# Recent trends in surgical management of Hallux valgus

Essay

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# التقنيات الحديثة في العلاج الجراحي للاعوجاج الخارجي للإصبع الأكبر بالقدم

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# Introduction

Hallux valgus is one of the most common foot disorders in civilized populations. (1)

The elements of the deformity are lateral deviation and rotation of the hallux, prominence of the medial side of the head of the first metatarsus (bunion), the lateral deviation of the hallux may lead to overcrowding of the lateral toes. The prominence of the first metatarsal head is due to subluxation of the metatarsophalangeal joint and there may be an overlying bursa and thickened soft tissue, in long-standing cases the metatarsophalangeal joint become osteoarthritic & the osteophytes add to the prominence. (2)

Prevalence estimates of hallux valgus range from 21 to 65%, with the largest study so far undertaken (involving 4,249 people aged over 30 years) reporting a prevalence of 28%. (3)

The etiology of hallux valgus is multifactorial. It includes wearing tight shoes, hereditary predisposition and anatomical abnormalities. (4)

Evaluation and diagnosis of hallux valgus depend on history, clinical examination for pain and tenderness on the

bunion, local deformity of the big toe and other lesser toes, range of motion of the first metatarsophalangeal joint, radiologic examination for metatarsophalangeal angle (normally less than 15°) and intermetatarsal angle (normally less than 9°), the congruity and the arthritic change of the first metatarsophalangeal joint. (5)

Hallux valgus has been shown to have a detrimental impact on health-related quality of life, and is associated with impaired gait and balance and an increased risk of falls in older people. (6)

The treatment options for hallux valgus are non-operative and operative treatment. Recently the ability for surgical repair of the various soft tissue and osseous abnormalities in hallux valgus has improved significantly, which allows the surgeon to address even the severest deformities and minimize post-operative care and complications. (5)

# Aim of the work

The aim of work is to overview the recent advances in surgical techniques for management of hallux valgus showing how these techniques improve the results of surgical correction of various degrees of hallux valgus deformity while reducing the postoperative complications.

**Chapter 1**

# NORMAL ANATOMY

## The metatarso-phalangeal joints (fig. 1-1)

The metatarsal bones are five in number. They are numbered from medial to latera1 side (in contrast to the metacarpal bones that are numbered from lateral to medial side). Each metatarsal bone has a distal end or head, a proximal end or base and an intervening shaft. The head is rounded. The base is enlarged and has proximal, dorsal, plantar, medial and lateral surfaces. The shaft is slightly convex on its dorsal side and concave on the plantar side. (7)

The metatarsals articulate proximally with the cuboid and cuneiform bones. (8)


Fig. 1-1: The metatarso-phalangeal joints. (10)

The metatarso-phalangeal joints lie 2.5cm proximal to the webs of the toes. The articular surfaces cover the distal and planter surfaces of the heads of the metatarsal bones however, do not extend on their dorsal surfaces. (9)

## Anatomy of the first metatarso-phalangeal joint

This chapter overview the following items:

1- Type.
2- Bony elements.
3- Articulations.
4- Nerve supply.
5- Supporting structures.
6- Movements.

### 1- Type:

The first metatarsophalangeal joint (MTPJ) is a shallow ball and socket type joint. (11)

### 2- Bony elements:

1. The first metatarsus.
2. Base of the proximal phalanx of great toe.
3. Sesamoid bones.

### 2/1- The first metatarsus: (fig. 1-2)

The head of the first Metatarsus is somewhat larger than the base of the proximal phalanx. (11)

The head of the first metatarsus carries a large, rounded, cartilage-covered prominence wider than the base of the phalanx with which they articulate. (12)

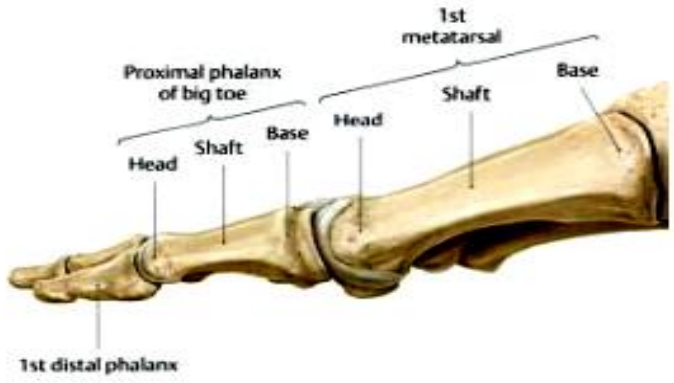


Fig. 1-2: The first metatarsus and base of the proximal phalanx of great toe. (10)

Two longitudinally oriented cartilage-covered grooves separated by a rounded ridge called the crista run along the plantar surface of the head (fig. 1-3). (11)

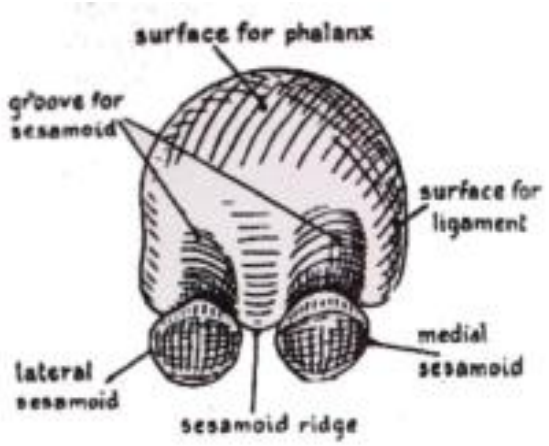


Fig. 1-3: Anterior view of head of metatarsus and sesamoids in their grooves. (12)

The shaft of the first metatarsal is the shortest and the strongest of the metatarsals. It has a prismatic contour, mainly in the proximal

two thirds, and presents three surfaces: dorsomedial, lateral and inferior. The three borders are superolateral, inferolateral and inferomedial. The dorsomedial surface is convex and oriented dorsally in the distal third. The lateral surface is flat and smooth and provides insertion to the first dorsal interosseous muscle from its posterior third. The inferior surface has a longitudinally concave contour; this concavity is exaggerated by the plantar tubercles of the base. (13)

**2/2- Base of the proximal phalanx of great toe:** (fig. 1-2)

The basal phalanx has an elliptical concavity for articulation with the metatarsus, and a swollen base, which receives the muscular and ligamentous attachments. (12)

**2/3- Sesamoid bones:** (fig. 1-3)

The MTPJ of the big toe differs from other toes in its sesamoid mechanism. (9)

The articulating surface of the sesamoid is also covered with hyaline carti1age. Morphologically the size and shape of the sesamoids vary widely, more than 10% of medial (or tibial) sesamoid are bipartite and should not be confused with a fracture. This finding is bilateral in 90% of cases and is seen far more commonly in the medial sesamoid than the lateral (or fibular) sesamoid. The medial sesamoid can be divided into three or four parts as well, whereas the lateral sesamoid rarely divided into more than two. The sesamoids are the attachment sites for a number of structures. (11)

The sesamoids, compared to coffee beans, are embedded in the planter pad, which is a mass of dense fibrous tissue, rectangular in outlines. The distal margin of the pad is attached firmly to the base of the phalanx. Its lateral border receives ligamentous and muscular attachments, and its proximal border receives a part of the short flexor tendon and is attached by a few loose fibers to the distal end of the metatarsus (fig. 1-4). (9)

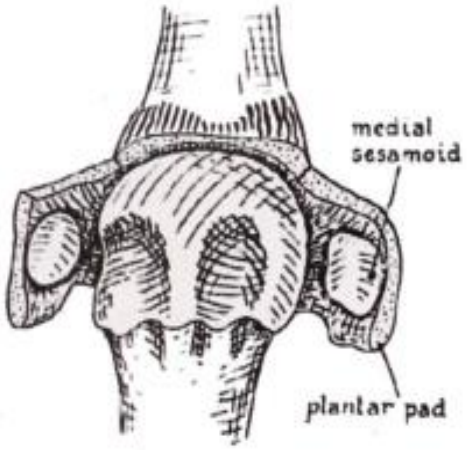


Fig. 1-4: First MTPJ, opened by splitting plantar pad, showing sesamoid. (12)

From the dorsal surface of the pad, project the cartilage-covered articular surface of the two sesamoids, each concave longitudinally to fit the metatarsal fits. The planter surface of the pad is raised on either side by the two sesamoids to form a groove in which the long flexor tendon plays, held in place by its fibrous tunnel. (9)

The sesamoids transmit a part of the pressure from the skin to the head of the metatarsus during standing, and thus relieving the flexor tendon from excessive compression. (9)

## 3- Articulations:

The first MTPJ is composed of the first metatarsal head and neck, proximal phalangeal base, medial and lateral sesamoids. (14)

It has two compartments: metatarso-phalangeal and metatarso-sesamoid compartments. The metatarso-phalangeal compartment composes of the oval, concave proximal phalanx articular surface and the convex metatarsal head articular surface. The proximal phalanx articular surface is smaller than the corresponding articular surface of the metatarsal head. The metatarso-sesamoid compartment composes of the articular surfaces of the sesamoid bones and the plantar articular surface, which is separated into two sloped surfaces by a small crista. The articular surface of each sesamoid is convex in the coronal plane and concave in the sagittal plane. (14)

## 4- Nerve supply:

The distribution of the cutaneous nerve is highly variable, but usually the dorsomedial and dorsolateral cutaneous branches originate from the medial dorsal cutaneous branch of the superficial peroneal nerve and the deep peroneal nerve, respectively. The plantar medial and plantar lateral branches originate from the medial plantar nerve. The dorsomedial cutaneous nerve is in proximity of the dorsomedial portal and is on average 13.1 mm medial to the extensor hallucis longus tendon but has been reported to be 2-5 mm from it. The plantar medial hallucial nerve is of average 10.6 mm plantar to the midline, which is the location for the medial portal. (14)

## 5- The supporting structures: (fig. 1-5)

The first MTPJ is held statically in place by medial and lateral collateral ligaments, the volar plate and the sesamoid complex on the planter aspect and the dorsum of the MTPJ. (15)

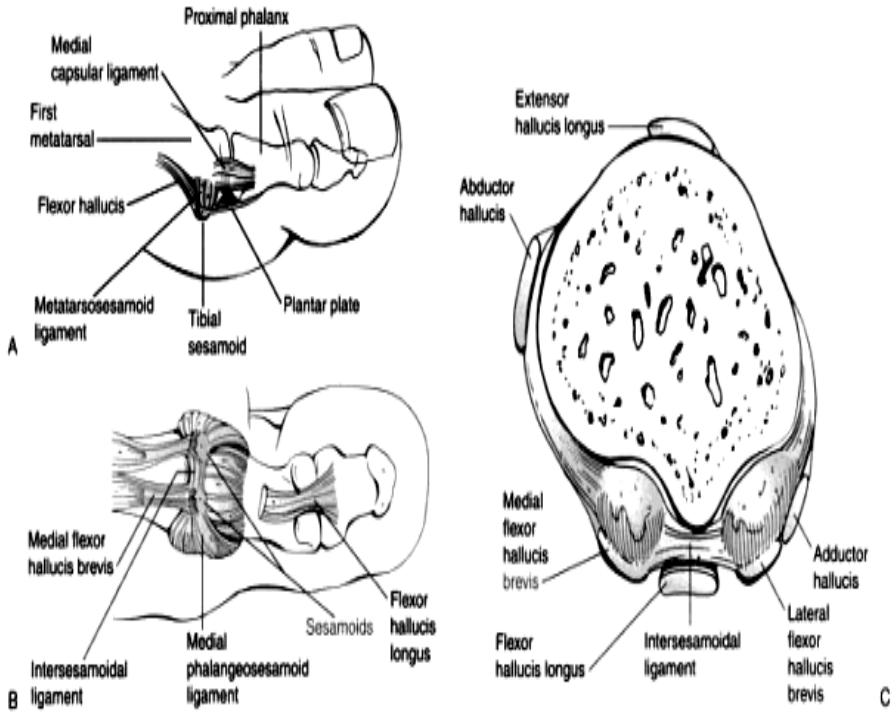


Fig. 1-5: (A) Medial view of first metatarsophalangeal joint.
(B) Plantar perspective.
(C) Cross-sectional anatomy through the first metatarso-phalangeal head. (11)

## 5/1- The joint capsule:

The joint capsule itself is a confluence of ligaments and tendons including the collateral ligaments, the plantar plate, the metatarso-sesamoid and phalangeo-sesamoid ligaments, the abductor and adductor hallucis muscles, the extensor digitorum brevis, and the flexor hallucis brevis. (11)

**5/2- The plantar plate:**

Plantar, the strong, fibrous plantar plate provides stability. The plantar plate attaches firmly to the base of the proximal phalanx but only loosely at the plantar aspect of the metatarsal neck as part of the joint capsule. (11)

**5/3- The collateral ligaments:**

Fan-shaped ligaments originating from the medial and lateral epicondyles of the metatarsal head constitute the medial and lateral collateral ligaments responsible for static restraint to valgus and varus stress respectively. (11)

**5/4- The intersesamoid ligament:**

Interconnecting the two sesamoids is a thick intersesamoid ligament that maintains the relationship of the sesamoids and proper course of the flexor hallucis brevis tendons. (11)

**5/5- The deep transverse metatarsal ligament:**

The sesamoids sit on either side of a crista. They are also held in place by the sesamoid metatarsal retinaculum with the lateral sesamoid tethered to the second metatarsal head by the deep transverse metatarsal ligament. (15)

**5/6- The muscles:** (fig. 1-6)

The dynamic stabilizers are the abductor hallucis medially, the adductor hallucis laterally (two heads indicate a conjoint tendon), the extensor hallucis longus and brevis dorsally and the flexor hallucis longus and brevis on the plantar aspect. (15)