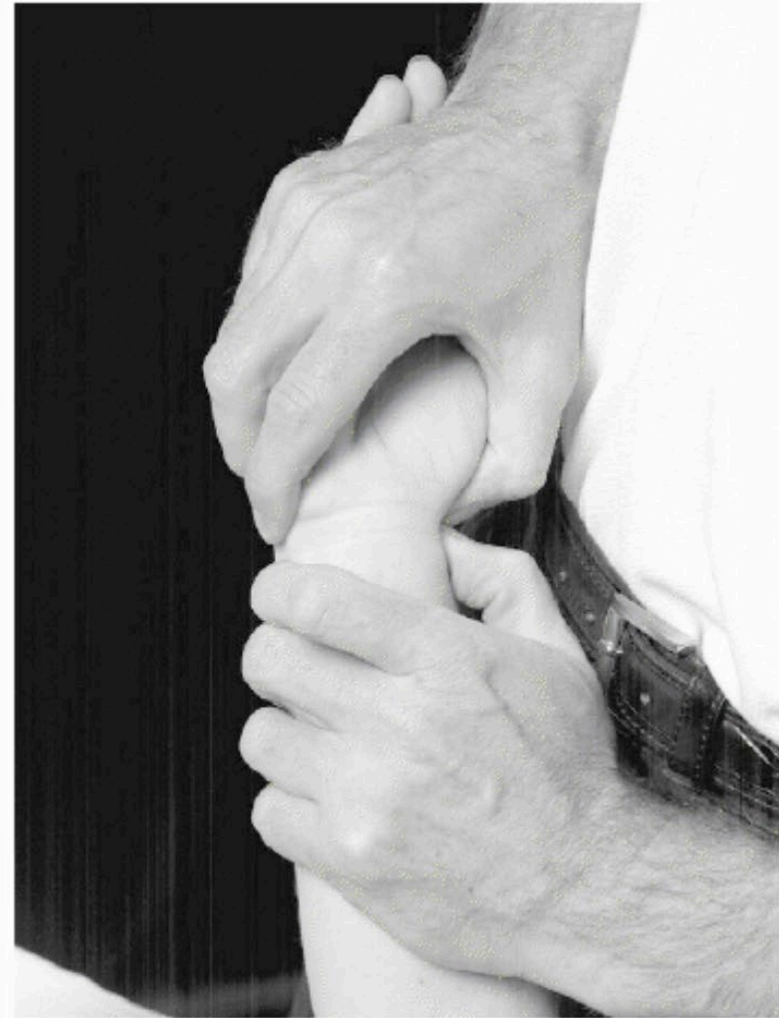


Figure 6.32 • Wrist radial deviation (local).

Pisiform Movements

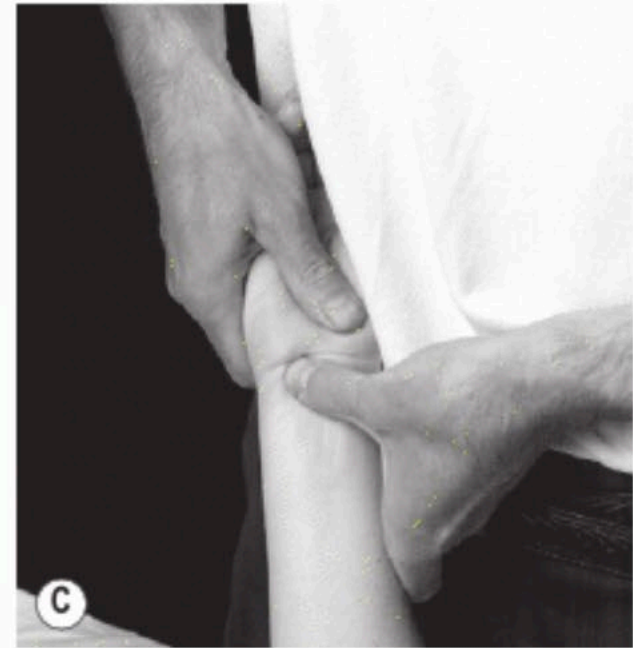
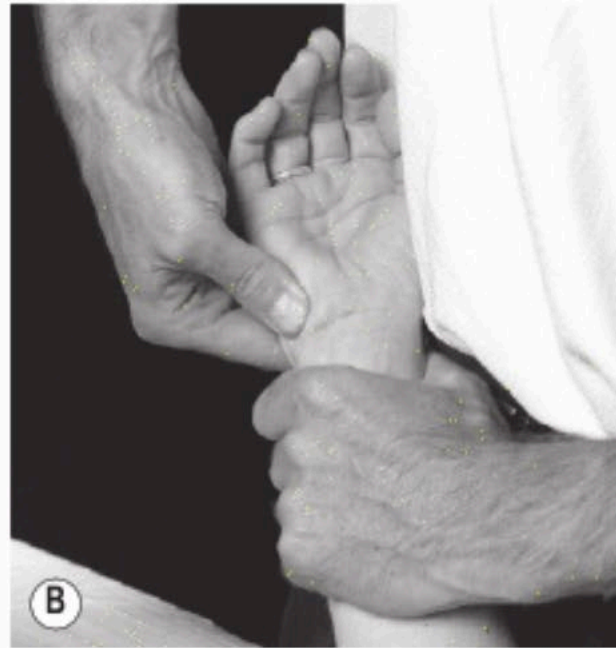
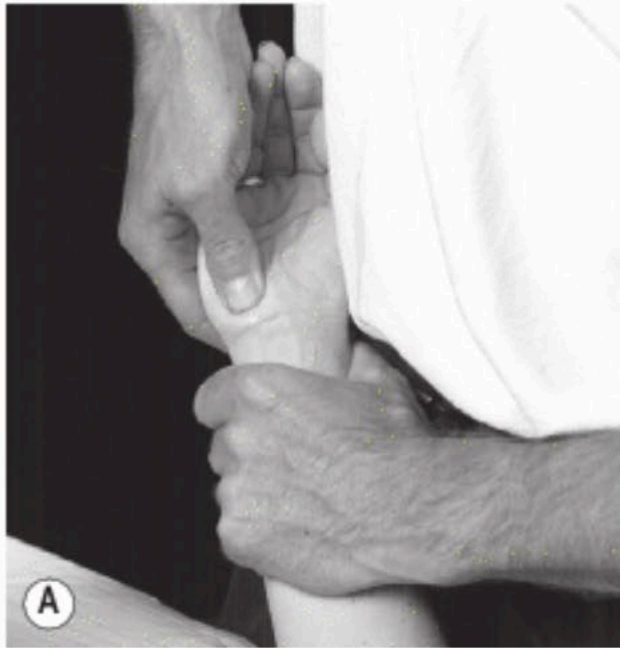


Figure 6.43 • Pisiform movements.

Carpometacarpal Extension



Figure 6.44 • Carpometacarpal extension.

Carpometacarpal Flexion



Figure 6.45 • Carpometacarpal flexion.

Intermetacarpal Movements

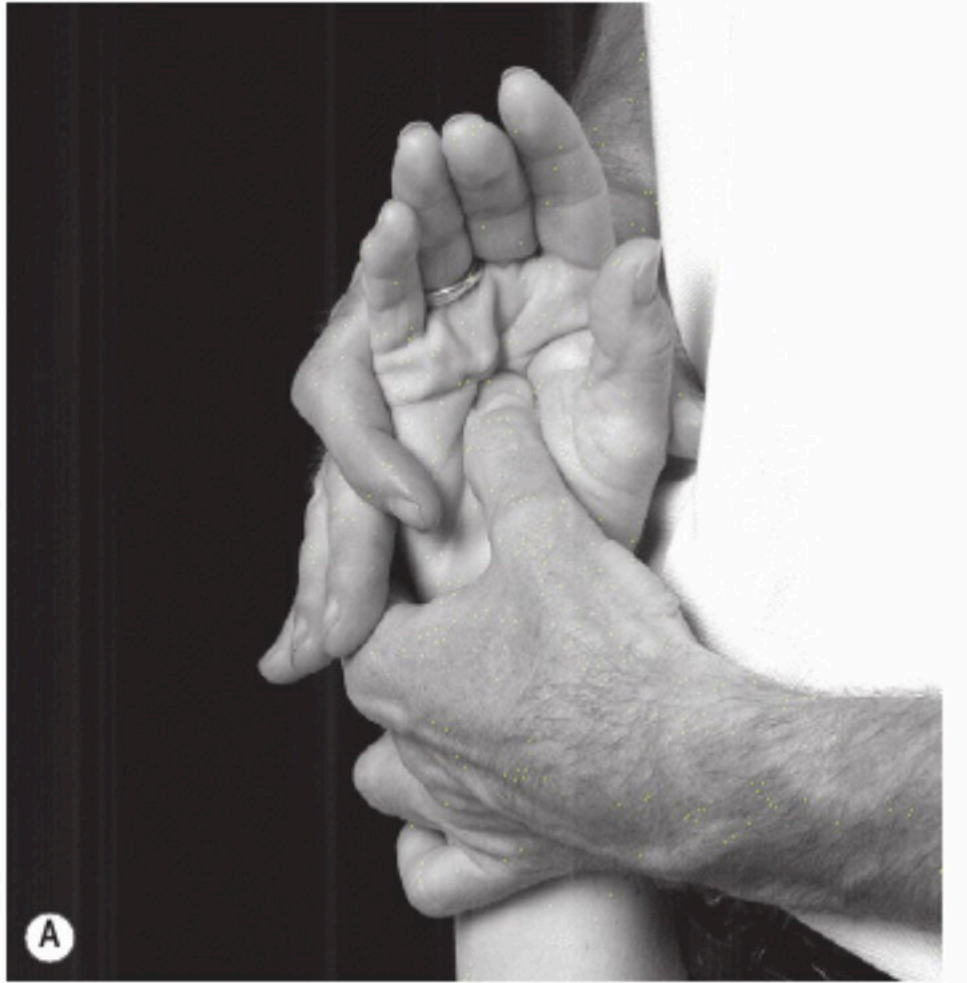


Figure 6.46 • Intermetacarpal movements: A HF; B HE.

Metacarpophalangeal Movements



Figure 6.47 • Metacarpophalangeal and interphalangeal joint: flexion.

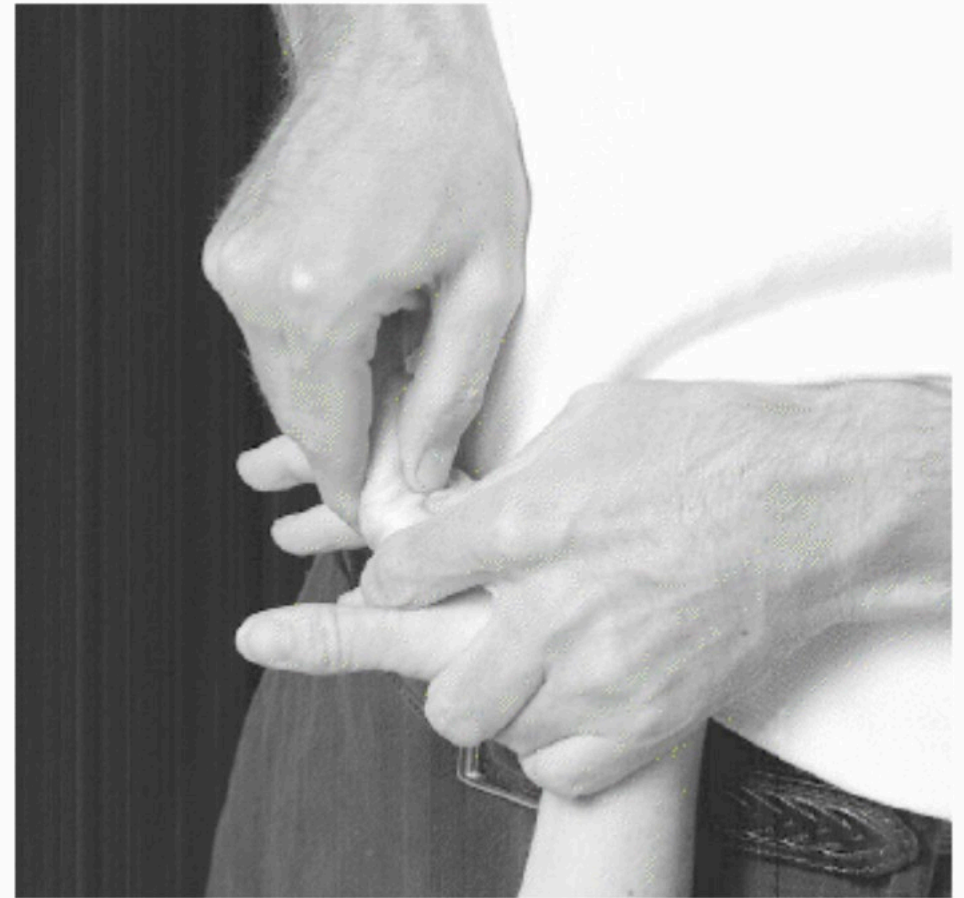


Figure 6.48 • Metacarpophalangeal and interphalangeal joint: extension.

Summary

So we've seen the anatomy of the wrist that fosters such ROM and precisional dexterity.

We've seen how tissues of the wrist can fail and become painful.

We've reviewed some of the manual therapy approaches you might select in attempting to improve ROM at the wrist.



Thank You