BONY AVULSION IN LONG FINGERS

– Written by Gregoire Chick, Switzerland and Qatar

Hand and wrist injuries represent 9% of all athletic injuries[1], which is an underestimated figure. Hand lesions are often trivialised by the athlete, coach, teammates and therapists. Most acute lesions are nonspecific. Some injuries are specific to certain types of sports, such as the jersey finger in rugby. Bone tearing is often indicative of ligament or tendon damage; these lesions can be treated as fractures or pure ligament lesions, depending on the size of the detached fragment. It is essential that a correct diagnosis is made quickly so that appropriate treatment options can be instigated. Physical examination is crucial: passive instability indicates ligament injury, and lack of active mobility denotes tendon injury. Radiographs should be taken to distinguish between a pure soft tissue injury and a fracture.

The objective is to enable the quickest return to the field, in the best possible conditions, without jeopardising the athlete's professional future or their career change.

BONY JERSEY FINGER

The avulsion of the flexor digitorum profundus (FDP) ('jersey finger') from the distal phalanx is a rare lesion, which occurs mainly in rugby, American football or judo. Emergency diagnosis is necessary because secondary reconstructions give uncertain results[2]. It can nonetheless be disastrous for a top-level athlete's career, due to the total interruption of sport for the several weeks required for treatment.

The mechanism of this injury is stereotypical: it results from the classic act of grabbing the jersey of an opponent, especially when tackling. Close-fitting jerseys should help decrease its frequency. The sudden hyperextension of the fingertip causes the rupture. The ring finger is particularly vulnerable (80% of cases)[3] because of its decreased independence in flexion/extension and the greater fragility of the insertion of the deep flexor at the distal phalanx.

Leddy and Parker[4] described a classification of this injury into three groups (Figure 1) that take into account the degree of retraction of the FDP, the degree of involvement of the vincula (part of the nutrition system) and the presence of a bone fracture.

Type III injuries are similar to a digit fracture and are therefore often diagnosed in emergencies. The patient usually signals major pain in the ring finger in the aftermath of a tackle. Functional impairment of the finger and difficulty in actively bending the distal phalanx over the intermediate phalanx leads the patient to seek care. On examination, the finger may be swollen, sometimes with a bruise on the fold of the distal interphalangeal (IP) joint. There is tenderness at the FDP insertion or along the digit. The loss of active flexion of the distal IP is demonstrated by asking the patient to bend the last joint, after stabilising the proximal IP in extension.

Type II: On palpation, a painful mass is sometimes found on the volar surface of the proximal IP, with a bruise on the fold of the proximal IP joint.

Lateral or anterior-posterior views of the finger can show a fracture of the distal phalanx (type III) or a fragment with osteoperiostitis on the volar surface of the finger (type II). An ultrasound or MRI may be useful in assessing the degree of tendon retraction (type I and II).

Treatment in acute lesions (< 3 weeks)

Treatment of type III injuries consists of reduction and fixation of the fracture using one or two screws or pins, depending on the size of the fragment. If the fragment is too small, there are several techniques for reinsertion of the FDP on the distal phalanx, including pull-out fixation on the pulp or on the nail or by one or two mini-anchors (Figure 2). For types I and II, the reinsertion of the distal phalanx is similar. Solid reinsertion allows an immediate active

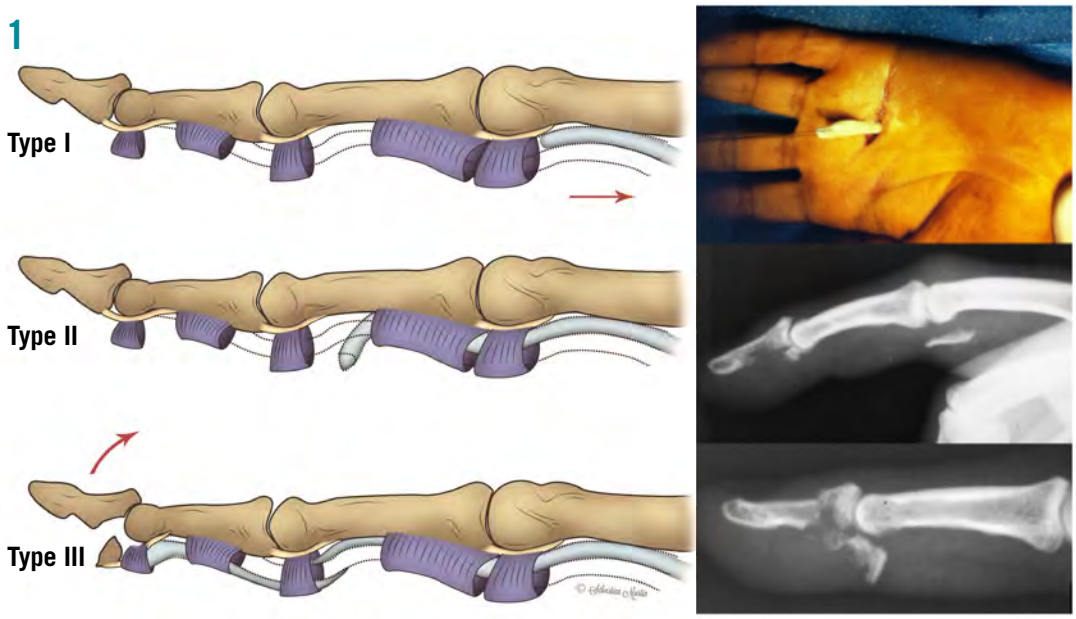


Figure 1: Leddy and Parker classification.

Type I: FDP tendon retracted to the palm. Leads to disruption of the vascular supply.

Type II: FDP retracts to the level of the proximal IP joint (a bone fragment may be present at this level).

Type III: Large avulsion fracture limits retraction to the distal IP joint.

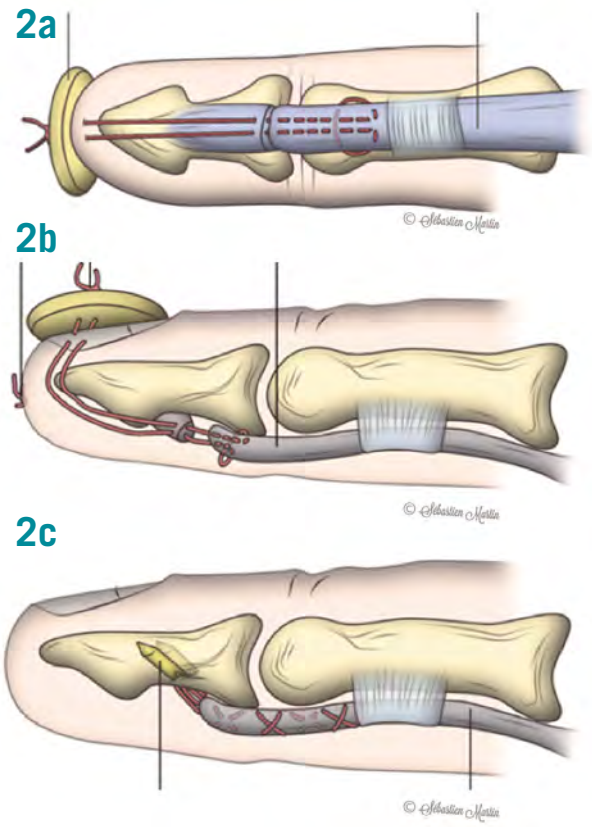


Figure 2: Reinsertion of the FDP to the distal phalanx. a) Pull-out fixation on the pulp. b) on the nail. c) by two mini-anchors.

rehabilitation with a protective splint in flexion for six weeks. It is not until the sixth week that extension is started. A dynamic extension brace is usually prescribed at eight weeks.

Therapeutic approach recommended in athletes

The reinsertion of the FDP on the distal phalanx to restore fine grip in the index finger or to lock grasp on the fifth finger is feasible before three weeks. Pull-out and anchor fixation combinations are preferred. Alternatively, a simple tenodesis or even an arthrodesis of the distal IP for the other fingers may be proposed if the athlete refuses the constraints of being inactive during convalescence, as well as the period of immobilisation that follows the tendon repair.

BONY MALLET FINGER

This is a common injury caused by disruption of the terminal extensor tendon of the distal IP joint. The disruption may be bony or tendinous, with one-third of these injuries being bony and two-thirds tendinous. The terminal extensor has poor vascularisation, like the dorsal skin of the last phalanx, and this zone is fragile. This injury is frequent during ball sports and often involves the long, ring and small fingers of the dominant hand.

The mechanism of injury (Figure 3) may be a traumatic forced flexion on the tip of the finger in the extended position is usually responsible for the tendinous mallet finger, mostly with light velocity; while an axial load is responsible for the bony mallet finger, or sometimes a crushing-type laceration in the dorsal distal IP joint.

The primary symptoms of bony mallet finger consist of a painful, swollen distal IP joint following injury to a finger, often in ball sports. At inspection, the fingertip rests at around 30–45 degrees of flexion, with a lack of active distal IP extension. Radiographs should be taken to distinguish between a pure soft tissue injury versus a fracture with possible subluxation[5]. X-rays provide a correct classification, indicating the type of treatment required (Figure 4).

Nonoperative treatment consists of distal IP joint splinting for six to eight weeks for 24 hours a day. This is used in acute soft tissue injury (less than 12 weeks) with or without a small dorsal avulsion fracture and nondisplaced bony fractures.

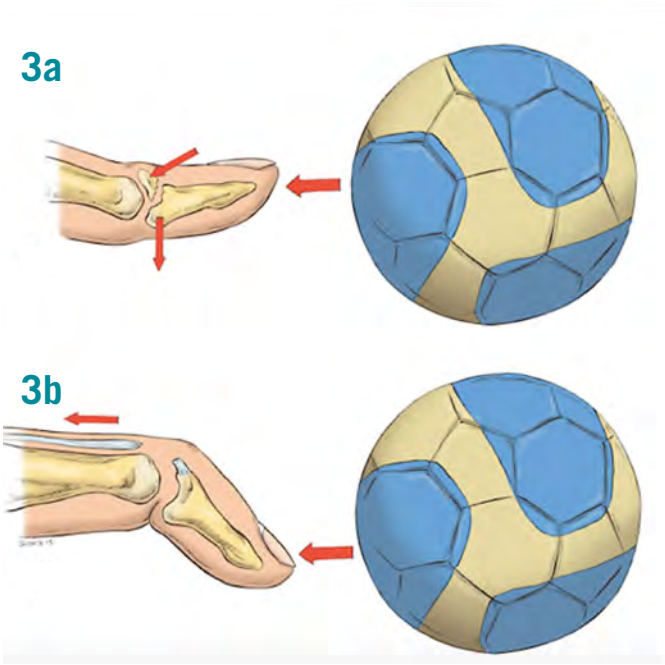


Figure 3 (a and b): Mechanism of injury in mallet finger.

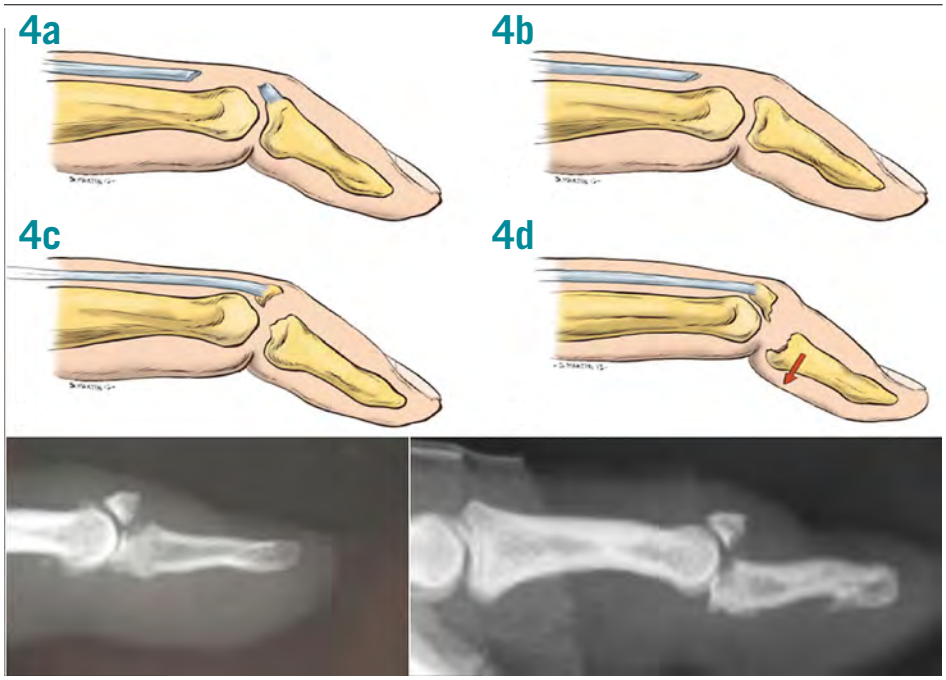


Figure 4: Mallet finger classification. a and b) Closed injury with or without a small dorsal avulsion fracture. c) Mallet fracture: fracture fragment involving 20–50 % of the articular surface. d) Fracture fragment > 50% of the articular surface with volar dislocation of distal phalanx.

Splinting is in neutral IP joint extension (avoid hyperextension), positioning by different techniques (volar or dorsal) while maintaining free movement of the proximal IP joint for six weeks (bony mallet) to eight weeks (Figure 5). If the fingertip is held up with a fashioned splint for six weeks in 90% of cases the bone will heal and excellent function is restored. The main risks are relapse after removing the splint.

The absolute indication for surgery is in cases of volar subdislocation of the distal phalanx. Relative indications for surgery are involvement of more than 50% of the joint surface or an articular gap bigger than 2 mm (Figure 6). Treatment may use simple pin fixation or dorsal blocking pins.

These injuries will usually respond to extension splinting, but missing the diagnosis can lead to a fixed dorsal IP joint flexion deformity. Swan neck deformities occur due to volar plate and transverse retinacular ligament of the proximal IP joint dorsal subdislocation of lateral bands, resulting proximal IP hyperextension. Contracture of the triangular ligament maintains the deformity. A slight residual extensor lag of > 10 degrees may be present at completion of closed treatment.

Surgery is fraught with complications and there is no good evidence that there is an earlier return to sport or a better long-term outcome. The exception is when the fracture is displaced so that the joint is no longer congruous. Surgery is then needed to restore the joint contour[5]. However, stiffness and wound problems are more likely with surgery.

PROXIMAL IP DISLOCATIONS

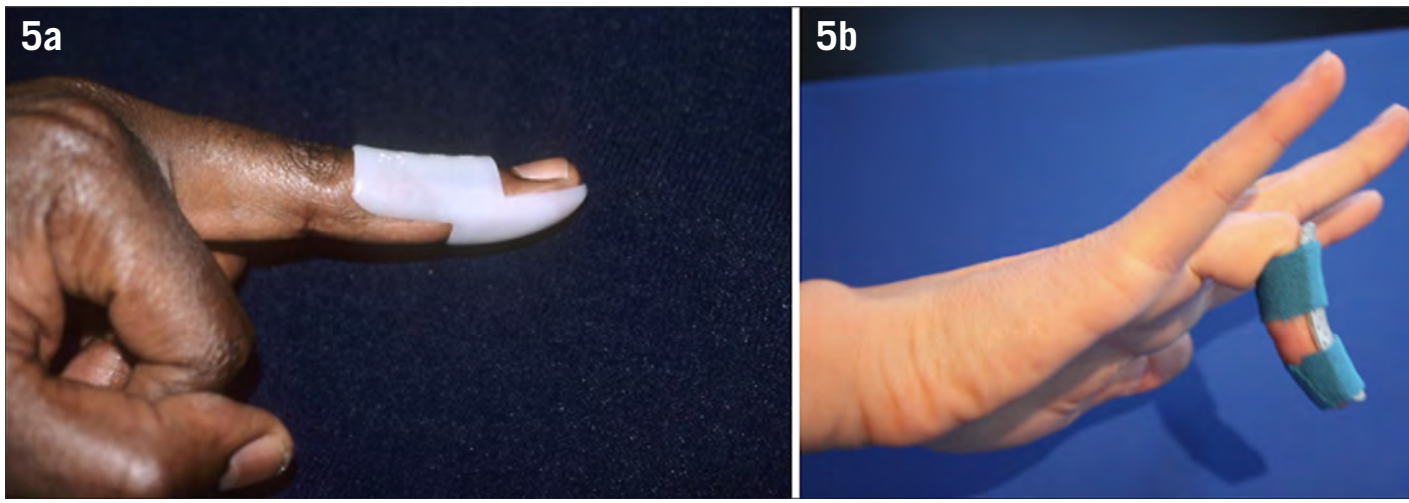
The proximal IP joint is the most common site of ligament injuries of the hand, ranging from simple sprains (jammed finger) to very challenging proximal IP fracture-dislocations[6]. Injuries to the proximal IP joint can be considered as soft tissue or bony lesions. According to the direction of the forces and the energy expended, one or more structures can be injured, to varying degrees. The diagnosis relies on the mechanism of the injury and clinical examination.

Treatment strategies are based on obtaining a congruent joint with early mobilisation to prevent future stiffness and osteoarthritis. The main concern here is motion. As minor as they might seem, they must never be underestimated. Neglected finger injuries may lead to chronic lesions such as instability, stiffness, deformities, persistent pain and osteoarthritis, with detrimental consequences for the practice of a sport.

Sprains of the volar plate

These sprains are the most common joint injuries of the hand. The mechanism is a hyperextension of the proximal IP joint, especially in ball sports and in the following order: handball, 22%; basketball, 13%; volleyball, 13%; rugby and soccer, 11%[6]. The finger becomes swollen and painful and a diffuse haematoma is observed around the volar side of the proximal IP joint.

Clinical examination is difficult because of the pain, which increases in hyperextension. There is no lateral instability. The search for a boutonniere deformity is difficult at this stage of examination and is often only a secondary finding. If there is the slightest proximal IP flexion with a distal IP hyperextension, the



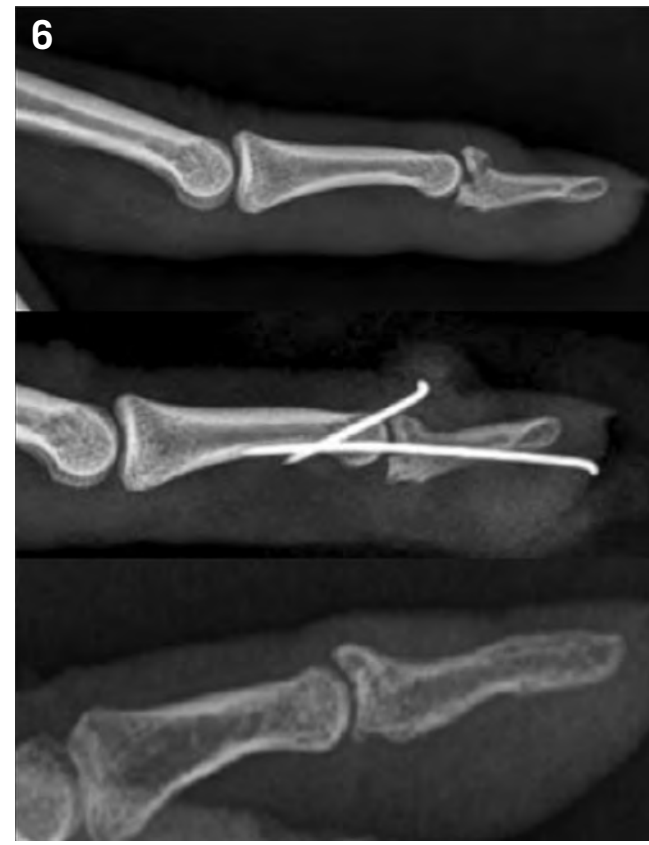


Figure 5 (a and b): Mallet splints.

Figure 6: Type 3 bony mallet finger. Pin fixation according to Viegas with distal IP joint blocking pin. Bone healing at three months.

lesion should be considered a boutonniere and treated as such. Lateral views show a small piece of bone at the base of the intermediate phalanx in 30–40% of cases, denoting a volar plate tear.

Treatment of volar plate lesions consists of early mobilisation, with buddy taping, regardless of the presence of a bone fragment. The return to sport is not possible before six weeks. Even after early mobilisation, a deficit in proximal IP joint extension may appear due to retraction of the volar plate. A dynamic splint (e.g., Cappener) and specialised rehabilitation are required. In any case, the patient should be warned about the classic sequelae: the almost definitive persistence of an enlargement of the joint with chronic pain and intolerance of cold for at least a year.

In cases of volar fracture affecting more than 40% of the articular surface, the therapeutic approach is identical for stable fracture-dislocations where there is a volar fragment, with a concentric joint after reduction.

Dislocations and fracture-dislocations

Ninety percent of proximal IP joint dislocations are dorsal and are often reduced immediately and quickly on the field before the onset of swelling and pain. The main concern here is identifying severe lesions. Return to play can occur after buddy taping, if strapping does not interfere with controlling the ball. The main decision is whether the injured athlete can continue playing and the patient must be re-examined by a hand surgeon after the game to properly evaluate the lesion. In case of signs of severe injury, such as failed reduction (entrapment of soft tissues), instability after the reduction, suspicion of an associated fracture or tendon injury or an open wound, the athlete should be removed from the field. An urgent assessment by a hand surgeon is necessary as certain types of lesions require surgical treatment and should thus be identified early[6]. In the emergency room, X-rays taken before reduction can detect any associated fracture as well as joint congruence after closed reduction.

Dorsal proximal IP dislocation

Dorsal proximal IP dislocations result from hyperextension injuries of the proximal IP joint. Usually an axial component contributes to the deformity of the finger. The middle phalanx is dorsally dislocated and the volar plate is avulsed from its distal insertion, which prevents its entrapment in the joint.

The on-field reduction of a seemingly trivial dislocation does not preclude the need for clinical and radiological examination to manage complex cases and avoid complications. Dorsal dislocations are most likely to have an associated fracture. Small avulsion fractures at the volar base of the middle phalanx should be treated as a soft tissue injury, but larger bony fractures may require surgery. Surgery is indicated in three

cases: when the dislocation is irreducible because of soft tissue entrapment, when the joint is unstable or incongruent beyond 30 degrees of flexion and in cases of fracture-dislocation affecting more than 40% of the articular surface with a concentric joint after reduction (Figure 7).

When a bone fragment cannot be repaired, removal of the fragment associated with a reinsertion-advancement of the volar plate by intraosseous anchoring is recommended. An injured collateral ligament is reinserted. The proximal IP should be splinted between a mild flexion and an authorised flexion, which gives time for the volar plate to heal.

Collateral ligament injuries

A complete interruption of the collateral ligament is always present in cases with a 20 degree displacement in extension, and in only 53% of cases when the displacement is < 20 degrees[6]. Tenderness at the radial or ulnar proximal IP joint may signify collateral ligament injury. Stress radiographs can demonstrate pathologic instability and subluxation suggests concurrent volar plate injury.

Radial injuries with proximal avulsion are the most common. Stable injuries respond to conservative management with buddy taping, with or without initial splinting, but surgical intervention is likely to be needed for unstable injuries.

Surgical repair of collateral ligaments is recommended in athletes, especially for injuries of the index finger involving the radial collateral ligament, which is essential for pinch grip, whether there is a bony fragment or not.

Whenever a bone fragment cannot be repaired, removal of the fragment associated with a reinsertion-advancement of the ligament by intraosseous anchoring is recommended. A large bone fragment with a true articular fracture is an indication for fixation (Figure 8). However, the indications must be carefully considered because there is a risk of stiffness after the surgical intervention.

Volar proximal IP joint dislocation

Without a rotational component

These dislocations are usually caused by anteroposterior trauma to a semi-flexed finger. The most common type of lesion involves the central extensor tendon. Reduction is usually achieved by

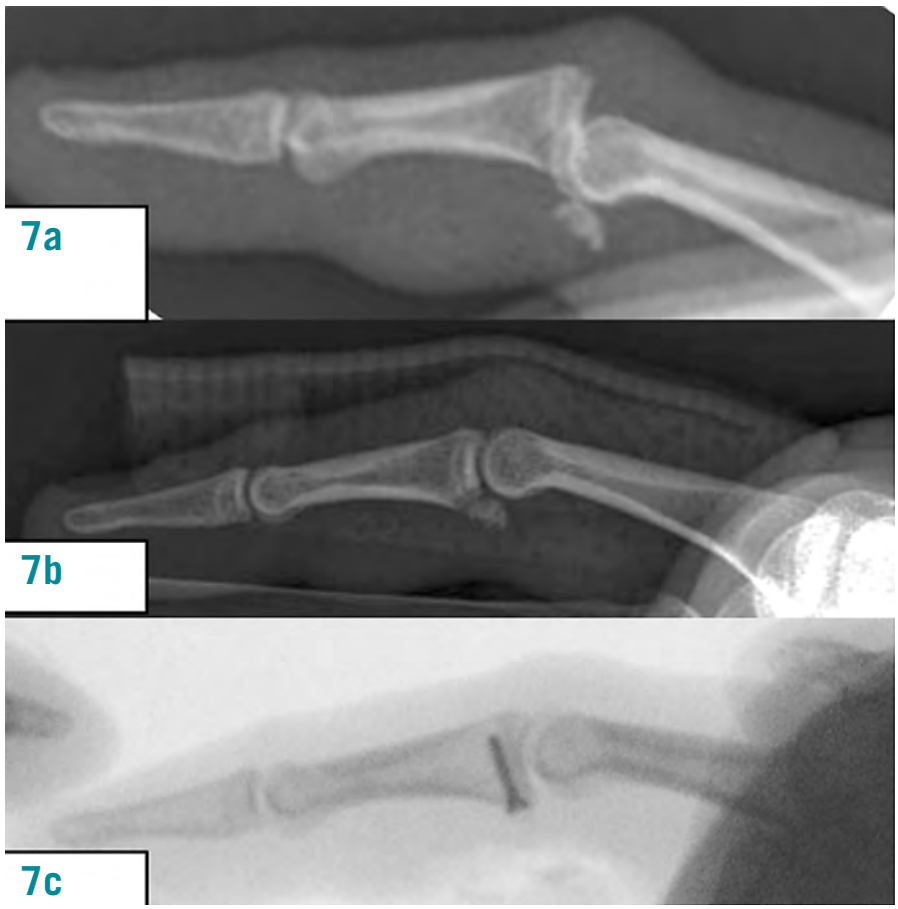


Figure 7: a) Dorsal proximal IP dislocation with avulsion fracture at the volar base of the middle phalanx. b) Unstable after reduction. c) Internal fixation using a compressive screw.

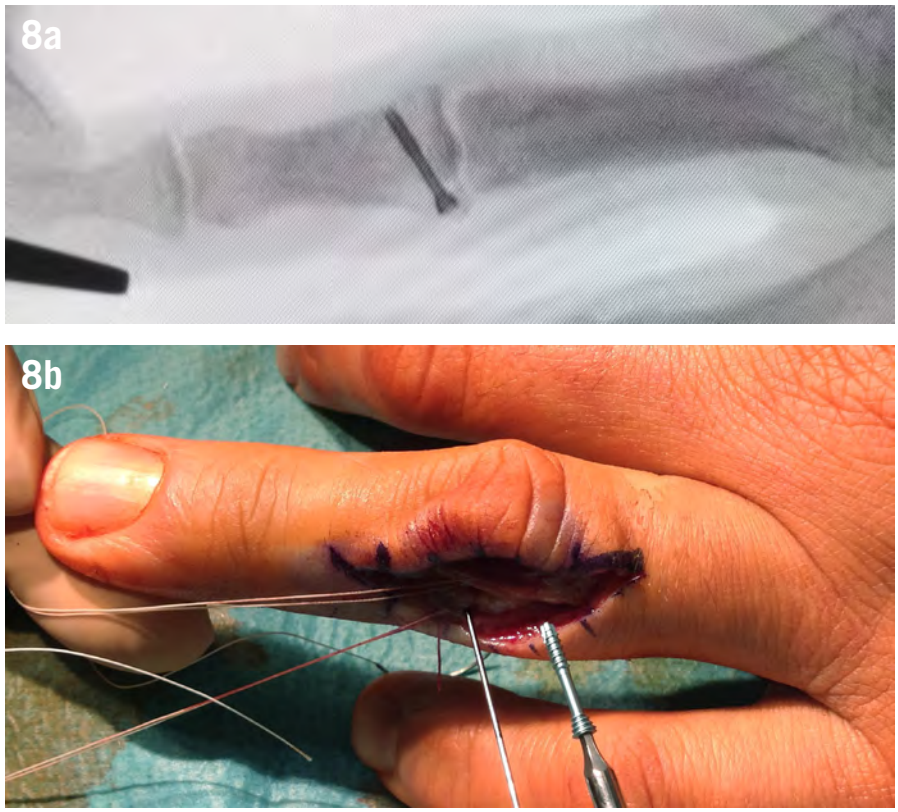


Figure 8 (a and b): Large ulnar proximal phalanx bone fragment, right ring: compressive screw fixation.

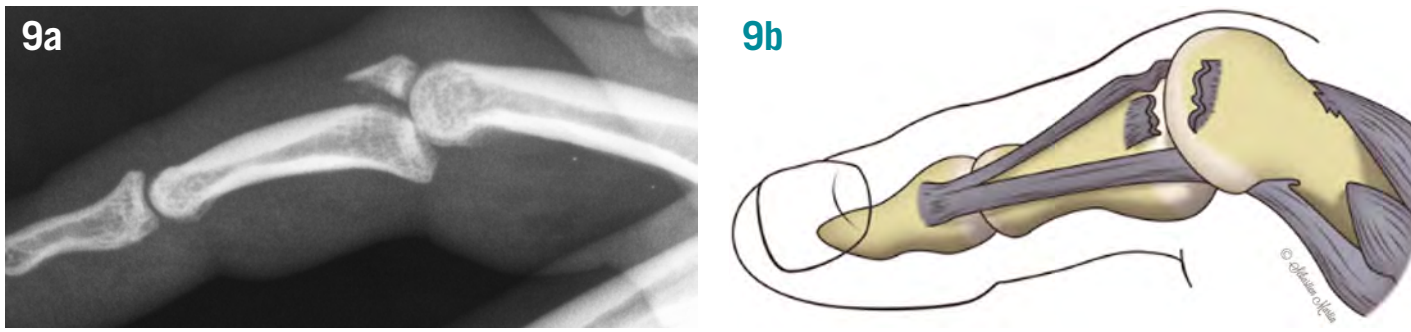


Figure 9 (a and b): Volar proximal IP joint dislocation without a rotational component; with a rotational component: noose effect.

longitudinal traction followed by extension of the proximal IP joint. Specialised examination is required to assess the integrity of the central tendon (Figure 9).

With a rotational component

These dislocations are usually caused by direct trauma to a semi-flexed finger with a varus or valgus component. This type of dislocation cannot be reduced by longitudinal traction because it induces a 'noose effect', wedging the condyle between the central and lateral extensor tendons. Open reduction is necessary (Figure 9).

In cases of a partial lesion of the central slip, conservative treatment is recommended. A large bone fragment with a true articular fracture is an indication for fixation (Figure 9). The fixation must be technically excellent and must be strong enough to allow immediate movement.

Tenderness to palpation at the central slip insertion suggests a tear and if the proximal IP joint cannot be actively extended or persists with an extensor lag of 25 degrees or more, a central slip rupture can be assumed. Again, early diagnosis and initiation of extension splinting (for three weeks) are critical to treatment of this injury, with immediate active motion of distal IP joint. The consequences of a missed rupture are progressive deformity and loss of function consistent with a boutonniere deformity. This sequela of late treatment commonly requires more invasive treatment and frequently entails a less satisfactory outcome.

CONCLUSION

A rigorous clinical and radiological examination is critical to ensure that an unstable lesion, incomplete reduction or associated fracture is not overlooked. There is an increased risk of re-injury or new injury. Osteoarthritis is a definite risk. Preventive treatment and education of the athlete are part of global treatment.

"Timing not only when to perform surgery but also when to clear an athlete for return to play after treatment is complex and multifactorial."

– MG Carlson
Elite athlete's hand and wrist injury
Hand Clinics 2012.

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