

The heel-tip test for restricted tarsal motion

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We describe a simple test that selectively reveals restricted tarsal motion. From functional anatomic data, it is evident that talocalcaneal motion, being essential for intrinsic tarsal mobility, is correlated with rotation of the tibia when tested in a standing person. When supination of the weight-bearing foot generates only a limited external rotation of the tibia, tarsal pathology must be assumed. In 9 feet with a talocalcaneal coalition, axial tibial rotation with the heel-tip test averaged only 8.4° in contrast to an average rotation of 27° in 60 control feet.

Based on observation of patients with tarsal coalition, we have developed a sensitive physical test that selectively reveals limitation of intrinsic tarsal motion: the heel-tip test. We compared values for the heel-tip test in healthy individuals with those in patients with tarsal coalition.

Patients and methods

We measured external tibial rotation with the heel-tip test bilaterally in 30 healthy individuals randomly selected from our nursing staff and in 7 patients with tarsal coalition, consecutively diagnosed in a 2-year period.

There were 6 patients (8 feet) with a middle facet calcaneotalar coalition and 1 patient with a posttraumatic talocalcaneal ankylosis.

Performing the heel-tip test, the investigator forces the foot of the relaxed standing patient into supination, by raising the medial forefoot while the lateral border of the foot and the heel maintain contact with the floor (Figure 1). External rotation of the tibia is clearly visible as a change of position of the patella, and can be quantified by measuring the angular deflection in a horizontal plane of a marker stick, attached perpendicular to the leg below the knee joint.

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Results

The mean external tibial rotation with the heel-tip test was 27° in the controls. The mean left-to-right difference was 2.8°. In the 7 patients (9 feet), external tibial rotation ranged from 5° to 12°. There was no overlap between the two groups (Table 1).

Discussion

Unlike most other peripheral joints, movement of the tarsus with its special kinematic behavior and oblique axis of rotation defies direct clinical measurement. Supination of the foot generates external rotation of the talus by a coupling of motions within the tarsal skele-

Table 1. Axial tibial rotation with the heel-tip test in 7 patients with calcaneotalar coalition (9 feet) and in 30 controls (60 feet)

Case	Sex	Age	Tibial rotation (°)	
			Coalition side	Normal side
1	M	15	12 and 10	—
2	M	16	5	24
3	F	19	7	38
4	F	20	11	31
5	M	25	5 and 10	—
6	M	31	8	17
7	F	23	8 ^a	35
Controls	M	15-35	—	26 ^b
Controls	F	15-35	—	28 ^b

^a Posttraumatic. ^b Mean SD.

ton (Huson 1961, Inman 1978). In a simplified drawing of the subtalar and ankle joints, we tried to visualize the conversion of calcaneal tilting in talar and tibial external rotation (Figure 1).

Olerud and Rosendahl (1987) found a linear correlation between tibial rotation and supination of the hindfoot, the correlation coefficient varying with extension and flexion of the ankle. During the heel-tip test, the ankle joint always being in the same position, tarsal motion can thus be reliably quantified in terms of tibial rotation.

Chambers et al. (1982) described a kind of a reversed heel-tip test to assess tarsal mobility; the foot had to be fixed to prevent it from slipping. McMaster (1976) estimated tarsal mobility by measuring inversion and eversion of the hindfoot. In contrast to those methods, our test can be performed without the use of any holding device or control of the neutral position of ankle and foot.

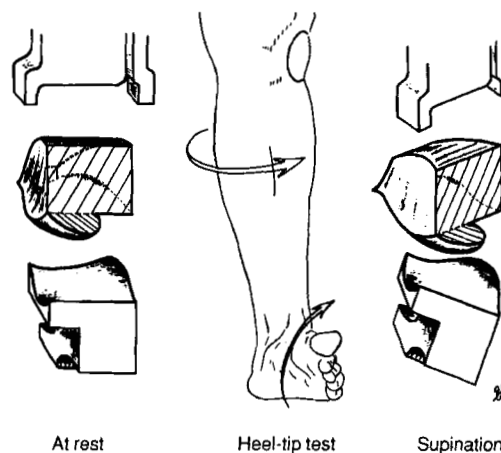


Figure 1. The ankle mortise, talus, and calcaneus with the ankle joint in the neutral position, when the talus is locked in the mortise. The articulations between calcaneus and talus are arranged in a posterolateral convex and anteromedial concave fashion. As a result of this geometry, at supination the talus externally rotates over the inverting calcaneus transferring its rotation to the tibia.

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