Chapter 8

Articulations & Movement
Chapter 8 Outline

I. Naming joints
II. Classes of joints
III. Types of movement
IV. Range of motion
V. Description of selected joints
VI. Effects of aging on the joints
I. Naming of joints

Joints are named according to the bones or parts of the bones involved in making the articulation (joint)
II. Classes of joints
II. Classes of joints
2 primary ways to classify joints

<table>
<thead>
<tr>
<th>Structure (anatomy)</th>
<th>Function (physiology)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dependent on the CT type holding bones together or presence or absence of a fluid-filled capsule</td>
<td>• Based on the degree of motion present at each joint.</td>
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<tr>
<td>I. Fibrous</td>
<td>I. Synarthrosis</td>
</tr>
<tr>
<td>II. Cartilaginous</td>
<td>➢ Non-mobile joint</td>
</tr>
<tr>
<td>III. Synovial</td>
<td>II. Amphiarthrosis</td>
</tr>
<tr>
<td></td>
<td>➢ Slightly mobile joint</td>
</tr>
<tr>
<td></td>
<td>III. Diarthrosis</td>
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<td></td>
<td>➢ Freely mobile joint</td>
</tr>
</tbody>
</table>
II. Classes of joints

Structural Classification: *Fibrous Joints*

- **Consist of:**
  - 2 bones united by fibrous CT,
  - *No joint cavity*
  - *Exhibiting little to no movement*

1. Sutures
2. Syndesmoses
3. Gomphoses
II. Classes of joints

Structural Classification: *Fibrous Joints*

1. **Suture**
   - Seams between bones of the skull that often interdigitate (have interlocking fingerlike processes).
     - These add considerable stability to sutures
   - Between bones is DRCollagenousCT & the periosteum of adjacent bones is continuous over the joint (Combined make the sutural ligament)
   - Margins of the bones within sutures are sites of continuous intramembranous growth, w/ many eventually becoming ossified (synostosis)
II. Classes of joints
Structural Classification: *Fibrous Joints*

- In a newborn, a membranous area present in some of the suture areas that makes the skull flexible during the birthing process & allows for growth of the head after birth.
II. Classes of joints

Structural Classification: **Fibrous Joints**

2. **Syndesmoses**
   - Fibrous joint in wh/distant bone are joined by ligaments
   - Some movement may occur in this joint because of the flexibility of the ligaments.

![Diagram of right radioulnar syndesmosis](image)
II. Classes of joints

Structural Classification: **Fibrous Joints**

3. **Gomphoses**
   - Specialized joints consisting of pegs that fit into sockets & are held in place by fine bundles of regular collagenous CT.
   - (Teeth in both mandible & maxilla)
   - Periodontal Ligaments
     - Slight amount of “give” during mastication (chewing)
II. Classes of joints

Structural Classification:

Cartilaginous Joints

- Unite 2 bones by either hyaline cartilage or fibrocartilage.

2 major types

1. Synchondroses
2. Symphysis
II. Classes of joints

Structural Classification: Cartilaginous Joints

1. **Synchondroses**
   - Immovable joints joined by hyaline cartilage
   - Most are temporary with cartilage eventually going thru synostoses, but some persist thru-out life
II. Classes of joints

Structural Classification: **Cartilaginous Joints**

Symphysis
- Consist of fibrocartilage joining bones.
- Some are slightly movable because of the nature of fibrocartilage.

**FIGURE 8.6 Symphysis Pubis**
II. Classes of joints

Structural Classification: Synovial Joints

- Contain synovial fluid which allow considerable movement between articulating bones
- These are more anatomically complex than either fibrous or cartilaginous joints.
• *Articular Cartilage*: hyaline cartilage that covers the ends of articulating bones providing a smooth surface where bones meet

• *Articular Disk*: (in some bones) a flat plate of fibrocartilage located between the articular cartilage (circumference is attached to the fibrous capsule)

• *Meniscus*: an incomplete crescent shaped fibrocartilage pad (knee/wrist) with a hole in the center (circumference is attached to the fibrous capsule)
Articulating bones are encased in a synovial joint cavity which is surrounded by a joint capsule.

- **Joint capsule** helps hold bones together while allowing for movement.
- **2 layers:**
  - a) **Fibrous capsule (outer)**
    - DRCT and continuous with the fibrous layer of the periosteum.
  - b) **Synovial membrane (inner)**
    - Thin delicate membrane that lines cavity except over the articular cartilage.
    - Cells secrete synovial fluid which is made of serum filtrate & secretions from synovial cells to make it slick.
- **Synovial membrane**
  - Bursa: extension of the synovial joints that protect skin, tendons or bone from structures that can rub against them.

- **Outer margins of the joint** have blood vessels & nerves running through them but not into the capsule.

- **Nerves** can enter the fibrous or synovial membrane to indicate pain, position, or degree of joint movement.
Types of Synovial Joints

- 6 types based on shape of articulating surfaces
  1) Plane
  2) Saddle
  3) Hinge
  4) Pivot
  5) Ball & socket
  6) Ellipsoid

- Movements of synovial joints are described as:
  1) Uniaxial: movement in 1 plane
  2) Biaxial: occurring around 2 axes situated at right angles from each other
  3) Multiaxial: along several axes
Types of Synovial Joints

1. Plane/gliding joints
   - 2 opposed flat surfaces in which a slight amount of gliding motion can occur between bones
   - Considered uniaxial because some rotation can occur but is limited by ligaments & adjacent bone

2. Saddle Joints
   - 2 saddle shaped articulating surfaces oriented at right angles so they fit together.
   - Considered Biaxial

**FIGURE 8.8** Plane Joint

**FIGURE 8.9** Saddle Joint
Types of Synovial Joints

3. Hinge Joint
- Convex cylinder of one bone fitting into a concave portion on another
- Uniaxial

4. Pivot Joint
- Relatively cylindrical bony process that rotates within a ring composed partly of bone & partly ligament.
- Uniaxial that restrict movement to rotation along 1 axis

FIGURE 8.10 Hinge Joint

FIGURE 8.11 Pivot Joint
Types of Synovial Joints

5. Ball & Socket
- A ball at the end of one bone that fits into the socket of the adjacent bone
- Multiaxial joint allowing for a wide range of movement in almost any direction

6. Ellipsoid/condyloid Joint
- Modified ball & socket joints where the articular surface is an oval shape
- Biaxial because the shape of the joint limits its motion

**FIGURE 8.12** Ball-and-Socket Joint

**FIGURE 8.13** Ellipsoid Joint
III. Types of Movement

Joint’s structure relates to the movements that occur at that specific joint.

Most movements are paired because they oppose each other.
III. Types of movement

1. **Gliding Movements**

2. **Angular Movements**
   - Flexion & Extension
   - Abduction & Adduction

3. **Circular Movements**
   - Rotation
   - Pronation & Supination

4. **Special Movements**
   - Elevation & Depression
   - Protraction & retraction
   - Excursion
   - Opposition & reposition
   - Inversion & eversion
1. Gliding Movements

• Simplest of all movement types
• Two flat surfaces that slide/glide over each other line Plane Joints
• Only slight movement
2. Angular Movements

- Movements in which 1 part of a linear structure is bent relative to another part of the structure, thus changing the angle between them.
- It can also mean that the angle with the trunk of the body has changed.

A. Flexion & Extension
- Bend (flex) & straighten (extend)
- Coronal Plane:
  - anterior to the coronal plane → flexion
  - Posterior to the coronal plane → Extension

B. Abduction & Adduction
- Take away (Abduct) & bring together (adduct)
- Abduction is movement from the median plane
- Adduction is movement toward the medial plane
hyperextension as the normal movement of structures, except the leg, into the space posterior to the anatomical position.

**FIGURE 8.15 Flexion and Extension Defined According to the Coronal Plane**
Flexion and extension of (a) the shoulder, (b) the neck, and (c) the trunk.

**FIGURE 8.16 Flexion and Extension of the Knee**

**FIGURE 8.17 Dorsiflexion and Plantar Flexion of the Foot**
FIGURE 8.18 Abduction and Adduction
Abduction and adduction of (a) the upper limb and (b) the fingers.
3. Circular Movements

- Movement of a structure around an axis or in an arc.

A. Rotation
- Turning of a structure around its long axis

B. Pronation & Supination
- Unique rotation of the forearm.
- Pronation (prone-lying face down) rotation so the palm faces posteriorly in anatomical position.
  - If elbow is bent palm is down
  - Radius & Ulna are crossed over each other
- Supination (Supine-lying face up) rotation so the palm faces anteriorly in anatomical position.
  - If elbow is bent palm is up
  - Radius & ulna are parallel

C. Circumduction:
- Combo of A & B from above
3. Circular Movements

A. Rotation
- Medial rotation
- Lateral rotation

B. Pronation & Supination
- Pronation
- Supination

C. Circumduction

FIGURE 8.19 Medial and Lateral Rotation of the Arm
FIGURE 8.20 Pronation and Supination of the Hand
FIGURE 8.21 Circumduction

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3. Special Movements

- Movements unique to 1 or 2 joints
- These do not fit into the other categories

A. Elevation & Depression
   - Elevation (move superiorly)
   - Depression (move inferiorly)

B. Protraction & Retraction
   - Protraction: move a structure in a gliding motion anteriorly
   - Retraction: move a structure in a gliding motion posteriorly (back to normal or further)

C. Excursion
   - Move laterally & medially

D. Opposition & Reposition
   - Thumb & pinky touching across the palm (OP) and returning (RP)

E. Inversion & Eversion
   - (IN) sole of the foot faces medially (EV)
   - sole of the foot faces laterally
Special Movements

**Elevation & Depression**

**Protraction & Retraction**

*FIGURE 8.22 Elevation and Depression of the Scapula*

*FIGURE 8.23 Protraction and Retraction of the Mandible*
Special Movements

Excursion

Opposition & Reposition

Inversion & Eversion
IV. Range of Motion

Amount of movement, active or passive, that can occur at a joint.
IV. Range of Motion (RoM)

- **Active RoM**
  - amount of movement that can be accomplished by contraction of the muscles that normally act across a joint

- **Passive RoM**
  - Amount of movement that can be accomplished when moved by an outside force (Therapist)

- **RoM influenced by:**
  a) Shape of articulating surfaces
  b) Amount & shape of articular cartilage covering the articular surfaces
  c) Strength & location of ligaments & tendons surrounding the joint
  d) Strength & location of the muscles associated with the joint
  e) Amount of fluid in & around the joint
  f) Pain in & around the joint
  g) Amount of use or disuse of the joint over time
V. Description of Selected Joints

Representative joints have been chosen because of their representative structure, important fxn, & clinical significance
Temporomandibular Joint

• Complex hinge & gliding joint between the temporal & mandibular bones.
• Capable of:
  – Elevation & Depression
  – Protraction & Retraction
  – Lateral & medial excursion
Shoulder Joint

- Ball & socket between the head of the humorous & glenoid cavity of the scapula.
- Permits a wide range of movements.
- Stability is maintained by 3 sets of ligaments & 4 muscles called the rotator cuff.
- Capable of flexion/extension; abduction/adduction; rotation & circumduction.
- Tendon from the biceps brachii supports the humorous by passing thru the capsule & attaching to the supraglenoid turbercle.

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![Diagram of Shoulder Joint](ap1-chapter8/37)

- Acromioclavicular ligament
- Acromion process
- Coracoclavicular ligament
- Coracohumeral ligament
- Subacromial bursa
- Transverse humeral ligament
- Humerus
- Tendon sheath on tendon of long head of biceps brachii
- Biceps brachii (long head) tendon
- Hook retracting subscapularis muscle
- Acromion process (articular surface)
- Subacromial bursa
- Joint cavity
- Tendon sheath on tendon of long head of biceps brachii
- Biceps brachii (long head) tendon
- Humerus
- Biceps brachii (long head) muscle
- Acromion (cut and elevated)
- Trapezoid ligament
- Coracoid ligament
- Coracoclavicular ligament
- Transverse scapular ligament
- Coracoid process
- Superior glenohumeral ligament
- Middle glenohumeral ligament
- Inferior glenohumeral ligament
- Joint capsule
- Triceps brachii tendon (long head)
- Articular cartilage over head of humerus
- Articular cartilage over glenoid cavity
- Scapula (cut surface)
- Glenoid labrum
- Joint capsule
- Clavicle
Elbow Joint

- Compound hinge joint between the humerus, ulna, & radius
  - Humeroulnar Joint
  - Humeroradial Joint
  - Proximal radioulnar Joint
- Movement is limited to flexion & extension
  - Because of the association of the trochlear notch with the trochlea of the humerus
- Pronation & supination of the hand
  - Rounded head of the radius & radial notch of the ulna against the capitulum of the humerus
Hip Joint

- Ball & socket joint between the head of the femur and the acetabulum of the coxal bone
- Greatly strengthened by ligaments
- Capable of a wide range of movements:
  - flexion/extension;
  - abduction/adduction;
  - rotation; & circumduction
Knee Joint

- Complex ellipsoid joint between the femur & the tibia supported by many ligaments
- Allows flexion & extension as slight rotation of the lower leg
The ankle joint & arches of the foot

- Ankle joint is a unique hinge joint made-up of the tibia, fibula, & talus.
- Allows for dorsiflexion/ plantar flexion & Inversion/eversion
- Ligaments of the foot arches hold the bones in an arch & transfer weight in the foot.

![Diagram of the ankle joint and arches](attachment:image.png)

**FIGURE 8.32 Ligaments of the Right Ankle Joint**
VI. Effects of aging on the joints
VI. Effects of aging on the joints

• With age:
  – CT of joints becomes less flexible & elastic
    • Collagen & elastin have more cross-linking in their proteins
  – Rate of cell proliferation declines as does new blood vessel formation (can effect synovial joints most)
    • B/c articulating cartilage can wear down this is bad
  – Rate of synovial fluid production also declines wh/contributes to wear on the joint
  – Ligaments & tendons shorten & b/c less flexible with age decrease in RoM
  – Resulting joint rigidity increases rate of wear on articulating surfaces.
  – Δ in CT also reduced RoM
  – Muscle strength weakens (thus so does stability of some joints)
  – Activity decreases also resulting in joint stiffness
Reading Assignment

- Page 254 Gingivitis
- Page 255 Joint changes during pregnancy
- Page 260 Hyperextension
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- Page 273-5 Clinical Focus