THE HAND is the most common area of injury in children. Hand injuries, including fractures and sprains, account for a large proportion of emergency room visits in children. Unlike older athletes, children have active physes (growth plates) that are vulnerable to trauma, increasing the risk of permanent growth abnormalities, angular deformities, and dysfunction. Growing bones are relatively more fragile than skeletally mature bone; thus, children are more likely to fracture bone than to sprain a ligament or tendon. Injuries to the hand and fingers not only affect function, skill, and athletic participation, but also self-esteem and confidence. Hence, it is imperative to identify those hand injuries in young athletes that have a higher risk of complications and may require surgical referral.

Pathoanatomy

The extensor and supinator musculature and tendons are located on the dorsal aspect of the forearm and hand, whereas the flexor and pronator structures lie on the volar aspect. The radial and ulnar arteries divide into digital arterial branches that supply the fingers. The hand and fingers are innervated by the radial (C5-C8, T1), ulnar (C8, T1), and median (C5-C7) nerves. A physis is located at the base of each phalanx and at the head of each metacarpal, with the exception of the first metacarpal where the growth plate resides at the base. Any of these structures can sustain associated damage during hand or finger injury.

History and Examination

Mechanism of injury can often guide the clinician to a diagnosis. Athletes frequently sustain axial loading (or “jamming”) injuries to their fingers, leading to tendon rupture and loss of function. Finger hyperextension injuries are a common cause of physeal fracture or joint dislocation. Crush injuries of the fingertips should raise suspicion for fracture, particularly tuft fracture. Evaluation of neurovascular status remains a critical component of the hand and finger evaluation. Radial pulse and capillary refill should be brisk, and overlying skin should be pink and warm. Sensation should be intact along the radial, median, and ulnar nerve distributions. The “O.K. Test” is a useful tool in the brief, rapid assessment of neurologic motor function. Ask the patient to make the “O.K.” sign with their injured hand and fingers. Inability to dorsiflex the wrist indicates radial nerve injury. Lack of abduction of digits #3-5 indicates dorsal interossei weakness caused by ulnar nerve damage. Finally, inability to appose the thumb and...
index finger demonstrates median nerve injury causing flexor pollicis longus and flexor digitorum profundus dysfunction.

Another essential element of the physical examination is evaluation of rotational or angular deformity or displacement. In flexion, the longitudinal axis of the fingers should each intersect at the same location within the carpal scaphoid bone. Comparison to the uninjured hand may be helpful. Long-term immobilization without recognition and correction of dislocations and malalignment, such as translated, rotated, or angulated fractures, can lead to permanent deformity, decreased range of motion, and dysfunction.

**Jersey Finger**

Forced extension of the distal phalanx while actively flexing at the distal interphalangeal joint (DIP) may cause a rupture of the flexor digitorum profundus (FDP) tendon. American football players may incur this injury while attempting a tackle of an opponent, hooking their finger on the opponent’s jersey. The 4th finger (ring finger) is the most commonly injured digit. Athletes may complain of pain and swelling at the DIP joint and report a “popping” sensation at the time of injury. On examination, there may be tenderness to palpation over the volar aspect of the injured finger and inability to flex at the DIP joint. The examiner can test the function of the FDP tendon by holding the proximal interphalangeal (PIP) joint in extension while having the injured athlete attempt flexion at the DIP joint. A grade III (complete) tear of the FDP tendon with an associated bony avulsion fracture can lead to compromised palmar digital artery blood supply. Left undiagnosed, complications include poor healing and loss of function. Hence, grade III tears must be recognized early to prevent delay of care. Standard x-rays of the injured digit in posterior-anterior (PA), lateral, and oblique views can visualize an avulsion fracture and the associated level of retraction of the torn FDP tendon. The injured finger should be splinted in a comfortable position and immediately referred to an orthopedic surgeon. Typical return to play is 6–12 weeks after surgery.

**Mallet Finger**

An axial load or forced flexion placed against an actively extending finger (“jammed finger”) can lead to rupture of the extensor digitorum (ED) tendon. Classic scenarios involve a baseball player diving into base or a basketball player catching a pass. Symptoms include pain and swelling at the dorsal aspect of the DIP joint. Injured athletes will be unable to extend at the DIP joint and will have tenderness to palpation over the dorsal proximal aspect of the distal phalanx. Dorsal bone avulsion fractures are concerning, as they typically signify a grade III rupture of the ED tendon. If untreated, complete ED tears lead to permanent DIP extensor lag. Three view x-rays of the injured digit may reveal a bony avulsion fracture from the dorsal proximal aspect of the distal phalanx. Without an avulsion fracture, the injured DIP joint should be splinted in full extension for 6–8 weeks, with an additional 6–8 weeks of splinting during sports activities. Compliance with extension splinting for the entire duration is absolutely mandatory; failure to comply may lead to poor healing, loss of function, and permanent DIP extensor lag. If an avulsion fracture is present, the finger can be placed in a dorsal splint in full extension for 4 weeks; however, if the fracture involves greater than 30 percent of the joint space, the athlete should be referred to an orthopedic surgeon for open reduction and internal fixation (ORIF). Reliable athletes may return to sport immediately with appropriate extension splinting.

**Skier’s Thumb (Gamekeeper’s Thumb)**

Hyperabduction of the thumb metacarpal-phalangeal (MCP) joint can produce a rupture of the ulnar collateral ligament (UCL). This injury may be seen in skiers who fall while holding onto their ski poles. Patients will complain of pain over the medial aspect of the MCP joint and pain with apposition or pinching. Many clinicians recommend x-ray evaluation prior to physical examination in order to rule out avulsion fracture, which can be displaced and unstable. On examination, the injured hand may demonstrate pain and swelling over the thumb MCP joint and a weak or painful pinch. If there is no radiographic evidence of avulsion fracture, joint laxity may be revealed with valgus stress on a fully flexed MCP joint. A soft endpoint or greater than 15 degrees difference in angular laxity compared to the uninjured thumb signify an UCL rupture. Avulsion fractures that are rotated or displaced greater than 2 mm are considered unstable, and an arthrogram is recommended to evaluate UCL integrity. Complications include prevention of primary healing by a
Stener lesion, which is superficial displacement of the torn end of the UCL into the aponeurosis of adductor pollicis. Stener lesions and unstable avulsion fractures should be referred to an orthopedic surgeon for ORIF (Figure 1). Otherwise, a Skier’s Thumb injury should be treated with a thumb spica short arm cast for 4–6 weeks.7 Athletes may return to play in the cast if permitted or immediately after completion of casting with subsequent splinting or bracing for sports activities for another 2–4 months.

**Middle Phalangeal Fractures**

Direct trauma or twisting forces are a cause of middle phalanx fractures. Pain, swelling, deformity, and tenderness to palpation over the middle phalanx can be indicative of fracture. Examiners should evaluate for rotation, angulation, and displacement of the digit. If stable and not displaced or angulated, these fractures can be splinted for 3–4 weeks and buddy-taped with immediate return to sports.7 If the fracture is intra-articular, severely angulated, or unstable, the injured athlete should be referred to an orthopedic hand surgeon.

**Proximal Phalangeal Fractures**

Pain, swelling, and deformity at the base of an athlete’s finger may be evidence of a proximal phalanx fracture. Spiral or oblique fractures of the proximal phalanx tend to shorten and are inherently unstable. They can be difficult to treat with closed management, and poor healing can lead to scarring and displacement, which disturbs tendon balance. Three view x-rays will show shortening, displacement, or angulation. Stable fractures can be managed with immobilization for 3–4 weeks with the wrist in slight extension and the MCP flexed to 70 degrees (Figure 2).7

**Boxer’s Fracture**

Poor punching technique can create an axial load or compressive force on the fourth and fifth metacarpals, leading to a fracture at the metacarpal neck. Pain, swelling, ecchymosis, and angular or rotational deformity may be present. Radiographs, particularly PA and lateral views, are helpful to define the fracture(s), evaluate for physeal involvement, and confirm angulation, rotation, or displacement. Less than 40 degrees of angulation in the fourth and fifth metacarpals is acceptable in preventing loss of function. Assessment of rotational deformity is critical, as these fractures
require reduction and stabilization. Prior to hand-based molded casting for 4 weeks, boxer’s fractures can be temporarily immobilized with an ulnar gutter splint with the MCP joints flexed to 70 degrees.8 If permitted, athletes may return to play while in the cast or with splinting for 4–6 weeks after cast removal.

**Dislocations**

Most commonly dislocated, PIP joint dislocations are typically dorsal in nature and are often caused by hyperextension of the joint with a simultaneous axial load.8 Athletes may present with pain, swelling, deformity, or an inability to move the joint. Lateral view x-rays reveal a dorsally displaced phalanx; three view x-rays can assess for associated avulsion fracture, physeal fracture, or angulation. Distal volar plate rupture with associated avulsion fracture can be a complication of dorsal dislocations. Without fracture, the dislocation can be reduced using gentle distal traction with pressure applied to the distal dislocated portion and counterpressure applied at the proximal intact portion. Postreduction radiographs are recommended to verify anatomic alignment of the joint.8 After reduction, the finger can be splinted with 30 degrees of flexion at the injured joint. DIP joints require 2–3 weeks of splinting, whereas PIP joints necessitate brief splinting, such as 3–5 days.7 Range-of-motion exercises are imperative to prevent stiffness and permanent loss of range of motion. Subsequent buddy-taping for sports activities is recommended for another 4–6 weeks.

**Conclusion**

Hand and finger injuries are very common in young athletes and can often be managed conservatively with relatively early return to play; however, growth plate injuries, unstable or deformed fractures, and complete rupture of tendons or ligaments should be referred to an orthopedic specialist for definitive management. Initial assessment of neurovascular status and rotational or angular deformity are vital in minimizing the risk of complications.

**References**


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