MEDICAL EDUCATION RESOURCE

Joints of the Hand

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Overview

- The joints of the hand form a **highly flexible and coordinated system** enabling precise movements required for grip and manipulation.
- These include:
    1. **Intercarpal joints** – between carpal bones.
    2. **Midcarpal joint** – between proximal and distal carpal rows.
    3. **Carpometacarpal (CMC) joints** – between carpus and metacarpals.
    4. **Intermetacarpal joints** – between adjacent metacarpals.
    5. **First carpometacarpal joint** – unique, highly mobile saddle joint of the thumb.

? Intercarpal, Midcarpal, and Intermetacarpal Joints

Type

- **Plane synovial joints.**

Articular Surfaces

- Adjacent **carpal bones** of proximal and distal rows articulate through **small, flat facets**.
- **Midcarpal joint** lies between the **two carpal rows** — functionally the most mobile part of the wrist complex.
- **Intermetacarpal joints** are small synovial articulations between **bases of 2nd–5th metacarpals**.

Ligaments

LIGAMENT	DESCRIPTION / FUNCTION
Dorsal & palmar intercarpal ligaments	Unite adjacent carpal bones, strengthen joint capsule.
Interosseous ligaments	Bind bones within each carpal row, restrict separation.
Dorsal & palmar carpometacarpal ligaments	Connect distal carpal row to metacarpal bases.
Intermetacarpal ligaments	Between bases of 2nd–5th metacarpals; stabilize arches of hand.

Joint Cavity

- Most **intercarpal**, **midcarpal**, and **CMC (2nd–5th)** joints communicate with one another, forming a **common synovial cavity**.
- **1st CMC joint** (thumb) and **pisiform joint** are **separate**.

Movements

- **Small gliding and rotational movements** between carpal bones allow:
  - **Flexion/extension** and **abduction/adduction** at wrist.
- Midcarpal joint contributes greatly to the **total wrist range of motion**.

? First Carpometacarpal (Thumb) Joint

Type

- **Saddle-type synovial joint** — unique and highly mobile.

Articular Surfaces

- **Trapezium:** Concavoconvex.
- **Base of 1st metacarpal:** Reciprocal concavoconvex surface.

Both are **covered with fibrocartilage** and oriented **at right angles** to each other ? enabling multiaxial movement.

Ligaments

LIGAMENT	FUNCTION
Capsular ligament	Loose but strong; surrounds joint.
Anterior & posterior oblique ligaments	Reinforce capsule; prevent displacement.
Intermetacarpal ligament	Connects base of 1st metacarpal to 2nd metacarpal; stabilizes thumb.

Movements at 1st CMC Joint

MOVEMENT	AXIS / PLANE	MUSCLES RESPONSIBLE
Flexion	Across palm (frontal plane)	Flexor pollicis longus & brevis
Extension	Away from palm	Extensor pollicis longus & brevis
Abduction	Perpendicular to palm (sagittal plane)	Abductor pollicis longus & brevis
Adduction	Toward palm	Adductor pollicis
Opposition	Combined flexion, abduction, medial rotation	Opponens pollicis (assisted by FPL, APB)

MOVEMENT	AXIS / PLANE	MUSCLES RESPONSIBLE
Reposition	Reverse of opposition	EPL, EPB, APL

Functional Significance

- Enables **opposition of thumb to fingers**, forming the anatomical basis of **precision grip** — a hallmark of human hand function.

Axis of Movement

- **Flexion–extension:** Transverse axis through trapezium.
- **Abduction–adduction:** Sagittal axis perpendicular to plane of palm.
- **Opposition–reposition:** Composite movement involving rotation around both axes.

Nerve Supply

- **Anterior interosseous branch of median nerve.**
- **Dorsal interosseous branch of radial nerve.**

Blood Supply

- **Radial artery** (through its superficial palmar and dorsal carpal branches).

? Dissection of Joints of Hand

Steps

1. Make dorsal and palmar incisions to expose the **carpal region**.
2. Remove **extensor retinaculum** and **dorsal tendons** to reveal **dorsal intercarpal ligaments**.
3. Open the capsule of **midcarpal joint** to show articulation between scaphoid–lunate–triquetral and trapezium–capitate–hamate.
4. Identify **interosseous ligaments** joining adjacent carpal bones.
5. Trace distal articulations to **carpometacarpal joints** — note the separate **thumb joint** capsule.
6. Demonstrate **movement of thumb base** on trapezium (flexion, extension, opposition, and rotation).
7. Observe the **pisiform–triquetral joint** (plane synovial, distinct capsule).

? Clinical Anatomy of Joints of Hand

1. Osteoarthritis of 1st CMC Joint

- Common in **postmenopausal women** and manual workers.
- Pain at thumb base during grip or pinching.
- Radiographs show joint space narrowing and osteophyte formation.

- May require **arthroplasty or fusion** in severe cases.

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2. Gamekeeper’s (Skier’s) Thumb

- Rupture of **ulnar collateral ligament** of 1st CMC joint due to forced **abduction** (fall while holding ski pole).
- Leads to **joint instability** and pain at thumb base.
- Treated with immobilization or surgical repair.

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3. Dislocation of 1st CMC Joint

- May occur after trauma or forced hyperextension.
- Thumb appears displaced dorsally; opposition impaired.

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4. Ligamentous Laxity

- Generalized hypermobility can cause **recurrent thumb base instability** ? weakness of grip.

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5. Carpal Instability (Midcarpal)

- Ligament injury between scaphoid–lunate or lunate–triquetral ? abnormal alignment, pain on wrist motion.

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6. Rheumatoid Arthritis

- Early involvement of **intercarpal and CMC joints**, especially ulnar side ? swelling, pain, “ulnar deviation” of fingers.