Hallux Metatarsophalangeal Arthroscopy: Indications and Techniques

Alberto Siclari, MD[a,*], Marco Piras, MD[b]

KEYWORDS

• Arthroscopy • Hallux metatarsophalangeal joint • Hallux valgus • Hallux rigidus • Arthrodesis

KEY POINTS

- Arthroscopy of the first metatarsophalangeal joint requires an experienced surgeon with arthroscopy skills.
- Many patients with pathologic conditions involving the hallux can be treated with an arthroscopic procedure, with good long-term outcomes comparable to those with open surgery, but with lower postoperative pain and complications.
- Frequently this procedure is only a part of the treatment of hallux disorders and should be considered within the management algorithm.

HISTORY

Wanatabe[1] first described arthroscopic treatment of the first metatarsophalangeal joint in 1972. Bartlett[2] first reported its use in 1988. Ferkel and Van Breuken[3] were the first to present their technique and results in a series of patients in 1991. In 2006, Debnath and colleagues[4] noted 95% of patients remained pain-free at 2 years after first metatarsophalangeal joint (MTPJ) arthroscopy for treatment of early signs of degenerative joint disease. In 2008, Lui[5] demonstrated a statistically significant correlation between joint cartilage erosion, joint synovitis, and pain in hallux valgus. He also noted a statistically significant correlation between the size of cartilage defect and severity of hallux valgus using diagnostic arthroscopy of the first MTPJ. In 2009, Wang and colleagues[6] noted a statistically significant decrease in recurrence of acute gouty arthritis to the first MTPJ after arthroscopic debridement of tophi when compared with patients treated by medical means alone. Lui[7] reported on performing

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[a] Orthopedic Department, Nuovo Ospedale degli Infermi, St Cantone Rondolina 50, Biella, ASLBI, Piemonte 13900, Italy; [b] Orthopedic Department, Nuovo Ospedale degli Infermi, Ponderano, Biella, ASLBI, Piemonte 13875, Italy
* Corresponding author.
E-mail address: alsicl@libero.it

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arthroscopy on the great toe joint for hallux valgus deformity, with good results. Siclari and Decantis[8] described combined treatment of hallux valgus deformity with arthroscopy and percutaneous distal osteotomy in 2009.

GROSS AND ARTHROSCOPIC ANATOMY

As with any surgical procedure, a firm understanding of the anatomy of the first MTPJ is required to perform arthroscopy.[9] In describing the first MTPJ complex, the base of the proximal phalanx of the hallux is ovoid in shape, wider than it is tall, and concave medial to lateral and dorsal to plantar. Little stability is gained from the chondral shape of the first MTPJ, because of the shallow articulation between the phalanx and the metatarsal head.[10] The rounded head of the first metatarsal has a side-to-side curvature that is greater than the vertical curvature and is somewhat wider (20–24 mm) than its height (16–20 mm).[11] The articular surface, covered by hyaline cartilage, extends onto the dorsal aspect of the metatarsal head and continues plantarly into the medial and lateral grooves, which serve as articulations for the sesamoid bones, with the medial groove larger and deeper to accommodate for the larger tibial sesamoid. The plantar grooves are separated by a median crest, known as the *crista*.[11] The joint capsule of the first MTPJ attaches close to cartilaginous edges dorsally; however, plantarly it attaches several millimeters proximal to the cartilage, with the plantar aspect of the capsule thicker than the dorsal capsule because of the presence of the plantar metatarsophalangeal ligament. The metatarsosesamoid ligaments thicken the medial and lateral aspects of the joint capsule, along with the medial and lateral collateral ligaments, which tract from the medial and lateral metatarsal tubercles to the corresponding tubercles on the sides of the phalanx.[11] The sesamoid bones of the flexor hallucis brevis muscle are attached to the metatarsal via the metatarsosesamoid ligaments and to the proximal phalanx of the hallux via the phalangeal sesamoid ligaments. The sesamoids also firmly adhere to the plantar metatarsophalangeal ligament, which results in a firm attachment to the proximal phalanx. The sesamoids therefore do not move relative to the proximal phalanx, but rather move relative to the metatarsal. Along with the ligamentous attachments already described, there are also tendon attachments to the sesamoid bones. The tibial sesamoid provides an insertion point for the abductor hallucis, and the fibular sesamoid provides an insertion point for the adductor hallucis and the deep transverse metatarsal ligament (**Fig. 1**).

The articular surface of the base of the first metatarsal is 25 to 30 mm deep and 16 to 20 mm wide, and the surface is concave dorsally and flat or slightly convex in the more plantar aspect of the joint.[12]

Intra-articular examination includes visualization of 10 major areas: the lateral gutter, the lateral corner of the metatarsal head, the central portion of the metatarsal head, the medial corner of the metatarsal head, the medial gutter, the medial portion of the proximal phalanx, the central portion of the proximal phalanx, the lateral portion of the proximal phalanx, the medial sesamoid, and the lateral sesamoid.

BIOMECHANICS

Biomechanically, the instant centers of motion for the first MTP joint are located within the metatarsal head. Motion occurs between the metatarsal head and the proximal phalanx via a sliding action at the joint surface. In full extension or flexion, this sliding action gives way to compression of the dorsal or plantar articular surfaces of the metatarsal head and the proximal phalanx.[13] Active range of motion of the hallux MTPJ in dorsiflexion averages 51° and 23° in plantar flexion. Additional passive range of motion in dorsiflexion averages 23°. In the hallux interphalangeal joint, the active flexion averages 46° and extension 12°, with additional passive dorsiflexion of 22°.[10]