🏋️‍♀️ ELBOW JOINT & RADIOULNAR JOINTS

🔹 OVERVIEW ⭐

- Elbow joint and radioulnar joints are closely related anatomically
- Often studied together but are structurally different

🔹 KEY CONCEPT ⭐

Feature	Elbow Joint	Radioulnar Joint
Structure	Separate	Separate
Function	Together	Together

Distal bone	Ulna	Radius
Movement type	Flexion/Extension	Pronation/Supination

💡 Structurally = 2, Functionally = 1

🟢 BONES & BONY LANDMARKS

🔹 Bones involved

- Humerus
- Radius
- Ulna

🔹 Important landmarks ⭐

On Humerus

- Trochlea
- Capitulum
- Coronoid fossa
- Radial fossa
- Olecranon fossa
- Medial epicondyle
- Lateral epicondyle

On Ulna

- Olecranon process
- Coronoid process
- Trochlear notch
- Ulnar tuberosity

On Radius

- Head of radius
- Radial tuberosity

🟢 ELBOW JOINT

🔹 TYPE ⭐

- Synovial
- Hinge joint (uniaxial)

🔹 ARTICULATIONS

- Humero-ulnar → Trochlea ↔ Trochlear notch
- Humero-radial → Capitulum ↔ Head of radius

🔹 FEATURES ⭐

- Very stable joint
- Helps in force transmission + positioning hand
- Asymmetrical trochlea → carrying angle

🔹 AXIS & MOVEMENT

- Axis → Transverse axis through trochlea & capitulum
- Movement → Flexion & Extension

🔹 BONY STOPS ⭐

- Flexion → Coronoid process + radial head in fossae
- Extension → Olecranon in olecranon fossa

🟢 JOINT CAPSULE

- Encloses all 3 articulations
- Continuous with proximal radioulnar joint
- Contains synovial membrane

🔹 SPECIAL FEATURE ⭐

- Sacciform recess → allows free rotation of radius

🟢 LIGAMENTS OF ELBOW

🔹 Ulnar Collateral Ligament ⭐

- Resists valgus stress
- Strong & always taut

🔹 Radial Collateral Ligament

- Resists varus stress

🔹 Annular Ligament ⭐

- Holds head of radius
- Essential for rotation

💡 Most forces at elbow are valgus → medial ligament more important

🟢 RADIOULNAR JOINTS

🔹 TYPES ⭐

- Proximal radioulnar → Synovial pivot
- Distal radioulnar → Synovial pivot

🟢 PROXIMAL RADIOULNAR JOINT

🔹 ARTICULATION

- Head of radius ↔ Radial notch of ulna

- TYPE

- Synovial pivot joint

- CAPSULE

- Continuous with elbow joint capsule

- SYNOVIAL MEMBRANE

- Continuous with elbow joint

- LIGAMENT ⭐

- Annular ligament (main stabilizer)

🔹 FUNCTION

- Rotation of radius → pronation/supination

🟢 DISTAL RADIOULNAR JOINT

🔹 ARTICULATION

- Head of ulna ↔ Ulnar notch of radius

🔹 TYPE

- Synovial pivot joint

🔹 CAPSULE

- Attached to margins of articular surfaces
- Deficient superiorly

🔹 SYNOVIAL MEMBRANE

- Lines the capsule

🔹 ARTICULAR DISC (VERY IMPORTANT ⭐)

- Separates joint from wrist
- Stabilizes joint

🔹 NERVE SUPPLY

- Anterior interosseous nerve
- Deep branch of radial nerve

🟢 INTEROSSEOUS MEMBRANE ⭐

🔹 FEATURES

- Fibrous sheet between radius & ulna
- Fibers run downwards & medially

🔹 FUNCTIONS

- Binds bones together
- Provides muscle attachment
- Transfers weight (radius → ulna)

🟢 MOVEMENTS (INTEGRATED) ⭐

🔹 At Elbow Joint

- Flexion
- Extension

🔹 At Radioulnar Joints

- Pronation
- Supination

💡 Mechanism:

- Radius rotates around ulna

🟢 STABILITY FACTORS ⭐

- Bony congruity
- Ligaments
- Annular ligament
- Interosseous membrane
- Muscles

🟢 CLINICAL CORRELATIONS 🩺

🔸 1. Pulled Elbow (Nursemaid's Elbow)

- Radial head slips from annular ligament
- Common in children

🔸 2. Dislocation of Elbow

- Usually posterior

🔸 3. Monteggia Fracture

- Ulna fracture + radial head dislocation

🔸 4. Radial Head Dislocation

- Affects pronation/supination

🔸 5. Carrying Angle Abnormality

- Cubitus valgus
- Cubitus varus

🔥 QUICK REVISION:

-> Elbow = Hinge → Flex/Extend

-> Radioulnar = Pivot → Rotate

-> Proximal RUJ → Annular ligament

-> Distal RUJ → Articular disc

-> Key: Radius moves, ulna fixed

🟢 MOVEMENTS OF ELBOW & RADIOULNAR JOINTS

🔹 OVERVIEW ⭐

- Movements occur at:
- Elbow joint → Flexion & Extension
- Radioulnar joints → Pronation & Supination

💡 Radius moves around ulna in rotation

🟢 FLEXION

🔹 DEFINITION

- Movement of forearm towards arm
- Decreases angle at elbow joint
- Occurs in sagittal plane

🔹 MUSCLES ⭐

🔸 Primary flexors

- Brachialis ⭐ (MOST IMPORTANT)
- Biceps brachii
- Brachioradialis

🔸 Accessory

- Pronator teres

🔹 KEY POINTS ⭐

- Brachialis = strongest flexor (works in all positions)
- Biceps brachii:
- Weak in pronation
- Strong during rapid movements / resistance
- Brachioradialis:
- Best in mid-prone position (handshake position)

🔹 FUNCTIONAL FACT

- Flexors are stronger than extensors

👉 Humans are better pullers than pushers

🟢 EXTENSION

🔹 DEFINITION

- Movement of forearm away from arm
- Increases angle at elbow
- Occurs in sagittal plane

🔹 MUSCLES ⭐

🔸 Primary

- Triceps brachii ⭐
- Anconeus

🔹 PARTS OF TRICEPS ⭐

- Long head → affected by shoulder position
- Medial head → "workhorse" (always active)
- Lateral head → active in powerful extension

🟢 PRONATION

🔹 DEFINITION

- Internal rotation of forearm
- Palm faces down/posteriorly

🔹 MECHANISM ⭐

- Radius crosses over ulna

🔹 AXIS

- From head of radius → styloid process of ulna

🔹 MUSCLES ⭐

🔸 Primary

- Pronator quadratus (always active)
- Pronator teres (rapid or forceful movement)

🔸 Accessory

- Brachioradialis

🟢 SUPINATION

🔹 DEFINITION

- External rotation of forearm
- Palm faces up/anteriorly

🔹 MUSCLES ⭐

🔸 Primary

- Supinator (slow movements)
- Biceps brachii (powerful/against resistance) ⭐

🔸 Accessory

- Brachioradialis

🟢 FUNCTIONAL INTEGRATION ⭐

🔹 Muscle roles

Movement	Main Muscles
Flexion	Brachialis, Biceps, Brachioradialis

Extension	Triceps, Anconeus
Pronation	Pronator teres, Pronator quadratus
Supination	Biceps, Supinator

🔹 IMPORTANT CONCEPT ⭐

- Biceps = flexion + supination
- Triceps = extension
- Radius = moving bone
- Ulna = stable bone

🟢 BIOMECHANICS ⭐

- During throwing:

👉 Early phase:

- Biceps + brachialis → flexion

👉 Acceleration:

- Triceps → extension

👉 Deceleration:

- Flexors contract again to control movement

💡 Biceps is most prone to strain here

🟢 CLINICAL CORRELATIONS 🩺

🔸 1. Overuse Injuries

- Due to repetitive activities
- Common in:
- Tennis 🎾
- Throwing sports

🔸 2. Valgus Stress ⭐

- Medial tensile forces ↑
- Lateral compressive forces ↑
- Posterior shear forces ↑

🔸 3. Myositis Ossificans

- Bone formation in muscle
- Common in brachioradialis

🔸 4. Elbow Dislocation

- Often associated with fractures

🔥 FINAL EXAM BOOSTER

⭐ QUICK REVISION:

- Flexion → Brachialis (main)
- Extension → Triceps
- Pronation → PQ + PT
- Supination → Biceps + Supinator
- Key: Radius moves, ulna fixed

🟢 MEDIAL & LATERAL ELBOW INJURIES

🔹 MEDIAL EPICONDYLITIS ("Little Leaguer's Elbow")

- Linked to high-velocity valgus extension movements
- Large valgus torque near maximal external rotation resisted by varus torque from soft tissues

Causes in young athletes

- Medial strain during initial forward phase of throw
- Hand & elbow lag behind trunk and shoulder
- Curveball pitching → increases medial strain → not recommended

Injuries associated

- Sprain/rupture of ulnar collateral ligament (UCL)
- Tendinitis of wrist flexors
- Avulsion fractures of medial epicondyle

- Osteochondritis dissecans of capitulum
- Radial head pushed into capitulum → compressive load from valgus force

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🔹 LATERAL EPICONDYLITIS ("Tennis Elbow")

- Microdamage/inflammation of lateral epicondyle tissues
- 30–40% of tennis players develop this
- Causes: poor technique, faulty equipment
- Off-center shots, tight racket strings
- Pain worsens with wrist extension
- Lifting, turning doorknobs, shaking hands

🟢 RADIOULNAR JOINTS

- Type: Diarthrodial uniaxial pivot

- Movements: Supination & Pronation
- Radius rotates around fixed ulna

🟢 WRIST & HAND

🔹 WRIST (Radiocarpal Joint)

- Type: Condyloid joint
- Ulna: Floats on articular disc → no direct contact with carpals
- Midcarpal joint: Scaphoid supports arm weight & transmits forces

Range of Motion (ROM)

- Flexion: 70–90° (10–15° needed for ADL)
- Extension: 70–80° (35° needed for ADL)

- ROM decreases when fingers flexed
- Radial deviation: 15–20°
- Ulnar deviation: 30–40°

🔹 CARPOMETACARPAL (CMC) JOINTS

- Concave transverse arch → facilitates gripping
- Thumb CMC = saddle joint → flex/ext, ab/adduction, rotation
- Opposition: Thumb touches each finger → essential for gripping

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🔹 METACARPOPHALANGEAL (MCP) JOINTS

- Fingers: Condyloid → flex/ext, ab/adduction
- Thumb: Hinge → only flex/ext

🟢 MUSCLES OF WRIST

- Extensors (Origin: lateral epicondyle)
  - Extensor carpi radialis longus & brevis
  - Extensor carpi ulnaris
  - Extensor digitorum & digiti minimi
- Flexors (Origin: medial epicondyle)
  - Flexor carpi radialis
  - Palmaris longus (absent in 13%)
  - Flexor carpi ulnaris → pisiform sesamoid improves mechanical advantage
- Deviations

- Radial deviation → radial muscles: FCR, ECR longus & brevis
- Ulnar deviation → ulnar muscles: FCU, ECU

🔹 EXTRINSIC & INTRINSIC MUSCLES

- Extrinsic: Originate in forearm → act on wrist/fingers
- Intrinsic: Hand muscles → thenar (thumb), hypothenar (pinky)

Grip strength

- Strongest: Slight ulnar deviation + hyperextension (~40° wrist extension)
- Neutral wrist: safest position → minimal strain
- Power grip: Extrinsic muscles
- Precision grip: Intrinsic muscles

- Thumb position critical for grip type

🟢 WRIST/HAND INJURIES

- 🔹 Traumatic
  - Fall on outstretched hand → extreme flexion/extension
  - Sprain of ligaments, strain of flexors
  - Scaphoid fracture → common due to low density & force
- 🔹 Overuse injuries
  - Tenosynovitis (radial flexors & thumb muscles) → canoeing, rowing, tennis, fencing
  - Medial epicondylitis → overuse of wrist flexors

🟢 CARPAL TUNNEL SYNDROME (CTS)

- 🔹 Pathophysiology
  - Compression of median nerve at wrist
  - Repetitive wrist flexion/extension → inflames flexor tendons → nerve pressure
  - Tunnel: Formed by carpals + transverse carpal ligament (roof)
- 🔹 Clinical features
  - Pain, numbness, tingling
  - Worse at night → patients may "flick" wrist (flick sign)
  - Atrophy of thenar muscles

- Surgical Release Steps

1. Small incision in palm (≤2 inches; extend if severe)
2. Incise palmar fascia to expose transverse carpal ligament
3. Cut ligament carefully → protect median nerve
4. Pressure relieved
5. Skin sutured; ligament gap fills with scar tissue

-> The End <-