

Joints.

Structural classification of joints - based on the material binding the bones together.

- 1) fibrous joints, the articulating bones are held together by fibrous connective tissue. There is no joint cavity.
- 2) cartilaginous joints, the articulating bones are held together by cartilage. There is no joint cavity.
- 3) synovial joints, ligaments aid in supporting the articulating bones. There is a joint cavity.

Functional classification of joints is based on the amount of movement allowed at the joint.

- 1) synarthroses are immovable joints.
- 2) amphiarthroses are slightly movable joints.
- 3) diarthroses are freely movable joints. This type of joint is lubricated by synovial fluid, which is produced by a highly vascular synovial membrane found on the inside of the joint capsule.

Discussion based on the structural classification of joints.

Fibrous Joints.

Suture joints are only found in the skull. A thin layer of dense fibrous connective tissue binds the articulating bones.

types of sutures:

- 1) serrate suture;

is the most common type of suture joint.

has interlocking articulations.

an example is the sagittal suture.

- 2) Lap suture;

in this type of suture bone overlaps bone.

an example is the squamous suture between temporal and parietal bones.

- 3) plane suture;

in this type of suture, the edges of the articulating bones are fairly smooth.

an example is the maxillary suture between the two halves of the hard palate.

- 4) synostosis;

this type of suture is only found during skull growth.

an example is the suture between the two portions of the frontal bone.

the articulating bones should fuse and leave no trace of the synostosis. If fusion does not occur, the suture is called a metopic suture.

Syndesmoses. In this joint the bones are held together by collagenous fibers or interosseous ligaments

an example is the joints at the distal ends of tibia/fibula and radius/ulna.

Gomphoses. This type of joint is described as a “peg in a socket” fibrous joint.

the only example of this type of joint in the human is a tooth in a bony alveolar socket

Cartilaginous joints

Synchondroses. This type of joint has a temporary plate of hyaline cartilage.

an example is the epiphyseal plate of a long bone. Once ossified it is called a synostosis.

Symphyses. in this type of joint a pad of fibrocartilage separates bones.

examples are the symphyses pubis and intervertebral disc.

Synovial Joints - in this type of joint the articulating bones are separated by a fluid containing joint cavity. These joints are freely movable and are functionally diarthroses. They have five distinguishing characteristics.

- 1) articular cartilage. This is hyaline cartilage that covers the ends of the opposing bones.
- 2) joint cavity. This is a potential space that is filled with lubricating synovial fluid.
- 3) articular capsule. This is a double membrane capsule surrounding the joint cavity. The inner layer is the synovial membrane which is responsible for the production of synovial fluid. The outer layer is a fibrous connective tissue that is continuous with the periosteum of the bone.
- 4) synovial fluid. This is the lubricating fluid of the joint. It is essentially a filtrate of blood plasma with hyaluronic acid.
- 5) reinforcing ligaments. These surround the joint to give it extra strength. There are three types of reinforcing ligaments.
 - a). intrinsic ligaments. These are thickened parts of the joint capsule.
 - b) extrinsic ligaments. These are extracapsular ligaments.
 - c) intracapsular ligaments. These are ligaments that travel deep to the joint capsule.

There are many factors that influence the stability of a synovial joint.

- 1) the shapes of the articular surfaces.
- 2) the size and number of ligaments surrounding the joint.
- 3) the tone of the muscle acting across the joint.

There are generally 6 types of synovial joints:

- 1) gliding. The motion possible is side to side, back and forth, and some rotation.
- 2) hinge. The motion is a bending in one plane.
- 3) pivot. The motion is rotation about an axis.
examples of a pivot joint; proximal radius and ulna, atlas and axis.
- 4) condyloid. The motion is up and down, and/or side to side.
- example: metacarpal/phalanges, radio-carpal joint.
- 5) saddle. Found at the base of the thumb.
- example: trapezium with the 1st metacarpal
- 6) ball and socket - greatest range of movement of all joints.
-example: hip and shoulder

Discussion based on the functional classification of joints

Synarthroses are immovable joints. They are primarily made of sutures and synchondroses

Sutures - only found in the skull. A thin layer of dense fibrous connective tissue binds the articulating bones

types of sutures:

1) serrate suture. This is the most common type of suture joint

Serrate sutures have interlocking articulations

example: sagittal suture.

2) Lap suture. In this type of suture bone overlaps bone

- example: squamous suture between the temporal and parietal bones.

3) plane suture. Here the edges of articulating bones are fairly smooth.

- example: maxillary suture between the two halves of the hard palate.

4) synostosis. This is only found during skull growth between two portions of the frontal bone

- if fusion does not occur it is called a metopic suture.

Synchondroses - have a temporary plate of hyaline cartilage

- example: epiphyseal plate. Once ossified it is called a synostosis.

Amphiarthroses. These joints have limited movement

There are 2 types of amphiarthroses

1) symphyses

In a Symphyses a pad of fibrocartilage separates the bones.

-example: symphyses pubis and intervertebral disc.

2) syndesmoses

In a Syndesmoses the bones are held together by collagenous fibers or interosseous ligaments

- example: distal ends of tibia/fibula and radius/ulna

Diarthroses - freely movable joints with a joint capsule containing synovial fluid.

generally there are 6 types of diarthroses.

- 1) gliding - side to side, back and forth, some rotation.
- 2) hinge - bending in one plane.
- 3) pivot - rotation about an axis.
- example: proximal radius and ulna, atlas and axis.
- 4) condyloid - up and down, side to side.
- example: metacarpal/phalanges, radio-carpal joint.
- 5) saddle - base of thumb.
- example: trapezium with 1st metacarpal.
- 6) ball and socket - greatest range of movement of all joints.
-example: hip and shoulder

In diarthroses the amount of movement at the joint is limited by 3 major factors.

- 1) the structure of the bones in the joint.
- 2) the strength and tautness of the associated ligaments, tendons, and joint capsule.
- 3) the size, arrangement, and action of the muscles that span the joint.

Do the bones of a diarthroses come in contact with each other? **NO**, only the articular cartilages contact each other.

Bursa. are pouchlike sacs filled with synovial fluid, usually found between muscles or where a tendon passes over a bone. Bursae function as a cushion.

Tendon sheath is modified bursa. It surrounds and lubricates tendons of certain muscles.

Movements

Movements can be angular or circular.

- 1) angular, is an increase or decrease in the joint angle.

the four types of angular movement are flexion, extension, abduction, and adduction.

- 2) circular, is a movement covering an arc.

There are 2 types of circular motion.

- 1) rotation, which is a movement of a bone around its axis. There is no lateral displacement. Examples would be turning the head side to side, or rotation of the radius as in pronation/supination.
- 2) circumduction - produces a circular or cone like pattern

Body movements as mechanics

Levers - magnify the force applied to a system to produce a greater force for movement

there are 4 components of a lever.

- 1) a rigid bar.
- 2) a fulcrum, or pivot.
- 3) a resistance. This would be the weight of the object that is moved.
- 4) force. This would be the effort put into the system.

there are three types of levers.

1) 1st class lever. In this lever the fulcrum is positioned between the effort and the resistance

An example is the skull at the atlantooccipital joint.

The weight of face and skull is the resistance

The neck muscles provide the effort

2) 2nd class lever. In this lever the resistance is positioned between the fulcrum and the effort

A wheelbarrow is a good example of this type of lever.

In a human, this would be analogous to using the calf muscles to raise up on the toes

3) 3rd class lever. In this lever the effort lies between the fulcrum and the resistance

This is the most common lever type in the body

An example would be flexion at the elbow. Here the effort is provided by the brachialis muscle. The fulcrum would be the elbow joint, and the resistance would be the weight of the forearm.

Clinical Definitions

Strain. A strain is the stretching of the tendons surrounding a joint

Sprain. A sprain is the tearing of the ligaments or tendons surrounding a joint. In this type of injury you may see synovitis, which is an inflammation of the joint capsule.

Luxation or dislocation. This is a derangement of the articulating bones that compose the joint

Subluxation. Subluxation is a partial dislocation

One of the most common sports related joint injuries is found at the knee. This injury is often referred to as the Terrible triad. The structures damaged in this injury are:

medial collateral ligament

medial meniscus

anterior cruciate ligament