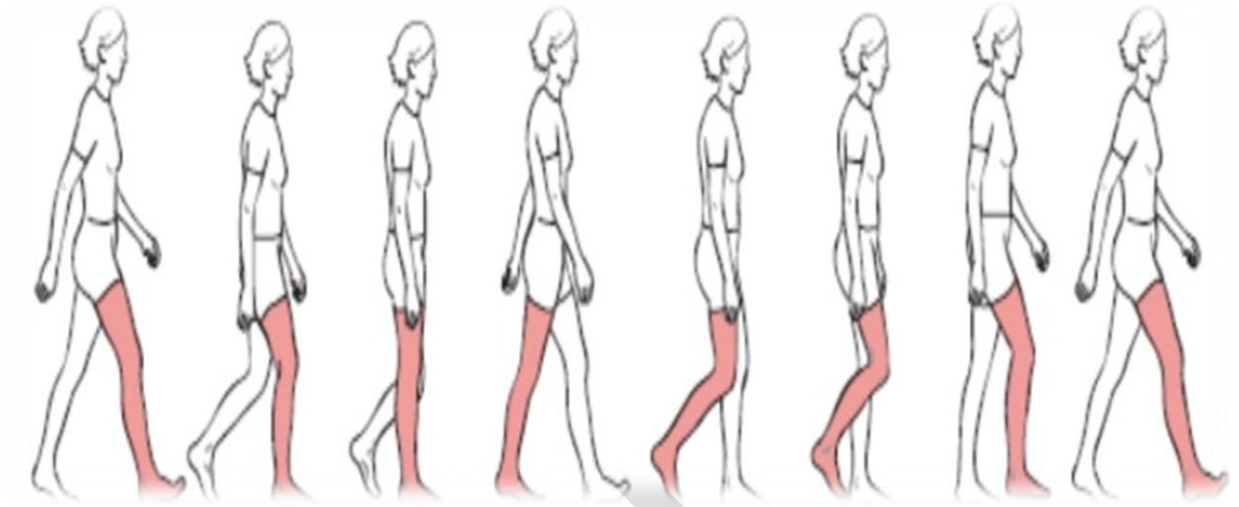
NORMAL GAIT

FUNDAMENTALS OF BIOMECHANICS & EXERCISE THERAPY:-



Index

- Definition of gait & normal gait
- Purpose of gait
- Prerequisites of gait
- Gait cycle
- Events in gait cycle
- Gait terminology
- Factors affecting gait
- Joint motion in 3 planes
- Gait analysis

DEFINITION:-

- Human gait may be **define as** " the translatory progression of the human body as a whole, produced by coordinated, rotatory movements of the body segments" is known as gait or human locomotion
- **Gait** is the medical term to describe human locomotion, or the way that we walk.
- Every individual has a unique gait pattern.

Normal Gait:-

Series of rhythmical, alternating movements of the trunk & limbs which result in the forward progression of the center of gravity & the body.

Fundamental Purposes of gait:-

- Support of the HAT.
- Maintenance of upright posture & balance of the body.
- Achieve safe ground clearance & a gentle heel or toe landing.
- Generation of mechanical energy to maintain the present forward velocity or to increase the forward velocity.
- Absorption of mechanical energy for shock absorption & stability or to decrease the forward velocity of the body.

Prerequisites of gait:-

There are (4) major criteria essential to walking.

- **Equilibrium**:
  The ability to assume an upright posture and maintain balance.

- **Locomotion**:
  The ability to initiate and maintain rhythmic stepping

- **Musculoskeletal Integrity:**
  Normal bone, joint, and muscle function

- **Neurological Control**:
  Must receive and send messages telling the body how and when to move. (visual, vestibular, auditory, sensori-motor input)
- **Forces for gait:**

  Muscular force.

  Gravitational force.

  Forces of momentum.

  Floor reaction force.

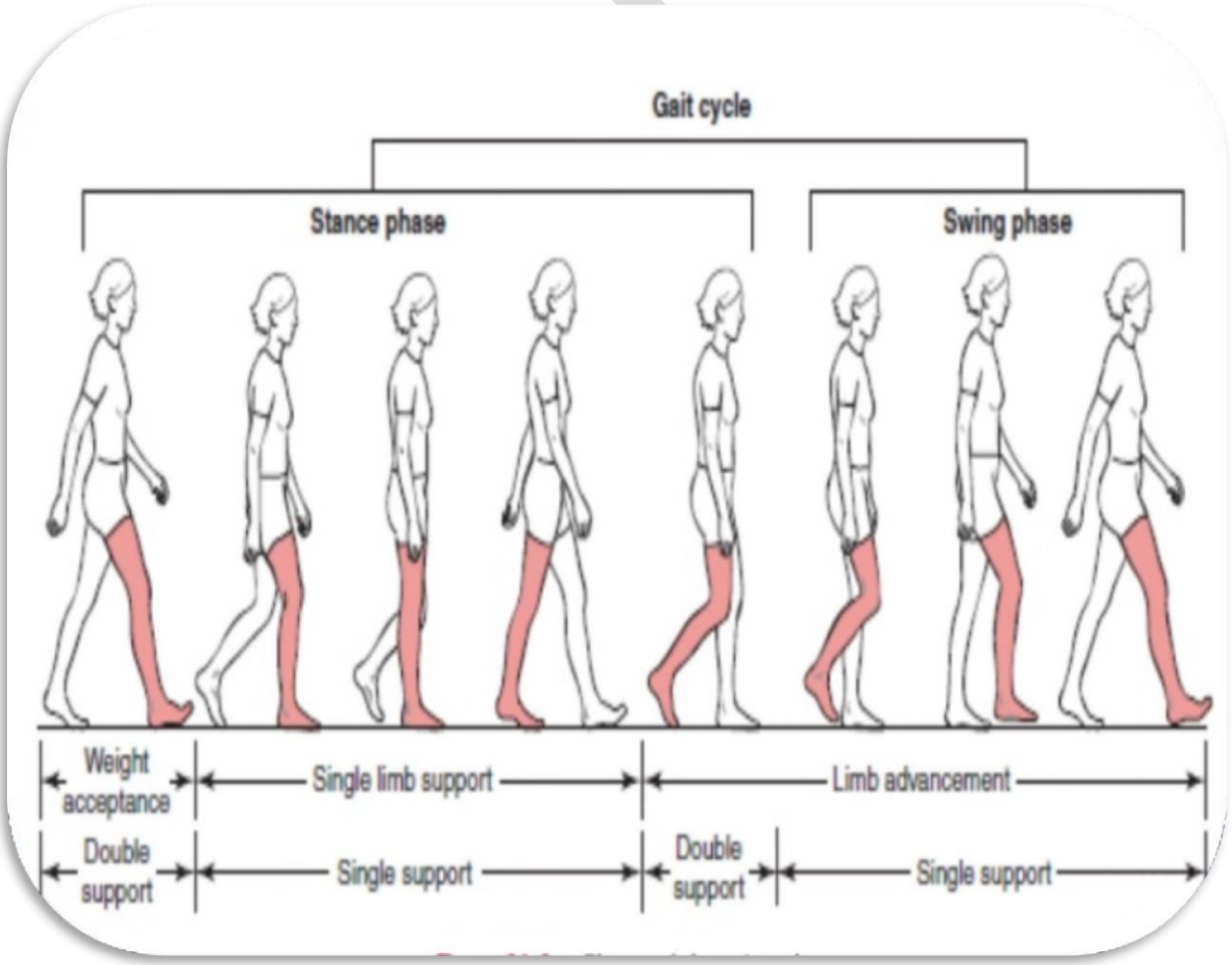
Gait cycle

- Describe the complex activity of walking, or our gait pattern.
- This cycle describes the motions from initial placement of the supporting heel on the ground to when the same heel contacts the ground for a second time.
- **Defined** as the period of time from one heel strike to the next heel strike of the same limb.
- Gait Cycle =
  – Single sequence of functions by one limb
  – Begins when reference foot contacts the ground
  – Ends with subsequent floor contact of the same foot on the ground.

One gait cycle consists of two phases

1) STANCE PHASE (60%)

2) SWING PHASE (40%)



EVENTS IN STANCE PHASE:-

- Heel strike
- Foot flat
- Mid-stance
- Heel off
- Toe off

EVENTS IN SWING PHASE:-

- **Acceleration**
- **Mid swing**
- **Deceleration**

The five subphases of stance phase.

A. Stance phase:

1. **Heel contact**: 'Initial contact'
2. **Foot-flat**: 'Loading response', initial contact of forefoot w. ground
3. **Midstance**: greater trochanter in alignment w. vertical bisector of foot
4. **Heel-off**: 'Terminal stance'
5. **Toe-off**: 'Pre-swing'

The three subphases of swing phase.

B. Swing phase:

1. **Acceleration**: 'Initial swing'
2. **Midswing**: Swinging limb overtakes the limb in stance
3. **Deceleration**: 'Terminal swing'

Stance Phase:-

- Heel strike phase:

Begins with initial contact & ends with foot flat

It is beginning of the stance phase when the heel contacts the ground.

- Foot flat:

It occurs immediately following heel strike

It is the point at which the foot fully contacts the floor

- Mid stance:

It is the point at which the body passes directly over the supporting extremity.

- Heel off:

The point following mid-stance at which time the heel of the reference extremity leaves the ground.

- Toe off:

The point following heel off when only the toe of the reference extremity is in contact with the ground.

Swing Phase:-

- **Acceleration phase**:

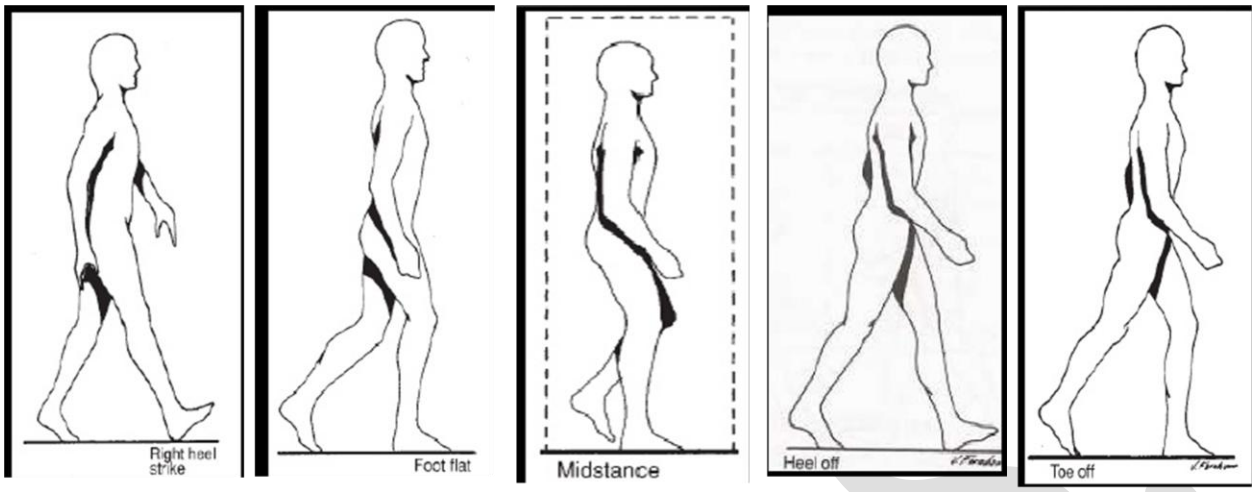
It begins once the toe leaves the ground & continues until mid- swing, or the point at which the swinging extremity is directly under the body.

- **Mid-swing:**

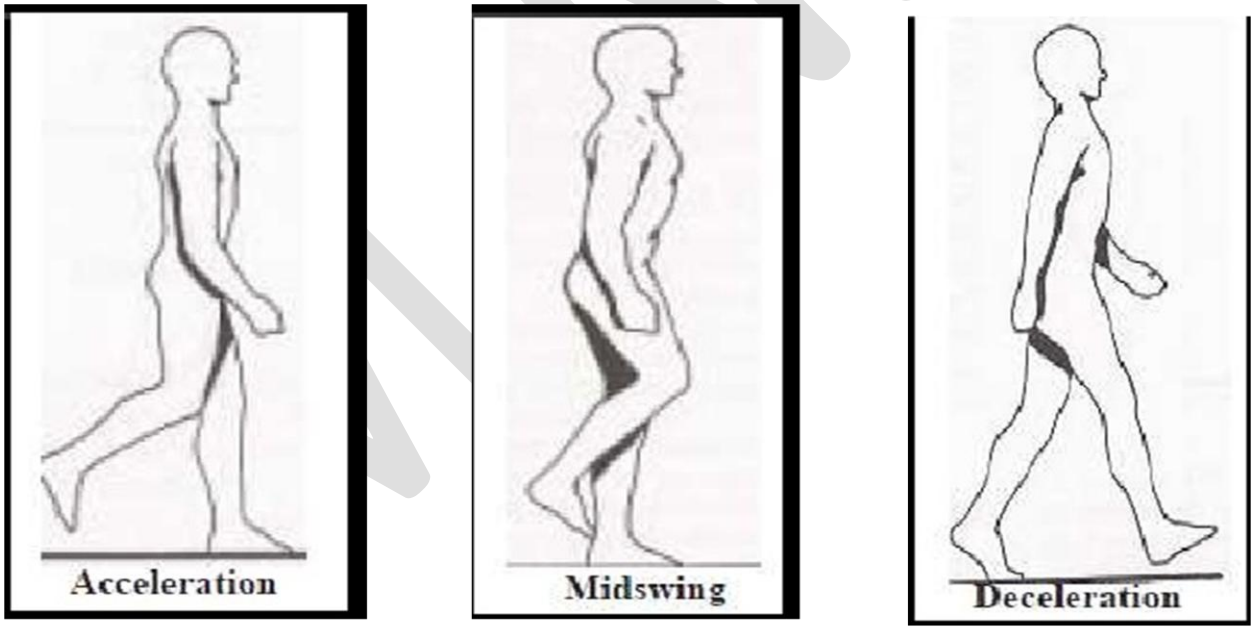
It occurs approx when the extremity passes directly beneath the body, or from the end of acceleration to the beginning of deceleration

- **Deceleration:**

It occurs after mid-swing when limb is decelerating in preparation for heel strike.



STANCE PHASE



SWING PHASE

GAIT TERMINOLOGIES

Temporal Variable

- **Stance time**
- **Single limb & double limb time**
- **Swing time**
- **Stride & Step time**
- **Cadence**
- **Walking Speed**

Distance Variable

- **Stride length**
- **Step length**
- **Step Width**
- **Degree of toe-out**

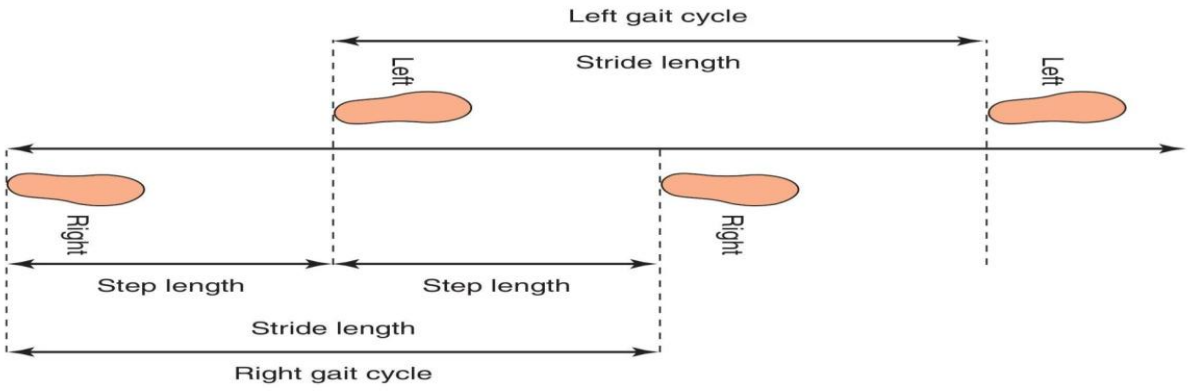


Figure 22-1. Gait cycle terminology. A right and left step make up a gait cycle (also called *stride*).