What to Do with the Spring Ligament

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KEYWORDS

• Spring ligament • Calcaneonavicular ligament • Posterior tibial tendon dysfunction • Flatfoot • Pes planovalgus

KEY POINTS

- The spring ligament complex is an important static restraint of the medial longitudinal arch of the foot and its failure has been associated with progressive flatfoot deformity.
- Reconstruction of the spring ligament is most appropriate in stage II posterior tibial tendon dysfunction, before severe peritalar subluxation and rigid deformity develops.
- Reconstruction of the spring ligament complex reestablishes a medial soft tissue restraint to minimize talonavicular joint subluxation and mitigate the need for nonanatomic bony procedures that have been associated with complications.
- Although most orthopedic foot and ankle surgeons perform spring ligament reconstruction for stage II deformity, there is still no current consensus regarding the best reconstruction technique.

INTRODUCTION

The calcaneonavicular ligament, commonly referred to as the spring ligament, is an important static restraint of the medial longitudinal arch. Failure of the spring ligament complex has been implicated in acquired flatfoot deformity.[1] Numerous surgical techniques have been described for the treatment of stage II posterior tibial tendon insufficiency, without a consensus among orthopedic foot and ankle surgeons in regards to the best treatment approach.[2] Reconstruction of the spring ligament is a powerful method of correcting peritalar subluxation and can minimize the need for nonanatomic reconstructive procedures. The role of spring ligament reconstruction is still debated and is the topic of ongoing investigation. This article reviews the pathoanatomy of the

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spring ligament complex and the potential role of spring ligament reconstruction in acquired flatfoot deformity, and highlights the most current research.

ANATOMY OF THE SPRING LIGAMENT COMPLEX

The spring ligament complex is a ligamentous structure that extends from the calcaneus to the tarsal navicular. The spring ligament complex supports the head of the talus by resisting plantar and medial talar head subluxation that occurs in more severe acquired flatfoot deformity. The bony and ligamentous structures that suspend and stabilize the talus at the talocalcaneonavicular articulation, including the spring ligament complex, has been collectively referred to as the acetabulum pedis.[3] The structures that form the acetabulum pedis include the anterior and middle articular facets of the calcaneus, the articular facet of the navicular, and the spring ligament complex.

The term spring ligament is a misnomer and has been used inconsistently in the literature to describe various supporting ligamentous and capsular structures of the medial talonavicular articulation.[4,5] Davis and colleagues[4] described two distinct ligamentous bands, the superomedial calcaneonavicular (SMCN) ligament and the inferior calcaneonavicular (ICN) ligament, which have collectively been referred to as the "spring ligament complex." The authors report that the spring ligament complex does not actually possess spring-like properties, but rather functions to provide a sling for the head of the talus.

The SMCN ligament is more than twice as strong as the ICN ligament, with an average load to failure of 665.5 N compared with 291.4 N, respectively.[4] The SMCN ligament is wider, longer, and thicker than the ICN ligament.[4] The origin of the SMCN ligament is from the sustentaclum tali and anterior facet of the calcaneus. The fibers project broadly and assume a concave shape before its insertion at the superior, medial, and inferior articular edge of the navicular.[4] The superficial fibers of the SMCN ligament are flattened by the posterior tibial tendon, which runs immediately adjacent to ligament, and is inspected during surgery with retraction of the tendon. The deep portion of the SMCN ligament contains a fibrocartilage facet that articulates with the plantar-medial aspect of the talar head. The fibrocartilage facet and histologic composition of the SMCN ligament suggests its primary role in load bearing.[4] The ICN ligament lacks a fibrocartilage facet and is primarily subjected to tensile forces.[4] The posterior tibial tendon has distal attachments to the SMCN ligament just proximal to its insertion at the navicular tubercle. The anterior portion of the superficial deltoid ligament also contributes fibers that insert directly onto the superior margin of the SMCN ligament. The distal extent of the SMCN is most frequently injured.[1,6]

The ICN ligament runs plantar and lateral to the SMCN ligament. The origin of the ICN ligament is between the anterior and middle calcaneal facets. The ligament extends medial and distal to its insertion at the inferior cortex of the navicular. The ICN ligament is located directly underneath the talonavicular joint, making it difficult to visualize during surgery.[5] The two bands of the spring ligament complex are demarcated by the routine presence of fat located near the navicular insertion.[3,4]

More recently, Taniguchi and colleagues[3] identified a third ligamentous structure that runs from the notch between the anterior and middle calcaneal articular facets to the navicular tuberosity (**Fig. 1**). The authors coined this structure the "third ligament" and report that it is a distinct part of the spring ligament complex.

The spring ligament complex receives its blood supply from penetrating branches of the medial plantar artery and calcaneal artery.[4] Indirect contributions arise at the sites of its ligamentous attachments to the navicular and sustentaculum tali. The central-third of the spring ligament complex is relatively avascular.