

Subtalar Anatomy and Mechanics



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KEYWORDS

- Subtalar joint • Mechanics • Pathomechanics • Talus • Calcaneus • Peritalar
- Osteotomy

KEY POINTS

- Sinus tarsi and its ligaments are late phylogenetic structures, typical of human feet that are prepared for bipedal position.
- To understand how the peritalar complex works, it may be assumed that the subtalar joint (STJ) axis is a single axis of a mitered hinge.
- By supinating the STJ during the second and third rockers of gait, the foot is converted from a shock-absorbing structure into a rigid lever, which provides the foot with the greatest mechanical efficiency for pushing off.
- In both pronatory and supinatory syndromes, reducing the mechanical stress on the injured area will promote healing and restore flexibility and strength of the involved tissues.
- Both nonoperative and operative management strategies regarding the STJ should aim to restore balance between the external and the internal moments, thus reducing tissue stress.

INTRODUCTION

There is ambiguity in the use of the term “subtalar joint” regarding the involvement of the talus, the calcaneus, and the navicular. Herein, the “subtalar joint” is referred to as synonymous with the talocalcaneal joint. The subtalar joint (STJ) is designed to quickly change from a flexible shock-absorbing structure to a rigid propulsive one. Function makes form. The embryology, anatomy, and mechanics of the STJ are reviewed. This article does not attempt to simply review the available literature on STJ anatomy and mechanics but instead tries to make STJ function easy to understand for the clinician. A correlation between mechanics and surgery around the STJ is also presented.

The authors have nothing to disclose.

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EMBRYOLOGY

Tarsal bones can be recognized as early as the 14 mm crown-rump (C-R) (43 days). Between the 14 and 17 mm C-R, the tarsus is shown as a mesenchymal structure located in the distal portion of the bones of the lower extremity.¹ A small artery, which appears at the 14 mm C-R and disappears at 18 mm C-R, divides the posterior tarsus into the talus medially and the calcaneus laterally.² At around 27 mm C-R (55 days), the sustentaculum tali arises and the talus is placed almost completely over the calcaneus. At 34 mm C-R (61 days), the posterior STJ surface is easily identified. At 110 mm C-R (16 weeks), the sinus tarsi is visualized and the nerve and vascular arch within the sinus tarsi are evident. Most authors consider the sinus tarsi artery as an anastomosis through the sinus tarsi between the plantar and dorsal systems.³ Ligaments at the sinus tarsi do not develop until the fetal stage is advanced (40 mm C-R) and possibly play a role in the straightening of the foot within the first weeks of the fetal stage. Sinus tarsi and its ligaments are late phylogenetic structures, typical of human feet that are prepared for bipedal position (**Fig. 1**).

DESCRIPTIVE ANATOMY

The Talus and Talar Articular Facets

The talus is covered by articular cartilage on more than 60% of its surface and has no muscle insertions. Thus, the talus moves because peritalar structures move. The STJ usually has 3 articular facets on the inferior part of the talus and the superior part of the calcaneus. The posterior facet is the largest and forms a saddlelike joint under the talus, with a concave shape in the long axis. There is considerable variation in shape and size of the facets. The posterior facet is separated from the anterior and middle facets. The anterior and middle facets are often continuous.

The Calcaneus and Calcaneus Articular Facets

Two or 3 articular facets mirror those of the talus. The posterior facet is located in the middle third of the calcaneus. The anterior third of the calcaneus supports the anterior and middle facets. The calcaneal surface contributes to the formation of the “sustentaculum tali” over which the talus leans. The sustentaculum tali provides a sliding surface for the posterior tibial tendon, the flexor hallucis longus tendon, and the flexor



Fig. 1. Ossification of the forefoot takes place earlier than that at mid- and hindfoot. Alizarin stained fetus from the Collection of the Department of Anatomy and Embryology 1. Faculty of Medicine, Universidad Complutense de Madrid, Spain.

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