Exercise Therapy

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Determinants of Gait

Learn and download pdf of determinants of gait and the factors that influence normal walking, joint movement, balance, energy efficiency and gait mechanics.

Definition

Determinants of gait are the specific movements and mechanisms of the pelvis and lower limbs during walking that help minimize excessive displacement of the body's centre of gravity, thereby producing a smooth and energy-efficient gait.

Determinants of the Gait are;

1. Pelvic rotation
2. Pelvic tilt (pelvic obliquity)
3. Knee flexion during stance
4. Ankle mechanism
5. Foot mechanism
6. Lateral displacement of the pelvis

Overall Function of the Determinants of Gait

The six determinants work together rather than independently. Their combined effect is to reduce excessive vertical and lateral displacement of the body's center of gravity. Pelvic rotation, pelvic tilt, stance-phase knee flexion, ankle movement, foot mechanisms, and lateral pelvic displacement allow the body to progress forward with relatively small fluctuations in the center of gravity. Therefore, the determinants of gait contribute to a gait pattern that is smooth, stable, efficient, and energy conserving.

1. Pelvic Rotation

During normal walking, the pelvis rotates forward approximately 4° of rotation occurs in each direction, giving a total excursion of about 8°.

When the pelvis rotates forward during the swing phase, the advancing limb is effectively lengthened. This reduces the amount of upward movement required by the body's center of gravity.

Pelvic rotation therefore helps reduce vertical displacement of the center of gravity and contributes to a smoother gait.

2. Pelvic Tilt

Pelvic tilt, also called pelvic obliquity, refers to the lowering of the pelvis on the side of the swinging limb during single-limb support.

During the first part of the stance phase, the pelvis drops slightly on the opposite side. This lowers the position of the body's center of gravity and reduces its upward displacement.

The movement is controlled mainly by the hip abductors of the supporting limb.

3. Knee Flexion during Stance

During normal gait, the knee flexes approximately 15° during the early stance phase after initial contact.
This flexion shortens the functional length of the supporting limb and prevents excessive elevation of the body's center of gravity. It also helps absorb shock following foot contact with the ground. The knee subsequently extends during midstance and then flexes again during the terminal stance and swing phases.
Thus, controlled knee flexion during stance contributes to smooth progression of the body and reduces vertical displacement.

4. Ankle Mechanism
After the foot becomes flat on the ground, the tibia progresses forward over the supporting foot as the ankle moves into dorsiflexion.
During midstance, controlled dorsiflexion allows the body to move smoothly forward over the foot. The ankle subsequently moves toward plantar flexion during terminal stance as the heel rises.
The ankle mechanism helps control the movement of the body's center of gravity and contributes to forward progression.

5. Foot Mechanism
The foot acts as an important mechanism for controlling the effective length of the lower limb during gait.
At initial contact, the heel contacts the ground and the foot gradually moves toward the floor. Later in stance, the heel rises and the body progresses over the forefoot.
The heel rocker, ankle rocker, and forefoot rocker allow the body to move smoothly over the supporting foot. These mechanisms help reduce abrupt changes in the height of the center of gravity and facilitate forward progression.

6. Lateral Displacement of the Pelvis
During walking, the body's center of gravity must move from one supporting limb to the other. Therefore, a small amount of lateral displacement occurs. The pelvis shifts toward the side of the supporting limb, bringing the body's center of gravity closer to the line of support. This reduces the amount of muscular effort required to maintain balance.
The amount of lateral displacement is influenced by factors such as the width of the base of support, the alignment of the lower limbs, and the angle of the femoral neck.

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