Introduction to the Wrist & Hand

Illustrations from:
Essential Clinical Anatomy 5th ed
Grant’s Atlas of Anatomy 13th ed
Clinically Oriented Anatomy 7th ed
Objectives

• Review functional anatomy of wrist and hand
• Review common injuries / pathologies affecting the wrist and hand
• Review surface anatomy landmarks
• Introduce clinical patterns
Resources

- Essential Clinical Anatomy pgs 473-481
- MSK lab manual
- SA video links
- Clinical pattern templates
• TOTAL: 13 bones in hand + radius and ulna
• 17 articulations
• Forearm, wrist and hand work together
• “Mechanical marvel”
Distal radio-ulnar joint (DRUJ)

- Concave ulnar notch of radius articulates with convex head of ulna
- Supination / Pronation
- Movement from proximal RU joint, distal RU joint and small contribution from wrist (radiocarpal) joint
Wrist (Radiocarpal) Joint

- Wrist allows hand to be placed in infinite number of positions, also enables hand to be locked in position to generate forces
- Numerous ligaments around wrist joint
- Radius articulates with scaphoid and lunate, lunate and triquetrum articulate with TFCC (articular disc)
  - Radius & scaphoid account for > than 50% of articular surface area
  - Radius and TFCC concave
  - Scaphoid, lunate & triquetrum convex
TFCC – triangular fibrocartilaginous complex

COMPONENTS: radio-ulnar disc, connective tissue wedge, fibrous attachments
• Cushions joint and disperses weight bearing forces, transmits load
• Increased load in pro/UD
• Stabilizes DRUJ
• Ulna does not participate as part of the radiocarpal joint except to serve as an attachment site for segments of the TFCC

Load bearing through wrist
Intact TFCC:
• radius – 60%
• ulna – 40%

Disrupted TFCC:
• radius – 95%
• ulna – 5%
Arthrokinematics: Wrist joint

**Flexion** - anterior roll of proximal carpal row on radius and TFCC, posterior glide

**Extension** - posterior roll, anterior glide

**Radial deviation** - rolls radially, glides ulnarly

**Ulnar deviation** - rolls ulnarly, glides radially
Intercarpal Joints/Ligaments

- **Midcarpal joint**: between the proximal row and distal row of carpal bones.
- **Intercarpal joints**: small amount of gliding between individual carpal bones, planar joints.
- **Intercarpal ligaments**: connect carpal bones.
- **Ligamentous attachments**: crucial in maintaining stability of the wrist region.
- **Scapholunate ligament**: important.

**Flexion / Extension, Radial / Ulnar Deviation**
- RC, MC, and intercarpal joint movement.

*Grants Atlas 13th ed*

*Essential Clinical Anatomy 5th ed*
Function of the Wrist & Hand

- Pinch and grasp requires mid-extension to neutral ROM
- Wrist flexion impairs strength by altering the muscle length –tension relationship
- For most ADL’s you need wrist:
  - Flexion 5-10 degrees
  - Extension 30-35 degrees
  - Radial deviation 10 degrees
  - Ulnar deviation 15 degrees
  - Wrist held in slight extension (10-15°) and slight UD for most functions requiring power at the wrist and allows for maximum function of the fingers and thumb.
1st CMC joint

- Saddle joint - allows for much greater movement compared to other CMC joints
- Trapezium and first metacarpal: concavoconvex joint surfaces
- Movements: flex/ext, abd/add, combined movement opposition – axial rotation of thumb

Grants Atlas 13th ed
1\textsuperscript{st} CMC Arthrokinematics

Flexion- ulnar roll of 1\textsuperscript{st} metacarpal, ulnar glide
Extension- radial roll, radial glide
Abduction- anterior roll, posterior glide
Adduction- posterior roll, anterior glide
Muscles

• Muscle tendon units affect every joint between attachment sites
• A tendon’s function is augmented at some joints by action of its antagonist at other joints
  – flex of PIP and DIP is augmented by active extension of the MCP by long extensor tendon
• Synergistic movements – ie finger flexion and wrist extension
Nerves of hand: Median nerve

**Median nerve**

**Sensory (S):** palmar radial 3 ½ digits

**Motor (M):** Abductor pollicis brevis, flexor pollicis brevis, opponens pollicis and lateral two lumbricals

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**Nerves: Ulnar nerve**

**Ulnar nerve**

**S:** dorsal and palmar ulnar 1 ½ digits

**M:** hypothenar eminence, medial 2 lumbricals, interossei, adductor pollicis, palmaris brevis

*Grants Atlas 13th ed*
Nerves: Radial nerve

Radial nerve
S: dorsal 3 ½ fingers, except tips of fingers
M: no muscles in hand

Golden yellow: Radial nerve

Grants Atlas 13th ed
TFCC Tears/Disruption

- Ulnar impaction – can cause overloading and degeneration
- Acute injury – especially with torque, hyperext
- Can be asymptomatic – cadaveric studies show degenerative perforations
- The prevalence of incidental TFCC findings in MRI scans of asymptomatic subjects is high.
- Surgery if complete rupture, or symptomatic
- May cause snapping and clicking
Common Injuries / Pathologies

- Hand and wrist most active & intricate parts of the UE but least protected and particularly vulnerable to injury

1\textsuperscript{st} CMC OA
- Usually women over age 50, between 20-30 % population (US data)
- Pain base of thumb
- Loss of ROM, weak grip and pinch
Common Injuries / Pathologies

FRACTURES

• **Colles #:** transverse # of radius 2.5 cm proximal to the articular surface
  – Females > males, over 40 years of age
  – Dinner fork deformity, lower radial fragment displaced posteriorly & laterally

• **Scaphoid:** most common fracture of the carpals (clinical pattern)
Fractures

May also occur in other carpal bones

- **Lunate**: be aware of potential for Kienbochs disease (avascular necrosis)
  - MOI- FOOSH
- **Hamate**: On hypothenar aspect of palm, hook of hamate is part of Guyon’s tunnel- ulnar nerve symptoms
  - MOI- Using hand as a hammer, direct blow to hand
  - Common complication – non union of hook
Fractures

**Metacarpal #’s:** 5\textsuperscript{th} MC most common

**Phalanx #’s:** proximal, middle (tend to be unstable requiring wiring) or distal (common)

• Contractures in hand / fingers common secondary to complex network of connective tissue / ligaments in hands → want to MOVE ASAP as long as # is solid
Carpal Dislocations

Perilunate dislocation: most common dislocation (other carpals dislocate around the lunate)

Volar lunate dislocation: lunate “squeezed” out from between radius and capitate (anteriorly)

MOI: FOOSH
Common Injuries / Pathologies

**Carpal tunnel syndrome:** clinical pattern

**Guyon tunnel syndrome:** entrapment of the ulnar nerve in the Guyon tunnel

- Floor formed by transverse carpal ligament
- Roof by the pisohamate ligament
- Bounded medially by pisiform and laterally by hook of hamate
- Leads to tingling / paraesthesia in ulnar 1 ½ digits
- Common in cyclists or occupations with ++ UD ie-hammering
DeQuervains Syndrome - clinical pattern

Intersection Syndrome -
- Tenosynovitis of area of 1st dorsal compartment – EPB, APL and 2nd compartment ECRL/B where tendons cross over
- Friction causes pain, swelling, crepitus
- MOI: Motions that strain extensor tendons ie. Skiing, raking, racket sports, weight lifting
Scaphoid

- In floor of anatomical snuff box, exposed with wrist flexion and ulnar deviation

Trapezium

- At base of 1st metacarpal just distal to scaphoid

Trapezoid

- At base of 2nd metacarpal on dorsal surface
SURFACE ANATOMY

Shaft of 3\textsuperscript{rd} metacarpal
- Felt through the extensor tendon on posterior surface on hand at 3\textsuperscript{rd} digit. Head is bony prominence at base of digit 3

Capitate
- In small depression proximal to base of 3\textsuperscript{rd} metacarpal in distal row of carpals. Flex wrist to feel it on dorsal surface

Lunate
- Just proximal to capitate, flex wrist to expose it on dorsal surface
SURFACE ANATOMY

Triquetrum
• Radially deviate wrist and palpate just distal to ulnar styloid process

Pisiform
• Medial bone at proximal row of carpal bones, proximal to base of hypothenar eminence.
• Sits on top of triquetrum

Hook of hamate
• Distal and radial to pisiform on palmar surface of hand

Radial pulse
• Lateral to flexor carpi radialis over distal anterior radius
• Runs btw FCR and abductor pollicis longus
CLINICAL PATTERNS

1. 52 year old female, office cleaning lady, with complaints of numbness in hand/fingers and decreased grip strength for approximately 1 year
   • CARPAL TUNNEL SYNDROME

2. 35 year old female with 2 month old infant with complaints of gradual worsening of thumb/wrist pain over past month
   • DEQUERVAINS SYNDROME
3. 25 year old male, fell while snowboarding 3 days ago

• *SCAPHOID FRACTURE*