

Subtalar Joint Biomechanics

From Normal to Pathologic

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KEYWORDS

- Subtalar joint • Hindfoot mechanics • Valgus • Varus • Subtalar joint axis
- Peritalar joint • Flatfoot • Dynamic varus

KEY POINTS

- Subtalar joint function is driven by the complex shape of its articulations.
- Motion about the subtalar joint is triplanar and described using the terms *inversion/eversion*, *adduction/abduction*, and *plantarflexion/dorsiflexion*.
- Congenital or traumatic changes to the articulations of the subtalar joint can lead to alterations in function.
- The orientation of the subtalar joint axis may be a primary risk factor for development of pes planus.

ANATOMY OF THE PERITALAR JOINT

The subtalar joint consists of 2 articulations with separate synovial sheaths. The first is between the posterior facets of the talus and calcaneus (the posterior talocalcaneal joint [TCJ]). This is separated from the second sheath by the sinus tarsi, a sulcus formed between the posterior and medial facets of the talus and calcaneus, respectively, and filled with the strong talocalcaneal interosseous ligament. The second articulation is made up of the anterior and medial facets of the calcaneus and talus, talar head, the navicular bone, and the cartilaginous surface of the calcaneonavicular ligament (talocalcaneonavicular joint [TCNJ]). The TCNJ is described as the acetabulum pedis by some investigators because it (in conjunction with the fibrocartilage surface of the spring ligament and posterior tibial tendon) forms a socket (acetabulum) for the talar head about which the foot is able to move in 3 planes.¹⁻³ Although anatomically made up of 2 separate joint capsules, these articulations do not move independently

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of one another.^{1,4} Therefore, the distinction is artificial and orthopedic surgeons consider the TCJ and TCNJ 1 functional unit.⁵

Despite these anatomic distinctions, the peritalar joint is often described in the literature as the TCJ (all 3 facets of the talus and calcaneus as well as the fibrocartilage surface of the spring ligament) and the talonavicular joint (TNJ) (the articulation between the head of the talus and posterior surface of the navicular, which shares a synovial sheath with the anterior/middle facets of the calcaneus). The terms, *TNJ* and *TCJ*, are used for this discussion of biomechanics of the peritalar joint.¹ The TNJ and TCJ do not function independently of one another and, therefore, are referred to as the peritalar joint complex.

Also critical to discussing the biomechanics of the subtalar joint is establishing a common vernacular for describing motion about the joint. Unfortunately, much discrepancy exists in the literature. The human foot is unique, because it has evolved to be oriented perpendicular to the axis of the body to allow for bipedal locomotion. The subtalar joint axis is also obliquely oriented, resulting in complex triplanar motion. This means that terms used to describe motion at the subtalar joint are inexact and confusing. As such, the authors prefer to avoid terms like supination and pronation as applied to the subtalar joint. Throughout this article, frontal plane motion is described as inversion or eversion, transverse plane motion is described as adduction or abduction, and sagittal plane motion is described as plantar flexion or dorsiflexion (**Fig. 1**).

The unique triplanar motion of the subtalar joint is a direct result of the bony shape of the articular surfaces of the TCJ and the TNJ. These may be classified as male and female ovoid surfaces. The posterior facet of the calcaneus and the head of the talus are male ovoid surfaces whereas the middle and anterior calcaneal facets, the

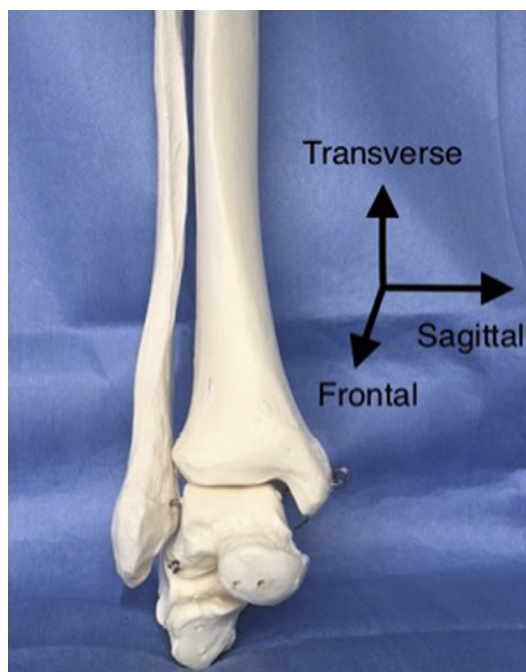


Fig. 1. The axes of the subtalar joint. Motion is perpendicular to the axes of the joint.

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