

Pathologic Gait

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Overview: etiology of pathologic gait deviations

- Compensation of gait:
 - Muscle weakness
 - Pain
 - Soft tissue injury
 - Bony injury
 - Neurologic dysfunction

History and Physical Exam

- History

- Congenital
- Acquired
- Degenerative

- Examination

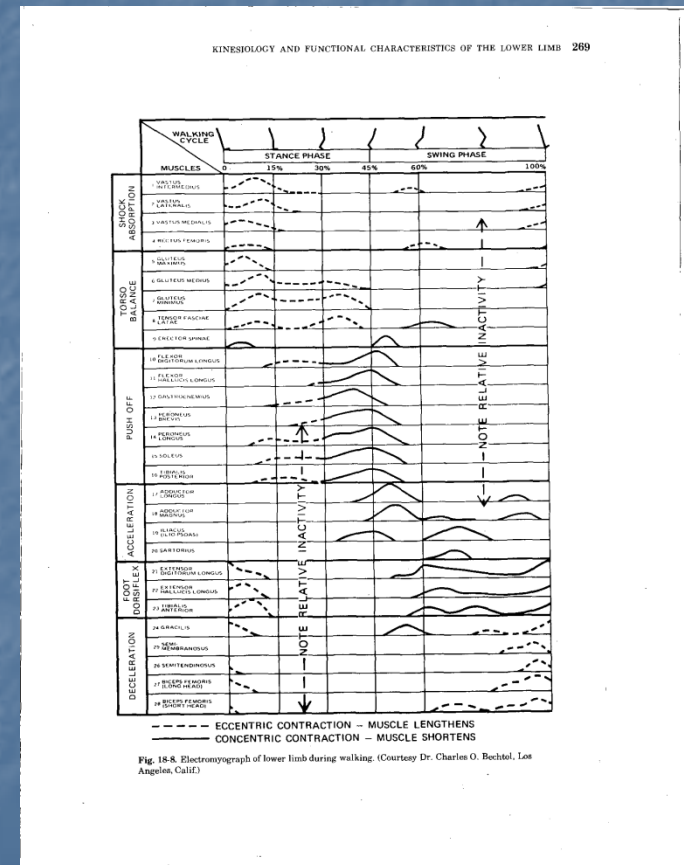
- Musculoskeletal
 - ROM
 - Joint
 - Soft tissue
 - Muscle
 - Connective tissue
 - Bone

- Neurologic

- General
- Focal
- Paralysis
 - Spastic
 - Flaccid
- Sensation
 - Pain
 - Light touch
 - Proprioception
- Balance
 - Central
 - Vestibular
 - Visual

Motor Control

- Recruitment
 - Timing
 - Quantity
- "Derecruitment"
 - Timing
 - Quantity



Other Factors

- Cardiac
- Pulmonary
- Fatigue

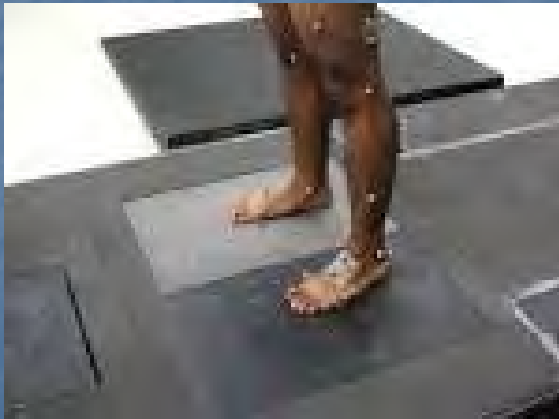
Gait Analysis

- Kinematics
 - Temporal and spatial joint/limb movement
 - Qualitative
 - Observational gait analysis
 - Quantitative
- https://www.youtube.com/watch?v=-WnLC-yJBwo&feature=player_embedded

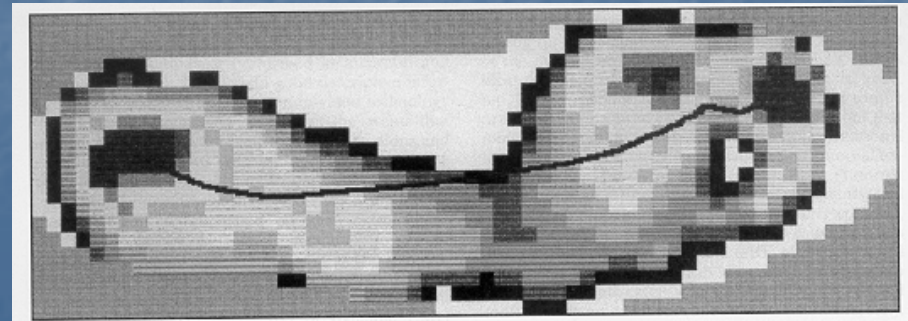
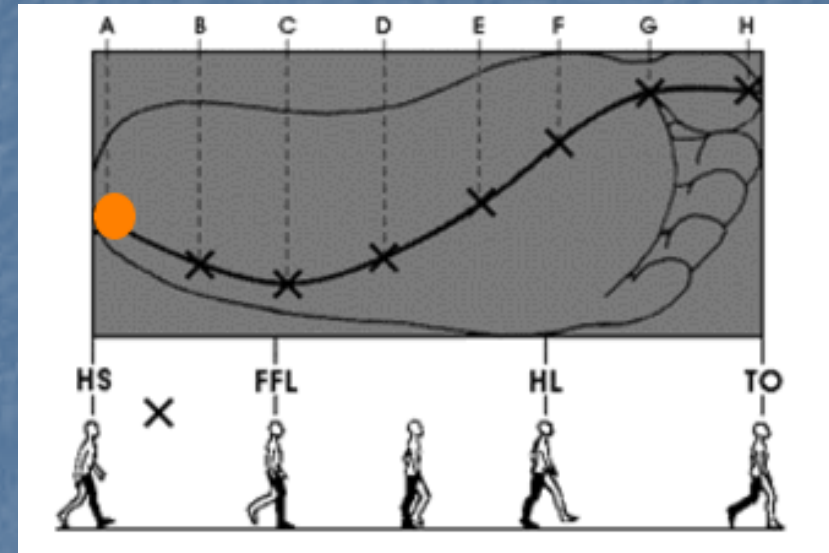
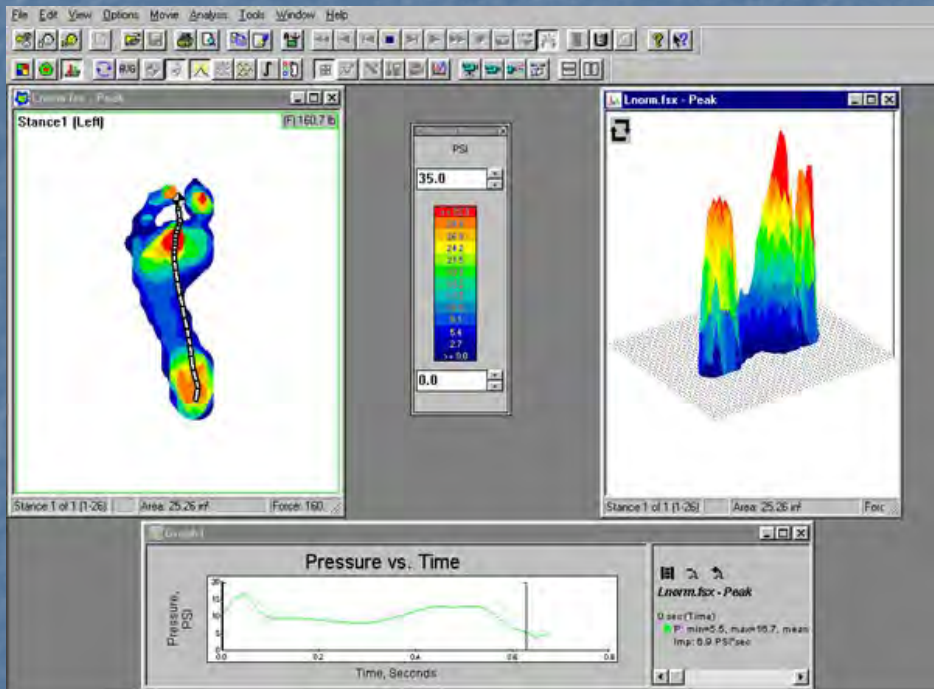


Gait Analysis

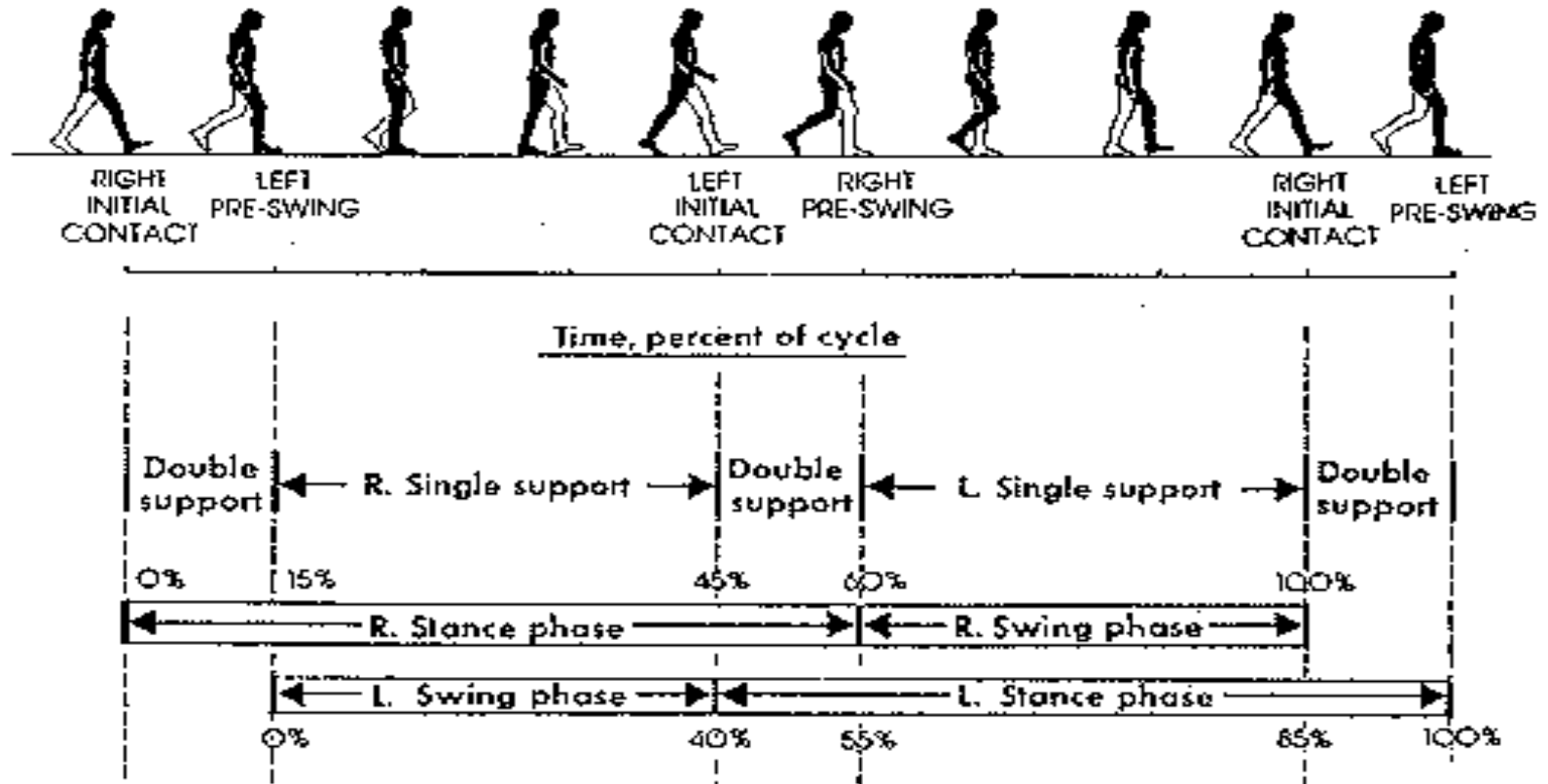
- Kinetics
 - Forces/torques that produce joint/limb movement



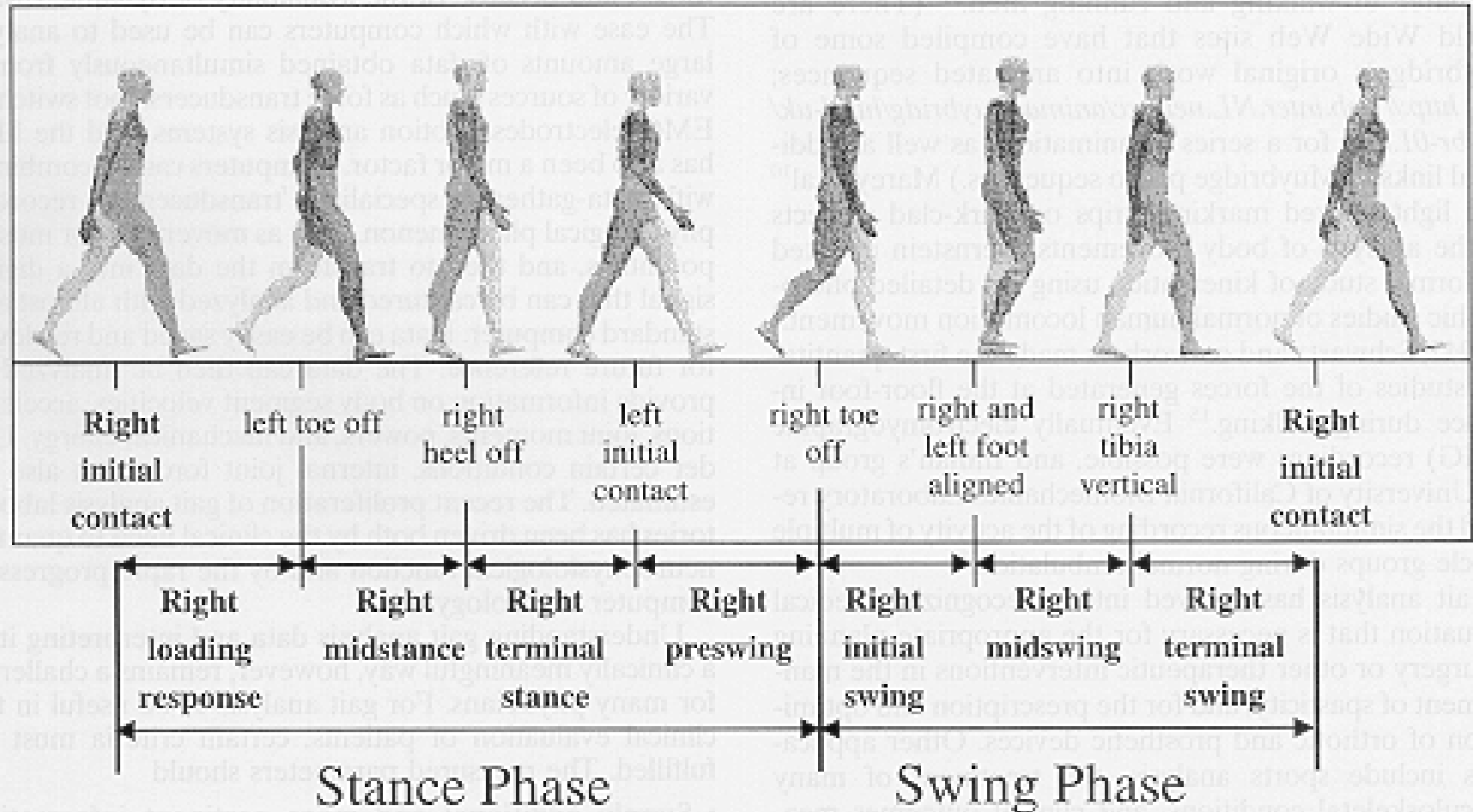
Summary of Pressures during Stance Phase



Normal Gait



Normal Gait



Hip ROM during normal gait cycle

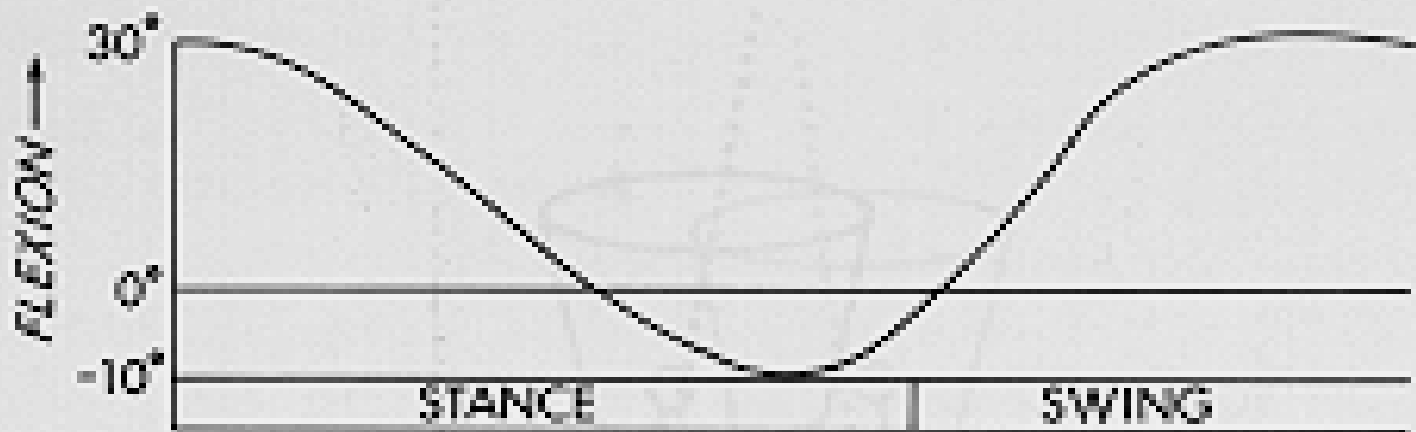


FIG 13-8.

Hip motion involves only 1 arc of flexion and 1 arc of extension. (Adapted from Perry J: *Clin Orthop* 1974; 102:18.)

Knee ROM during normal gait cycle

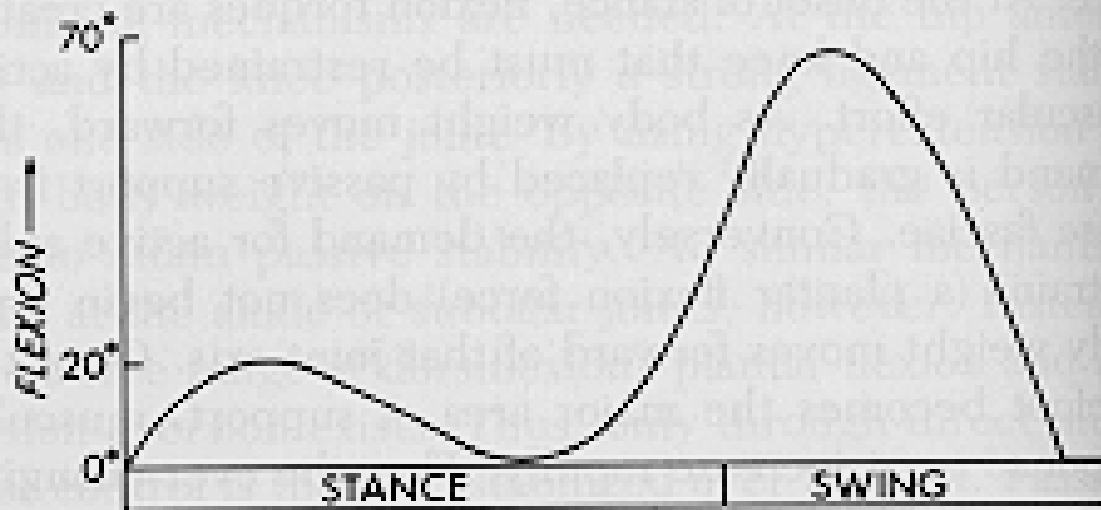


FIG 13-7.

The knee attains 35 degrees of flexion by the end of stance. Peak flexion is reached in the first third of swing while the limb is in a trailing position. (Adapted from Perry J: Clin Orthop 1974; 102:18.)

Ankle ROM during normal gait cycle



FIG 13–6.

Ankle motion during the gait cycle ranges from 10 degrees of dorsiflexion to 20 degrees of plantar flexion. (Adapted from Perry J: *Clin Orthop* 1974; 102:18.)

Ankle dorsiflexor weakness/paralysis

- Loading phase “foot slap”
- Footdrop (toe drag) in swing phase
- Excessive swing phase hip/knee flexion

- Ex. Fibular (peroneal) nerve palsy affecting anterior tibialis function

Ankle plantarflexor weakness/paralysis

- Uncontrolled ankle rotation during loading response to midstance
- Uncontrolled heel and toe off in terminal stance and preswing
- Loss of "propulsion" with an appearance of dropoff in latter stance phase
- Ex. Tibial nerve palsy affects gastrosoleus function

Quadriceps weakness/paralysis

- Affects all phases of gait
- Knee extension at initial contact
- 15-20 degrees knee flexion at midstance--loss of control of knee flexion in loading phase
- Loss of knee extension at terminal stance
- Loss of knee extension at terminal swing
- Ex. Femoral neuropathy

Hamstrings weakness/paralysis

- Uncontrolled knee extension and hip flexion—terminal swing
- Uncontrolled swing phase limb deceleration—loss of eccentric hamstrings contraction
- Harsh initial contact
- Difficulty placing the swing limb for initial contact
- Ex. Sciatic neuropathy

Hip extensor weakness/paralysis

- Gluteus maximus—loss of eccentric hip extension control in loading response
- Sudden posterior thrust of trunk after initial contact
- Ex. Inferior gluteal nerve palsy

Hip flexor weakness/paralysis

- Iliopsoas—loss of hip flexion in early swing phase
- Ex. Femoral neuropathy, lumbosacral plexopathy

Hip abductor weakness/paralysis

- Gluteus medius—"dropping" of the pelvis on the affected side in loading and midstance, resulting in trendelenburg gait
- Ex. Superior gluteal neuropathy, myopathy

Ataxia

- Impaired balance
 - Lack of motor coordination
 - Widened base of support
 - Variable step length
 - Associated movements are exaggerated (lurch, stagger)
 - Watches feet
-
- Ex. Brainstem CVA, olivopontocerebellar atrophy, Friedreich's ataxia

Parkinsons/Parkinsonism

- Poor posture
 - Short step length
 - Shuffling
 - Lack of associated movements (reciprocating)
 - Festination
-
- Ex. Parkinsons disease

Hemiplegia

- Synergy
 - Upper limb flexor
 - Lower limb extensor
 - Ex. CVA, TBI, MS, CP
- Spasticity
 - Velocity-dependent increase in resistance to muscle stretch after upper motor neuron injury
 - Spastic dystonia

Hemiplegia

Upper extremity flexion synergy

- Scapular retraction and depression
- Shoulder internal rotation
- Shoulder adduction
- Forearm pronation
- Elbow flexion
- Wrist flexion
- Finger flexion



Hemiplegia

Lower extremity extension synergy

- Pelvic elevation
- Hip extension, adduction, internal rotation
- Knee extension
- Ankle plantarflexion
- Foot inversion
- Toe plantarflexion
- Hallux extension



Hemiplegia

- Stance phase:
 - "slap"/equinovarus
 - Knee flexion/extension
 - Trendelenburg/extension
 - Hip flexion/extension
 - Toe drop off/clenching
- Swing phase:
 - Adductor swing
 - Circumduction
 - Toe drag
 - Sound limb vaulting

Equinus

- Ankle plantarflexion inversion spasticity
- Stance phase
 - Initial contact midfoot/forefoot
 - Weight bearing shifted laterally
- Swing phase
 - Toe drag
- Ex. CVA, TBI, MS, CP

Scissor

- Hip adductor spasticity
- Narrowed base of support
- Knee crosses midline--stance and swing
- Ex. Cerebral palsy

Antalgia

- Deviation dependent on pain location and severity
- Affected side—decreased stance phase
- Non-affected side—decreased step length

Antalgia

- Joint/bone:
 - Arthritis
 - Fracture
- Soft tissue injury
 - Bursitis
 - Tendonitis
 - Sprain/strain
 - Overuse
 - DOMS

