



## S.T.J. Mechanics in Functional Limb Length Discrepancy

### Anatomy

The Subtalar Joint (STJ) is formed by three articulations between the inferior surface of the talus with the superior surface of the calcaneus. These articulations are referred to as the posterior, middle and anterior facets. The STJ axis runs in a medial, anterior, dorsal direction and functions about a single axis. The normal axis is positioned 42 degrees from the transverse plane, 16 degrees to the sagittal plane and 45 degrees (Merriman and Tollafield, 1995) from the frontal plane, as shown in figure 1. Due to this axis the STJ produces the triplanar motion of pronation and supination. Pronation relates to the dorsiflexion, eversion and abduction of the foot whilst supination involves plantar flexion, inversion and adduction.

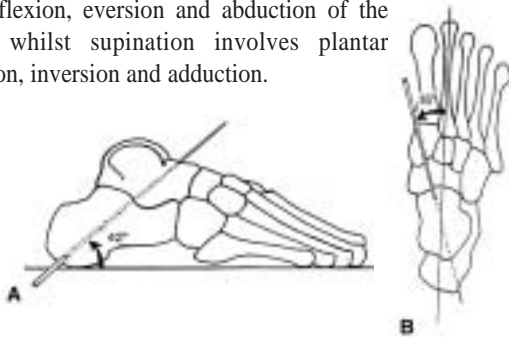


Figure 1: A. Transverse axis of STJ.

Figure 1: B. Sagittal plane axis of STJ (Seibel, 1988)

### Subtalar Joint Function

The subtalar joint is one of the most important joints in the foot. The position of the subtalar joint can determine the amount of compensation that is available in the foot. This is due to its major influence on other joints within the foot, particularly the midtarsal joint and the first and fifth rays. (Lorimer, French and West, 1997)

The STJ functions to pronate and supinate during the gait cycle. This is essential for adaption to surface and structural abnormalities. As the STJ pronates it allows the foot to become more mobile and adaptive. This usually occurs during the contact period of gait. This position changes during midstance as the STJ supinates and effectively locks the foot so that it can act as a rigid lever during propulsion. (Lorimer, French and West, 1997)

The STJ can effectively reduce the effect of impact forces due to its ability to pronate. Pronation causes the talus to adduct and plantar flex thus resulting in a lowering of the ankle. Furthermore it causes internal tibial rotation and knee flexion. Thus resulting in the dissipation of forces throughout the gait cycle. Although the STJ pronates and supinates in normal gait it may do so abnormally and excessively to compensate for a number of intrinsic or extrinsic structural abnormalities.

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One of these is a functional leg length discrepancy. Therefore it is necessary to evaluate these abnormal biomechanics in patients who present with a discrepancy in order to treat them in the most effective manner.

### Subtalar Joint Compensation

A limb length discrepancy may be compensated for in many different ways. Commonly the shorter side will attempt to become functionally longer and the longer limb will attempt to become shorter. The shorter side may attempt to bring the heel closer to the ground just prior to heel strike. Clinically this presents as an inverted STJ position, which may create a functional rearfoot varus deformity. The longer limb may attempt to bring the leg closer to the ground thus functionally shortening the limb. This is achieved by excessive pronation at the STJ.

Clinically a patient may present with an asymmetrical relaxed calcaneal stance position (RCSP), with the shorter side being more inverted than the longer side. The effects on gait may also be evident. Due to the functional rearfoot varus in the shorter limb there will be an increased range and speed of subtalar joint pronation during the contact period. Effects of asymmetrical subtalar joint pronation include: (Michaud, 1997):

- Internal rotation of lower extremity which causes it to drop inferiorly
- Increased stress on iliopsoas and piriformis
- Narrowing of greater sciatic notch (*predisposing it to nerve entrapment*)
- Rotation and flexing of lumbar spine
- Disproportionate compression on discs

### Conclusion

Limb length discrepancy can alter subtalar joint mechanics. Therefore a thorough assessment of a patient presenting with such pathology must involve the evaluation of this joint. The patient must be evaluated in both open and closed kinetic chain to determine the presence and effects of any asymmetrical subtalar joint motion. Thus in order to effectively manage a patient it is necessary to have an understanding of the anatomy, function, compensation and importance of the subtalar joint and its relationship with other joints within the foot.

### References:

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