Chapter 9

Joints

Classification of Joints

- Structural classification is based on the presence or absence of a synovial (joint) cavity and type of connecting tissue. Structurally, joints are classified as
  - fibrous, cartilaginous, or synovial

- Functional classification based upon movement:
  - immovable = synarthrosis
  - slightly movable = amphiarthrosis
  - freely movable = diarthrosis

Joints

- Joints hold bones together & sometimes permit movement
- Point of contact
  - between 2 bones
  - between cartilage and bone
  - between teeth and bones
- Arthrology = study of joints
- Kinesiology = study of motion

Fibrous Joints

- Lack a synovial cavity
- Bones held closely together by fibrous connective tissue
- Little or no movement (synarthroses or amphiarthroses)
- 3 structural types
  - sutures
  - syndesmoses
  - gomphoses
Sutures

- Thin layer of dense fibrous connective tissue unites bones of the skull
- Immovable (synarthrosis)

Syndesmosis

- Fibrous joint
  - bones united by ligament
- Slightly movable (amphiarthrosis)
- Anterior tibiafibular joint and interosseous membrane

Gomphosis

- Ligament holds cone-shaped peg in bony socket
- Immovable (synarthrosis)
- Teeth in alveolar processes

Cartilaginous Joints

- Lacks a synovial cavity
- Allows little or no movement
- Bones tightly connected by fibrocartilage or hyaline cartilage
- 2 types
  - synchondroses
  - symphyses
Synchondrosis

- Connecting material is hyaline cartilage
- Immovable (synarthrosis)
- Epiphyseal plate or joints between first pair of ribs and sternum

Symphysis

- Fibrocartilage is connecting material
- Slightly movable (amphiarthrosis)
- Intervertebral discs and pubic symphysis

Synovial Joints

- Synovial cavity separates articulating bones
- Freely moveable (diarthroses)
- Articular cartilage – reduces friction – absorbs shock
- Articular capsule – surrounds joint – thickenings in fibrous capsule called ligaments
- Synovial membrane – inner lining of capsule

Articular Capsule

- The articular capsule surrounds a diarthrosis, encloses the synovial cavity, and unites the articulating bones
- The articular capsule is composed of two layers - the outer fibrous capsule (which may contain ligaments) and the inner synovial membrane (which secretes a lubricating and joint-nourishing synovial fluid)
- The flexibility of the fibrous capsule permits considerable movement at a joint, whereas its great tensile strength helps prevent bones from dislocating
- Other capsule features include ligaments and articular fat pads
• Synovial Membrane
  – secretes synovial fluid containing slippery hyaluronic acid
  – brings nutrients to articular cartilage
• Accessory ligaments
  – extracapsular ligaments
    • outside joint capsule
  – intracapsular ligaments
    • within capsule
• Articular discs or menisci
  – attached around edges to capsule
  – allow 2 bones of different shape to fit tightly
  – increase stability of knee - torn cartilage
• Bursae = saclike structures between structures
  – skin/bone or tendon/bone or ligament/bone

Special Features

Sprain versus Strain

• Sprain
  – twisting of joint that stretches or tears ligaments
  – may damage nearby blood vessels, muscles or tendons
  – swelling & hemorrhage from blood vessels
  – ankle is frequently sprained
• Strain
  – generally less serious injury
  – overstretched or partially torn muscle

Bursae and Tendon Sheaths

• Bursae
  – fluid-filled saclike extensions of the joint capsule
  – reduce friction between moving structures
    • skin rubs over bone
    • tendon rubs over bone
• Tendon sheaths
  – tubelike bursae that wrap around tendons at wrist and ankle where many tendons come together in a confined space
• Bursitis
  – chronic inflammation of a bursa

TYPES OF MOVEMENT AT SYNOVIAL JOINTS

• Gliding
• Angular movements
  – Flexion/extension/hyperextension
  – Lateral flexion
  – Abduction/adduction
  – Circumduction
• Rotation
• Special movements
  – Elevation/depression
  – Protraction/retraction
  – Inversion/eversion
  – Dorsiflexion/plantar flexion
  – Pronation/supination
  – Opposition
Gliding (Linear) Movements

- *Gliding* movements occur when relatively flat bone surfaces move back and forth or side to side with respect to one another
- In gliding joints there is no significant alteration of the angle between the bones
- Occur at carpal and plantar joints

Flexion, Extension & Hyperextension

- *Flexion* - decrease in the angle between articulating bones
- *Extension* - increase in the angle between articulating bones
- *Hyperextension* - continuation of extension beyond the anatomical position

Abduction and Adduction

- *Abduction* - movement of a bone away from the midline
- *Adduction* - movement of a bone toward the midline

Circumduction

- Movement of a distal end of a body part in a circle
- Occurs at ball and socket, saddle and condyloid joints
Rotation

• Bone revolves around its own longitudinal axis
  – medial rotation is turning of anterior surface in towards the midline
  – lateral rotation is turning of anterior surface away from the midline
• At ball & socket and pivot type joints

Special Movements of Mandible

• Elevation = upward
• Depression = downward
• Protraction = forward
• Retraction = backward

Special Hand & Foot Movements

• Inversion
• Eversion
• Dorsiflexion
• Plantarflexion
• Pronation
• Supination

Special Movements

• Supination is a movement of the forearm at the proximal and distal radioulnar joints in which the palm is turned anteriorly or superiorly
• Pronation is a movement of the forearm at the proximal and distal radioulnar joints in which the palm is turned posteriorly or inferiorly
• Opposition is the movement of the thumb at the carpometacarpal joint in which the thumb moves across the palm to touch the tips of the finger on the same hand
• A dislocation or luxation is a displacement of a bone from a joint
TYPES OF SYNOVIAL JOINTS

6 types of synovial joints:

- **Planar joints**
- **Hinge joints**
- **Pivot joints**
- **Condyloid joints**
- **Saddle joints**
- **Ball-and-socket joints**

### Planar Joint

- Bone surfaces are flat or slightly curved
- Side to side movement only
- Rotation prevented by ligaments
- **Examples**
  - intercarpal or intertarsal joints
  - sternoclavicular joint
  - vertebrocostal joints

### Hinge Joint

- Convex surface of one bones fits into concave surface of 2nd bone
- Uniaxial like a door hinge
- **Examples**
  - Knee, elbow, ankle, interphalangeal joints
- **Movements produced**
  - flexion = decreasing the joint angle
  - extension = increasing the angle
  - hyperextension = opening the joint beyond the anatomical position

### Pivot Joint

- Rounded surface of bone articulates with ring formed by 2nd bone & ligament
- Monoaxial since it allows only rotation around longitudinal axis
- **Examples**
  - Proximal radioulnar joint
    - supination
    - pronation
  - Atlanto-axial joint
    - turning head side to side “no”
Condyloid or Ellipsoidal Joint

- Oval-shaped projection fits into oval depression
- Movements are flexion-extension, abduction-adduction, and circumduction
- Examples
  - wrist and metacarpophalangeal joints for digits 2 to 5

Saddle Joint

- One bone saddled-shaped; other bone fits as a person would sitting in that saddle
- Biaxial
  - Circumduction allows tip of thumb travel in circle
  - Opposition allows tip of thumb to touch tip of other fingers
- Example
  - trapezium of carpus and metacarpal of the thumb

Ball and Socket Joint

- Ball fitting into a cuplike depression
- Multiaxial
  - flexion/extension
  - abduction/adduction
  - rotation
- Examples (only two!)
  - shoulder joint
  - hip joint

Hip Joint

- Head of femur and acetabulum of hip bone
- Ball and socket type of joint
- All types of movement possible
Hip Joint Structures

- Acetabular labrum
- Ligament of the head of the femur
- Articular capsule

Hip Joint Capsule

- Dense, strong capsule reinforced by ligaments
  - iliofemoral ligament
  - ischiofemoral ligament
  - pubofemoral ligament
- One of strongest structures in the body

Knee Joints

- This is the largest and most complex joint of the body
- Consists of three joints within a single synovial cavity
- Some common injuries are rupture of the tibial collateral ligament and a dislocation of the knee.

Tibiofemoral Joint

- Between femur, tibia and patella
- Hinge joint between tibia and femur
- Gliding joint between patella and femur
- Flexion, extension, and slight rotation of tibia on femur when knee is flexed
Tibiofemoral Joint

- Articular capsule
  - mostly ligs & tendons
- Many bursa
- Vulnerable joint
- Knee injuries damage ligaments & tendons since bones do not fit together well

Intracapsular Structures of Knee

- Medial meniscus
  - C-shaped fibrocartilage
- Lateral meniscus
  - nearly circular
- Posterior cruciate ligament
- Anterior cruciate ligament

Arthroscopy & Arthroplasty

- Arthroscopy = examination of joint
  - instrument size of pencil
  - remove torn knee cartilages & repair ligaments
  - small incision only
- Arthroplasty = replacement of joints
  - total hip replaces acetabulum & head of femur
  - plastic socket & metal head
  - knee replacement common

DISORDERS: HOMEOSTATIC IMBALANCES:

- Osteoarthritis is a degenerative joint disease commonly known as “wear-and-tear” arthritis. It is characterized by deterioration of articular cartilage and bone spur formation. It is noninflammatory and primarily affects weight-bearing joints.
- Gouty arthritis is a condition in which sodium urate crystals are deposited in soft tissues of joints, causing inflammation, swelling, and pain. If not treated, bones at affected joints will eventually fuse, rendering the joints immobile.
Rheumatoid Arthritis

- Autoimmune disorder
- Cartilage attacked
- Inflammation, swelling & pain
- Final step is fusion of joint