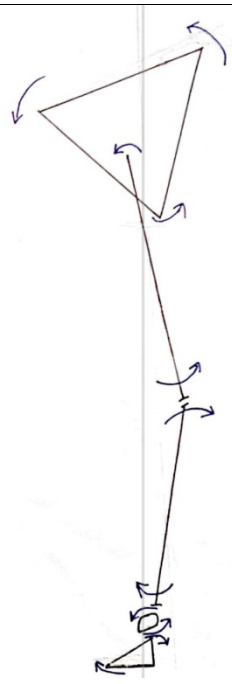
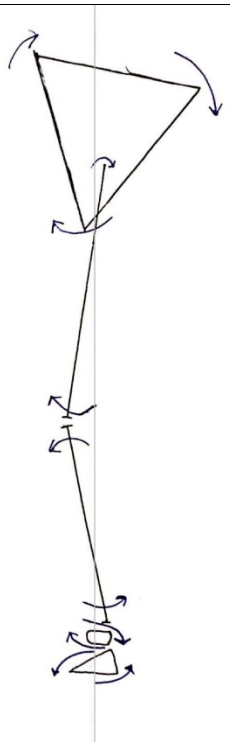
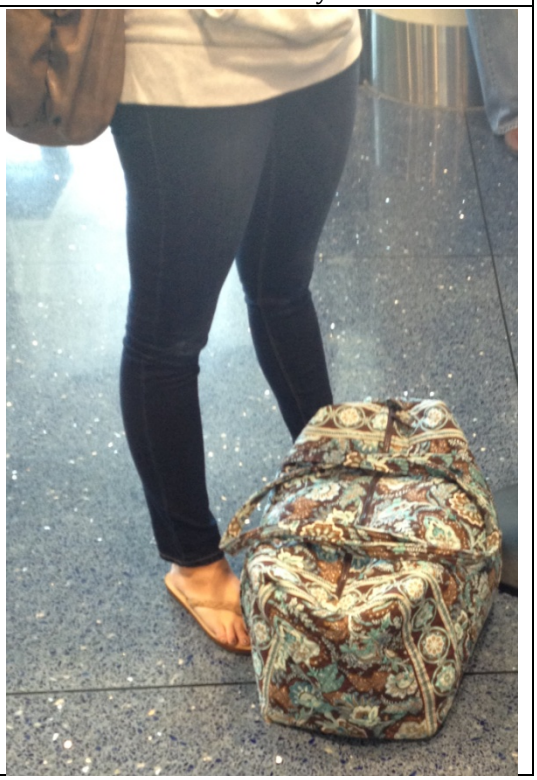
Sagittal Plane Arthrokinematic Tendencies in a Non-compensated Left AIC Pattern

Josh Olinick DPT, MS, PRC

In order to understand how shoe type can affect a PRI Lumbo-Pelvic Restoration program, it is important to understand Pelvic and Calcaeal relationships or arthrokinematic "tendencies" in a Left AIC pattern. This will be part one in a three part series dealing with non compensated triplanar hemipelvic-calcaneal tendencies and will be discussed in terms of right and left.

The sagittal orientation of the hemipelvis in a Left AIC oriented patient is of anterior rotation on the left side and posterior on the right. This is discussed in depth in myokinematic restoration and pelvis restoration courses and is visually represented in pics 1a & 1b. In this position, the left acetabulum moves (trends) posterior and superior to the sagittal "midline" of COG (noted by the gray line). You will note that while pic 1a shows the innominate anteriorly rotated, the acetabulum is in front of the midline. This represents a transverse plane influence and will be made more clear in later segments. At this point it is important to understand that the left hemipelvis has anteriorly rotated and trended the AF joint towards a state of flexion.

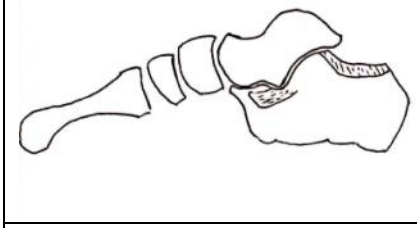
Pic 1a Left Side	Pic 1b. Right Side	Picture courtesy of a patron of the Charlotte Airport. Note the L knee hyper extension with less extension tendency on the R.
		

Bipedal upright function requires an interesting trait, a zero sum net balance. Newton's 3rd law of motion states that *when two bodies interact by exerting a force on each other, these action and reaction forces are equal in magnitude, but opposite in direction.* In short, opposite and equal reactions must occur to remain in balance. When the innominate on the left moves anteriorly and causes a state of flexion in the acetabulum, the femoral-tibial joint has little choice but to trend towards a state of extension (pic 1a) causing a continued chain of events. As the knee moves posterior to the midline, the distal tibial-fibular joint trends anterior causing a plantar flexion tendency at the talocrural joint. In order to maintain a balance, the calcaneus on the left trends towards a state of dorsiflexion. The table below summarizes these relationships and also presents the right side tendencies as well.

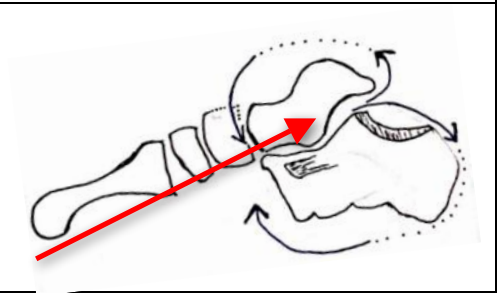
	Tendency (Moment)	
	Left	Right
Hemi-Pelvis	Anterior rotation	Posterior rotation
Acetabulum	Flexed position	Extended position
Knee	Extension tendency	Flexed tendency
Talo-crural	Plantar flexed (tendency)	Dorsiflexed (tendency)
Talo-calcaneal	Dorsiflexed (tendency)	Plantar flexed (tendency)

Soft tissue interaction is important to note at this point (refer to pictures 1a & 1b). The left hamstring is in a lengthened state and the right is shortened. Left hamstring injuries will have a lengthened sagittal influence while right hamstring injuries will have a shortened sagittal influence.

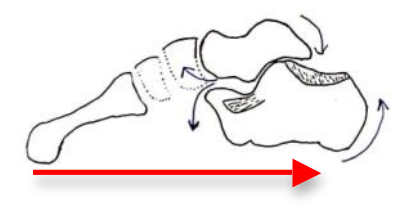
Pic 2. Neutral Calcaneal Alignment.



Pic 2a. Left foot Calcaneus trending towards DF.



Pic 2b. Right Foot Calcaneus trending towards PF.



The left Achilles also trends towards a lengthened state while the right, a shortened state (see pics 1a & b, 2a & 2b). Therefore, left achillies injuries will tend to be "over lengthened" injuries, whereas, the right achillies is accustomed to being short and can more easily become "over stretched" causing injury. The last "sagittal tendency" injury to mention at this point is plantar fascitis. Please refer to pic 2, a neutral talo-calcneal relationship. Pic 2.a shows the influence of the L AIC on the L talocalcaneus, which positions the calcaneus in a posterior rotated position and moves the dorsal plantar fascial attachment superior which increases stress at the anterior position of the plantar fascia (especially at toe off in gait). On the right, (Pic 2.b) the calcaneus trends more towards a position of anterior rotation, and as a result, the anterior plantar surface of the calcaneus moves inferior and posterior, elongating the dorsal plantar facial tissue (especially at heel strike).

These sagittal tendencies occur as a result of the Left AIC pattern, but uncorrected, patterned, inefficient movement can prevent progression of a Postural

Restoration program and limit maintained sagittal plane position when in upright.

This is a good point to begin discussion of shoe attributes that will compliment a Postural Restoration program and help to limit Left AIC dominance. Thus far the discussion has been focused on defining a relationship between the pelvis and the calcaneus in the sagittal plane. When we examine the calcaneal result of a L AIC we now see that the right calcaneus is in a state of plantarflexion and the left in a state of dorsiflexion.

The PRI recommended qualities of a good shoe are:

1. Solid heel counter
2. Excellent heel support (no outer heel give)
3. You can feel the arches of the shoe
4. Non-flexible midsole

All four of these qualities assist in sagittal plane control of the calcaneus. For sagittal plane support, the non-flexible midsole is potentially the most necessary on the Right side based on the discussion above. The right plantar flexed calcaneus needs to be supported anteriorly on the plantar surface to prevent further excess motion in that direction and continued stretch on the plantar fascia during stance phase of gait. Quality heel support is needed on the Left at heel strike for timed proprioceptive awareness of ground contact to initiate hamstring contraction for sagittal plane AF control in early stance (Left Calcaneal Reference Center) . A solid counter and arches and will be discussed in later essays.

Part two of this series will cover frontal plane calcaneal tendencies in the L AIC pattern.