

Chapter 9 Outline

I. INTRODUCTION

- A. A *joint* (*articulation* or *arthrosis*) is a point of contact between two or more bones, between cartilage and bones, or between teeth and bones.
- B. The scientific study of joints is called *arthrology*.

II. JOINT CLASSIFICATION

- A. 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*.
- B. Functional classification of joints is based on the degree of movement permitted. Joints may be *synarthroses* (immovable), *amphiarthroses* (partially movable), or *diarthroses* (freely movable).

III. FIBROUS JOINTS

- A. Fibrous joints lack a synovial cavity, have the articulating bones held together by fibrous connective tissue, and permit little or no movement.
- B. Types of fibrous joints include *sutures*, *syndesmoses*, and *gomphoses*.
 - 1. A *suture* is a fibrous joint composed of a thin layer of dense fibrous connective tissue that unites skull bones.
 - a. A *synostosis* is a suture joint that has ossified. An example of a synostosis is the frontal suture (metopic) between the left and right sides of the frontal bone.
 - b. A synostosis is functionally classified as a *synarthrosis*.
 - 2. A *syndesmosis* is a fibrous joint in which there is more fibrous connective tissue than in a suture. An example is the distal tibiofibular joint.
 - a. It permits slight movement (amphiarthrosis).

b. a *gomphosis (dentoalveolar joint)* is a special case which is classified as a syndesmosis. It is the articulation between the root of a tooth and its socket (alveolus) in the maxilla or mandible. It is immovable (synarthrosis).

3. An interosseous membrane is a large sheet of dense irregular connective tissue that binds neighboring long bones.

IV. CARTILAGINOUS JOINTS

A. A *cartilaginous joint* lacks a synovial cavity, has the articulating bones connected by either fibrocartilage or hyaline cartilage, and allows little or no movement.

B. The two types of cartilaginous joints are synchondroses and symphyses.

1. A *synchondrosis* is a cartilaginous joint in which the connecting material is hyaline cartilage . Functionally it is a synarthrosis. An example is an epiphyseal plate.
2. A *symphysis* is a cartilaginous joint in which the connecting material is a disc of fibrocartilage. Functionally, it is an amphiarthrosis. Examples are the intervertebral discs and the pubic symphysis.

V. SYNOVIAL JOINTS

A. *Synovial joints* have a synovial (joint) cavity between the articulating bone and are freely movable (diarthrotic).

B. Structure of Synovial Joints

1. *Articular cartilage*

- a. The articular cartilage covers the bones at synovial joints.
- b. The articular cartilage reduces friction at the joint with movement and helps absorb shock.

2. Articular Capsule

- a. The *articular capsule* surrounds a diarthrosis, encloses the synovial cavity, and unites the articulating bones.

- b. 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).
 - c. The flexibility of the fibrous capsule permits considerable movement at a joint, whereas its great tensile strength helps prevent bones from dislocating.
 - d. Other capsule features include *ligaments* and *articular fat pads*.
3. Synovial *fluid*, secreted by the synovial membrane, lubricates and reduces friction in the joint and supplies nutrients to and removes metabolic wastes from the joint.
4. Accessory Ligaments and Articular Discs
- a. Many diarthroses also contain *accessory ligaments* and *articular discs* (*menisci*).
 - b. *Ligaments* help hold bone to bone.
 - c. *Articular discs* modify the shape of the joint surfaces of the articulating bones, help maintain the stability of the joint, and direct the flow of synovial fluid to areas of greatest friction.
5. Torn *cartilage*, occurring frequently in the knees of athletes, is damage to the articular discs that lie between the ends of some bones. Removal, to prevent erosion and arthritis, is usually accomplished by arthroscopy.

C. Nerve and Blood Supply

- 1. Nerves that supply a joint are the same as those that supply the skeletal muscles that move the joint.
- 2. Numerous arteries and veins supply the joints and surrounding structures.

D. Bursae and Tendon Sheaths

- 1. *Bursae* are synovial fluid filled saclike structures that cushion the movement of one body part over another. They are found where one part of the body moves over another.

2. *Tendon sheaths* are tubelike bursae that wrap around tendons where there is considerable friction, such as the tendon of the biceps brachii at the shoulder joint.

E. Types of Synovial Joints

1. *Planar joints* permit mainly side-to-side and back-and-forth gliding movements. These joints are nonaxial and include the intercarpal, intertarsal, sternoclavicular, acromioclavicular, sternocostal, and vertebrocostal joints.
2. A *hinge joint* contains the convex surface of one bone fitting into a concave surface of another bone. It is monaxial. Movement is primarily flexion or extension in a single plane. Examples include the elbow, knee, ankle, and interphalangeal joints.
3. In a *pivot joint*, a round or pointed surface of one bone fits into a ring formed by another bone and a ligament. Movement is rotational and monaxial. An example is the atlas rotating about the axis.
4. In an *condyloid joint*, an oval-shaped condyle of one bone fits into an elliptical cavity of another bone. It is biaxial. Movements are flexion-extension, abduction-adduction, and circumduction; an example is the joint between the carpals and the radius.
5. A *saddle joint* contains one bone whose articular surface is saddle-shaped and another bone whose articular surface is shaped like a rider sitting in the saddle. It is also biaxial. Movements are flexion-extension, abduction-adduction, and circumduction.
6. In a *ball-and-socket joint*, the ball-shaped surface of one bone fits into the cuplike depression of another. It is multiaxial (polyaxial). Movements are flexion-extension, abduction-adduction, rotation, and circumduction; the only examples are the shoulder joint and hip joint.

VI. TYPES OF MOVEMENT AT SYNOVIAL JOINTS

- A. *Gliding* movements occur when relatively flat bone surfaces move back and forth and from side to side with respect to one another.

1. In gliding joints there is no significant alteration of the angle between the bones.

2. Gliding movements occur at planar joints.

B. Angular Movements

1. In *angular movements* there is an increase or a decrease in the angle between articulating bones.

2. The principal angular movements are flexion, extension and hyperextension.

a. *Flexion* results in a decrease in the angle between articulating bones.

b. *Extension* results in an increase in the angle between articulating bones.

c. *Lateral flexion* involves the movement of the trunk sideways to the right or left at the waist. The movement occurs in the frontal plane and involves the intervertebral joints.

d. *Hyperextension* is a continuation of extension beyond the anatomical position and is usually prevented by the arrangement of ligaments and the anatomical alignment of bones.

3. Abduction, Adduction, and Circumduction

a. *Abduction* refers to the movement of a bone away from the midline.

b. *Adduction* refers to the movement of a bone toward the midline.

c. *Circumduction* refers to movement of the distal end of a part of the body in a circle.

1) *Circumduction* occurs as a result of a continuous sequence of flexion, abduction, extension, and adduction.

2) Condylod, saddle, and ball-and-socket joints allow circumduction.

C. In *rotation*, a bone revolves around its own longitudinal axis.

1. Pivot and ball-and-socket joints permit rotation.

2. If the anterior surface of a bone of the limb is turned toward the midline, *medial rotation* occurs. If the anterior surface of a bone of the limb is turned away from the midline, *lateral rotation* occurs.

D. Special Movements

1. *Elevation* is an upward movement of a part of the body.
2. *Depression* is a downward movement of a part of the body.
3. *Protraction* is a movement of a part of the body anteriorly in the transverse plane.
4. *Retraction* is a movement of a protracted part back to the anatomical position.
5. *Inversion* is movement of the soles medially at the intertarsal joints so that they face away from each other.
6. *Eversion* is a movement of the soles laterally at the intertarsal joints so that they face away from each other.
7. *Dorsiflexion* refers to bending of the foot at the ankle in the direction of the superior surface.
8. *Plantar flexion* involves bending of the foot at the ankle joint in the direction of the plantar surface.
9. *Supination* is a movement of the forearm at the proximal and distal radioulnar joints in which the palm is turned anteriorly or superiorly.
10. *Pronation* is a movement of the forearm at the proximal and distal radioulnar joints in which the distal end of the radius crosses over the distal end of the ulna and the palm is turned posteriorly or inferiorly.
11. *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.