DISPLAY 22-3

# Planar Motion

## General Principles of Planar Motion

- Joint motion occurs perpendicular to an axis.
- Joint motion is often described by the cardinal plane in which it occurs.
- The three cardinal planes are frontal, sagittal, and transverse.
- An axis that lies in two planes will give rise to a single plane motion in the third plane.

## Planar Motion of the Ankle and Foot

- In the foot and ankle, an axis that lies in the frontal and transverse plane gives rise to plantar flexion and dorsiflexion in the sagittal plane.
- An axis falling in the sagittal and transverse planes gives rise to inversion and eversion in the frontal plane.
- An axis running in the frontal and sagittal planes gives rise to abduction and adduction in the transverse plane.
- An axis that obliquely crosses the three cardinal planes gives rise to motion in all three planes, or triplane motion.

## General Principles of Triplane Motion

- Triplane motion is often described by the component motions from each cardinal plane.
- The angulation or pitch of an axis determines the amount of each component motion.
- A triplane axis that is pitched evenly across all three planes gives rise to motion with equal components from each plane.
- If the axis is pitched closer to one plane, there is a larger or dominant component motion. For example, if a triplane axis lies close to the sagittal plane, the dominant component motion is inversion or eversion. Abduction or adduction and plantar flexion or dorsiflexion are less significant.

## Triplane Motion of the Ankle and Foot

- Motion at the talocrural, subtalar, and midtarsal joints occur around triplane axes.
- These axes run from a posterior lateral plantar position to an anterior medial dorsal position.
- Triplane motion at the foot and ankle that occurs around an axis in the previously described angulation is called pronation and supination.
- Pronation is movement in the direction of eversion, abduction, and dorsiflexion.
- Supination is movement toward inversion, adduction, and plantar flexion.
- The axis of each joint has a different pitch and therefore has different degrees of component motions from the cardinal planes.
- Triplane motion at the foot and ankle during open chain motion is readily apparent by observing the plantar surface of the forefoot.
- During closed kinetic chain function, weight-bearing forces provide some element of distal fixation, which limits motion distal to the axis and promotes motion above the joint axis.
- Triplane motion under load is less apparent because of the motion occurring distal and proximal to the joint axis.
- It is important to understand triplane motion in the open and closed kinetic chain to duplicate the ideal biomechanics during range of motion exercise and functional retraining of the ankle and foot complex and its relationships to the talofibular, tibiofemoral, and hip joints.

Hall & Brody: Therapeutic Exercise: Moving Toward Function, 2nd Edition