The Flexible Adult Flatfoot

Anatomy and Pathomechanics

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KEYWORDS

• PTTD • Pes planus • Johnson and Strom • Posterior tibial • Tendon dysfunction • Ankle

KEY POINTS

- Flexible flatfoot deformity in adults is a complex, multifaceted pathology.
- Understanding of the pertinent anatomy of flexible flatfoot deformity is critical in making an accurate and timely diagnosis.
- Many times, complaint of ankle pain is when a patient may first seek treatments for flexible flatfoot deformity.

INTRODUCTION

Adult acquired flatfoot deformity is generally associated with a collapsing medial longitudinal arch and progressive loss of strength of the tibialis posterior tendon. It is most commonly associated with posterior tibial tendon (PTT) dysfunction (PTTD) that can have an arthritic or traumatic cause. With an increasing population of obese patients, the often misdiagnosed and overlooked PTTD will only continue to present more often in the foot and ankle specialist's office. This article focuses on the anatomy, classification, and pathomechanics of the flexible adult flatfoot.

CLASSIFICATION

Johnson and Strom

Many classification systems have been described in the literature formulated from clinical findings, radiographic findings, and/or etiology of the pathology. In 1989, Johnson and Strom[1] introduced a classification system that was intended to correlate the presentation, physical findings, and radiographic findings that would ultimately guide surgical intervention and still remains the most widely used.

Stage 1, tenosynovitis is predominant. There is an absence of hindfoot valgus, too many toes, and patients are generally able to perform a single heel raise. Tendon

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length is preserved and patients elicit pain with direct palpation of the tendon distal to the medial malleolus.

Stage 2 is typically when the first sign of deformity presents. The tendon has developed degeneration and elongation and a hindfoot valgus is appreciated with possible forefoot abduction (Fig. 1). Patients may be able to perform a single heel raise in this stage but as the dysfunction progresses the ability is lost (Fig. 2). It is important to remember that in this stage, the deformity remains flexible. A trend in recent years has been to subdivide this category into "A" and "B," where the "A" group represents patients with medial pain and the ability to perform a single heel raise. "B" group patients have fibular impingement pain and incompetence of the PTT.

Stage 3 is for the patient that has developed a rigid deformity. The examiner is unable to correct the forefoot abduction or hindfoot valgus on examination, patients typically complain of only lateral pain, and patients are unable to perform single heel raise.

Stage 4 is reserved for the patient that progresses to ankle joint involvement. The dysfunction leads to a valgus talus and eventually attenuation of the deltoid ligament. The once subfibular impingement pain is now pain generally related to ankle arthritis.

ANATOMY

Pertinent anatomy of the flexible flatfoot deformity involves more than simply a failure of the PTT. The calcaneonavicular ligament, deltoid complex, and the articular involvement of the talonavicular joint (TNJ) should always be taken into consideration when evaluating any flatfoot deformity.

PTT

The PTT has origins on the posterior aspect of the tibia, fibula, and interosseous membrane. It was Morimoto[2] in 1983 that suggested the fibular origin is the strongest and evolutionarily newer than the tibial side. It is the more lateral origin of the muscle that improves the lever arm and provides greater inversion of the foot. The tendon crosses the medial aspect of the posterior talus, the medial aspect of the talar neck, and the inferior surface of the inferocalcaneonavicular ligament and is located above the sustentaculum tali.[3] According to Bloome and colleagues,[4] just in front of the navicular tuberosity the PTT splits into three bands: (1) anterior, (2) middle, and (3) posterior. The anterior band is the largest and a direct continuation of the tendon that inserts into the navicular tuberosity, the inferior surface of the navicular-cuneiform joint, and the plantar aspect of the first metatarsal cuneiform joint. The middle component

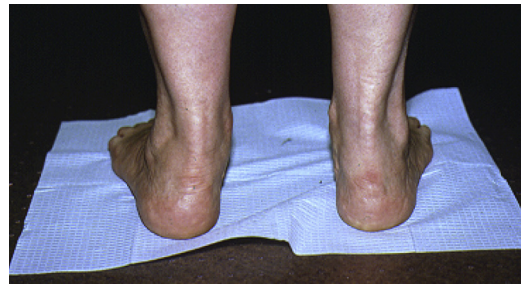

Fig. 1. Development of hindfoot valgus is noted.