Walking and Running Gait

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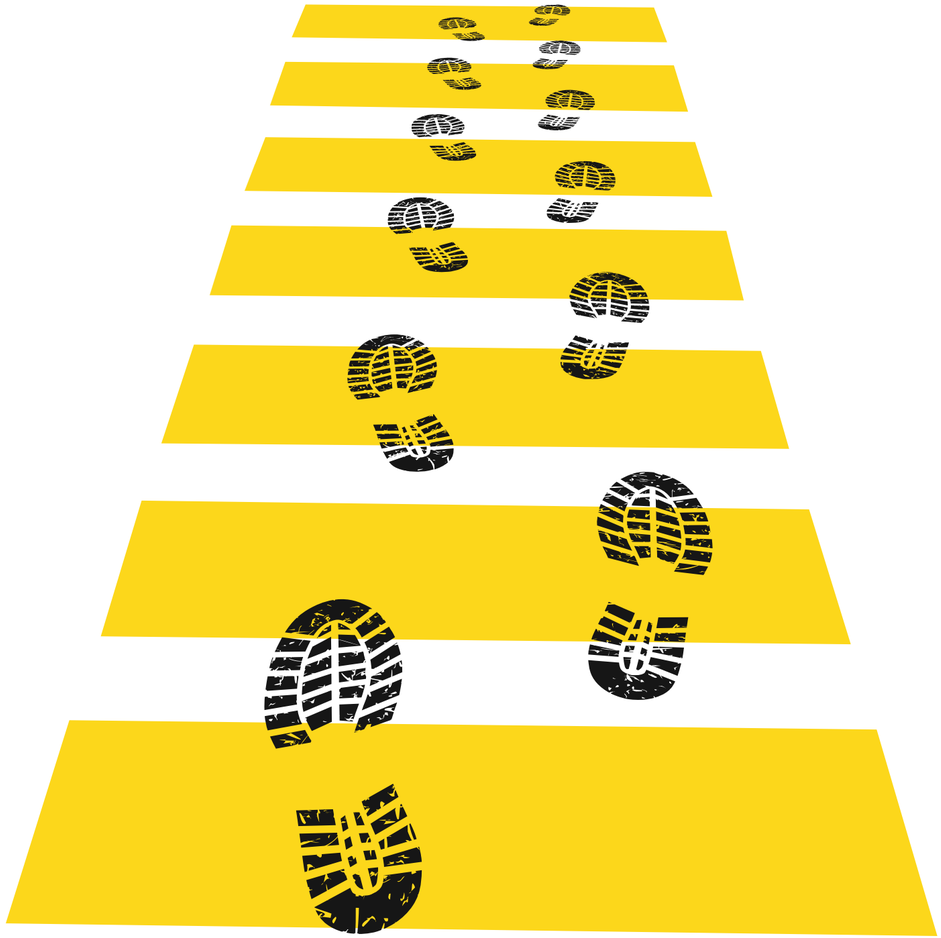

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What is Gait?

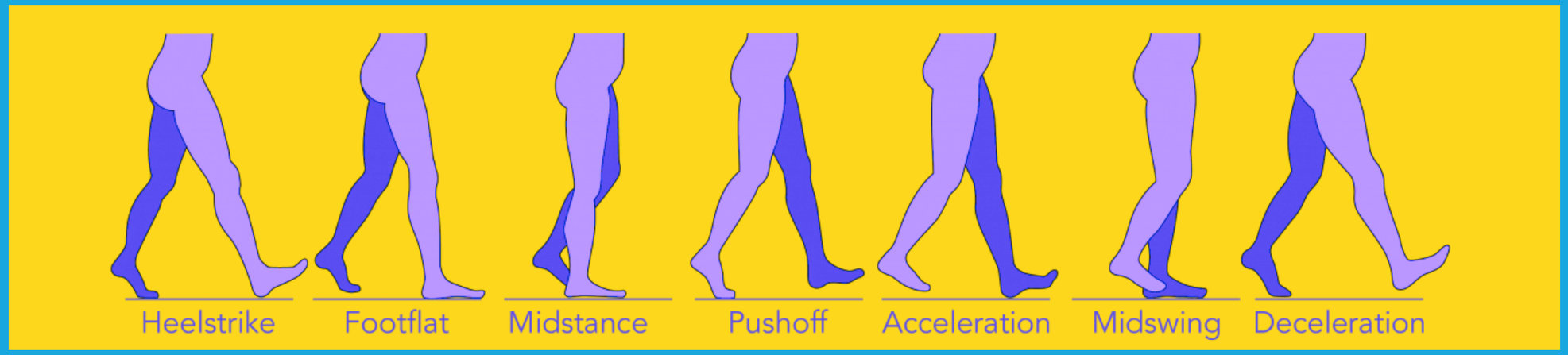
Definition

The rhythmic, alternating movement of the trunk and limbs that results in the forward progression of the body.

The Gait Cycle

The gait cycle begins when one foot hits the ground and ends when that same foot strikes the ground again.

1 gait cycle = 1 stride = 2 steps



Muscle Function in Gait

Concentric

Muscles used to accelerate limbs

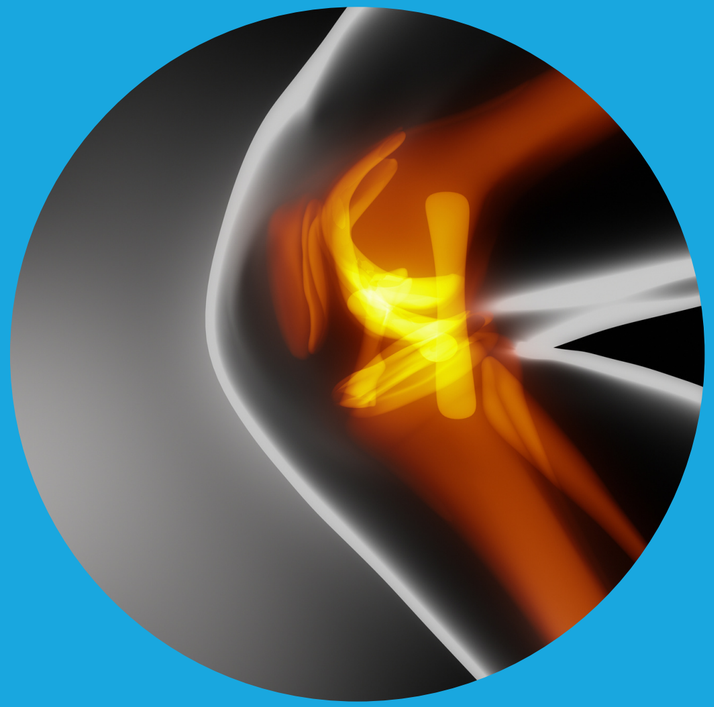
Eccentric

Muscles used to slow down, limit, and decelerate movements

Isometric

Muscles that resist load in stance

Eccentric Actions



Muscles that lengthen to slow down movement at a joint.

Examples:

- Quads limiting knee flexion after taking a step
- Hamstrings decelerating hip flexion during the end of the swing phase

Isometric Actions

Muscles that keep us stable during stance phases.

Example:

- Gluteus medius keeping the hips in line when standing on one leg

Trendelenburg gait: Abnormal gait categorized by hip dropping due to weak gluteus medius and minimus muscles.

Concentric Actions

Muscles that shorten to accelerate limb segments.

Examples:

- Hip flexors accelerating hip flexion during swing phases
- Quads and plantar flexors accelerating knee and ankle into extension

4 Properties of Normal Gait

Stability in Stance

Propulsion and Progression

Shock Absorption

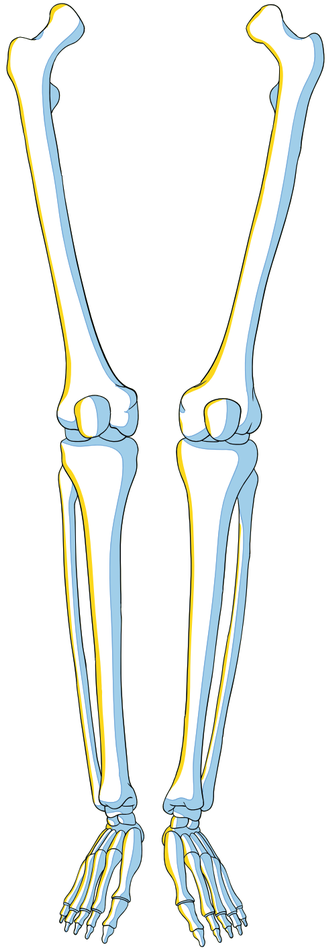
Energy Conservation

Stability in Stance

Muscles work to maintain joint integrity and position. We need the controlling forces of our muscles to limit extraneous movement that can damage our joints.

Keeping stability in stance is difficult:

- Our bodies are top-heavy
- The lower limbs are long, multi-segmented, and have round edges



Propulsion and Progression

Forward progression of the body results from the following:

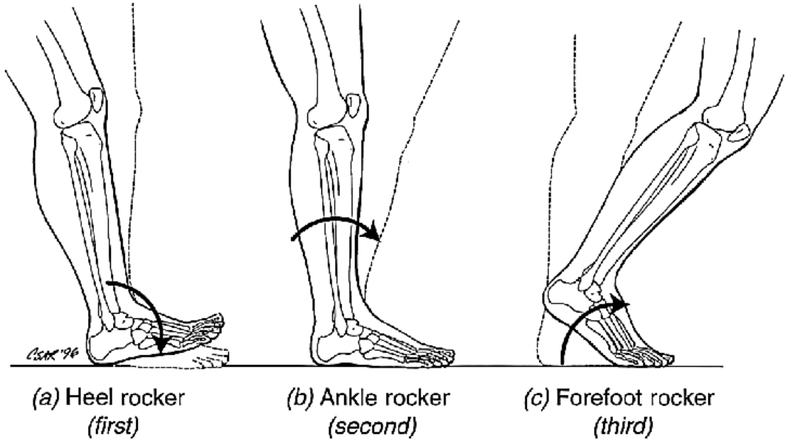
- Free falling due to gravity
  - Walking is like “controlled falling;” our body is falling from a higher point to a lower point in order to progress
- Stance limb mobility
  - The flexibility of the ankle allows for propulsion
- Forward swing of the opposite leg
  - Contractions of the muscles that accelerate the swinging leg

Shock Absorption

Walking and running results in an abrupt weight transfer at the hip, knee, and ankle.

How do we deal with this?

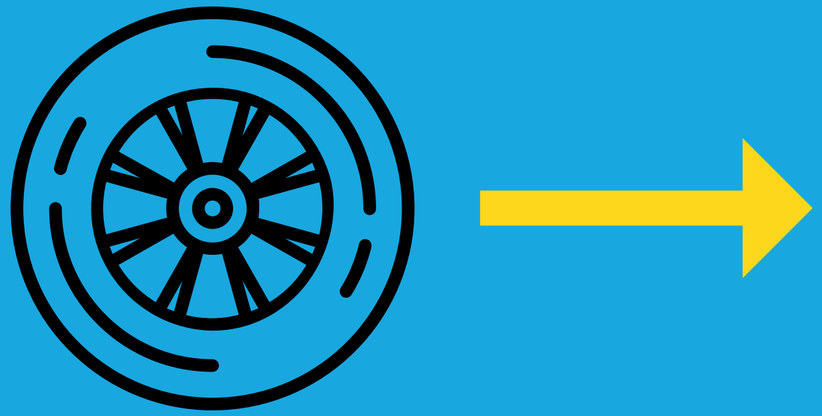
- Muscles contracting to control movement.
- Compensating for these forces by performing joint actions during gait, such as adduction at the hip and plantarflexion at the ankle.



Energy Conservation

The goal of efficient gait is to minimize the movement of the center of mass (COM) while still moving forward.

Why is the wheel so efficient? It's COM stays consistent!



The goal of efficiency is why our pelvis and joints move to minimize our vertical movement.

Walking vs Running Gait

The biggest difference between walking and running gait:

The double support phase you have in walking is eliminated and replaced with a floating, no support phase in running.

Double Support Phase (DS)

Floating No Support Phase

Improving Your Gait

Balance and Gait Training

Goals:

- Increasing strength
  - Training postural muscles for stability
  - Resistance exercises
- Increasing range of motion
  - Training flexibility of the joints
  - Stretching
- Improving balance and coordination
  - Challenging balance and motor skills

Aging adults can especially benefit from these as we start to slow down and become less efficient and stable with respect to gait.

Effect of Shoes on Gait

What the research says:

- Continuous use of footwear has been known to influence foot structure and thus affects foot position and mechanics.
- Walking barefoot allows for more foot spreading. People who walk barefoot frequently have shown to have a reduced stride length and increased cadence (step frequency).
- Footwear directly affects instantaneous load rate. Minimalistic shoes were seen to lower the load rate when compared to a standard shoe.

Thank you!

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References

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