Chapter 8
Joints
Lecture 15

Lecture Overview

• Functions of joints
• Classification of joints
• Types of joints
• Types of joint movements
• Some representative articulations

Functions of Joints (Articulations)

• Form functional junctions between bones
• Bind parts of skeletal system together
• Make bone growth possible
• Permit parts of the skeleton to change shape during childbirth
• Enable body to move in response to skeletal muscle contraction

A “joint” joins two bones or, parts of bones, together, regardless of ability of the bones to move around the joint
Some Useful Word Roots

- **Arthros** – joint
- **Syn** – together (immovable)
- **Dia** – through, apart (freely moveable)
- **Amphi** – on both sides (slightly moveable)

Some Examples:

- **Synarthrosis** – An immovable joint
- **Amphiarthrosis** – A slightly movable joint
- **Diarthrosis** – Freely movable joint

What does the term ‘synostosis’ mean?

Classification of Joints

How are the bones held together?  How does the joint move?

3 answers 3 answers

**Structural**

- **Fibrous Joints**
  - dense connective tissues connect bones
  - between bones in close contact

- **Cartilaginous Joints**
  - hyaline cartilage or fibrocartilage connect bones

- **Synovial Joints**
  - most complex
  - allow free movement
  - have a cavity

**Functional**

- **synarthrotic**
  - immovable
  - amphiarthrotic
  - slightly movable
  - diarthrotic
  - freely movable

Joint Classification

**Structural Classification of Joints**

<table>
<thead>
<tr>
<th>Fibrous</th>
<th>Cartilaginous</th>
<th>Synovial (D)</th>
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<tr>
<td>Gomphosis (S)</td>
<td>Synchronostosis (S)</td>
<td>Gliding (N)</td>
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<td>Suture (S)</td>
<td>Symphysis (A)</td>
<td>Hinge (M)</td>
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<tr>
<td>Syndesmosis (A)</td>
<td></td>
<td>Pivot (M)</td>
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(S) = Synarthrosis
(A) = Amphiarthrosis
(D) = Diarthrosis

This would be a really good chart to know for the exam!
Fibrous Joints

- No synovial cavity (space between bones)
- fibrous CT
- little or no movement

3 Types
- Gomphosis
- Suture
- Syndesmosis

Syndesmosis (desmos = band or ligament; to bind)
- long fibers connect bones
- amphiarthrotic (slightly movable)
- distal ends of tibia and fibula
- radius and ulna
- broad sheets or bundles

Mnemonic for types of fibrous joints: “Go su e synde for telling a fib”

Suture (sewing together)
- between flat bones
- synarthrotic
- thin layer of connective tissue connects bones

Gomphosis (bolting together)
- cone-shaped bony process in a socket
- tooth in jawbone
- peg-in-socket
- synarthrotic

Cartilaginous Joints

- No synovial cavity
- hyaline or fibrocartilage
- little or no movement

2 Types
- Synchondrosis
- Symphyses

Synchondrosis
- bands of hyaline cartilage unite bones
- epiphyseal plate (temporary)
- between manubrium and first rib (sternocostal)
- synarthrotic (no movement)

Mnemonic for cartilaginous joints: “Cartilage either sinks or swims” (sinks or swims)
**Cartilaginous Joints**

- **Symphysis**
  - pad of fibrocartilage between bones
  - public symphysis (or symphysis pubis)
  - joint between bodies of vertebrae
  - amphiarthrotic

**Synovial Joints**

* Diarthrotic (freely movable)

Structural features of diarthrotic joints:
- joint cavity*
- articular cartilage
- synovial membrane
- synovial fluid
- reinforcing ligaments, bursae, and tendons

Synovial fluid: Lubricates, distributes nutrients, and absorbs shock

**Types of Synovial Joints**

Mnemonic for types of synovial joints (least movable to most movable):
“Geeky Humans Play Competitive Saddle Ball”

- **Girling Joint**
  - between carpals
  - between tarsals
  - between vertebrae

- **Hinge Joint**
  - elbow
  - knee
  - between phalanges

Flat surfaces move past one another (nonaxial)
Angular open/close motion (monaxial)
Types of Synovial Joints

**Pivot Joint**
- between proximal ends of radius and ulna

**Saddle Joint**
- between carpal and metacarpal of thumb
- sternoclavicular joint

Rotation around long axis (monaxial)

**Ball-and-Socket Joint**
- hip
- shoulder

**Condyloid Joint**
- between metacarpals and phalanges
- between radius and carpals

Movement around 3 axes and in between (multiaxial)

Angular motion (baxial)

Movement of Synovial Joints

- *All movements are based upon*
  - The body being in anatomical position
  - All axial and appendicular joints being in full extension when in anatomical (zero) position

- Important to define which joint you are examining before trying to define movement
Flexion and Extension

Usually occur in the sagittal plane
- **Flexion** – decrease in angle between bones and parts come together (usually in direction of greatest mobility)
- **Extension** – increase in angle between bones and parts move further apart (usually after flexion)
- **Hyperextension** – Extension beyond the anatomical position (limited by tendons/ligaments/bones)
- **Lateral Flexion** – movement from side-to-side (in the frontal plane)

Flexion and Extension

ABduction, ADduction, and Circumduction

Usually occur in the frontal plane
- **ABduction** – movement away from midline
- **ADduction** – movement toward midline
- **Circumduction** – Movement of the distal end of a limb in a circle
Abduction, Adduction, and Circumduction

Figure from: Martini, Anatomy & Physiology, Benjamin Cummings, 2004

Rotation, Pronation/Supination

(Special movement – doesn’t fit into the other categories)

Figure from: Marieb & Hoehn, Human Anatomy & Physiology, 9th ed., Pearson, 2013

Special Movements of Synovial Joints

Anterior/posterior movement in the transverse plane

Superior/inferior movement in the coronal plane

Figure from: Marieb & Hoehn, Human Anatomy & Physiology, 9th ed., Pearson, 2013
Special Movements of Synovial Joints

Figure from: Martini, Anatomy & Physiology, Benjamin Cummings, 2004

Shoulder (Glenohumeral) Joint

- ball-and-socket
- head of humerus
- glenoid cavity of scapula
- loose joint capsule
- bursae
- ligaments prevent displacement
- very wide range of movement (but not as stable as hip)

Aka: humeroscapular joint

Figure from: Hole’s Human A&P, 12th edition, 2010
**Rotor Cuff**

Rotator cuff muscles = the SITS muscles

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**Elbow Joint**

- hinge joint (1)
  - trochlea of humerus
  - trochlear notch of ulna
  - humeroradial joint
- gliding joint (2)
  - capitulum of humerus
  - head of radius
  - humeroulnar joint
  - radiohumeral joint (annular lig.)
- flexion and extension
- many reinforcing ligaments
- stable joint

Which arm, and which view, are we looking at here?
Hip (Coxal) Joint

- ball-and-socket joint
- head of femur
- acetabulum
- heavy joint capsule
- many reinforcing ligaments
- less freedom of movement than shoulder joint, but very strong

Fovea capitis and ligamentum capitis (teres)

Hip Joint

Knee (Tibiofemoral) Joint

- largest, most complex joint
- medial and lateral condyles of distal end of femur
- medial and lateral condyles of proximal end of tibia
- femur articulates anteriorly with patella (patellofemoral joint)
- modified hinge joint
- flexion/extension/limited rotation
- strengthened by many ligaments and tendons
- menisci (fibrocartilage discs) separate femur and tibia
- bursae
**Life-Span Changes**

- Joint stiffness is an early sign of aging
- Regular exercise can prevent stiffness
- Changes in symphysis joints of vertebral column diminish flexibility and decrease height
- Synovial joints lose elasticity

**Clinical Application – Joint Disorders**

**Sprains**
- Damage to cartilage, ligaments, or tendons associated with joints
- Forceful twisting of joint

**Bursitis**
- Inflammation of a bursa
- Overuse of a joint

**Arthritis**
- Inflamed, swollen, painful joints
  - Rheumatoid Arthritis (RA)
  - Osteoarthritis (OA)
  - Gout

**Rheumatoid Arthritis (RA)**

Result of autoimmune attack on the joints

*From: Saladin, Anatomy & Physiology, McGraw Hill, 2007*
Be sure to check out the ExRx Articulations link on the Web site to get familiar with joint movements.

Review

- Because the bones of the skeleton are rigid, movement can only occur at articulations (joints)
- Joints can be classified by
  - Structure (newer style)
  - Function (older style)
- A structural classification of joints includes:
  - Fibrous joints
  - Cartilaginous joints
  - Synovial joints

Joint Classification

Structural Classification of Joints

- Fibrous
  - Gomphosis (S)
  - Suture (S)
  - Syndesmosis (A)
- Cartilaginous
  - Sessilis (S)
  - Synchondrosis (S)
  - Symphysis (A)
- Synovial (D)
  - Gliding (N)
  - Hinge (M)
  - Pivot (M)
  - Condyloid (B)
  - Saddle (B)
  - Ball/Socket (P)

This would be a really good chart to know for the exam!
A functional classification of joints includes:
- Synarthroses (no movement)
- Amphiarthroses (little movement)
- Diarthroses (free movement)

Important movements of joints to **be familiar with**:
- Flexion/Extension and Hyperextension
- Abduction/Adduction and Circumduction
- Supination/Pronation
- Rotation
- Dorsiflexion/Plantar flexion