38.3B: Movement at Synovial Joints

Synovial joints allow for many types of movement including gliding, angular, rotational, and special movements.

Learning Objectives

• Differentiate among the types of movements possible at synovial joints

Key Points

• Gliding movements occur as relatively flat bone surfaces move past each other, but they produce very little movement of the bones.

• Angular movements are produced when the angle between the bones of a joint changes; they include flexion, extension, hyperextension, abduction, adduction, and circumduction.

• Rotational movement involves moving the bone around its longitudinal axis; this can be movement toward the midline of the body (medial rotation) or away from the midline of the body (lateral rotation).

• Special movements are all the other movements that cannot be classified as gliding, angular, or rotational; these movements include inversion, eversion, protraction, and retraction.

• Other special movements include elevation, depression, supination, and pronation.

Key Terms

• **adduction**: the movement of a bone toward the midline of the body

• **abduction**: moving a bone away from the midline of the body

• **supination**: the action of rotating the forearm so that the palm of the hand is turned up or forward
- **pronation**: the action of rotating the forearm so that the palm of the hand is turned down or back

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**Movement at Synovial Joints**

The range of movement allowed by synovial joints is fairly wide. These movements can be classified as: gliding, angular, rotational, or special movement.

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**Gliding Movement**

Gliding movements occur as relatively flat bone surfaces move past each other. They produce very little rotation or angular movement of the bones. The joints of the carpal and tarsal bones are examples of joints that produce gliding movements.

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**Angular Movement**

Angular movements are produced by changing the angle between the bones of a joint. There are several different types of angular movements, including flexion, extension, hyperextension, abduction, adduction, and circumduction. Flexion, or bending, occurs when the angle between the bones decreases. Moving the forearm upward at the elbow or moving the wrist to move the hand toward the forearm are examples of flexion. In extension, the opposite of flexion, the angle between the bones of a joint increases. Straightening a limb after flexion is an example of extension. Extension past the normal anatomical position is referred to as hyperextension. This includes moving the neck back to look upward or bending the wrist so that the hand moves away from the forearm.

Abduction occurs when a bone moves away from the midline of the body. Examples of abduction include moving the arms or legs laterally to lift them straight out to the side. Adduction is the movement of a bone toward the midline of the body. Movement of the limbs inward after abduction is an example of adduction. Circumduction is the movement of a limb in a circular motion, as in swinging an arm around.
Figure \(\PageIndex{1}\): Angular and rotational movements: Synovial joints give the body many ways in which to move. (a)–(b) Flexion and extension motions are in the sagittal (anterior–posterior) plane of motion. These movements take place at the shoulder, hip, elbow, knee, wrist, metacarpophalangeal, metatarsophalangeal, and interphalangeal joints. (c)–(d) Anterior bending of the head or vertebral column is flexion, while any posterior movement of the head is extension. (e) Abduction and adduction are motions of the limbs, hand, fingers, or toes in the coronal (medial–lateral) plane of movement. Moving the limb or hand laterally away from the body, or spreading the fingers or toes, is abduction. Adduction brings the limb or hand toward or across the midline of the body or brings the fingers or toes together. Circumduction is the movement of the limb, hand, or fingers in a circular pattern, using the sequential combination of flexion, adduction, extension, and abduction motions. Adduction/abduction and circumduction take place at the shoulder, hip, wrist, metacarpophalangeal, and metatarsophalangeal joints. (f) Turning of the head side to side or twisting of the body is rotation. Medial and lateral rotation of the upper limb at the shoulder or lower limb at the hip involves turning the anterior surface of the limb toward the midline of the body (medial or internal rotation) or away from the midline (lateral or external rotation).

Rotational Movement

Rotational movement is the movement of a bone as it rotates around its longitudinal axis. Rotation can be toward the midline of the body, which is referred to as medial rotation, or away from the midline of the body, which is referred to as lateral rotation. Movement of the head from side to side is an example of rotation.

Special Movements

Some movements that cannot be classified as gliding, angular, or rotational are called special movements. Inversion involves moving the soles of the feet inward, toward the midline of the body. Eversion, the opposite of inversion, involves moving the soles of the foot outward, away from the midline of the body. Protraction is the anterior movement of a
bone in the horizontal plane. Retraction occurs as a joint moves back into position after protraction. Protraction and retraction can be seen in the movement of the mandible as the jaw is thrust outwards and then back inwards. Elevation is the movement of a bone upward, such as shrugging the shoulders, lifting the scapulae. Depression is the opposite of elevation and involves moving the bone downward, such as after the shoulders are shrugged and the scapulae return to their normal position from an elevated position. Dorsiflexion is a bending at the ankle such that the toes are lifted toward the knee. Plantarflexion is a bending at the ankle when the heel is lifted, such as when standing on the toes. Supination is the movement of the radius and ulna bones of the forearm so that the palm faces forward or up. Pronation is the opposite movement, in which the palm faces backward or down. Opposition is the movement of the thumb toward the fingers of the same hand, making it possible to grasp and hold objects.

Figure $(\PageIndex{1})$: **Special movements**: (g) Supination of the forearm turns the palm upward in which the radius and ulna are parallel, while forearm pronation turns the palm downward in which the radius crosses over the ulna to form an “X.” (h) Dorsiflexion of the foot at the ankle joint moves the top of the foot toward the leg, while plantar flexion lifts the heel and points the toes. (i) Eversion of the foot moves the bottom (sole) of the foot away from the midline of the body, while foot inversion faces the sole toward the midline. (j) Protraction of the mandible pushes the chin forward, while retraction pulls the chin back. (k) Depression of the mandible opens the mouth, while elevation closes it. (l) Opposition of the thumb brings the tip of the thumb into contact with the tip of the fingers of the same hand.