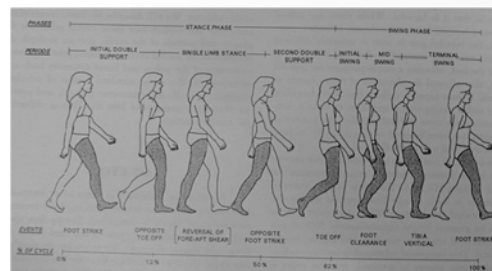


BIOMECHANICS OF THE FOOT AND ANKLE

an overview

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The Gait Cycle

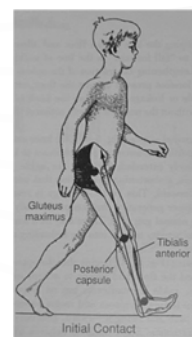


Muscle Activity

- Important to attach to gait events – often the cause of pathology

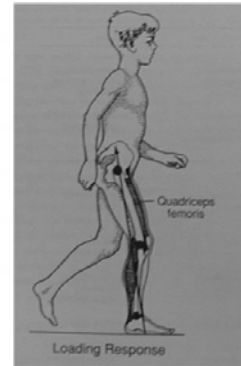
Heel Strike

- Bring foot slowly down
- Decelerate the limb
- Absorb the blow of heel strike
- Anterior Tibialis (eccentric)
- Hip Extensors contract eccentrically
- Hamstrings contract



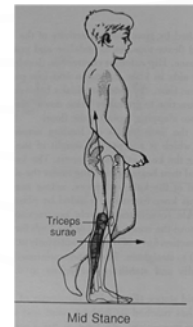
Loading Response

- Accept weight
- Counteract Fall of Pelvis
- Decelerate the Limb
- Quadriceps
- Hip Abductors
- Gastrosoleus



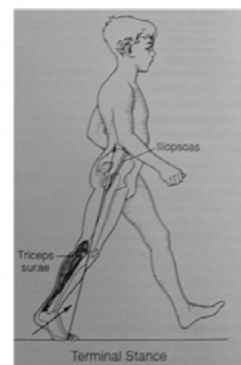
Mid Stance

- Stabilize Knee
- Gastrosoleus



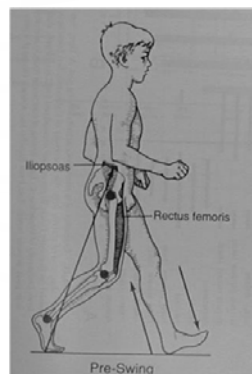
Terminal Stance

- Accelerate Mass
- Gastrosoleus



Pre Swing

- Begin accelerating proximal leg forward
- Hip flexors – psoas, rectus
- Let other leg take the weight
- Gastrosoleus goes quiet *immediately* after opposite heel strike

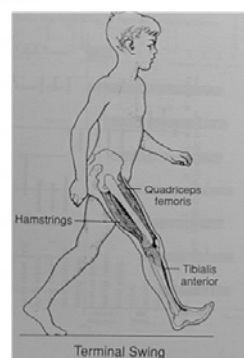


Mid Swing

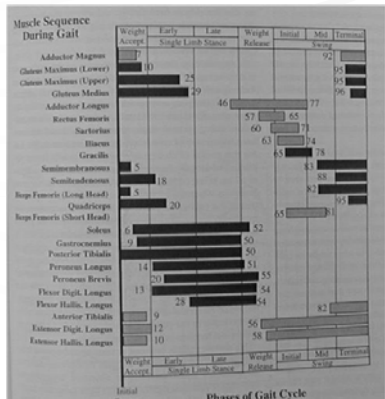
- Clear foot
- Ankle Dorsiflexors

Terminal Swing

- Decelerate leg
- Hamstrings and Gluteus Maximus
- Position foot
- Anterior Tibialis
- Prepare for weight acceptance
- Quadriceps



Composite Picture of Motor Function



Key Points

- Gait cycle consists of 60% stance, 40% swing
- Eccentric contraction of the anterior tibialis prevents foot slap after heel strike
- Anterior tibialis concentrically contracts to clear ground during swing

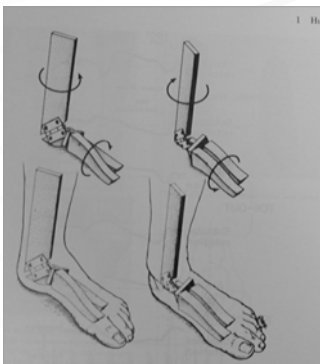
Key Points

- Gastrocnemius concentrically contracts to propel forward after heel off
- Gastrocnemius eccentrically contracts to decelerate the mass and accept weight just after heel strike

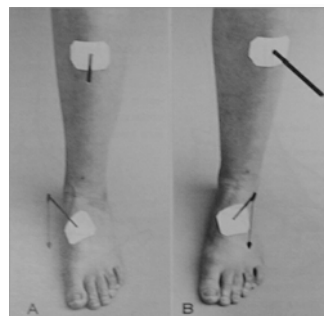
The foot is designed to passively use rotations of the pelvis and tibia above it to its own design

The subtalar joint is the key

- It provides an articulation whose axis is between the plane of the floor and the plane of the leg.



Internal rotation of the tibia causes pronation, External rotation causes supination



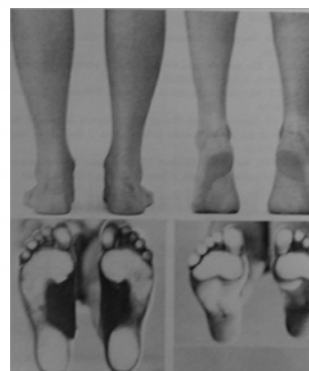
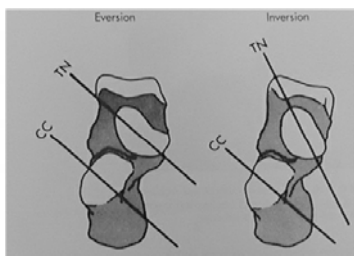
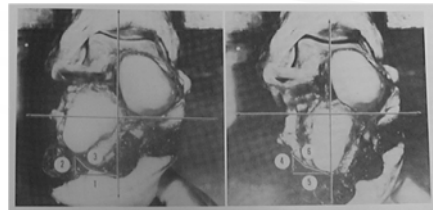
The Normal Function of the Posterior Tibial Tendon

The Foot Normally “Locks and Unlocks” During Gait

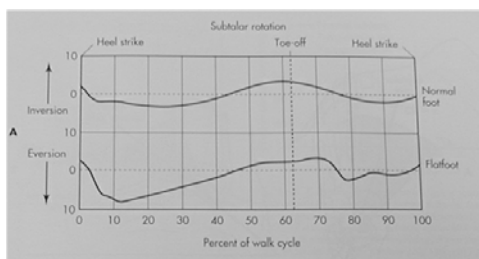
Think of the Talus as a fulcrum around which the remainder of the foot rotates

This occurs through the subtalar and the transverse tarsal joints

- The posterior tibial tendon inverts the hindfoot by pulling on the navicular
- The anterior process lines up under the talar head. The talar head cannot “drop” and the arch is locked.



Inversion and Eversion During the Gait Cycle



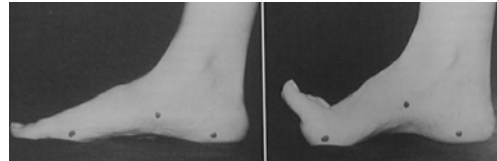
Center of Pressure

- At heel strike – on the heel
- Rapidly moves forward to the forefoot during stance
- Remains on the 2nd metatarsal head for 30 – 55% of stance phase in normal conditions

The Second Metatarsal is therefore the most vulnerable to overload conditions.

Other Passive Factors Aiding the Arch

Windlass Mechanism



Disruption of the Windlass Mechanism

- Occurs in hallux valgus, severe pes planus
- Helps lead to transfer metatarsalgia