Ligaments and Joints of the Upper Limb

Sternoclavicular joint

Type of joint
- Saddle type synovial joint; but it functions like a ball-and-socket joint
- ATYPICAL: fibrocartilage cover articular surfaces

Articulating surfaces
- Sternal facet of clavicle, clavicular facet of manubrium
- There is also an ARTICULAR DISC

Articular capsule
- Surrounds the joint, including the clavicular epiphysis
- Attached to the articular disc
- Lined with synovial membrane, contains synovial fluid

Ligaments
- Anterior and posterior sternoclavicular ligaments
- Interclavicular ligament
- Costoclavicular ligament

Stability factors
- Not many muscles around, and the surfaces are incongruous, so the joint relies on the ligaments for stability.
- Anterior and posterior sternoclavicular ligaments reinforce it anteriorly and posteriorly
- Interclavicular ligament reinforces it superiorly
- Costoclavicular ligament reinforces it inferiorly
- Articular disc limits medial displacement

Movements
- Flexion, extension, rotation, anterior and posterior movement, circumduction

Blood supply
- Internal thoracic and subscapular arteries

Nerve supply
- Nerve to subclavius
- Medial supraclavicular nerve

All joint stability depends on 3 factors:
1) shape of articulating surfaces; i.e. how well the bones fit together
2) the ligaments
3) the tone of the surrounding muscles
# Acromioclavicular joint

<table>
<thead>
<tr>
<th>Type of joint</th>
<th>Plane type synovial joint</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Articulating surfaces</strong></td>
<td>Acromial end of the clavicle, and the acromion process of the scapula</td>
</tr>
<tr>
<td><strong>Articular capsule</strong></td>
<td>Attached to the margins of the articular surfaces</td>
</tr>
<tr>
<td></td>
<td>Lined with synovial membrane</td>
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<tr>
<td></td>
<td>Contains synovial fluid</td>
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<tr>
<td></td>
<td>Strengthened superiorly by fibers from the trapezius</td>
</tr>
<tr>
<td><strong>Ligaments</strong></td>
<td>Acromioclavicular ligament</td>
</tr>
<tr>
<td></td>
<td>Conoid ligament</td>
</tr>
<tr>
<td></td>
<td>Trapezoid ligament</td>
</tr>
<tr>
<td><strong>Stability factors</strong></td>
<td>Stability is maintained by extrinsic ligaments, far from the joint itself</td>
</tr>
<tr>
<td></td>
<td>Conoid and trapezoid ligaments anchor the clavicle to the coracoid process, suspending the free limb and scapula from the clavicle</td>
</tr>
<tr>
<td><strong>Movements</strong></td>
<td>The acromian rotates on the clavicle</td>
</tr>
<tr>
<td><strong>Blood supply</strong></td>
<td>Suprascapular and thoracoaromial arteries</td>
</tr>
<tr>
<td><strong>Nerve supply</strong></td>
<td>Lateral pectoral and axillary nerve</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous lateral supraclavicular nerve</td>
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</table>
### Coracoclavicular joint

**Type of joint**
Not really much of a joint, as the two bones don’t really articulate. There is a rare anatomical abnormality when they actually come into contact, but normally the coracoid process attaches indirectly to the clavicle by means of the strong coracoclavicular ligaments, the conoid and the trapezoid.

**Articulating surfaces**
- Normally, none.
- The superior surface of the coracoid process attaches to the conoid and the trapezoid line of the clavicle by the ligaments abovementioned

**Articular capsule**
- No capsule

**Ligaments**
- Conoid ligament
- Trapezioid ligament

**Stability factors**
- Conoid and trapezoid ligaments anchor the clavicle to the coracoid process, suspending the free limb and scapula from the clavicle

**Movements**
- There is limited movement at this joint; the clavicle rotates on the acromion.

**Blood supply**
- Suprascapular and thoracoaromial arteries

**Nerve supply**
- Lateral pectoral and axillary nerve
- Subcutaneous lateral supraclavicular nerve
Glenohumeral joint

**Type of joint**
Ball and socket synovial joint

**Articulating surfaces**
Humeral head articulates with the glenoid cavity. The cavity is deepened by the glenoid labrum. About 1/3rd of the head actually sits in the cavity.

**Articular capsule**
Attaches proximally to the margins of the glenoid cavity, and distally to the anatomical neck of the humerus.
IT HAS HOLES IN IT.
One hole admits the tendon of the long head of biceps brachii, and the other communicates with the subscapular bursa.
THE WEAKEST PART is the inferior part which is not reinforced by the rotator cuff muscles

**Ligaments**
Glenohumeral ligaments: intrinsic ligaments, three fibrous thickenings of the capsule, anteriorly
Coracohumeral ligament — from the base of coracoid to the anterior aspect of the greater tubercle
Transverse humeral ligament—acts as the roof over the bicipital groove
Coracoacromial ligament—forms the roof over the glenohumeral joint

**Stability factors**
The joint is too shallow to be stable; stability is sacrificed to mobility
The socket is deepened by the glenoid labrum
The joint is stabilized mainly by muscles:
- supraspinatus
- infraspinatus
- teres minor
- subscapularis
they hold the ball in the socket
the coracoacromial arch and supraspinatus tendon limit superior displacement
supraspinatus and teres minor limit posterior displacement
subscapularis limits anterior displacement

**Movements**
Greatest freedom of movement of any joint in the body
Flexion/extension, abduction/adduction, medial and lateral rotation, circumduction
Assisted by the movement of the pectoral girdle (the scapula and the clavicle)

**Blood supply**
Anterior and posterior circumflex humeral arteries
Branches of the suprascapular artery
Factors Influencing the Stability of the Glenohumeral Joint

MAINLY, THE ROTATOR CUFF: supraspinatus, infraspinatus, subscapularis and teres minor
They hold the head of humerus in the glenoid fossa

SOMEWHER, THE LIGAMENTS:
   Glenohumeral
   Coracohumeral
   Coracoacromial arch

SLIGHTLY, THE GLENOID LABRUM

Nerve supply
Suprascapular, axillary and lateral pectoral nerves
Elbow Joint

Type of joint
- typical synovial hinge joint

Articulating surfaces
- Trochlea of humerus articulates with the trochlear notch of the ulna
- Capitum of the humerus articulates with the head of radius
  - the surfaces are most congruent when the arm is halfway pronated, and the elbow is flexed to a right angle

Articular capsule
- laterally and medially, just attaches to the margins of the articular surfaces
- Anteriorly and posteriorly, the capsule comes up more proximally, to enclose the coronoid fossa and the olecranon fossa
- Distally, it blends with the capsule of the proximal radioulnar joint

Ligaments
- all are intrinsic- thickened parts of the joint capsule
  - the lateral one is the Radial Collateral ligament
  - blends distally with the annular ligament of the radius; attaches to radial notch margins
  - the medial one is the Ulnar Collateral ligament
  - triangular, fan-like
  - the ANTERIOR band is the STRONGEST
  - the POSTERIOR band is the weakest
  - the slender and feeble OBLIQUE band merely serves to deepens the socket for the trochlea of the humerus

Stability factors
- Major stability factor: bony alignment; The bones articulate well, the olecranon fossa limits hyperextension, and the coronoid fossa limits hyperflexion. The medial and lateral collateral ligaments serve to limit abduction and adduction- a minor stability factor

Movements
- It is PERMANENTLY ABDUCTED to 17 degrees:
  - The “carrying angle”
  - this angle is 10 degrees greater in women
  - it DISAPPEARS when the arm is PRONATED
- but the elbow only allows flexion and extension

FLEXORS: biceps brachii, brachialis, brachioradialis
EXTENSORS: Triceps Brachii, Anconeus
  - when the forearm is supinated, the biceps brachii helps flex it
  - when the forearm is pronated, the pronator teres helps flex it.
  - major flexor is the brachialis; minor flexor is brachioradialis

Blood supply
- Derived from the anastomosis around the elbow joint

Nerve supply

BURSAE: under every muscle attachment... the most important are:
- Intratendinous olecranon bursa sometimes inside the tendon of the triceps
- Subtendinous olecranon bursa between the olecranon and the triceps tendon
- Subcutaneous olecranon bursa in the subcutaneous tissue over the olecranon
## Proximal Radioulnar Joint

<table>
<thead>
<tr>
<th>Type of joint</th>
<th>Pivot type synovial joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articulating surfaces</td>
<td>The head of radius articulates with the radial notch of the ulna</td>
</tr>
<tr>
<td>Articular capsule</td>
<td>The fibrous part blends into the elbow joint</td>
</tr>
<tr>
<td></td>
<td>The synovial part is continuous with the elbow joint</td>
</tr>
<tr>
<td></td>
<td>There is also a SACCIFORM RECESS of the joint, a distal extension of it down the radius which allows the radius to rotate without tearing the synovium</td>
</tr>
<tr>
<td>Ligaments</td>
<td>The ANULAR ligament encircles the head of the radius</td>
</tr>
<tr>
<td>Stability factors</td>
<td>The bones articulate well</td>
</tr>
<tr>
<td></td>
<td>The ANULAR ligament is the main stability factor, preventing dislocation of the radial head.</td>
</tr>
<tr>
<td></td>
<td>The INTEROSSEOUS MEMBRANE also prevents distraction of the radius</td>
</tr>
<tr>
<td></td>
<td>The joint is surrounded by muscles eg. brachioradialis and brachialis, which contribute to its stability in a minor way</td>
</tr>
<tr>
<td>Movements</td>
<td>Pronation and supination</td>
</tr>
<tr>
<td></td>
<td>Supination is the palm turning up, as if to receive alms</td>
</tr>
<tr>
<td></td>
<td>The axis of rotation passes through the head of radius and through the site of attachment of of radius and ulna distally</td>
</tr>
<tr>
<td></td>
<td>THE RADIUS IS THE ONE THAT ROTATES the ulna stays stationary</td>
</tr>
<tr>
<td>Blood supply</td>
<td>Supplied by the radial portion of the periarticular arterial anastomosis of the elbow, which is the anastomosis of radial and middle collateral arteries with the radial and recurrent interosseous arteries</td>
</tr>
<tr>
<td>Nerve supply</td>
<td>Supplied by the musculocutaneous, median and radial nerves, where</td>
</tr>
<tr>
<td></td>
<td>▪ pronation is work of the median</td>
</tr>
<tr>
<td></td>
<td>▪ supination is the work of the radial and musculocutaneous nerves</td>
</tr>
</tbody>
</table>
**Distal Radioulnar Joint**

**Type of joint**
- Pivot type of synovial joint

**Articulating surfaces**
- The head of ulna articulates with the ulnar notch of the medial distal radius
- which separates the cavity of the distal radioulnar joint from the cavity of the wrist joint

**Articular capsule**
- The synovial membrane extends superiorly between the radius and the ulna to form a SACCIFORM RECESS, which accommodates for the twisting of the capsule.

**Ligaments**
- Intrinsic ANTERIOR and POSTERIOR ligaments strengthen the joint capsule
- These are weak transverse bands

**Stability factors**
- The ARTICULAR DISC is the main uniting structure of the joint, because it brings the ends of the radius and the ulna together

**Movements**
- During pronation, the radius crosses the ulna
- During supination, the radius is parallel with the ulna
- Supination is produced by Supinator
- Pronation is produced by the Pronator Quadratus
  - ...as well as Pronator Teres
  - FCR, PL and brachioradialis also help when the forearm is mid-pronated

**Blood supply**
- Anterior and posterior interosseous arteries

**Nerve supply**
- Anterior and posterior interosseous nerves
Radiocarpal joint

Type of joint
- Condyloid (ellipsoid) type of synovial joint

Articulating surfaces
- Three of the carpal bones (scaphoid, triquetrum and lunate) articulate with the radius
- The pisiform and the ulna don’t participate

Articular capsule
- Stretches from the distal ends of the radius and ulna, to the proximal row of carpal bones (but not the pisiform)

Ligaments
- The PALMAR radiocarpal ligaments stretch from the radius to both of the two rows of carpal bones;
- The DORSAL radiocarpal ligament does the same
- These ligaments make sure the hand follows the radius in its rotation
- The ULNAR COLLATERAL LIGAMENT passes from the ulnar styloid to the triquetrum
- The RADIAL COLLATERAL LIGAMENT passes from the radial styloid to the triquetrum

Stability factors
- The radius articulates tightly with the carpus; the styloid processes of the radius and ulna limit abduction and adduction
- The ligaments and tendons supply most of the stability

Movements
- The movements of this joint are augmented by the slight movements permitted by the intercarpal and midcarpal joints. These are
  - flexion + extension (greater range of flexion than extension)
  - flexion is produced by FCR and FCU, Palmaris longus, APL, Flexors of the fingers and thumb
  - extension is produced by ECRL, ECRB, and ECU
  - Extensors of fingers and thumb
  - adduction + abduction (ulnar and radial deviation)
  - greater range of adduction(ulnar) than abduction, because of the larger radial styloid.
  - Most abduction occurs at the midcarpal joint.
  - Adduction is produced by Simultaneous ECU and FCU action
  - Abduction is produced by APL, FCR, ECRL and ECRB together
  - Circumduction – consists of successive flexion, adduction, extension and abduction

Blood supply: Branches of the dorsal and palmar carpal arch
Nerve supply: Anterior interosseous branch of the median nerve, posterior interossous branch of the radial nerve, and dorsal and deep branches of the ulnar nerve
Intercarpal joints

**Type of joint**  
Plane synocial joints

**Articulating surfaces**  
- Joints between carpal bones of the middle row  
- Joints between carpal bones of the distal row  
- MIDCARPAL JOINT: between the proximal and distal rows of the joints  
- PISOTRIQUETRAL JOINT: articulation between the pisiform and the palmar surface of the triquetrum

**Articular capsule**  
The articular cavity is common to all intercarpal and carpometacarpal joints – EXCEPT the thumb, which has its own carpometacarpal capsule.

**Ligaments**  
All the carpals are united with anterior, posterior and interosseous ligaments

**Stability factors**  
The ligaments above contribute most;  
The fibrous articular capsule wraps the carpal bones up, and keeps them together

**Movements**  
Slight movements which extent the range of motion available at the radiocarpal joint

**Blood supply**  
Dorsal and palmar carpal arches

**Nerve supply**  
- Anterior interosseous branch of the median nerve  
- Dorsal and deep branches of the ulnar nerve
Carpometacarpal and Intermetacarpal Joints

**Type of joint**
Plane type synovial joints - EXCEPT the carpometacarpal joint of the thumb, which is a saddle type joint.

**Articulating surfaces**
Distal surfaces of the carpal bones articulate with the bases of the metacarpals.

The important thumb joint is the articulation between the trapezium and the base of the first metacarpal.

The INTERMETACARPAL joints are adjacent metacarpals articulating with each other's bases.

**Articular capsule**
The medial four carpometacarpal joints, and the three intermetacarpal joints, are all enclosed by the same articular capsule.

The thumb CMC joint has its own capsule.

**Ligaments**
All these bones are united by the palmar and dorsal carpometacarpal ligaments, and by the intermetacarpal ligaments. The DEEP TRANSVERSE METACARPAL LIGAMENT and the SUPERFICIAL TRANSVERSE METACARPAL LIGAMENT (which is part of the palmar aponeurosis) both work to prevent separation of the metacarpal bases.

**Stability factors**
The above ligaments are the major stability factors.

**Movements**
Almost no movement at the CMCs of the 2nd and 3rd fingers, slight movement at the 4th CMC, moderate movement of the 5th CMC (flexion, extension, and rotation).

**Blood supply**
Periarticular arterial anastomoses of the wrist and hand (basically, the arterial arches).

**Nerve supply**
Anterior interosseous branch of the median nerve, posterior interosseous branch of the radial nerve, and dorsal and deep branches of the ulnar nerve.

The carpometacarpal joint of the thumb is independent – it has its own synovial capsule.
Joint at the base of the thumb: First carpometacarpal joint

Type of joint
  Saddle-type synovial joint

Articulating surfaces
  Trapezium and the base of the 1st metacarpal

Articular capsule
  Covers the articulating surfaces

Ligaments
  anterior oblique (volar) ligament (AOL)
  dorsoradial ligament,
  posterior oblique ligament
  intermetacarpal ligament.

Stability factors
  Ligaments, mainly

Movements
  Angular movements in any plane:
    Flexion- extension
    Adduction-abduction
    (thus, circumduction)
    opposition

Blood supply
  Periarticular arterial anasomoses of the wrist and hand
  (basically, the arterial arches)

Nerve supply
  Anterior interosseous branch of the median nerve,
  posterior interosseous branch of the radial nerve, and dorsal
  and deep branches of the ulnar nerve
Metacarpophalangeal and interphalangeal joints

**Type of joint**
Metacarpophalangeal joints are condyloid synovial joints
Interphalangeal joints are hinge joints

**Articulating surfaces**
- Bases and heads

**Articular capsule**
Joint capsules surround each joint, attaching to the margins

**Ligaments**
Each MCP ad ICP joint is reinforced by a medial and lateral collateral ligaments
Each of these ligaments has two parts:
- The dense cord-like part passes from one head to the next base;
- the thin fan-like part passes anteriorly to fuse with the anterior (palmar) part of the joint capsule
The cord-like parts are slack during extension and taught during flexion - this means you usually cannot spread (abduct) the fingers when the fingers are fully flexed
The fan-like parts move like a visor over the underlying heads
The palmar ligament (thick part of the capsule) blend with the digital sheaths and provide grooves for the flexor tendons to glide in.
At the MCPs, THE PALMAR LIGAMENTS ARE UNITED by the deep transverse metacarpal ligament

**Stability factors**
- ligaments

**Movements**
MCPS: flexion, extension, adduction, abduction

**Blood supply**
- Digital arteries

**Nerve supply**
- Digital nerves from the median and ulnar nerves

References: Moore’s Clinically Oriented Anatomy 5th edition