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# Fractures of the Sesamoid Bones of the Thumb

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## ABSTRACT

Stability of the thumb metacarpophalangeal joint is provided by the collateral ligament proper, the accessory collateral ligament, the proximal and distal palmar ligaments, and the palmar plate. The adductor pollicis and flexor pollicis brevis muscles also provide soft tissue support and insert on the proximal phalanx of the thumb by way of the sesamoid bones. Fractures of the metacarpophalangeal joint sesamoid bones are uncommon but are often associated with sporting injuries during which the joint is acutely hyperextended. Routine anteroposterior and lateral radiographs may be unremarkable, and oblique views are often necessary to document the fracture.

We report eight cases of fracture of the thumb metacarpophalangeal joint sesamoid. Seven were isolated sesamoid fractures, and one was associated with a metacarpophalangeal joint dislocation. None of the fractures were evident on anteroposterior radiographs, but all were seen in the oblique projection. Six fractures were treated with splint or cast immobilization for 2 to 3 weeks, and two were taped. Clinical followup of the seven patients with isolated sesamoid fracture at 6 to 8 weeks revealed pain-free normal function. One patient could not be reached for followup.

Fracture of a metacarpophalangeal joint sesamoid bone is an uncommon injury. These fractures usually result from hyperextension of the thumb and are generally associated with direct trauma. An association with an acute sporting injury is not uncommon.

## MATERIALS AND METHODS

Eight patients with fractures of a thumb sesamoid were seen at our clinic between 1991 and 1994. The patients' ages ranged from 19 to 69 years; seven patients were less than 30 years old. Five of the injuries were sports related, occurring in basketball (two patients), gymnastics, football, and surfing. Two patients sustained the injury during a fall, and one patient was injured while wrestling on the floor with a friend. All fractures involved the ulnar sesamoid. In seven patients there were no additional bony injuries (Figs. 1 and 2). The other patient had a radial-dorsal dislocation of the metacarpophalangeal joint associated with the sesamoid fracture (Fig. 3).

All patients had radiographs taken shortly after the injury in the AP, lateral, and oblique projections. None of the fractures were evident on the AP projections. Six of the eight were evident on the lateral radiographs, and all were apparent on the oblique radiographs.

Five patients with isolated sesamoid fractures were treated with cast or splint immobilization for 2 weeks with the metacarpophalangeal joint in 30° to 40° of flexion. Two athletes were treated with taping only and were allowed to return to activities as tolerated. The metacarpophalangeal joint dislocation was reduced in the emergency department, and a splint was applied for 3 weeks with the metacarpophalangeal joint in 40° of flexion.

## RESULTS

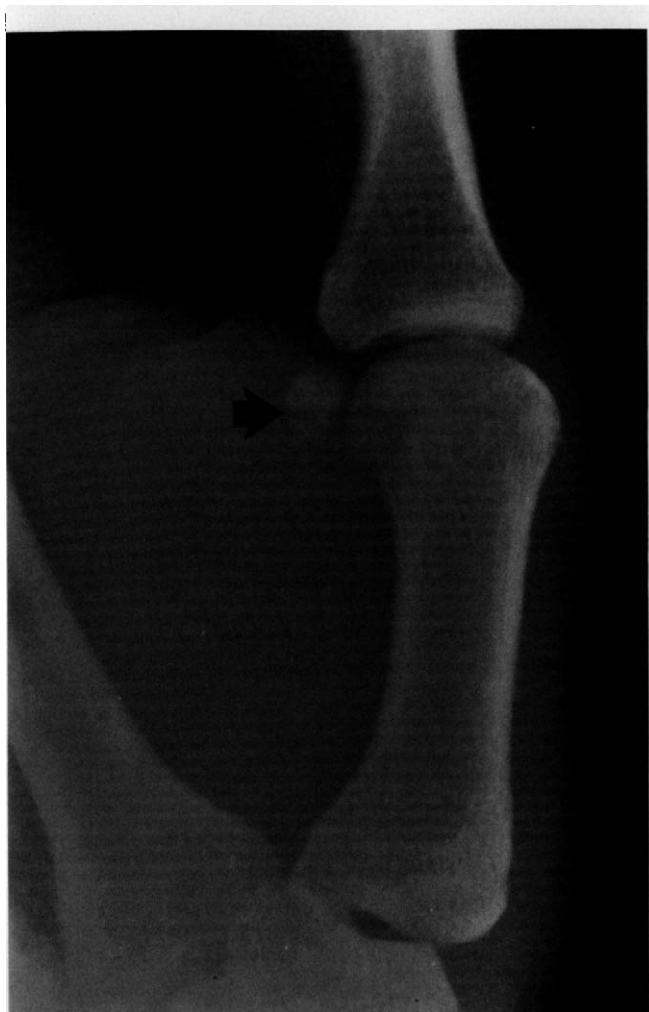
Clinical followup at 6 to 8 weeks in the seven patients with isolated sesamoid fractures revealed full range of motion and pain-free function. None required surgical intervention. Follow-up radiographs were obtained in two of these patients 18 months after the injury; both showed that the fractures were completely healed in anatomic alignment. The patient with the metacarpophalangeal joint dislocation could not be reached for followup.

## DISCUSSION

Sesamoid bones derive their name from the flat, oval seeds of *Sesamum indicum*, an ancient East Indian medicinal

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**Figure 1.** Oblique radiograph shows a nondisplaced horizontal fracture through the proximal aspect of the ulnar sesamoid (arrow).

herb used by Greek physicians for the purpose of purging. In 1892, Pfitzner<sup>14</sup> published a treatise concerning the anatomy and physiology of sesamoid bones. The first radiograph of a sesamoid was presented by Fawcett<sup>3</sup> in 1896.

In the adult, there are usually four to five sesamoid bones in the hand. Two are associated with the metacarpophalangeal joint of the thumb in 98% to 100% of the population.<sup>7,14</sup> The others are most commonly found on the radial side of the index finger metacarpophalangeal joint (40.5%) and the ulnar side of the small finger metacarpophalangeal joint (79.2%).<sup>7</sup> Far less commonly, sesamoid bones are present along the radial aspect of the long, ring, or small fingers or the ulnar aspect of the index or ring fingers.<sup>7</sup> Cartilaginous analogs for two sesamoid bones have been found at each metacarpophalangeal joint in the hands of human embryos at about 3 to 4 months.<sup>12</sup> The stimulus for some sesamoid bones to ossify while others do not remains controversial.

Ossification of the sesamoid bones generally begins around the time of puberty<sup>4</sup> and may occur from multiple centers. Failure of fusion between two ossification centers may result in bipartite sesamoid bones. Bipartite sesamoid



**Figure 2.** Lateral radiograph shows a slightly distracted fracture through the proximal portion of the ulnar sesamoid (arrow).

bones were found in 0.6% of 529 cadaveric hands by Hubay,<sup>7</sup> and in 6% of 200 cadaveric hands by Inge and Ferguson.<sup>8</sup> This normal variant should not be confused with a sesamoid fracture. The bipartite sesamoid bone will generally have a smooth surface and rounded edges, and the two pieces do not "fit together." The edges of the fractured sesamoid are more often irregular and are not corticated. Callus formation over time confirms the presence of a fracture. Nonunion of a fractured, unossified sesamoid bone in a child may lead to a bipartite sesamoid after ossification is complete.<sup>13</sup>

The first reported fracture of a sesamoid bone in the thumb was described by Skillern<sup>16</sup> in 1915. Since that time, at least 29 additional cases have been reported in the Western literature.<sup>1, 2, 5-10, 13, 15, 16, 18, 19</sup> In 20 of these reported cases the sesamoid bone involved was indicated: the ulnar sesamoid was injured in 12, the radial sesamoid in 4, and both sesamoids in 4. There have been only two reported cases of fractures of the sesamoid bones of the small finger.<sup>19</sup> Although there have been no reported cases of fractures of the sesamoid bones of the index finger, we have encountered one patient with this injury. The patient was a 40-year-old woman who complained of pain after prolonged needle work. The fracture appeared to be caused by overuse and thus represented a stress fracture.

Stability of the thumb metacarpophalangeal joint is derived from several structures (Fig. 4).<sup>5,11,17</sup> The adductor pollicis and the flexor pollicis brevis muscles assist in supporting the joint and insert onto the proximal phalanx of the thumb by way of the sesamoid bones: the adductor pollicis via the ulnar sesamoid and the flexor pollicis brevis via the radial sesamoid. There are also several fibrous and ligamentous structures associated with the sesamoid

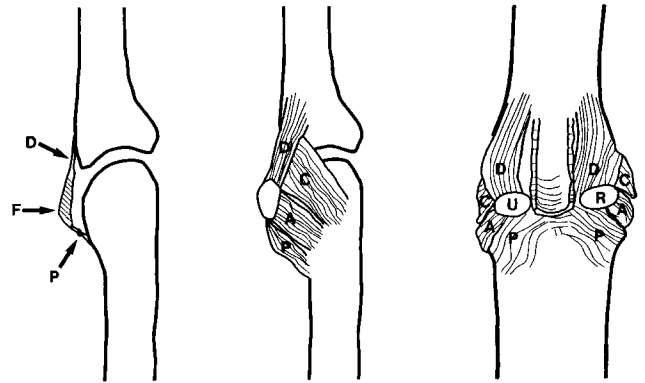


**Figure 3.** Lateral radiograph shows dorsal dislocation of the first metacarpophalangeal joint and a nondisplaced fracture through the ulnar sesamoid (arrow).

bones. The palmar plate is a fibrous structure that connects the radial and ulnar sesamoids by transverse fibers. The accessory collateral ligaments insert onto the lateral margins of the sesamoid bones. The distal palmar ligaments connect the sesamoid bones to the proximal phalanx, and the proximal palmar ligaments connect the head of the first metacarpal to the palmar plate and the proximal aspect of the sesamoid bones. Dorsally, the sesamoid bones are invested in hyaline cartilage. This allows them to slide against the ulnar and radial condyles of the metacarpal head.

In 1990, Patel et al.<sup>13</sup> reported three cases of thumb sesamoid fracture and offered a classification system based on the ability of the patient to flex the thumb metacarpophalangeal joint. Type 1 fractures were associated with an intact palmar plate and normal thumb metacarpophalangeal flexion. Type 2 fractures were associated with rupture of the palmar plate and an inability to flex the thumb metacarpophalangeal joint. Stener<sup>17</sup> explored the palmar plate and fracture fragments in three patients with fracture of the thumb sesamoid bones and found that the palmar plate was ruptured at the fracture site in all instances.

Fractures of the thumb sesamoids are usually caused by hyperextension injuries and have been associated with



**Figure 4.** Normal anatomy of the thumb metacarpophalangeal joint. D, distal palmar ligament; P, proximal palmar ligament; F, fibrous palmar plate; C, collateral ligament proper; A, accessory collateral ligament; U, ulnar sesamoid bone; R, radial sesamoid bone. (Adapted from Stener B: Hyperextension injuries to the metacarpophalangeal joint of the thumb—rupture of ligaments, fracture of sesamoid bones, rupture of flexor pollicis brevis: An anatomical and clinical study. *Acta Chir Scand* 125: 275–293, 1963.)

various sports including football, basketball, and skiing.<sup>13</sup> Patients usually have ecchymosis on the flexor side of the thenar eminence and tenderness over one or both of the sesamoid bones. Standard AP and lateral radiographs of the thumb metacarpophalangeal joint may not demonstrate the fracture; therefore radial and ulnar oblique views should be obtained if there is clinical suspicion of a fracture. Clinically, fractures of the thumb sesamoid bones should be differentiated from disruption of the ulnar collateral ligament (gamekeeper's thumb).

Treatment for sesamoid bone fractures may be determined by the extent of associated soft tissue injury; immobilization is often adequate.<sup>1</sup> Ligamentous laxity is evaluated by stress testing of the thumb metacarpophalangeal joint in extension and 40° of flexion using local anesthesia if necessary. If the joint is stable (Patel Type 1), immobilization with the metacarpophalangeal joint in 30° of flexion for 2 to 4 weeks has been recommended. This position ensures that the fracture fragments are not pulled proximally by the adductor pollicis and flexor radius brevis and affords the fibrous palmar plate the opportunity to heal. Our experience has shown that taping may be adequate. The fractures in our series were either nondisplaced or only minimally displaced and were considered incidental to an injury to the palmar plate. Taping addressed the soft tissue injury and expedited return to normal activities by providing external support. This treatment proved to be particularly acceptable to the athletes in our population, and no complications arose. If pain and discomfort should persist after adequate conservative treatment, excision of the bone may be needed.<sup>6</sup> Patel Type 2 fractures may require surgical reduction of the fracture fragments and repair of the palmar plate if instability of the metacarpophalangeal joint is clinically demonstrated.<sup>13,17</sup>

Fractures of the sesamoid bones of the thumb metacarpophalangeal joint are unusual injuries associated with hyperextension of the thumb and are often related to sports injuries. Minimally displaced or nondisplaced fractures not associated with metacarpophalangeal joint instability may be treated with taping and gradual return to activities as tolerated. Since sesamoid fractures may not be evident on routine AP and lateral radiographs of the metacarpophalangeal joint, oblique radiographs should be obtained when the diagnosis of a sesamoid fracture is clinically suspected.

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