

Laboratory Exercise

18

Joint Structure and Movements

Materials Needed

Textbook
Human skull
Human skeleton, articulated
Models of synovial joints (shoulder, elbow, hip, and knee)

For Demonstrations:

Fresh animal joint (knee joint preferred)
Radiographs of major joints



Safety

- Wear disposable gloves when handling the fresh animal joint.
- Wash your hands before leaving the laboratory.

Joints are junctions between bones. Although they vary considerably in structure, they can be classified according to the type of tissue that binds the bones together. Thus, the three groups of structural joints can be identified as fibrous joints, cartilaginous joints, and synovial joints. Fibrous joints are filled with dense fibrous connective tissue, cartilaginous joints are filled with a type of cartilage, and synovial joints contain synovial fluid inside a joint cavity.

Joints can also be classified by the degree of functional movement allowed: synarthroses are immovable, amphiarthroses allow slight movement, and diarthroses allow free movement. Movements occurring at freely movable synovial joints are due to the contractions of skeletal muscles. In each case, the type of movement depends on the type of joint involved and the way in which the muscles are attached to the bones on either side of the joint.

Purpose of the Exercise

To examine examples of the three types of joints, to identify the major features of these joints, and to review the types of movements produced at synovial joints.

LEARNING OUTCOMES

After completing this exercise, you should be able to

- ① Identify the structural and functional characteristics of fibrous, cartilaginous, and synovial joints.
- ② Locate examples of each type of joint.
- ③ Locate examples of each of the six types of synovial joints.
- ④ Demonstrate the types of movements that occur at synovial joints.
- ⑤ Examine the structure of the shoulder, elbow, hip, and knee joints.

EXPLORE

Procedure A—Types of Joints

1. Review the section entitled “Classification of Joints” in chapter 8 of the textbook.
2. Examine the human skull and articulated skeleton to locate examples of the following types of joints:

fibrous joints

suture (synarthrotic joint)—skull
gomphosis (synarthrotic joint)—tooth sockets
syndesmosis (amphiarthrotic joint)—
tibiofibular joint

cartilaginous joints

synchondrosis (synarthrotic joint)—epiphyseal plates
symphysis (amphiarthrotic joint)—
intervertebral discs

3. Complete Part A of Laboratory Report 18.
4. Locate examples of the following types of synovial joints (diarthrotic joints) in the skeleton. Experiment with each joint to experience its range of movements. **A A**

synovial joints

- ball-and-socket joint—hip; shoulder
- condylar (ellipsoidal) joint—radiocarpal; metacarpophalangeal
- plane (gliding) joint—intercarpal; intertarsal
- hinge joint—elbow; knee; interphalangeal
- pivot joint—radioulnar at elbow; dens at atlas
- saddle joint—base of thumb with trapezium

5. Examine models of the shoulder, elbow, hip, and knee joints. Locate the major knee joint structures of figure 18.1 that are visible on the knee joint model.
6. Complete Parts B and C of the laboratory report.

Demonstration

Examine a longitudinal section of a fresh synovial animal joint. Locate the dense connective tissue that forms the joint capsule and the hyaline cartilage that forms the articular cartilage on the ends of the bones. Locate the synovial membrane on the inside of the joint capsule. Does the joint have any semilunar cartilages (menisci)? **A**

What is the function of such cartilages?

Knee Quiz

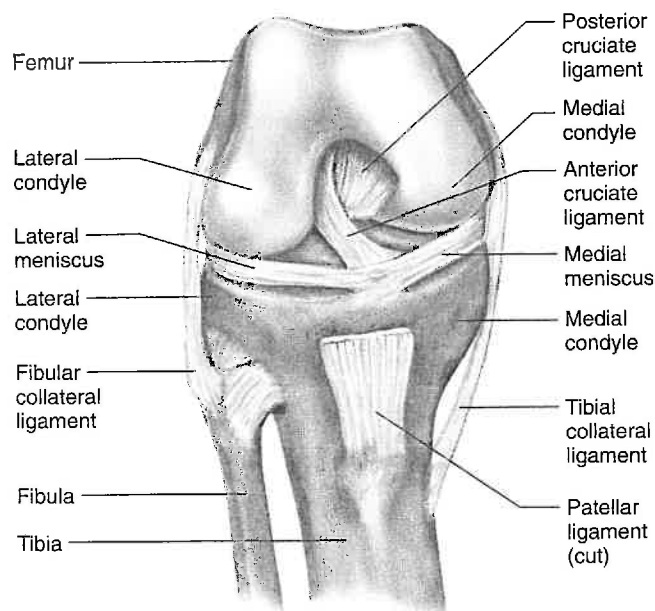


Figure 18.1 Anterior view of right knee (patella removed).

EXPLORE

Procedure B—Joint Movements

1. Review the section entitled “Types of Joint Movements” in chapter 8 of the textbook and study figures 18.2 and 18.3.
2. When the body is in anatomical position, most joints are extended and/or adducted. Skeletal muscle action involves the movable end (*insertion*) being pulled toward the stationary end (*origin*). In the limbs, the origin is usually proximal to the insertion; in the trunk, the origin is usually medial to the insertion. Use these concepts as reference points as you move joints. Move various parts of your body to demonstrate the joint movements described in tables 18.1 and 18.2. **A**
3. Have your laboratory partner do some of the preceding movements and see if you can correctly identify the movements made. **A**



Critical Thinking Application

Describe a body position that can exist when all major body parts are flexed.

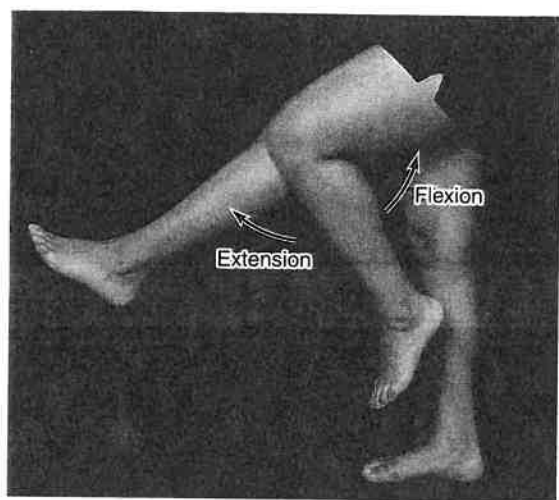
4. Complete Parts D and E of the laboratory report.

Demonstration

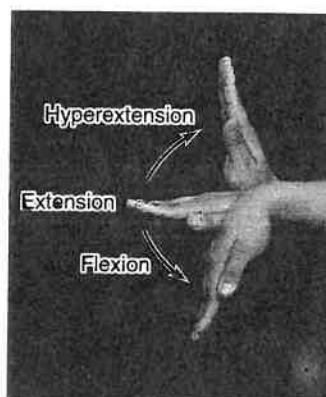
Study the available radiographs of joints by holding the films in front of a light source. Identify the type of joint and the bones incorporated in the joint. Also identify other major visible features.

Table 18.1 Angular and Rotational Movements

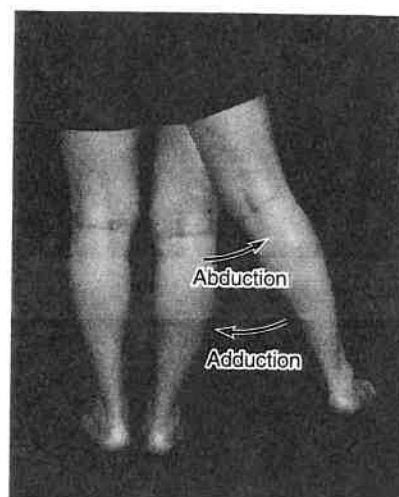
| Movement | Description |
|--------------------|---------------------------------------------------------------------------|
| Flexion | Decrease of an angle (usually in the sagittal plane) |
| Extension | Increase of an angle (usually in the sagittal plane) |
| Hyperextension | Extension beyond anatomical position |
| Abduction | Movement away from the midline (usually in the frontal plane) |
| Adduction | Movement toward the midline (usually in the frontal plane) |
| Circumduction | Circular movement (combines flexion, abduction, extension, and adduction) |
| Rotation | Movement of part around its long axis |
| Medial (internal) | Inward rotation |
| Lateral (external) | Outward rotation |



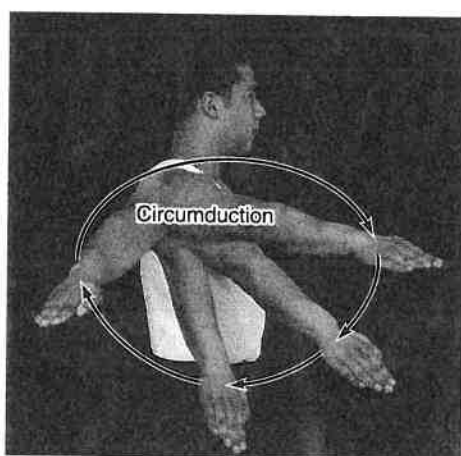
(a) Flexion and extension of the knee joint



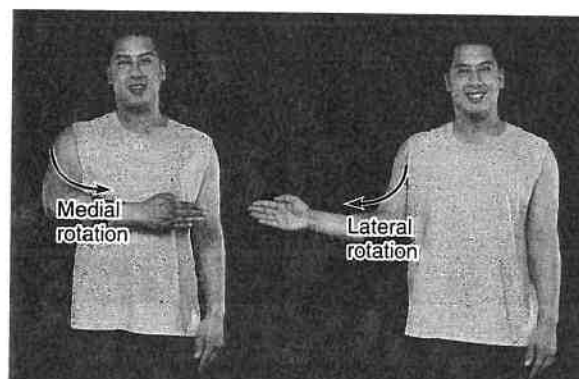
(b) Flexion, extension, and hyperextension of the hand at the wrist joint



(c) Abduction and adduction of the hip joint



(d) Circumduction of the shoulder joint

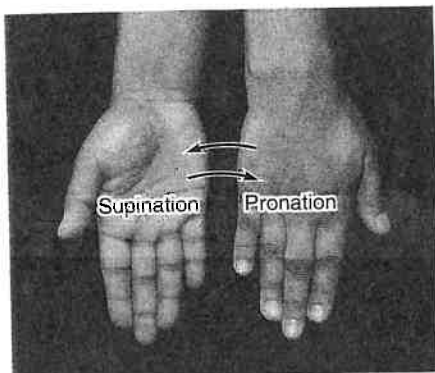


(e) Medial and lateral rotation of the arm at the shoulder joint

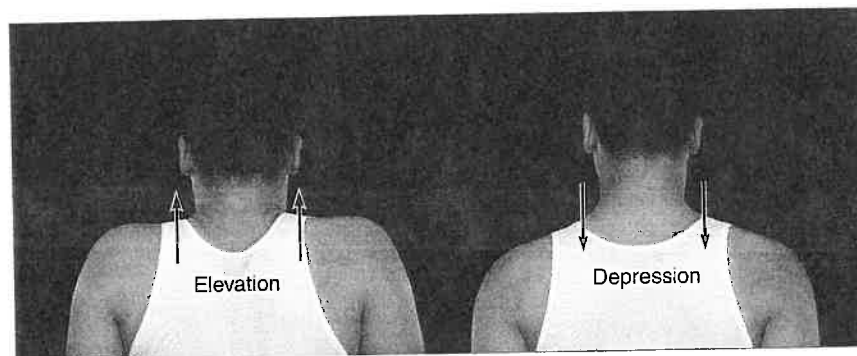
Figure 18.2 Examples of angular and rotational movements of synovial joints.

Table 18.2 Special Movements (pertain to specific joints)

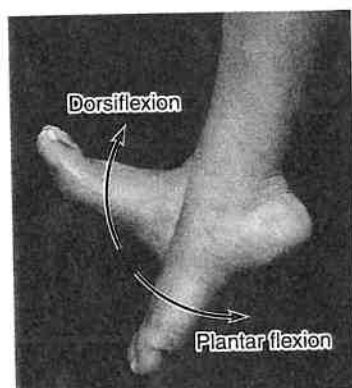
| Movement | Description |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Supination | Movement of palm of hand anteriorly or upward |
| Pronation | Movement of palm of hand posteriorly or downward |
| Elevation | Movement of body part upward |
| Depression | Movement of body part downward |
| Dorsiflexion | Movement of ankle joint so dorsum (superior) of foot becomes closer to anterior surface of leg (as standing on heels) |
| Plantar flexion | Movement of ankle joint so the plantar surface of foot becomes closer to the posterior surface of leg (as standing on toes) |
| Inversion (called supination in some health professions) | Medial movement of sole of foot at ankle joint |
| Eversion (called pronation in some health professions) | Lateral movement of sole of foot at ankle joint |
| Protraction | Anterior movement in the transverse plane |
| Retraction | Posterior movement in the transverse plane |



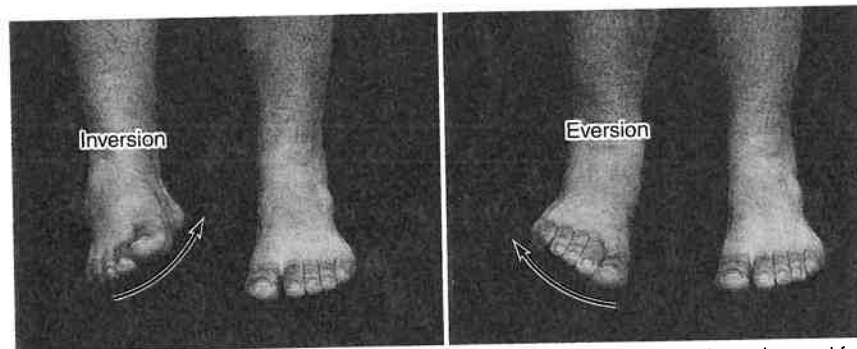
(a) Supination and pronation of the hand involving movement at the radioulnar joint



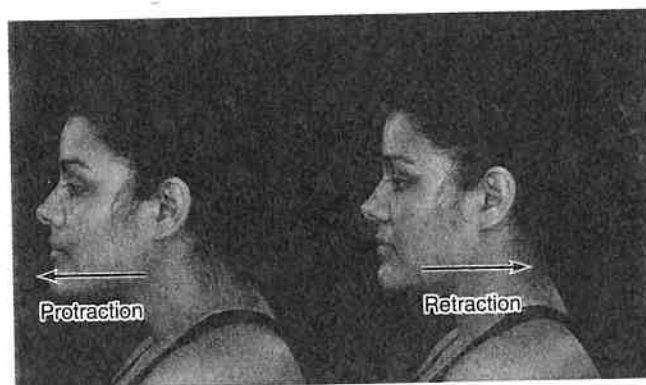
(b) Elevation and depression of the shoulder (scapula)



(c) Dorsiflexion and plantar flexion of the foot at the ankle joint



(d) Inversion and eversion of the right foot at the ankle joint (The left foot is unchanged for comparison.)



(e) Protraction and retraction of the head

Figure 18.3 Special movements of synovial joints.