Problems Associated with the Excision of the Hallux Sesamoids

Clare F. Taylor, BM, MRCS, Michael Butler, MA, MB BS, FRCS (Tr&Orth), Stephen W. Parsons, MA, BS, FRCS, FRCS (Ed)*

KEYWORDS

• Sesamoid • Sesamoidectomy • Indications for sesamoidectomy • Sesamoiditis • Sesamoid fracture • Complications post sesamoidectomy

KEY POINTS

- Sesamoids have a complex function within the forefoot.
- A careful history, examination, and appropriate investigations are required to diagnose patients with sesamoid abnormality.
- Other underlying abnormalities can give symptoms that arise from the region of the sesamoids, and will not respond to sesamoidectomy.
- Any pathologic deformity should be addressed before sesamoidectomy.
- Sesamoidectomy must only be considered following failure of conservative treatment.

INTRODUCTION

Anatomy

A sesamoid bone is embedded within a tendon, usually found at locations where these tendons run over a joint. There are 2 sesamoids associated with the first metatarsophalangeal joint (MTPJ) of the hallux, the medial (tibial) sesamoid and lateral (fibular) sesamoid. The hallux sesamoids ossify around the eighth year in girls and the twelfth year in boys, with congenital absence being extremely rare.[1] Bipartite sesamoids are present in around 19% to 31% of the population.[2] The literature reports that approximately 80% are in the medial sesamoid[3] and that up to 90% of people with bipartite sesamoids have them bilaterally.[4]

The hallux sesamoids are located within the medial and lateral slips of the flexor hallucis brevis (FHB) tendon, which insert into the base of the proximal phalanx,

Funding Sources: None.
Conflicts of Interest: None.
Department of Trauma and Orthopaedics, Royal Cornwall Hospital, 5 Penventinnie Lane, Truro, Cornwall TR1 3LJ, UK
* Corresponding author.
E-mail address: Stephen.Parsons@rcht.cornwall.nhs.uk

Foot Ankle Clin N Am 19 (2014) 425–436
http://dx.doi.org/10.1016/j.fcl.2014.06.014 **foot.theclinics.com**
1083-7515/14/$ – see front matter

forming part of the plantar plate. The 2 sesamoids are connected by a strong intersesamoid ligament with the flexor hallucis longus (FHL) tendon running in the groove between them. The dorsal facets of the sesamoids are covered by articular cartilage and articulate with the plantar aspect of the first metatarsal (MT) head.[1] Abductor hallucis and adductor hallucis tendons have fibrous insertions into the medial and lateral sesamoids, respectively, as do the medial and lateral FHB tendons. The lateral sesamoid has an attachment to the deep transverse ligament. These attachments, together with the medial and lateral sagittal hoods, transverse metatarsal ligament, and importantly the plantar fascia create the sesamoid complex.[1]

The medial sesamoid receives a greater weight-bearing load, is larger than the lateral sesamoid, and is more commonly injured.

Function

In general, the presence of a sesamoid bone within a tendon acts to hold the tendon further from a joint's center of rotation, thereby increasing its moment arm. The hallux sesamoids increase the mechanical advantage of FHB, thereby increasing MTPJ flexion power. These sesamoids act as a platform to the floor as the metatarsal head roles and glides over the plantar plate and as the weight-bearing load moves forward through the medial column. Friction is reduced at the metatarsal head, and the FHL tendon is protected as it glides between the 2 sesamoids.[5,6]

Windlass Mechanism

As part of the plantar plate and its attachments to the plantar fascia, the hallux sesamoids play an important role in the windlass mechanism of the foot. In 1954 Hicks[7] discussed the mechanics of the foot, focusing on the relationship of the plantar aponeurosis to the arch. He believed that functionally there were 2 structures of importance, the plantar plates of the MTPJs and the plantar aponeurosis, which is attached to them through 5 digital processes.

Hicks[7] observed that each plantar plate with its attached process of plantar aponeurosis was seen to constitute a continuous strong band forming a direct connection between the proximal phalanx and the calcaneus, like a tie or bow-string. When the toes are extended the ties pull the plantar plates forward around the heads of the metatarsals, akin to a cable being wound on to a windlass. The longitudinal arch of the foot is induced to rise because the distance between the MT heads and the calcaneus is shortened. Thus when the toes are in the extended position toward the end of the stance phase of gait, the arch rises by this ligamentous mechanism, namely the windlass mechanism.[7] This effect is greatest in the hallux and gradually reduces in the second, third, and fourth rays. It is almost completely absent in the fifth ray, which may be related to the size of the MT head acting as the pulley and the length of the toe as the lever.[8]

The reversed windlass mechanism occurs at the foot-flat stage phase of gait. It can be observed when standing with toes over the edge of a surface. When weight bearing on the MT heads, the toes flex down and the proximal phalanges resist being pushed up into dorsiflexion. The interphalangeal joints remain mobile, indicating that the long flexor and extensor tendons are not responsible, and that flexion of the proximal phalanges is due to the tight plantar fascia tethering the plantar plates.[7] Therefore in this phase of gait, the reverse windlass mechanism passively holds the great and lesser toes in line with the MT heads and in contact with the ground.

It therefore follows that pathologic disorder or surgery that disrupts the plantar plate of the first ray will interfere with both active and passive functions of the first MTPJ and