Today's Goal = Gain Information

- to gain some more global knowledge about human gait
  - assist in injury risk and management
  - expand the interpretation of a patient’s global presentation / disease / ailment
  - understand that what you “see” and what you clinically “find” are often 2 different things
  - more knowledge will help you understand the “Why’s” behind what you see
Gait Cycles

• We are dynamic machines moving over 2 tripods, sort of
• Loss of medial tripod is common
• The foot and the homunculus
• Is the foot where the asymmetries begin? R=L?
Impaired Forefoot Rocker
Using shoes to help rocker deficits

Changing foot progression to help rockers

Gait is all encompassing

- Gait control requires complete activation of the entire nervous system and musculoskeletal system
- Gait requires both postural and phasic systems
- Any movements, voluntary or involuntary require a postural framework from which the limbs move from/off of
Janda’s Layered Syndrome

- Tonic: tight
- Phasic: weak
- any movements, voluntary or involuntary require a postural framework from which the limbs move from/off of

Gait is all encompassing

- postural adjustments must anticipate the limb movements
- faulty postural programs/patterns will predict faulty limb (gait) movements
- Volitional and non-volitional movements (as in arm-leg motions in gait) always accompany adequate and appropriate postural system control. The postural planning for dynamic stability of the human must fit volitional, anticipatory and reactionary plans and adjustments. This requires an intact cerebral cortex, basal ganglia, cerebellum, brainstem and descending systems.

Movement Rules

1. When the foot is on the ground, the gluteal muscles are in charge
2. When the foot is off the ground, the abdominals are in charge

Thus, would it suffice to say then that we need balanced, asymmetrical, S.E.S. (skill, strength, endurance) in all 3 divisions of the glutes and all layers of the abdominals and their synergists to follow efficient locomotion?
3. Asymmetry is the rule though!

Kinematic stride cycle asymmetry is not associated with sprint performance and injury prevalence in athletic sprinters. [source: Source here]
Movement Rules

4. You must not cheat the CNS

- The power of compensation
- Repetitive movement patterns made in compensation to an injury or improper training techniques get recorded in your central nervous system, both in the cerebellum (the motor coordination center) and the parabrachial nucleus (the pattern generator in the brainstem).

*Example: when the toes go down, the arch should not follow the pattern*

The neuromechanical adaptations to Achilles tendinosis. Yu-Jen Cheng and Kornelia Kulig

Gait programs are variable

- principles of mobility and stability
- locomotion is based off varying degrees and times of automated programs, and intentional programs depending on environment, distractions, intent etc.
- distractions tap into executive function capacity

Step width variability, but not step length variability or step time variability, discriminates gait of healthy young and older adults during treadmill locomotion. Owings TM1, Grabiner MD.

Gait Neurology

- motor programs utilize one’s body “schema” which is preserved and updated in the temporoparietal cortex
- motor programs are transmitted to the brainstem by the cortico-reticulospinal system so that posture is anticipatorily controlled
- this enable the corticospinal system to generate limb trajectory and achieve accurate foot placement
Foot tripod restoration

• when the toes go down, the arch should not follow

Poll Question # 1

- Rhythmic arm and leg movements
- The lower limb runs the show
- Anti-phasic gait shown here
- Pain and phasic often go together
- How might ankle rocker or hallux pain impact this? Or affect arm swing?
- Why is internal hip rotation important?


Gait: automated control
Poll Question #2

We like to say, "the load is going to go somewhere", the body will adapt. The problem is, we believe the body often looks for the easiest opportunity, not often the best one.

The body does not have the foresight to anticipate the consequences of its choices in the future. As long as the adaptation is not immediately painful, the choice often seems reasonable and thus is implemented.

The effects of gluteus maximus and abductor hallucis strengthening exercises for four weeks on navicular drop and lower extremity muscle activity during gait with flatfoot
Young-Mi Goo, MS, PT,1 Tae-Ho Kim, PhD, PT,1,* and Jin-Yong Lim, MS, PT,1 J Phys Ther Sci. 2016 Mar; 28(3): 911–915.

Trendeleburg gait

Trendelenburg video case
Foot Drop

• Foot drop video case
• foot targeting changes
• step width, length
• postural control

Improper Forefoot loading video

• - Shuffle walk skill
• - anterior compartment S.E.S.
• - knee and hip flexion can occur if pattern is wrong

Right calf tight video

• Ankle rocker screen
• - foam roller under knees
• - calf tight?
Hip flexor gait

- Trampoline ankle Fx
- knee hyperextension
- ankle rocker impaired
- hip flexion strategy

Ankle Circumduction video

- circumducting gait can originate from the hip or ankle
- peroneus brevis weak?
- lack of hip flexion?
- lack of ankle rocker?
- impact on the hips?

Bouncy Gait video

- fixed or correctable?
- it is a patterning problem that may be feeding off ablative or functional deficits
- cause? cure? Rx?
• Right Foot drop video case
  • - sometimes it doesn’t show up unless you tease it out
  • - some soft lesions can have a threshold

Medial gait collapse
• 3 videos
  • A- Crossover uncorrected
  • A- Crossover Balance beam
  • A- Crossover Texas walk
  • - getting to the glutes and relearning joint stacking

B- External rotation/Frontal Plane video case
• - failed ankle rocker
• - midfoot collapse
• - tib posterior insufficiency
• - weak right glute / frontal plane
• - turning foot into frontal plane
• C-Peroneal Lesion Video Case
  • head trauma
  • right foot drop
  • foot drop can be from weak peroneus brevis-tertius
  • weak left hip frontal plane
  • look for hip flexion and steppage gaits and toe clearance issues

• D- Loss Ankle Rocker video case
  • congenitally blocked ankle rocker
  • rearfoot pronation
  • medial knee collapse
  • cross over strategy
  • rigid apropulsive gait

• do not coach out arm swing dislikes if you have not addressed the problems in the lower limbs
  • photo: clearly left hip frontal plane sway, and right arm swing frontal plane sway.
  • Those 2 limbs are neurologically paired. The arm is acting like a ballast in the opposite frontal plane to help her stay centered. She is failing, compensating, but at least not falling over.
  • Focusing on the cause(s) of the left frontal pelvis-hip drift would be our direction, not coaching out the arm swing.
• We hope you have a greater appreciation for the entirety of the system now in locomotion.
• The parts cannot be separated, and thus, for us to truly succeed, our examinations must be more comprehensive.

Thank You!