Chapter 9
Joints

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

9-1

Classification of Joints

- Structural classification based upon:
  - presence of space between bones
  - type of connective tissue holding bones together
    - collagen fibers
    - cartilage
    - joint capsule & accessory ligaments
- Functional classification based upon movement:
  - immovable = synarthrosis
  - slightly movable = amphiarthrosis
  - freely movable = diarthrosis

9-2

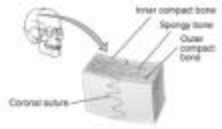
Fibrous Joints

- 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

9-3

Sutures

- Thin layer of dense fibrous connective tissue unites bones of the skull
- Immovable (synarthrosis)
- If fuse completely in adults is synostosis



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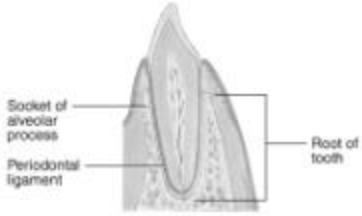
Syndesmosis

- Fibrous joint
  - bones united by ligament
- Slightly movable (amphiarthrosis)
- Anterior tibiofibular joint and Interosseous membrane

9-5

Gomphosis



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

9-6

Cartilaginous Joints

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

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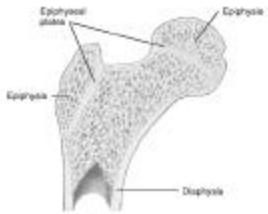
Synchondrosis



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

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Symphysis

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

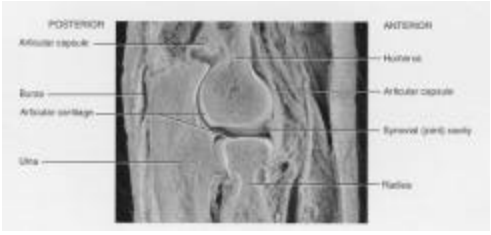
9-9

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
  - secretes synovial fluid containing hyaluronic acid slippery)
  - brings nutrients to articular cartilage

9-10

Example of Synovial Joint



- Joint space is synovial joint cavity
- Articular cartilage covering ends of bones
- Articular capsule

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Other Special Features

- 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

9-12

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

9-13

Torn Cartilage and Arthroscopy

- Damage to menisci of the knee joint
- Visualization of the inside of a joint
  - arthroscope
  - requires only small incisions
- Repair may include removal of torn cartilage

9-14

Nerve and Blood Supply

- Nerves to joints are branches of nerves to nearby muscles
- Joint capsule and ligaments contain pain fibers and sensory receptors
- Blood supply to the structures of a joint are branches from nearby structures
  - supply nutrients to all joint tissues except the articular cartilage which is supplied from the synovial fluid

9-15

Sprain versus Strain

- Sprain
  - twisting of joint that stretches or tears ligaments
  - no dislocation of the bones
  - may damage nearby blood vessels, muscles or tendons
  - swelling & hemorrhage from blood vessels
  - ankle if frequently sprained
- Strain
  - less serious injury
  - overstretched or partially torn muscle

9-16

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

9-17

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

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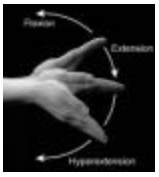
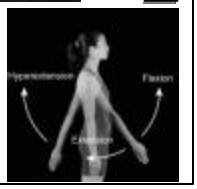
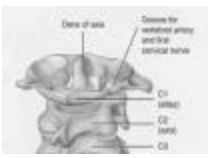
Flexion, Extension & Hyperextension





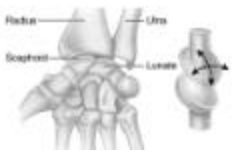
Pivot Joint



- 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”

9-20

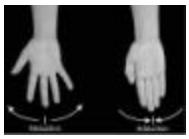
Condyloid or Ellipsoidal Joint



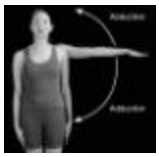
- Oval-shaped projection fits into oval depression
- Biaxial = flex/extend or abduct/adduct is possible
- Examples
  - wrist and metacarpophalangeal joints for digits 2 to 5

9-21

Abduction and Adduction

Condyloid joints




Ball and Socket joints

9-22

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

9-23

Ball and Socket Joint

- Ball fitting into a cuplike depression
- Multiaxial
  - flexion/extension
  - abduction/adduction
  - rotation
- Examples
  - shoulder joint
  - hip joint

9-24

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

9-25

Summary of Movements at Synovial Joints

- Gliding
  - no change in angle of joint
- Angular movements
  - increase or decrease in angle between articulating bones
    - flexion, extension, hyperextension
    - adduction, abduction
    - circumduction is a combination of above movements
- Rotation
  - bone revolves around its own axis
- Special movements
  - uniquely named movements for jaw, hand and foot

9-26

Circumduction

- Movement of a distal end of a body part in a circle
- Combination of flexion, extension, adduction and abduction
- Occurs at ball and socket, saddle and condyloid joints

9-27

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

9-28

Special Movements of Mandible

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

9-29

Special Hand & Foot Movements

- Inversion
- Eversion
- Dorsiflexion
- Plantarflexion
- Pronation
- Supination

9-30

Shoulder Joint

- Head of humerus and glenoid cavity of scapula
- Ball and socket
- All types of movement

9-31

Glenohumeral (Shoulder) Joint

- Articular capsule from glenoid cavity to anatomical neck
- Glenoid labrum deepens socket
- Many nearby bursa (subacromial)

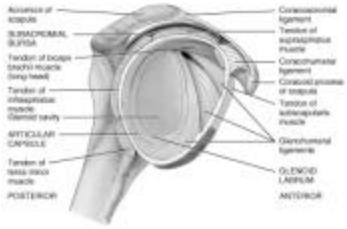
9-32

Supporting Structures at Shoulder

- Associated ligaments strengthen joint capsule
- Transverse humeral ligament holds biceps tendon in place

9-33

Rotator Cuff Muscles



- Attach humerus to scapula
- Encircle the joint supporting the capsule
- Hold head of humerus in socket

9-34

Elbow Joint

- Hinge joint
  - trochlea notch of ulna and trochlea of humerus
  - flexion and extension of elbow
- Pivot joint
  - head of radius and capitulum of humerus
  - supination and pronation of forearm

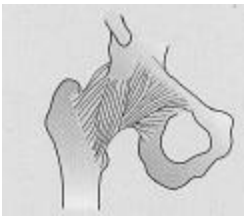
9-35

Articular Capsule of the Elbow Joint

- Radial annular ligament hold head of radius in place
- Collateral ligaments maintain integrity of joint

9-36

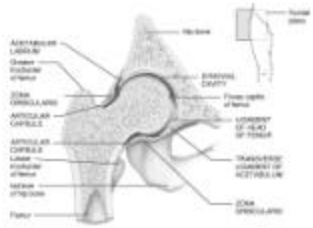
Hip Joint



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

9-37

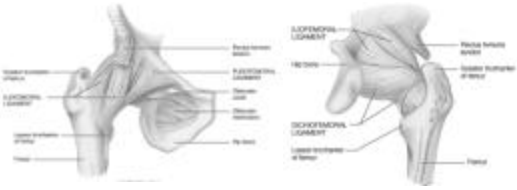
Hip Joint Structures



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

9-38

Hip Joint Capsule



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

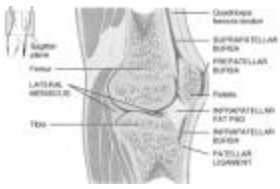
9-39

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

9-40

Tibiofemoral Joint



- Articular capsule
  - mostly ligs & tendons
- Lateral & medial menisci = articular discs
- Many bursa
- Vulnerable joint
- Knee injuries damage ligaments & tendons since bones do not fit together well

9-41

External Views of Knee Joint

- Patella is part of joint capsule anteriorly
- Rest of articular capsule is extracapsular ligaments
  - Fibular and tibial collateral ligaments

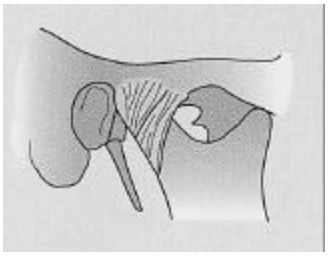
9-42

Intracapsular Structures of Knee

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

9-43

Temporomandibular Joint



- Synovial joint
- Articular disc
- Gliding above disc
- Hinge below disc
- Movements
  - depression
  - elevation
  - protraction
  - retraction

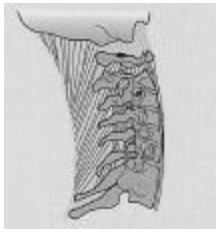
9-44

Atlanto-occipital joints

- Atlas and occipital condyles
- Condyloid Joint
- Flexion
- Extension
- Slight lateral tilting

9-45

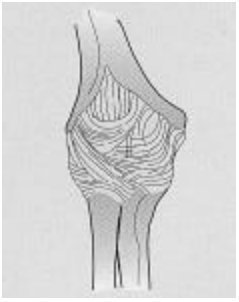
Intervertebral Joints



- Between bodies and intervertebral discs
  - symphysis
- Between vertebral articular processes
  - synovial
- Flexion
- Extension
- Lateral flexion

9-46

Elbow Joint



- Trochlea of humerus, trochlear notch of ulna & head of radius
- Pivot and hinge types
- Flexion, extension, pronation & supination

9-47

Radiocarpal Joint

- Articular disc
- Condyloid type
- Flexion, extension, abduction & adduction

9-48

Talocrural Joint

- Tibia & fibula with talus
- Hinge
- Inversion, eversion, plantarflexion & dorsiflexion

9-49

Range of Motion in a Synovial Joint

- Shape of articulating bones
- Tension & strength of joint ligaments
- Arrangement of muscles around joints
- Apposition (coming together) of soft parts
- Hormones
  - relaxin from placenta loosens pubic symphysis
- Disuse
  - decreased synovial fluid, decreased flexibility of ligaments, reduced size of muscles

9-50

Rheumatoid Arthritis

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

9-51

Osteoarthritis

- Degenerative joint disease
  - aging, wear & tear
- Noninflammatory ---no swelling
  - only cartilage is affected not synovial membrane
- Deterioration of cartilage produces bone spurs
  - restrict movement
- Pain upon awakening--disappears with movement

9-52

Gouty Arthritis

- Urate crystals build up in joints ---pain
  - waste product of DNA & RNA metabolism
  - builds up in blood
  - deposited in cartilage causing inflammation & swelling
- Bones fuse
- Middle-aged men with abnormal gene

9-53