

Those Magnificent Sesamoids

By

O. A. Mercado, D.P.M.

O. Kent Mercado, D.P.M., J.D.

Cynthia M. Mercado-Ciessau, D.P.M., F.A.C.F.A.S.

The sesamoid bones are one of Mother Nature's finest anatomical creations. Embedded within certain tendons, the principal function of the sesamoids is to allow tendons to glide over joints without getting caught or impinged. Sesamoids can also act as a fulcrum point for tendons, thus assisting with their function and improving their leverage. It is commonly accepted that the sesamoids were given their name by some early anatomist who saw a similarity in their shape to that of a grain of wheat, the sesame seed. Some authors, however, believe that since the name sesamun, is a botanical term applied to a plant that produces oil (ricinus), it is more likely that the anatomist naming these bones was probably thinking more about the castor oil seed, common in those days, than the sesame seed. At any rate, **Galen** (A.D. 129-199) is usually credited with giving the sesamoids their name, or at least, popularizing the name. The ancient Arabian Medical Men were also enthralled with the sesamoids. So much so, that they gave the medial sesamoid of the foot its very own name. They called it, Albadaran.

Sesamoids are not always composed of bone and may appear as a combination of fibrous tissue, cartilage and bone. This accounts for the fact that very frequently, particularly in the case of the **interphalangeal sesamoids**, the contour of this small bone is lost in the radiograph as it blends in with the opacity of the larger bones. This is mainly true if the sesamoid is not completely ossified. In fact, when studies have been done to evaluate the frequency of sesamoid bones, investigators studying cadaveric specimens find more sesamoids than when the data is obtained from just x-ray evaluation. This is an important fact for the podiatric surgeon to keep in mind, particularly in cases where there may be symptoms of a sesamoid and no radiographic evidence of one.

Anatomy of the Sesamoids

As a rule, sesamoids are oval in shape. They present a rough, convex surface dorsally which is imbedded within the tendon and a concave articulate facet on the plantar side for gliding over the joint (Figure 1).

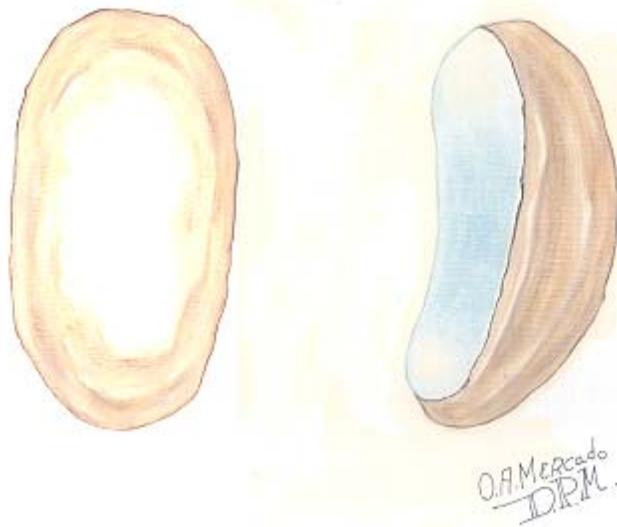


Figure 1. Sesamoid Anatomy

In the foot sesamoid bones are always present on the inferior aspect of the first metatarsal head. They are frequently found on the plantar aspect of the interphalangeal joint of the hallux. Often they are located under one or more of the lesser metatarsal heads, as well as in areas where tendons encounter a great deal of friction, such as the Peroneal Longus tendon as it courses underneath the peroneal groove of the cuboid. This particular sesamoid has a name of its own; it is called Os Peroneus (Figure 2).

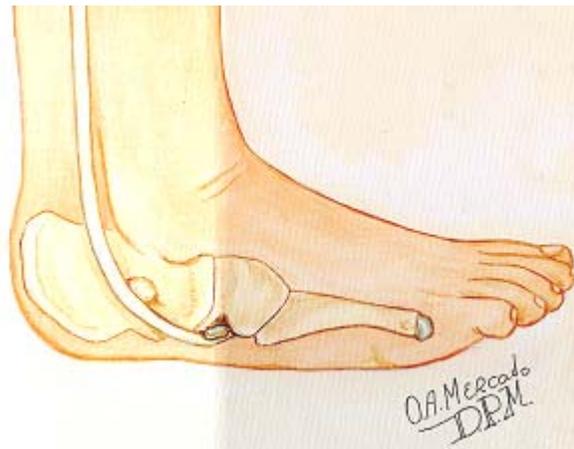


Figure 2. Os Peroneus

There are two constant sesamoids present on the plantar aspect of the first metatarsal head. They are found within the tendinous heads of the bipenniform muscle, Flexor Hallucis Brevis. Their names are designated according to the location that they occupy. They are called the medial and lateral sesamoid. In the great majority of cases the medial sesamoid is the largest.

The lateral sesamoid is almost always single. The medial sesamoid sometimes is divided into two parts (bipartite), three parts (tripartite), or even four parts (quadripartite). These divided sesamoids function as well as the single ones. Their only clinical importance is that they are sometimes mistaken for a fractured sesamoid. Fracture lines in sesamoids usually run transversely, resembling bipartite sesamoids. A fracture line, however, will be irregular, whereas the margin of a bipartite sesamoid is smooth and regular.

The Medial Sesamoid

Of the two, it is the medial sesamoid that most often causes problems to the patient. When the medial sesamoid becomes enlarged, it can give rise to a well circumscribed hyperkeratotic lesion under the first metatarsal head. When the hyperkeratosis becomes painful and intractable, then resection of the hypertrophic sesamoid is indicated. When evaluating the patient for surgery, it is important to differentiate between an intractable plantar keratosis caused by a hypertrophic medial sesamoid and one caused by a plantar flexed first metatarsal ray. Fortunately, the differential diagnosis is simple. Here is what to look for:

1. On a **dorsal plantar** x-ray view, the medial sesamoid will be much larger than the lateral sesamoid. In a plantar flexed first ray, the sesamoids appear normal.
2. On a **sesamoidal axial** view, the medial sesamoid will be larger and, not infrequently, somewhat irregular on its plantar aspect. On a plantar flexed first ray, the sesamoids will appear normal.
3. On a **lateral** x-ray view, the first ray will have a normal angle of declination. A plantar flexed first ray will present an acute angle of declination.
4. On palpation, when the foot is loaded and the intractable plantar keratosis is pushed dorsally, the first metatarsal head will move to the level of the lesser metatarsal heads. In a plantar flexed ray, the first metatarsal head will remain lower {more plantar wards} than the other heads.
5. Statistically, hypertrophic medial sesamoids are more **common** than plantar flexed first rays.

Medial Sesamoidectomy

Over the years, removal of the medial sesamoid has proven to be a safe and efficacious procedure that yields consistently good results. However, it became fashionable for some authors to warn against performing medial sesamoidectomies because of the likelihood of a hallux valgus forming following the surgery. They theorize that the bipennate heads of Flexor Hallucis Brevis, act as abductors and adductors of the hallux. Consequently, when the medial sesamoid is taken out, the lateral head of Flexor Hallucis Brevis will undergo hypertrophy, becoming more powerful and pulling the great toe lateral wards.

The fallacy of this theory lies in the belief that the two heads of Flexor Hallucis Brevis adduct or abduct the great toe. They do not, anymore so than the Adductor and Abductor Hallucis adduct or abduct the hallux. These muscles are primarily **stabilizing** muscles that have had the misfortune of having been named by anatomists who, thinking of the foot as an imperfect hand, used improper terminology that assigned functions to many of the intrinsic muscles of the foot that they just do not have. As an example, the Adductor and Abductor Pollicis in the hand really **do** adduct and abduct the thumb. This can be readily ascertained by holding your hand out and moving the thumb in and out (towards the hand and away from the hand). You cannot do the same thing with the big toe.

The foot is a weight-bearing organ designed for locomotion. Every year that passes we learn more about its function and realize how inadequate are the anatomical names given to the intrinsic musculature of the foot, and how misleading they are in describing their **true** function.

We can talk a great deal about the inadequacy of the anatomical nomenclature used in the foot, however, the important and most practical thing for the podiatric surgeon to remember is that the medial sesamoidectomy is an extremely valuable procedure, if performed for the right reason, and if executed with great care. When done correctly, this procedure will allow the surgeon to peel the hypertrophic medial sesamoid from the tendon, without loss of function to the medial head of Flexor Hallucis Brevis.

Medial Sesamoidectomy Procedure

Figure 3A-B, illustrates the important points of the procedure. They are as follows:

1. A lineal incision is made on the medioplantar aspect of the first metatarsophalangeal joint. The incision is deepened and the superficial bleeders are ligated. Next, dissection is performed through the superficial and deep fascia and the capsular ligament is exposed.

2. The hallux is then flexed dorsally and plantarly a number of times, so that the movement of the medial sesamoid can be palpated.

3. Once the location of the medial sesamoid is determined, an incision is made right over the point where the sesamoid articulates with the metatarsal head.

4. The capsule is retracted dorsally and plantarly and the medial sesamoid is exposed. The sesamoid is grasped with a thumb and finger forceps and literally peeled from the tendon (medial head) of Flexor Hallucis Brevis.

5. The sesamoids are attached by a very strong and fibrous intersesamoidal ligament. This ligament has to be cut in order to free the medial sesamoid from the lateral sesamoid. Extreme care must be exercised during this maneuver as the tendon of Flexor Hallucis Longus lies immediately below.

6. It is essential to remove only the sesamoid, leaving the tendon of the medial head of flexor Hallucis Brevis intact. The hallux is flexed dorsally and plantarly to check the integrity of the tendon.

7. The capsule is then closed with the suture material of choice. as is the deep, superficial tissues and skin.

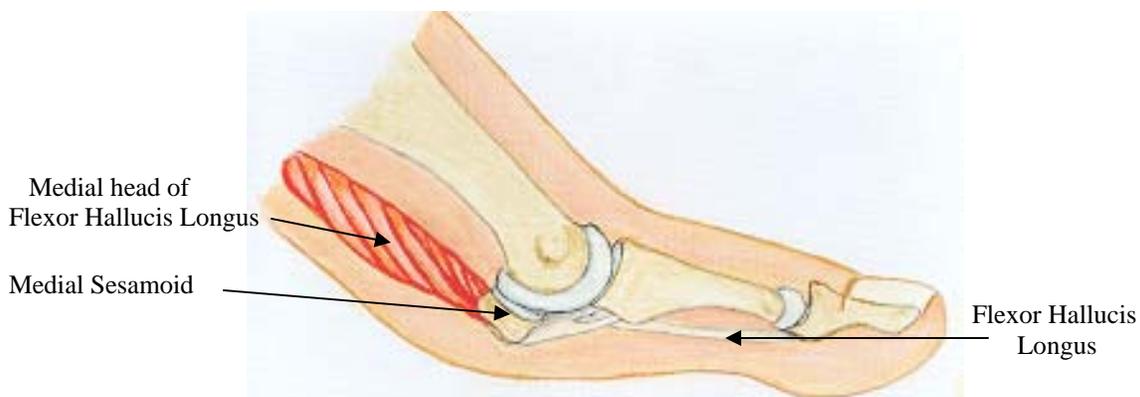


Figure 3A. Medial Sesamoid

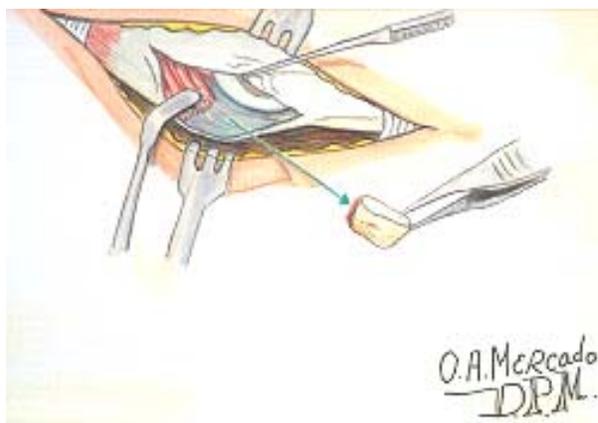
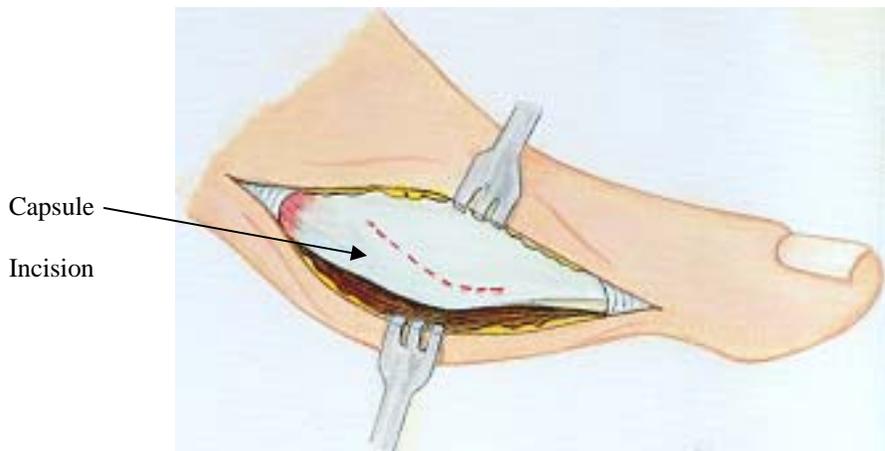


Figure 3B. Medial Sesamoidectomy

The Lateral Sesamoid

The lateral sesamoid becomes involved in hallux valgus deformities. As the first metatarsal moves medially, the great toe moves lateral wards, taking with it the sesamoidal complex. Figure 4A, shows an anterior view of the first metatarsal head and the normal arrangement of the sesamoidal complex. Note that the articular cartilage of the metatarsal head is in pristine condition. The crista is well defined and the sesamoids align perfectly with the medial and lateral articular sesamoidal facets of the metatarsal head. Everything is in place and working correctly.

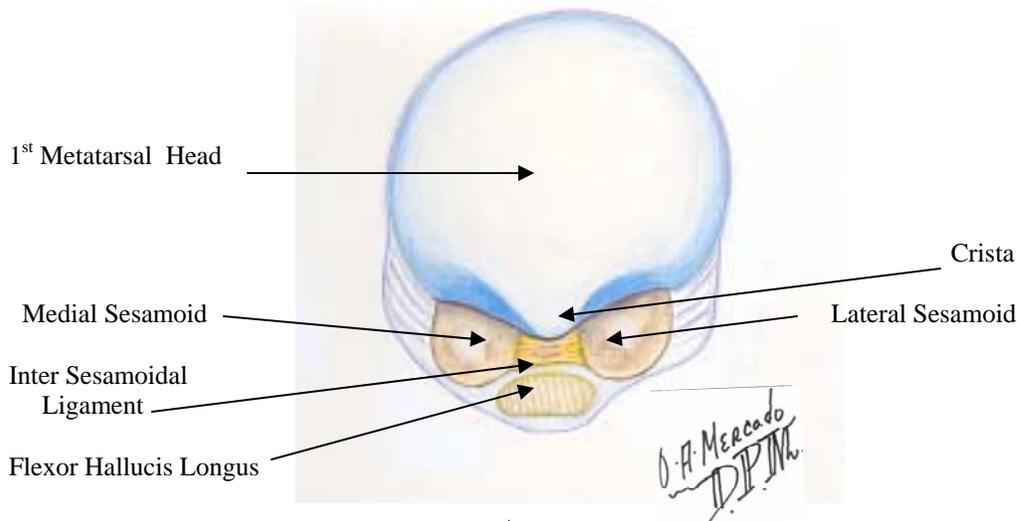


Figure 4A. Normal 1st Metatarsal Head Left (Anterior View)

The lower illustration of figure 4B, shows the progression of the sesamoidal complex from a normal joint, to an advanced hallux valgus deformity. Note that the metatarsal head has moved medially. This increases the pressure on the medial aspect of the metatarsal head against the shoe, resulting in the formation of an exostosis. Most importantly, as the metatarsal moves medially, the hallux moves inwardly, rotating the sesamoidal complex lateral wards.

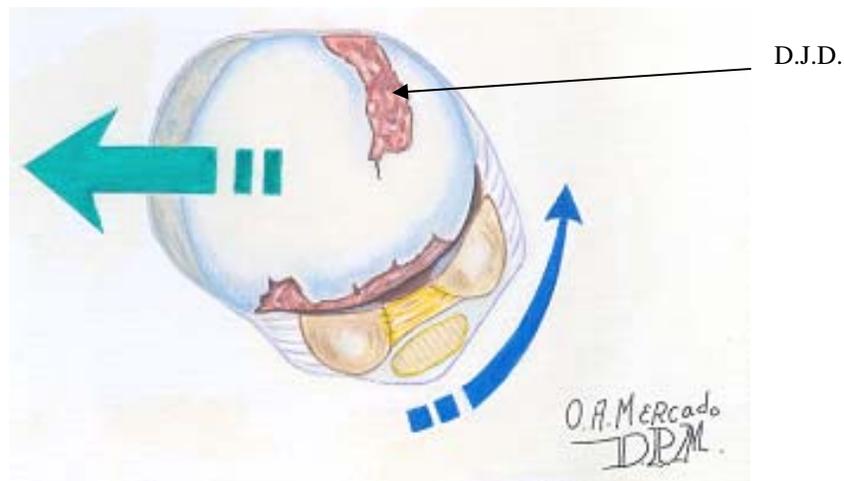


Figure 4B. 1st Metatarsal Left in Hallux Valgus (Anterior View)

With the sesamoids unable to track properly on the articulate facets of the metatarsal head, there is loss of motion and destruction of joint congruity. Cartilage is a very fragile tissue structure that needs mobility in order to remain viable. Without mobility, the result is atrophy and degenerative joint disease. The illustration shows areas of the metatarsal head that have become denuded of cartilage, down to the subchondral bone. Note that the crista has also been worn down to subchondral bone.

The Interphalangeal Sesamoid

The interphalangeal sesamoid (Figure 5A) is particularly interesting for two reasons. One, it lies at a transverse plane to the joint, not longitudinally like the sesamoids under the first metatarsal bone. Two, the interphalangeal sesamoid very often is not completely ossified and it is found as a thick fibrocartilagenous tissue. In fact, many anatomists believe that a fibrocartilagenous tissue type of interphalangeal sesamoid is almost always found in the interphalangeal joint of the hallux. However, because this tissue is not radioluscent, many diagnoses of interphalangeal sesamoids are missed.

Interphalangeal
Sesamoid

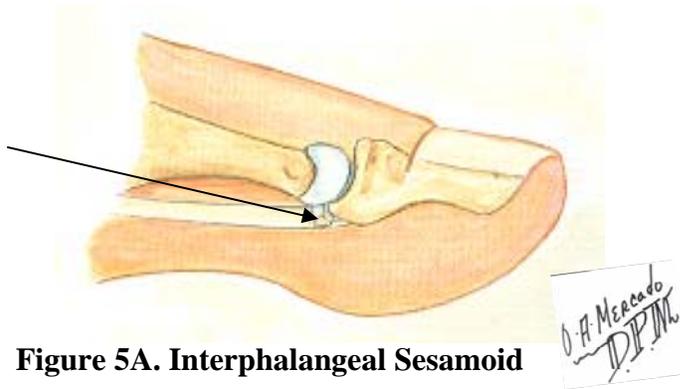


Figure 5A. Interphalangeal Sesamoid

Sometimes, interphalangeal sesamoids become troublesome to the patient, causing undue pressure and pain during the propulsive (toe-off) stage of walking. When they are enlarged, they will usually create a somewhat circular hyperkeratosis on the plantar aspect of the interphalangeal joint of the hallux.

Interphalangeal sesamoids are not difficult to resected, but the surgeon must make the proper surgical approach. Figure 5B-F illustrates the proper technique, which can be summarized as follows:

1. A medioplantar incision is made on the medial aspect of the interphalangeal joint of the hallux.

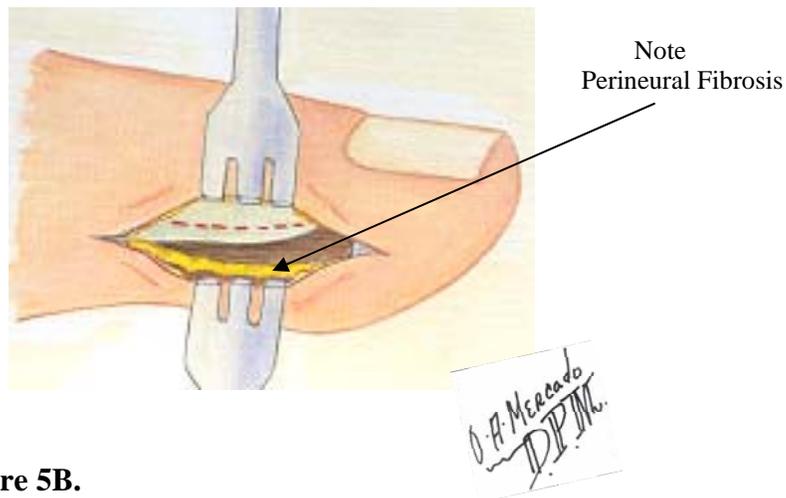


Figure 5B.

2. An important point that the surgeon has to keep in mind, is that the medial digital nerve that runs in this area more often than not becomes inflamed and painful, when the interphalangeal sesamoid is symptomatic. In time a perineural fibrosis will form in this area. It is therefore essential that the surgeon be on the lookout when the incision is made, for the enlarged digital nerve. This nerve is almost always found on the plantar aspect of the incision, immediately under the skin.

3. When a perineural fibrosis is found, the nerve is first cut distally, and tracked proximally as far possible. Ideally, it should be tracked to normal nerve tissue and then cut.

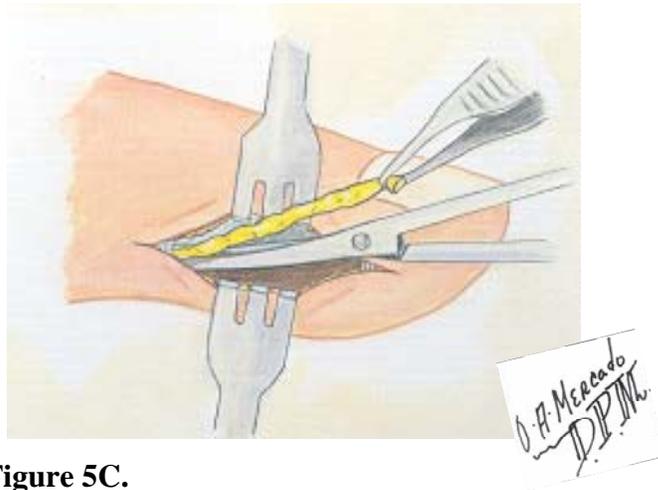


Figure 5C.

4. A perineural fibrosis can be easily diagnosed, grossly, as can be seen in the telescopic view shown in illustration 5D below. This view shows a normal nerve filament at the top. Note that the normal nerve filament will become thinner as it courses distally, very much like the branches of a tree will become smaller the farther away they go from the trunk of the tree. A perineural fibrosis is lumpy and much more enlarged than normal nerve.

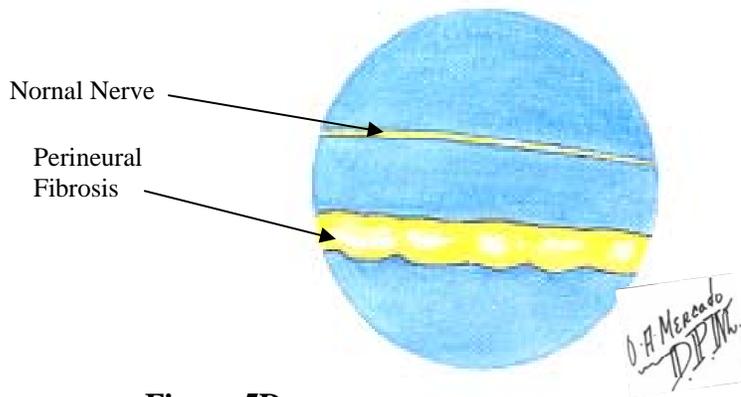


Figure 5D.

5. It is important to resect the perineural fibrosis, so as to alleviate pain.

6. Once the perineural fibrosis is resected, the wound is deepened and the capsular ligament is incised. The long flexor tendon is identified and retracted. At this point it is important to remember that the sesamoid will be found dorsal to the tendon. Also, the sesamoid, or thick fibrocartilagenous tissue, will be lying on a transverse plane.

7. It is necessary, particularly when the sesamoid is not completely ossified, to obtain enough exposure so that the entire plantar aspect of the interphalangeal joint is visible. In this manner, it will be possible to remove the interphalangeal sesamoid in-toto.

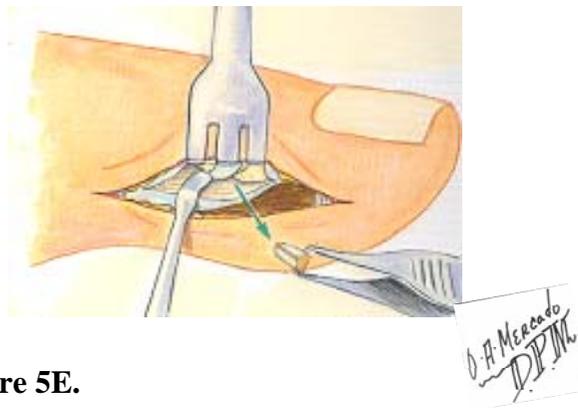


Figure 5E.

8. Figure 5F, shows a dorsal view of the interphalangeal joint. The proximal phalanx has been removed to reveal the location of the interphalangeal sesamoid on the tendon. The illustration to the right of the interphalangeal sesamoid, shows the fibrocartilagenous tissue that is usually found instead of a true sesamoid.

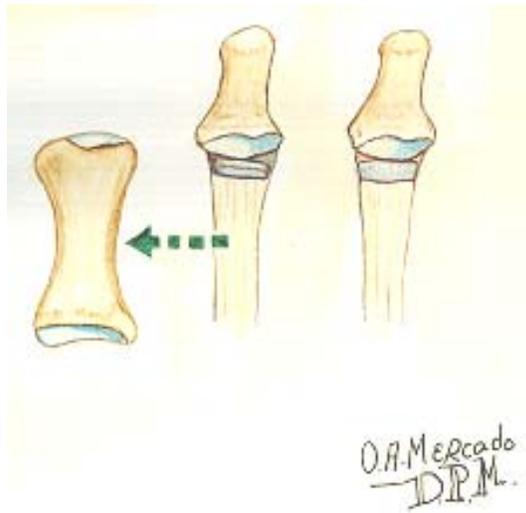


Figure 5F.

9. The wound is closed in the usual manner, healing is usually uneventful.

In future articles we will be discussing the first osteotomy specifically designed for hallux valgus surgery (can you guess which one it is?), as well as interesting and practical surgical procedures of the foot and ankle. If you have an interesting topic that you would like to see us discuss and illustrate, please email us at:

oamercado@yahoo.com

Recommended Viewing:

Medial Sesamoidectomy from The *Art of Surgery* video series.

For more information, press the **DVDs** button.

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