PART I

Basic Clinical Kinesiology and Anatomy

CHAPTER 1

Basic Information

Introduction

Kinesiology is the study of movement through the application of anatomy, physiology, physics, and mechanics. The amount of information in all these fields of study is challenging to retain and apply using only memorization for tests. The real test, however, is application of the knowledge of these fields of study to patients and clients.

Biomechanics is the term used when applying the more general term *mechanics* (the study of forces exerted on an object) to the study of human movement. The two components of biomechanics are kinematics and kinetics. **Kinematics** is the branch of mechanics describing the movement of a body, without consideration of the forces or torques producing that movement, or how two objects move relative to each other without consideration of the forces that influence movement. Examples of kinematics include **osteokinematics**, the movement of bones in space about a joint axis, examples of which include flexion and extension, and **arthrokinematics**, the movement of bone surfaces during joint movement, examples of which include roll and glide. **Kinetics** is the branch of mechanics describing how forces and torques affect the body. An example of kinetics is the force of a muscle acting on a bone, creating osteokinematic and arthrokinematic movement. These concepts will be discussed throughout the text.

While proceeding through the text, keep in mind a few simple concepts. First, the human body is arranged in a very logical way. But like all aspects of life, there are exceptions. Sometimes the logic of these exceptions is apparent, and sometimes not. When this occurs, note the exception and move on. Second, a good grasp of descriptive terminology and visualization of a concept or feature decrease reliance on only strict memorization.

By keeping in mind some basic principles applied to joints and muscles, understanding kinesiology need not be mind-boggling. For example, knowing (1) what

movements a joint allows, (2) that a muscle must span a specific side of a joint surface to cause a certain movement, and (3) what the muscle's line of pull is, specific action(s) of a muscle can be known. The elbow joint allows only flexion and extension. To move the elbow joint against gravity, a muscle must span the elbow joint anteriorly to flex and posteriorly to extend the elbow. The biceps brachii muscle spans the anterior aspect of the elbow. Therefore when in the *anatomical position,* the biceps brachii is an elbow flexor, flexing the elbow against gravity. The triceps brachii muscle spans the posterior aspect of the elbow. Therefore when in a position where elbow extension is performed against gravity, the triceps brachii is an elbow extensor. In the anatomical position, the triceps brachii does not act as an elbow extensor because gravity causes elbow extension from a flexed position.

Yes, kinesiology *can* be understood by mere mortals. The study of kinesiology can even be enjoyable. A word of caution should be given, however. Like exercise, studying in short sessions several times a week is preferable to studying for one long session. Kinesiology is foundational material necessary to understanding future courses and patient care management. To promote retention of this information, practice, observation, and discussion in laboratory exercises, study groups, and clinical internships are recommended. The initial chapters of this text provide basic information, which is then applied to the study of human movement in the remaining chapters.

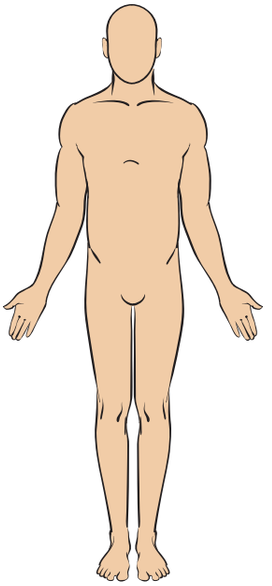

Figure 1-1. Anatomical position.

Descriptive Terminology

Describing the organization of the human body and the relationship of limb segments and movements to each other requires a standardized position to serve as a reference point. The **anatomical position** (Fig. 1-1) is this standardized position and is defined as the human body standing in an upright position, eyes level and facing forward, feet parallel and close together, and arms at the sides of the body with the palms facing forward. The anatomical position is the neutral position from which limb segment movements (osteokinematics) are defined and limb segment movement is measured.

Specific terms are used to describe the location of a structure and its position relative to other structures (Figs. 1-2 and 1-3). The following terms are defined in relation to the anatomical position. **Medial** refers to a location or position toward the midline, and **lateral** refers to a location or position farther from the midline. For example, the ulna is on the medial side of the forearm, and the radius is lateral to the ulna.

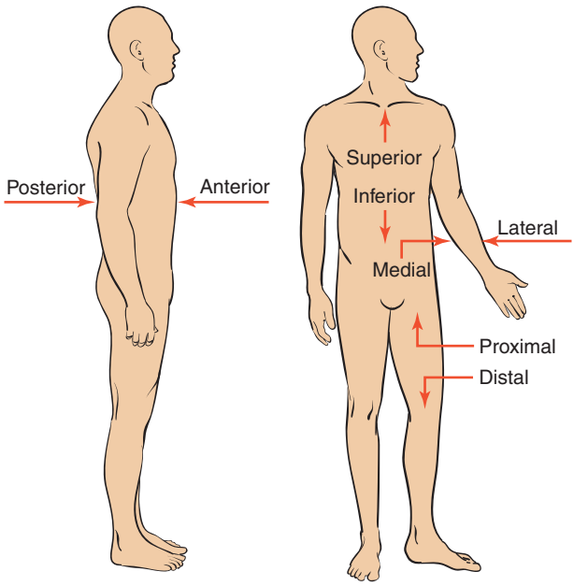

Figure 1-2. Descriptive terminology.

Anterior refers to the front of the body or to a position closer to the front. **Posterior** refers to the back of the body or to a position closer to the back. For example, the sternum is located anteriorly on the chest wall, and the scapula is located posteriorly. **Ventral** is a synonym (a word with the same meaning) of *anterior,* and **dorsal** is a synonym of *posterior; anterior* and *posterior* are more commonly used in kinesiology. *Front* and *back* also refer

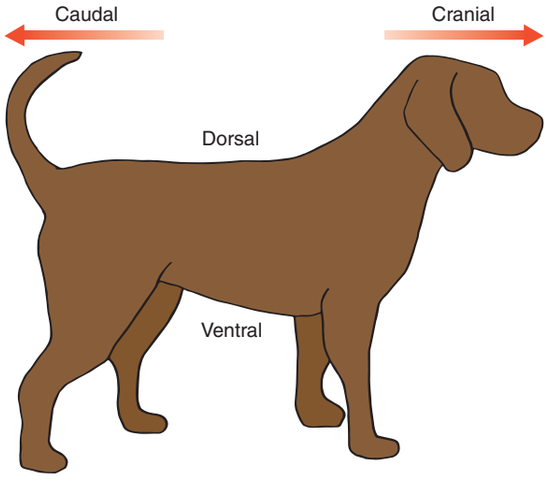

Figure 1-3. Descriptive terminology for a quadruped.

to the surfaces of the body, but these are considered lay terms and are not generally used in documentation by health-care professionals.

Distal and *proximal* are used to describe locations on the extremities. **Distal** means away from the trunk, and **proximal** means toward the trunk. For example, the humeral head is located on the proximal end of the humerus. The elbow is distal to the shoulder and proximal to the wrist.

Superior is used to indicate the location of a body part that is above another, or to refer to the upper surface of an organ or a structure. **Inferior** indicates that a body part is below another, or refers to the lower surface of an organ or a structure. Superior and inferior are terms used to refer to the relative location of structures of the head, neck, and trunk. For example, the ribs are superior to the pelvis, and thus the pelvis is inferior to the ribs. Sometimes people use **cranial** or *cephalad* (Greek: *cephal,* meaning "head") to refer to a position or structure closer to the head. **Caudal** (Latin: *cauda,* meaning "tail") refers to a position or structure closer to the feet. For example, *cauda equina* (Latin: "horse's tail") is the bundle of spinal nerve roots descending from the inferior end of the spinal cord. *Cranial* and *caudal* are terms that arise from the descriptive positions of a quadruped (a four-legged animal). Humans are bipeds (two-legged). Were the dog in Figure 1-3 to stand on its hind legs, dorsal would become posterior and cranial would become superior, and so on.

A structure may be described as **superficial** or **deep,** depending on its relative depth from the surface of the body. For example, in describing the layers of the abdominal muscles, the external oblique is superficial to the internal oblique, and the transversus abdominus is deep to the internal oblique.

Supine and *prone* are terms that describe the body when lying in a horizontal position. When **supine,** the anterior surface of the body faces upward, and the posterior surface of the body is in contact with a supporting surface, such as a treatment table or floor. When **prone**, the anterior surface of the body faces downward, in contact with a supporting surface, and the posterior surface of the body faces upward.

Bilateral refers to two, or both, sides. For example, bilateral transfemoral (above-knee) amputations refer to both right and left legs being amputated above the knee. **Contralateral** refers to the opposite side. A person who had a stroke affecting the right side of the brain may have contralateral paralysis of the left arm and left leg. Conversely, **ipsilateral** refers to the same side of the body.

Segments of the Body

The extremities are divided into segments according to the major bone(s) in the segment (Fig. 1-4). In the upper extremity, the **arm** is the bone (humerus) between the shoulder and the elbow joint. The **forearm** (radius and ulna) is between the elbow and the wrist. The **hand** is distal to the wrist. The lower extremity is made up of three similar segments. The **thigh** (femur) is between the hip and knee joints. The **leg** (tibia and

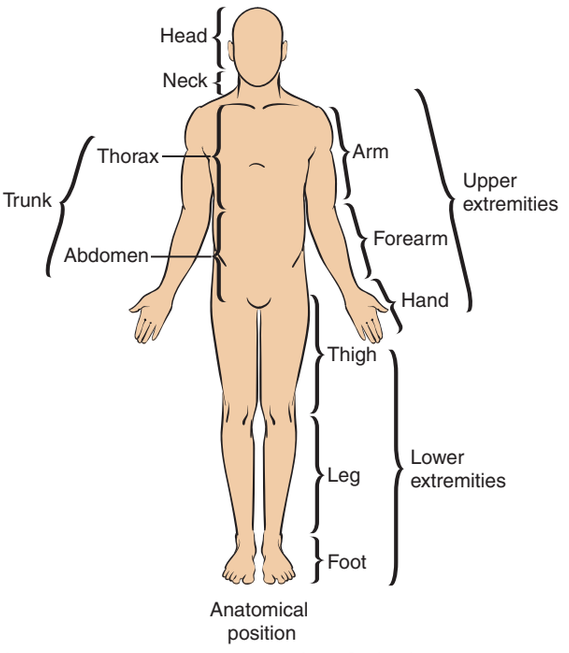

Figure 1-4. Descriptive terminology for body segments.

fibula) is between the knee and ankle joints, and the **foot** is distal to the ankle.

The trunk has two segments: the thorax and the abdomen. The **thorax,** or chest, is made up primarily of the ribs, sternum, and thoracic vertebrae. The **abdomen,** or lower trunk, is made up primarily of the pelvis, internal organs, and lumbar vertebrae. The **neck** (cervical vertebrae) and **head** (cranium) are separate segments.

Body segments are rarely used to describe joint movement. For example, flexion of the upper extremity occurs at the shoulder and is termed *shoulder flexion.* The movement occurs at the joint (shoulder), and the body segment (upper extremity) just goes along for the ride! An exception to this concept is the forearm, where the body segment functions as a joint as well. Joint movements termed *forearm pronation* and *forearm supination* occur at the proximal and distal radioulnar joints.

Kinetic Chains

A **kinetic chain** is a series of connected rigid links, which in the human body are the segments of the extremities. The upper and lower extremities are in fact kinetic chains. Because the links are connected, movement of one link affects movement at the other links in a predictable way. The two types of kinetic chains are a closed kinetic chain and an open kinetic chain. A **closed kinetic chain** occurs when the *distal* segment is fixed (closed), providing stabilization at the distal end of the kinetic chain and the *proximal* segment(s) is free to move (Fig. 1-5). For example, when arising from sitting in a chair to a standing position, the foot (distal end) is fixed on the floor, and the hip, knee, and ankle (joints proximal to the fixed end of the limb) are free to move and do so in a predictable manner.

An **open kinetic chain** occurs when the *distal* segment is not fixed (open) and the *proximal* segment is fixed. This configuration provides stabilization of the proximal end of the kinetic chain and freedom of movement (open) of the *distal* segments (Fig. 1-6). For example, consider knee extension while sitting. When performing this activity, the hip joint (proximal end) is fixed, and the knee and ankle joints (distal to the fixed end of the limb) are free to move, creating an open kinetic chain.

For a comparison of the two types of kinetic chains in the upper extremity, consider the activities of performing a pull-up (Fig. 1-7A) and bringing a glass to the mouth (Fig. 1-7B). When performing a pull-up, the hand (*distal* end) is fixed (closed), and the shoulder, elbow, and wrist joints (joints *proximal* to the distal end of the kinetic chain) are free to move. Thus this is a closed kinetic chain activity. When lifting a glass to the mouth, the shoulder joint (*proximal* end) is fixed, and the elbow and wrist joints (joints *distal* to the proximal end of the kinetic chain) are able to move. Thus this is an open kinetic chain activity.

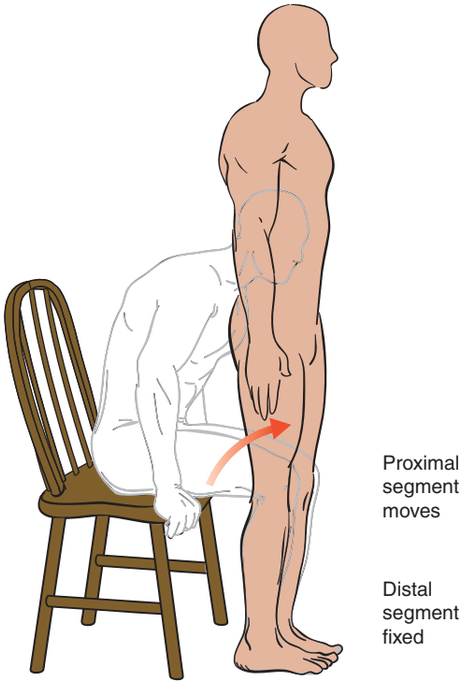

Figure 1-5. Closed kinetic chain.

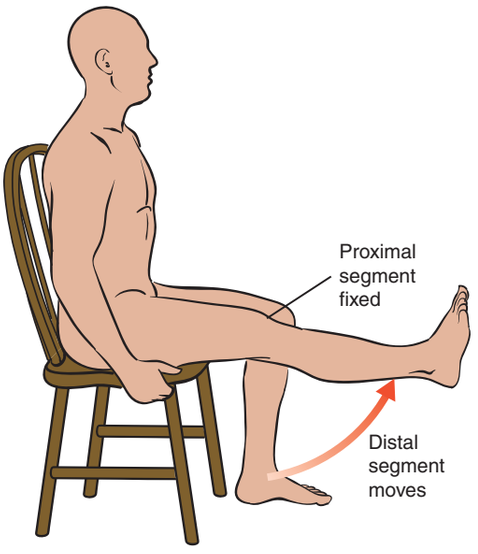

Figure 1-6. Open kinetic chain.

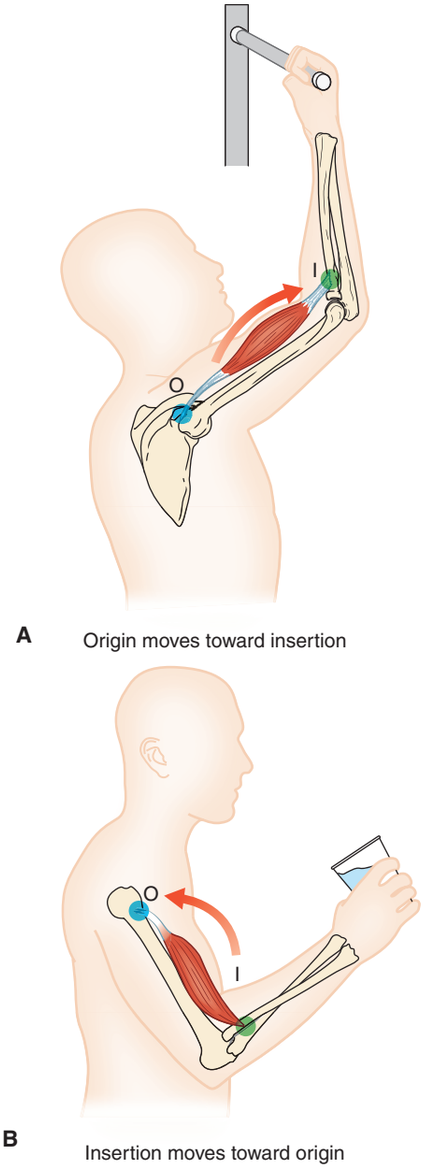

Figure 1-7. Direction of movements of biceps brachii muscle attachments: **(A)** Origin moves toward insertion during pull-up. **(B)** Insertion moves toward origin as glass is raised to mouth.

Table 1-1 Joint Motions

Plane	Axis	Joint Movement
Sagittal	Frontal	Flexion/extension
Frontal	Sagittal	Abduction/adduction
		Radial/ulnar deviation
		Eversion/inversion
Horizontal	Vertical	Medial-lateral rotation
		Supination/pronation
		Right/left rotation
		Horizontal abduction/adduction

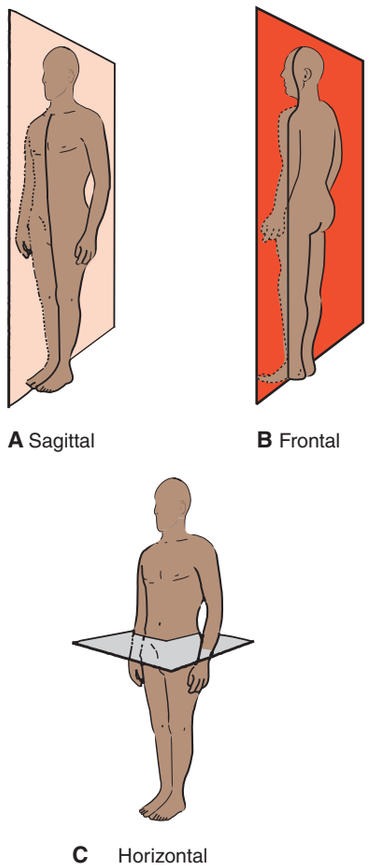

Figure 1-8. Planes of the body.

Planes and Axes of Motion

Joint movement is described by reference to *planes* and *axes* (Table 1-1). Movement occurs *within* a plane and *about* an axis. There are three planes within which movement occurs, and each plane is perpendicular to the other two planes (Fig. 1-8). There are two vertical planes and one horizontal plane. Think of the vertical planes as walls and the horizontal plane as a floor. Axes are lines that pass through a joint, about which a limb segment moves (Fig. 1-9). Thus joint axes are always perpendicular to their joint planes of motion.

A **sagittal plane** passes through the body vertically from anterior to posterior (or vice versa), dividing the body into right and left portions. The mid-sagittal plane

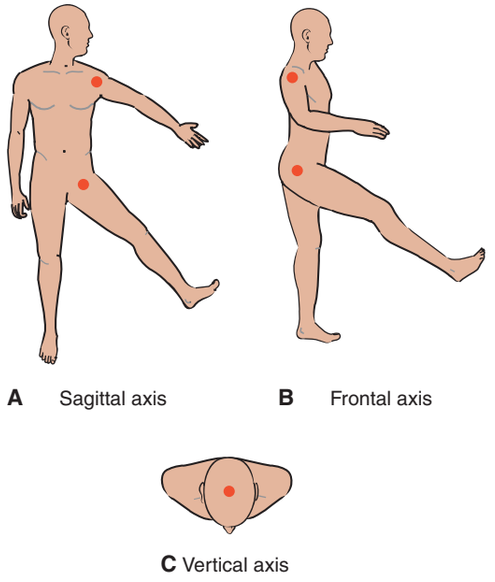

Figure 1-9. Axes of the body.

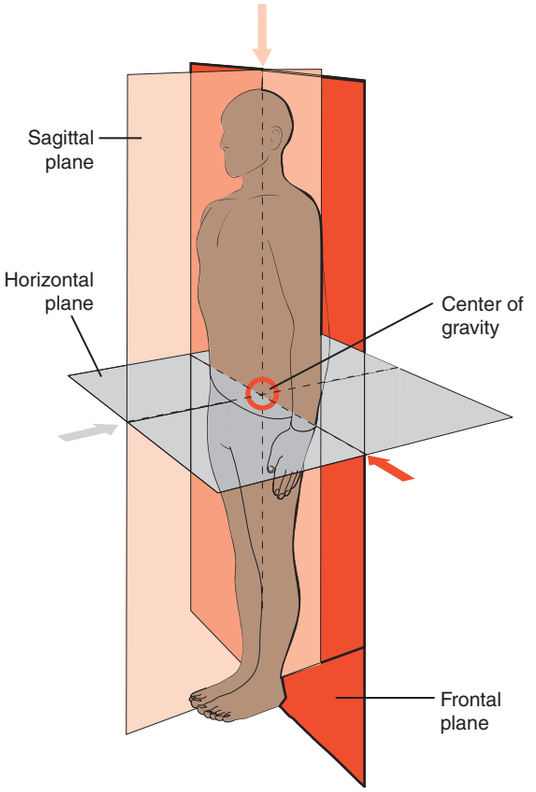

Figure 1-10. The three cardinal planes are considered to intersect at the center of gravity.

divides the body into equal left and right parts. Movements occurring within this plane are flexion and extension. A **frontal plane,** also termed a *coronal plane,* passes through the body vertically from side to side, dividing the body into anterior and posterior portions. Movements occurring within this plane are abduction and adduction. A **horizontal plane,** also termed a *transverse plane,* passes through the body horizontally and divides the body into superior and inferior portions. Rotation occurs within this plane. When a plane—sagittal, frontal, or horizontal—divides the body into equal halves on each side of the plane, it is termed a *cardinal plane*. The three cardinal planes intersect at the mid-point of each dimension. Body mass within each half of the body determined by cardinal plane is not always equal. The center of gravity, a two-dimensional concept, is at the mid-sagittal plane slightly anterior to the second sacral vertebra (Fig. 1-10), and is not the same as the center of mass.

A **sagittal axis,** sometimes termed an *anterior-posterior axis,* is a line that passes through a joint from anterior to posterior (or vice versa). Abduction and adduction occur about a sagittal axis. A **frontal axis,** sometimes termed a *medial-lateral axis,* is a line that passes through a joint from side to side. Flexion and extension occur about a frontal axis. A **vertical axis,** sometimes termed a *longitudinal axis,* is a line that passes through a joint from superior to inferior (or vice versa). Rotation occurs about a vertical axis.

Joint movement occurs within a plane and about an axis. When in the anatomical position, a given joint movement always occurs within the same plane and about the same axis. Flexion and extension typically occur within a sagittal plane and about a frontal axis. Abduction and adduction typically occur within a frontal plane and about a sagittal axis. Rotation typically occurs within a horizontal plane and about a vertical axis. Movements such as radial and ulnar deviation of the wrist also occur within a frontal plane about a sagittal axis. Thumb movements are the exception to orientation of these planes and axes of motion. Thumb flexion and extension occur within a frontal plane and about a sagittal axis. Thumb abduction and adduction occur within a sagittal plane and about a frontal axis. Table 1-1 presents joint movement in relation to planes and axes.

Degrees of Freedom

Joints are also described by the degrees of freedom, the number of planes within which joints can move. For example, a uniaxial joint has movement within one plane about one axis. Therefore a uniaxial joint moves in one plane of motion, and thus has one degree of

freedom. A biaxial joint moves in two planes of motion, and thus has two degrees of freedom. A triaxial joint moves in three planes of motion, and thus has three degrees of freedom. The maximum number of degrees of freedom a single joint can have is three. When examining multiple joints within one extremity, the total number of degrees of freedom is the sum of the number of degrees of freedom at each individual joint.

Osteokinematic Movements

Joint movement is one bone moving on another through a *range of motion* (ROM). The movements are flexion, extension, abduction, adduction, and rotation. These movements are termed **osteokinematic movements,** which are performed as either active or passive movements. *Active range of motion* (AROM) occurs when muscles contract to move joints through a range of motion. *Passive range of motion* (PROM) occurs when muscles are not contracting, and an external force moves a joint through its ROM. Synovial joints move freely in many different directions, depending upon their anatomical structure.

A non-moving limb segment can be described as static or stable. A moving limb segment can be described as dynamic (Fig. 1-11). Limb segment positions are described in relation to the anatomical position. An elbow in the anatomical position is extended and is flexed as it is bent. Dynamic (osteokinematic) movements, such as flexion and extension and abduction and adduction, describe the *direction* of movement with respect to the anatomical position. For example, when the anterior surfaces of the arm and forearm are moving closer together, the movement is described as *flexing* the elbow. The terms describing joint position (static) and joint movement (dynamic) are both nouns and verbs. When used clinically, the intent and meaning of terms such as flex/flexing/flexion/flexed or extend/extending/extension/extended are understood by considering the context in which the term is used.

Flexion, occurring within a sagittal plane and about a frontal axis, is movement of one limb segment on another about a joint axis, bringing two anterior limb segment surfaces *toward* each other. The most notable exception to this definition is knee flexion. During knee flexion, the posterior limb segment surfaces of the thigh and leg move *toward* each other. Figure 1-12B presents the anatomical position of the head and neck. In the case of the neck, flexion is a "bowing down" movement (see Fig. 1-12A) in which the head moves toward the anterior chest. Elbow flexion is the anterior surface of the forearm moving toward the anterior surface of the arm (see Fig. 1-12D). Wrist flexion is the moving of the anterior surface of the hand toward the anterior surface of the forearm (see Fig. 1-12F). Movements of the ankle are exceptions to the typical definitions of flexion and extension, and are both termed *flexion*. There are, however, specific terms for the movement in each direction. The position in which the toes are pointing downward toward the floor is termed *plantar flexion* (see Fig. 1-12H), and in which the toes are pointing upward toward the chin is termed *dorsiflexion* (see Fig. 1-12I).

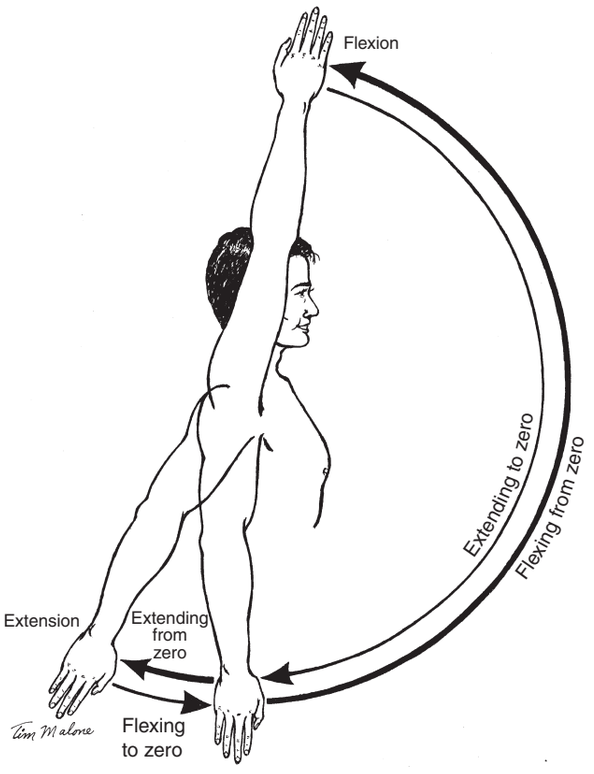

Figure 1-11. Flexion and extension of the shoulder. (From Norkin & White. Measurement of Joint Motion, 4E. Philadelphia, PA: F. A. Davis; 2009, with permission.)

Extension, occurring within a sagittal plane and about a frontal axis, is movement of one limb segment on another about a joint axis, moving the anterior limb segment surfaces *away* from each other. The most notable exception to this definition is knee extension. During knee extension, the posterior limb segment surfaces move *away* from each other. Extension of the head and neck occurs when the head tips posteriorly, tilting the face toward the ceiling (moving beyond the anatomical position) (see Fig. 1-12C). Elbow extension occurs when the anterior surface of the forearm moves away from the anterior surface of the arm (see Fig. 1-12E).

When the prefix "hyper-" is added to a movement, the term describes movement of a joint beyond its

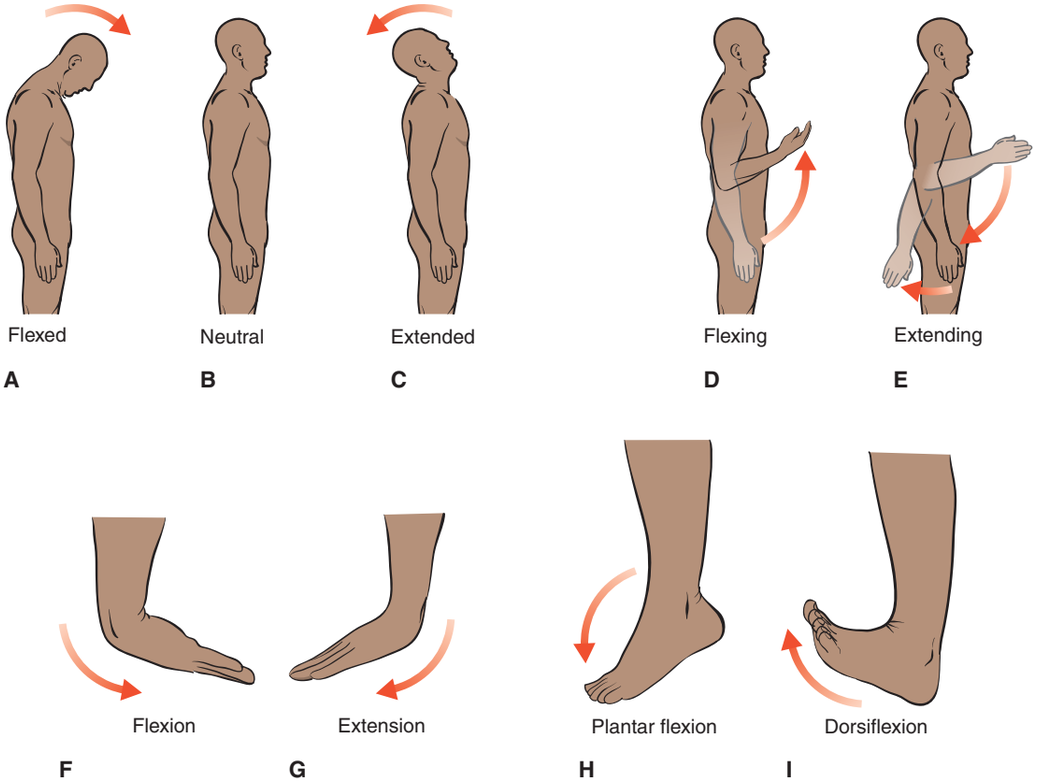

Figure 1-12. Joint movements of flexion and extension.

normal ROM. Thus **hyperextension** is extension of a joint beyond its nonpathological (expected normal, without injury or disease) extension ROM.

Abduction is movement away from the midline of the body (Fig. 1-13A), and **adduction** (see Fig. 1-13B) is movement toward the midline. Abduction and adduction occur within a frontal plane and about a sagittal axis. The shoulder and hip can abduct *and* adduct. Exceptions to this midline definition are the fingers and toes. The reference point for the fingers is the middle finger. Movement away from the middle finger is abduction, and adduction is movement toward the middle finger. The middle finger abducts (medially and laterally) but adducts only as a return movement to the midline from abduction. The point of reference for the toes is the second toe. Similar to the middle finger, the second toe abducts either medially or laterally but does not adduct, except as a return movement from abduction. *Horizontal abduction* and *adduction* are movements that do not occur from the anatomical position of the shoulder. The shoulder must be abducted to 90 degrees before the movements of horizontal abduction and adduction can be performed. When the shoulder has been abducted initially, shoulder movement laterally is **horizontal abduction** (see Fig. 1-13C) and movement medially is **horizontal adduction** (see Fig. 1-13D). Horizontal abduction and adduction occur in a horizontal plane and about a vertical axis. There are no similar movements at the hip.

Radial deviation and *ulnar deviation* are terms commonly used to refer to wrist abduction and adduction. **Radial deviation** occurs when the hand moves laterally, or toward the radial/thumb side of the hand (see Fig. 1-13E). **Ulnar deviation** occurs when the hand moves medially, or toward the ulnar/little finger side of the hand (see Fig. 1-13F). Radial and ulnar deviation occur within a frontal plane and about a sagittal axis.

Lateral flexion is the term used when the trunk bends to the side, moving the shoulder toward the ipsilateral hip. The trunk can laterally flex to the right or

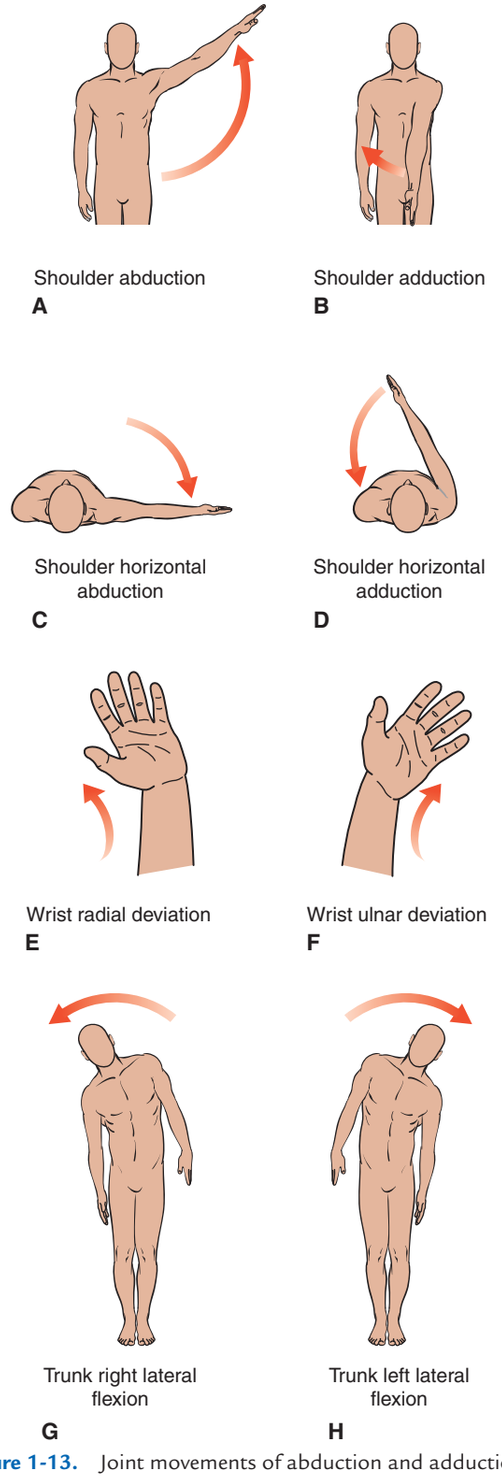

Figure 1-13. Joint movements of abduction and adduction.

the left (see Fig. 1-13G and H). With lateral flexion of the neck, the ear moves toward the ipsilateral shoulder. Lateral flexion occurs within a frontal plane and about a sagittal axis.

Rotation is movement of a limb segment within a horizontal plane and about a vertical axis. **Medial rotation** occurs when the anterior surface of a limb segment turns toward the midline (Fig. 1-14A). Medial rotation is also termed *internal rotation*. **Lateral rotation** occurs when the anterior surface of a limb segment turns away from the midline (see Fig. 1-14B). Lateral rotation is also termed *external rotation*. Joints capable of performing medial and lateral rotation are the shoulder and the hip. The neck and trunk also rotate to either the right or left (see Fig. 1-14C and D). Rotation of the head, neck, and trunk are termed *right* or *left rotation*.

Rotation of the forearm is termed *supination* and *pronation*. In the anatomical position (see Fig. 1-1), the forearm is in **supination** (see Fig. 1-14E). Thus the palm of the hand is oriented anteriorly. In **pronation** (see Fig. 1-14F), the palm is oriented posteriorly. The plane of motion and axis of motion for supination and pronation are the same as for rotation: within a horizontal plane and about a vertical axis. When the elbow is flexed, the "palm up" position is a result of supination, and the "palm down" is a result of pronation.

Some limb segments have unique movements. Among these are circumduction, inversion/eversion, opposition, and scapular protraction/retraction. The examples that follow are only a sample of unique movements. Specifics for each joint movement are presented in later chapters.

Circumduction is a triplanar movement, producing a circular, cone-shaped pattern in which distal segments move through larger arcs of movement than proximal segments. For example, circumduction of the shoulder requires the sequential movements of flexion, abduction, extension, adduction, with rotation. The shoulder serves as the point of the cone, and the elbow and hand move through arcs of movement, with the hand moving through a larger arc of movement than the elbow and shoulder (Fig. 1-15). Circumduction may also occur at the wrist, hip, ankle, thumb, and head/neck.

The classical, or anatomical, definition of **inversion** is moving the ankle so that the sole of the foot faces medially (Fig. 1-16A), and **eversion** is moving the ankle so

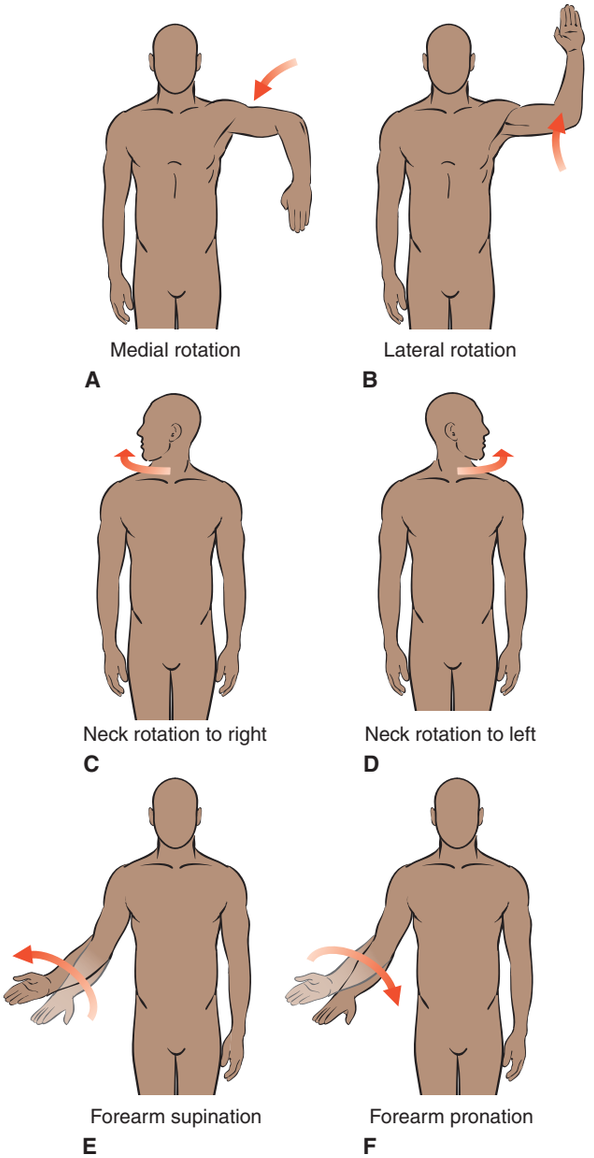

Figure 1-14. Joint rotation movements. In **A** and **B**, the shoulder is abducted to 90 degrees only to demonstrate the rotation more clearly.

that the sole of the foot faces laterally (see Fig. 1-16B). Clinically, the triplanar movements that occur at the ankle are termed *supination* (inversion, adduction, and plantar flexion) and *pronation* (eversion, abduction, and dorsiflexion).

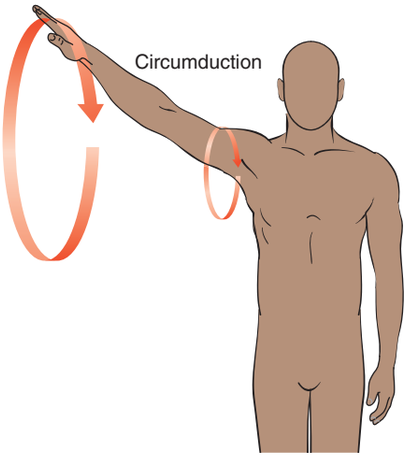

Figure 1-15. Circumduction movement.

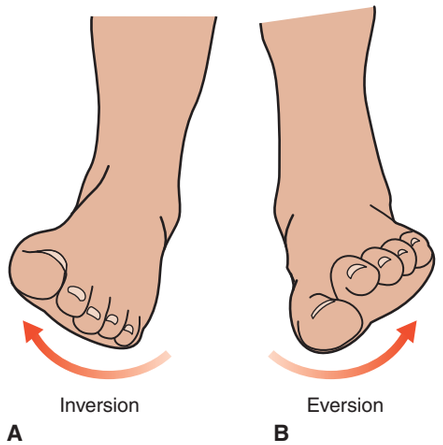

Figure 1-16. Inversion and eversion of left foot.

Opposition is movement of the thumb such that the pad of the thumb faces the pads of the other four fingers. **Reposition** is movement that returns the thumb to the anatomical position. (Fig. 1-17).

Scapular protraction is movement of the scapula laterally along the posterior chest wall (Figs. 1-18A and 1-19A). **Scapular retraction** is movement of the scapula medially along the posterior chest wall (see Figs. 1-18B and 1-19A). **Scapular elevation** is movement of the scapula superiorly along the posterior chest wall. **Scapular depression** is movement of

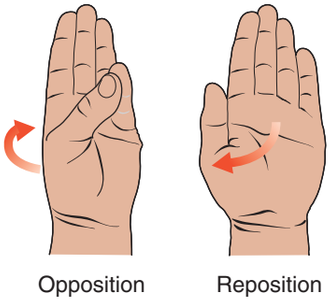

Figure 1-17. Thumb opposition.

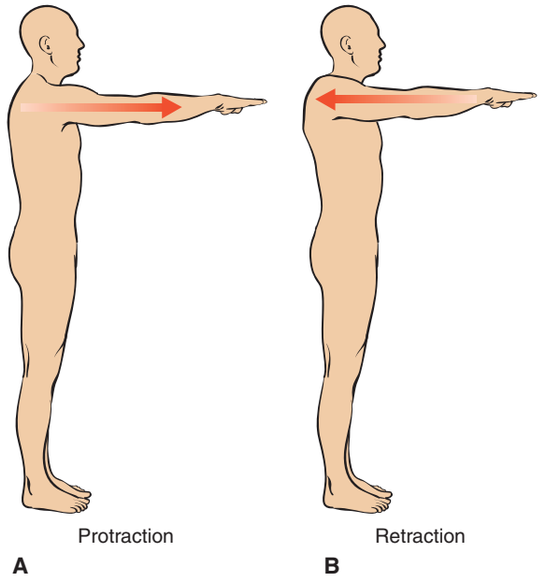

Figure 1-18. Scapular protraction and scapular retraction.

the scapula inferiorly along the posterior chest wall. Scapular elevation and depression are both presented in Figure 1-19B.

Range of Motion and Goniometry

Each movement at every joint or region of the body has a *range of motion*. **Range of motion (ROM)** is the amount of movement a joint can move in any of its possible directions, and is measured using a *goniometer* (Fig. 1-20). The anatomical position is the starting position for the measurement of joint ROM. Because

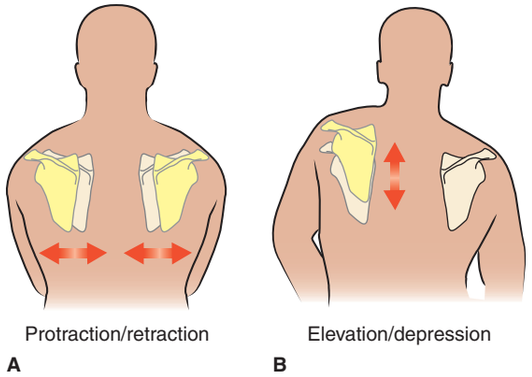

Figure 1-19. Shoulder girdle movements.

ROM is a measure of a "range," the measurement has starting and ending points, measured in degrees. The results of the measurement may also be given as the number of degrees moved. Norms for nonpathological joint ROM are published by several organizations and presented in professional publications. In this text, the ranges of motion are those published by the American Academy of Orthopaedic Surgeons (AAOS). The norms of each joint's ROM are included in this text within the chapter focusing on that joint.

For example, nonpathological elbow flexion is measured from the anatomical position of 0 degrees to 145 degrees of flexion, and the ROM is documented as "0 – 145." The amount of movement would be reported as 145 degrees. To avoid confusion of the degree sign "°" with the number "0" (zero), the degree sign is not used in documentation. In the presence of elbow pathology, when full elbow ROM is not present, the starting point of the ROM is documented as the number of degrees of flexion closest to the anatomical position, and the ending point of the ROM is documented as the endpoint of elbow flexion. For example, pathology where the elbow lacks 20 degrees of full extension and the full range of flexion is present, the ROM is recorded as 20 – 145 and the amount of movement is 125 degrees.

Measurements of movement of some regions of the body are measured using a tape measure or ruler. For example, flexion of the trunk when performing a toe-touch is measured by the distance from the floor to the fingertip of the third finger and recorded in inches (in) or centimeters (cm).

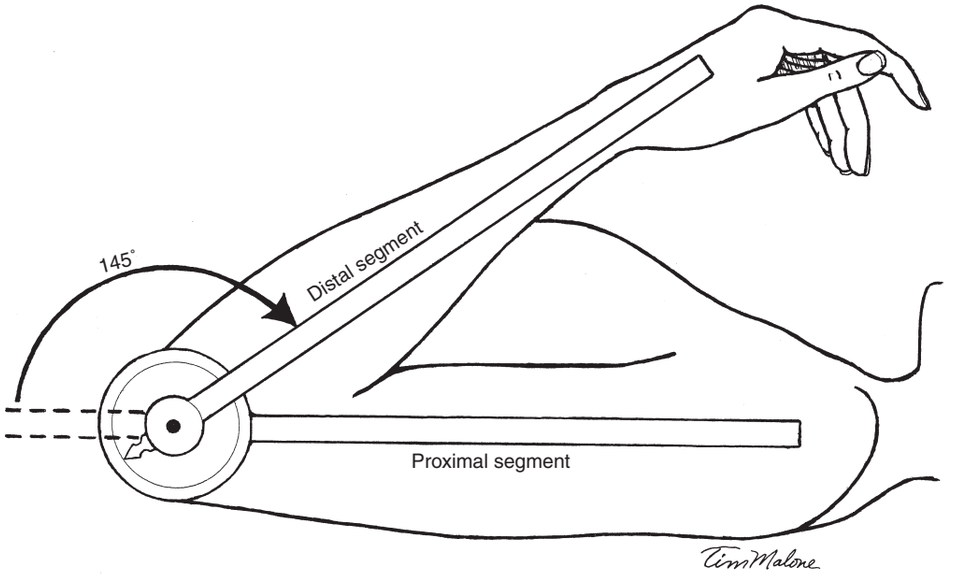

Figure 1-20. Goniometry. (From Norkin & White. Measurement of Joint Motion, 4E. Philadelphia, PA: F. A. Davis; 2009, with permission.)

Review Questions

1. Using anatomical descriptive terminology, complete the following:
   a. The sternum is _____ to the spine.
   b. The heel is on the _____ portion of the foot.
   c. The thigh is _____ to the pelvis and _____ to the leg.
   d. The shoulder girdle is _____ to the pelvis and _____ to the head.
2. Using the left hand to touch the:
   a. Left knee is using the _____ extremity.
   b. Right knee is using the _____ extremity.
3. Sitting in a chair with the feet supported while playing catch:
   a. The upper extremities are in a(n) _____ kinetic chain.
   b. The lower extremities are in a(n) _____ kinetic chain.
4. Osteokinematic movements occur within a plane and about an axis, and are described based on the _____ _____.
5. With few exceptions, osteokinematic movements, such as flexion, occur within the same plane about the same axis at all joints.
   _____ True
   _____ False
6. Which osteokinematic movement(s) occur(s) within the following planes?
   a. Sagittal plane: _____
   b. Frontal plane: _____
   c. Horizontal plane: _____
7. A joint that can flex/extend, abduct/adduct, and rotate has _____ degrees of freedom.
8. When rising from a sitting position, the hip and knee are performing:
   a. The osteokinematic movement of _____.
   b. Within the _____plane.
   c. About the _____ axis.
   d. A(n) _____ kinetic chain activity.

Review Questions—cont'd

9. Lying supine, position the arms so they form a right angle with the trunk. The osteokinematic movement performed to achieve this position of the shoulder is _____.

10. Often, several terms can be used to describe the same thing. Match the following terms.

____ Posterior and anterior	A. Proximal and distal
____ Superior and inferior	B. Internal rotation
____ Medial rotation	C. Head and tail
____ Cranial and caudal	D. Dorsal and ventral