This article describes the office treatment for five common hand fractures. In addition to examination findings and treatment options, guidelines are provided for those complications that necessitate orthopedic referral. The five fractures reviewed include mallet finger fractures, distal phalangeal fractures, fractures from volar plate injuries to the middle phalanx, dorsal dislocations of the proximal interphalangeal joint, and fractures of the fifth metacarpal.

For the practicing physician, successful office treatment of orthopedic problems can provide great satisfaction. Patients are most gratified when their family physician provides appropriate care while allowing an acute injury to heal. There are a number of extremity fractures that are seen in the office and can be successfully treated without orthopedic consultation. For the family physician in a rural setting, successful office treatment of these fractures can provide cost savings and convenience for the patient. For those in a managed-care environment, treatment of common extremity fractures may be an expected responsibility of the family physician. The five hand fractures discussed in this article are among the most common extremity fractures that are seen in an office setting.

**MALLET FINGER**

A mallet finger, also known as a baseball or drop finger, occurs when there is forced flexion at the tip of an extended finger. This sudden flexion causes the extensor tendon to rupture as it inserts into the distal phalanx. In addition to the rupture of the extensor tendon, there may be an associated fracture of the distal phalanx. The mallet finger most commonly occurs as a result of a sports injury such as when a small ball, like a baseball, strikes an outstretched finger. It can occur in a number of other conditions, such as striking an outstretched finger against a floor or wall during a fall.

**Examination**

Examination of the typical mallet finger will show a flexion deformity of the distal phalanx. The patient will be unable to extend the distal interphalangeal (DIP) joint. When a mallet finger is identified, a roentgenogram of the finger should be obtained since these findings will dictate the treatment of the injury. Most commonly, the roentgenogram shows no abnormality, but in one quarter of cases, there is a small avulsion fracture of the dorsal aspect of the distal phalanx. Less frequent but more serious roentgenogram findings include a large articular fragment or subluxation of the distal phalanx. Evidence of subluxation by roentgenography indicates an unstable injury. Adequate treatment of this problem requires orthopedic stabilization of the distal phalanx.

**Treatment**

Because surgical management may also be required for treatment of large articular fragments, the family physician should consider referral of a mallet finger when the avulsion fragment involves greater than 30% of the articular surface or when a small fragment is displaced by more than 2 mm (Figure 1). Another unusual mal-

*From the Family Practice Residency Program, Saint Margaret Memorial Hospital, Pittsburgh, Pa.*
let fracture occurs in children, where insertion of the extensor tendon may result in a Salter III fracture in an adolescent or an open Salter I or II fracture in a younger child. The more complex nature of these epiphyseal plate injuries may also require orthopedic intervention.2

The care of a mallet finger with a small avulsion fracture is identical to the care of a tendon injury without a fracture. Treatment involves placing the finger in extension for a prolonged period. The distal phalanx should be straightened and a short splint should be applied. There continues to be considerable debate regarding the appropriate splint for a mallet finger.3 Premade stack splints are convenient, although it may be difficult to get an exact fit for the patient. In some patients, edema over the dorsal surface may make placement of a stack splint impractical, while other patients experience edema after the splint is in place for several days. Either a dorsal or volar splint is acceptable, and if properly applied, either will permit adequate tendon healing.4 Even a basic splint such as a paper clip or a piece of wooden tongue depressor can be used. While proper finger extension is important, hyperextension should be avoided since sloughing of the dorsal skin may occur in this position. Blanching of the dorsal skin indicates potential vascular compromise if the DIP joint remains hyperextended for the lengthy time required for treatment of a mallet finger. While careful splinting of the DIP joint is important for successful treatment of a mallet finger, the proximal interphalangeal (PIP) joint should not be incorporated into this splint. Prolonged immobilization of the PIP joint in extension will freeze the PIP collateral ligaments in a shortened position. Once this occurs, extensive rehabilitation is needed to regain PIP motion. Allowing initial motion at the PIP joint will prevent this potential complication.

After the splint is applied for treatment of a mallet finger, the patient should be advised never to flex the DIP joint until the tendon has completely healed.3 This generally requires full-time splinting for approximately 8 weeks. Some physicians will allow the patient to change the splint at home with the assistance of another person, but this should be done with great caution. Frequently, patients will not be careful in their handling of the unsplinted finger, even for a few minutes. If the tendon is slightly bumped, avulsion of the softened healing tendon will occur, and the entire process will need to be restarted, but this time, with a decreased chance of complete tendon healing. It may be helpful to tell patients that they have "married" the splint for the duration of treatment. Any changes to the splint should be performed at the office, and at no time should the distal phalanx be allowed to drop into flexion. After 8 weeks of continuous splinting, a protective splint should then be worn for another 4 to 8 weeks during any athletic activities. The key to successful splinting is to maintain pure 180° extension for the entire 8 weeks. After initial placement of the splint, the physician should schedule a follow-up visit in 1 to 2 weeks to evaluate patient compliance and to assess adequacy of the placement of the splint. Another interim visit may be scheduled before final removal of the continuous splint at about 8 weeks. Even with optimal treatment, only about one half of patients recover complete extension of the DIP joint, and some weakness may be expected when the splint is removed. There are several factors that indicate a lower chance of successful treatment of a mallet finger, including the following: age greater than 60 years; delay in treatment over 4 weeks; initial extensor lag greater than 50°; inadequate immobilization time, especially if less than 4 weeks; and short, stubby fingers.4

When a patient presents with a mallet finger that was injured several weeks to several months ago, treatment is less likely to be successful. Nevertheless, splint immobilization for at least 8 weeks can be attempted. If further treatment of a failed mallet finger is desired, several orthopedic surgical procedures can provide complete extension, but at the expense of decreased DIP mobility.

DISTAL PHALANGEAL FRACTURES

Besides a mallet finger with a small avulsion fracture, the other major fracture of the distal phalanx is a crush injury. As the most exposed portion of the hand, the distal phalanx may constitute over half of all hand fractures.4 If only the distal half has been involved, a comminuted fracture may be present (Figure 2). Unless there is severe fracture angulation, an open fracture, or nail bed injury, treatment is uncomplicated. The fibrous septae of the fin-

Figure 1. Left, The small avulsion fracture has not caused any joint subluxation and can be treated as a conventional mallet finger. Right, This larger fragment constitutes approximately 40% of the joint surface and should therefore be considered for orthopedic referral since nonsurgical treatment may result in joint instability.
ger pulp serve as internal stabilizers, which naturally hold the fracture and minimize displacement. Treatment, therefore, is directed at controlling soft-tissue damage. Because the area is quite sensitive, a major goal is protection of the fingertip while healing occurs. A number of devices, including a spoke splint and frog splint, provide loose protection for the fingertip. Tight circumferential taping of the splint should be avoided, since this causes vascular compromise and increased pain. Although protective splinting will be needed for only 2 to 4 weeks, the patient should be advised that annoying symptoms, especially cold hypersensitivity, may be present for 6 months or more.

Severely displaced fractures of the base of the distal phalanx may require reduction or pinning, but no manipulation should be attempted of the "crushed eggshell" fracture of the tuft. Open fractures of the distal phalanx should be carefully cleansed, débrided, and inspected for foreign bodies. If there is severe soft-tissue injury as well as fracture, chronic pain and disability may result. Open fractures should also be treated with antibiotics. Distal fractures in crush injuries will often have an associated subungual hematoma. Although hematoma evacuation theoretically converts the injury to an open fracture, the procedure is widely regarded as safe and without increased risk of infection. Hematoma evacuation with a hot paper clip or electrocautery unit certainly reduces pain. When a subungual hematoma involves more than 25% of the nail bed, or when distal fractures involve damage to the nail or nail matrix, the nail bed may require exploration. Lacerations of the nail bed or matrix require meticulous repair to reduce the risk of future nail abnormalities.

![Figure 2](image1.png)

**Figure 2.** This comminuted fracture of the distal tuft, resulting from a crush injury to the fingertip, merely requires protection of the fingertip during the healing time of 2 to 4 weeks.

![Figure 3](image2.png)

**Figure 3.** These fractures along the proximal volar aspect of the middle phalanx are typical of avulsion fractures caused by a pull of the distal insertion of the volar plate. Even the nondisplaced articular fragment (right) will heal well with proper immobilization.

**VOLAR PLATE INJURIES TO THE PIP JOINT**

**Examination**

The volar plate is a thick connective tissue bridging the middle and proximal phalanx, which separates the flexor tendon from the underlying joint space. The major purpose of the volar plate is to limit hyperextension of the PIP joint. When the PIP joint is hyperextended, the volar plate may be disrupted at its distal insertion into the middle phalanx. Because the connective tissue at this distal insertion is thick, the usual result is avulsion of a small fragment of the proximal portion of the middle phalanx (Figure 3). In deciding whether this fracture is appropriate for office treatment, two items should be considered: First, as was the case with mallet fingers, a large articular fragment may reflect joint instability. A large fracture of the volar lip of the middle phalanx will result in dorsal subluxation and subsequent PIP joint instability. Second, the lateral stability of the finger should be examined since simultaneous disruption of a collateral ligament is a more serious injury. With any injury to the PIP joint, the finger should be carefully examined and palpated on all surface areas. For most hyperextension injuries, the greatest tenderness will be on the volar aspect where the volar plate is located. When palpation of the radial or ulnar collateral ligament elicits pain, the joint should be stressed with radial or ulnar deviation to determine if collateral instability is present. Stress roentgenography can confirm suspected collateral ligament instability. If collateral ligament instability or middle phalangeal subluxation has been identified with a volar plate fracture, an orthopedic surgical opinion should be obtained since a more complicated treatment regimen may be required.

**Treatment**

Care of an avulsion fracture of the middle phalanx is directed at preserving integrity of the volar plate. A flexion splint at 15° to 30° applied for several weeks will allow ad-
equate healing. Even a simple frog splint will suffice for adequate immobilization of the middle phalanx. After 2 weeks, the splint can be removed. For a sedentary person, no further treatment is needed. For the athletically inclined, however, some dynamic support will be required during any activities in which the finger could potentially be hyperextended and reinjured. Taping the finger to an adjacent finger (ie, buddy taping) will provide the appropriate support. This will prevent hyperextension of the affected PIP joint and yet allow full finger mobility. The patient should be advised that buddy taping should be continued for an additional 4 to 6 weeks to permit complete healing. If significant tenderness of the PIP joint remains after 2 weeks of immobilization, an extension block splint can be used to help prevent hyperextension of the PIP joint. This appliance can be made in the physical therapy or occupational therapy department or can be fashioned in the office, using a padded aluminum splint over the dorsum of the finger (Figure 4). The splint is flexed 30° to 60° at the PIP joint and the proximal phalanx is secured to the splint. Since the middle and distal phalanges are free, full PIP flexion is permitted, while extension of the PIP joint is restricted by the splint. Over several weeks, the extension at the PIP joint is gradually increased. An extension block splint provides mechanical restriction to prevent full finger extension and thus reduce the risk of dorsal subluxation. At the same time, the splint allows complete finger flexion so that the collateral ligaments and other soft-tissue structures can heal while minimizing joint stiffness.

**DORSAL DISLOCATIONS OF THE PIP JOINT**

Another sports medicine problem that will present in the office is a dorsal dislocation of the PIP joint. This injury, which is the most common dislocation in the hand, is also caused by significant hyperextension. Clinically, the dislocation is usually obvious. Often the patient presents with a “coach’s finger” after the dislocation has been reduced by an experienced trainer or coach. When not reduced, this dislocation is usually easy to treat (Figure 5). On the playing field, immediate reduction is acceptable, but in the office, a prereduction roentgenogram should be obtained to confirm that no other problem exists. After the prereduction film, gentle traction followed by finger flexion will relocate the middle phalanx. Care must be taken to avoid placing excess traction on the middle phalanx, which may cause the volar plate to become entrapped within the joint space, thus preventing reduction. While one hand of the physician is applying gentle traction, the thumb of the opposite hand can gently push the middle phalanx to assist in the reduction. Occasionally, hyperextension of the middle phalanx will be needed to release the middle phalanx before traction can be applied. Anesthetizing the finger before reduction is optional, but generally, the reduction is easily performed without anesthesia.

Because the volar plate has been disrupted, treatment for a dorsal dislocation should proceed as described for a volar plate injury: flexion splinting for 2 weeks followed by extension block splinting for another 4 to 6 weeks. Treatment is unchanged if there is a small avulsion fracture of the middle phalanx. When the dislocation occurs during an athletic event, the finger may be relocated and buddy taping may be applied so that the athlete can continue participation. More complete assessment and roentgenograms can then be obtained after the game. In the rare event that a dorsal dislocation cannot be easily reduced, there may be entrapment of a tendon of the volar plate that is physically impeding the reduction. In this case, an open exploration of the finger will be required to correct the problem. Of greater con-
cern is a fracture dislocation or fracture subluxation of the PIP joint. A large fracture fragment of the volar lip of the middle phalanx will not permit stable alignment of the proximal and middle phalanges. On examination of the finger, hyperextension of the PIP joint will result in volar instability. A roentgenogram will demonstrate the middle phalanx to be subluxed dorsal to the proximal phalanx. These complex injuries require orthopedic referral since operative intervention may be indicated.

In contrast to dorsal dislocations that are easily treated, a volar dislocation is a more uncommon but potentially more serious problem. Here, the injury involves the central slip of the extensor tendon and can result in a permanent boutonnière deformity if it is not treated appropriately. Immediate orthopedic consultation should be obtained for exploration of the extensor mechanism.

When office treatment is provided for a dorsal dislocation or volar plate avulsion fracture, the patient should be advised that some residual soreness can be expected in the PIP joint for as long as 6 to 12 months. Even with optimal treatment, some modest degree of residual PIP enlargement can be expected because of fibrous scarring within the soft tissues surrounding the PIP joint.

FIFTH METACARPAL FRACTURES (BOXER’S FRACTURES)

A boxer’s fracture is the eponym given to fractures of the fifth metacarpal. Those who understand boxing realize that “brawler’s fracture” would be a better term since professional boxers punch with the force of their first and second metacarpals, not with the fourth or fifth metacarpal. Any impact injury of the fifth metacarpal will result in this common fracture. Typically, the patient will present with pain over the fifth metacarpal and a recent history of impact injury. Examination will reveal tenderness in this area as well as loss of the metacarpal head (the knuckle). Roentgenograms of the hand will confirm the diagnosis. Usually, there is some angulation of the fracture, with the apex pointing dorsally (Figure 6, left).

In the past, there had been much emphasis on the reduction of the angulation of the fracture before immobilization in a splint or a cast. Although there continues to be some orthopedic controversy, closed reduction with manipulation of fracture fragments is not necessary for most patients. Recent studies have demonstrated that a satisfactory reduction cannot be maintained with immobilization in a cast because of the pull of intrinsic hand muscles. As long as the patient can accept the mild cosmetic deformity that will result in loss of the knuckle and a small bump on the palm of the hand, the functional result with simple immobilization is good. The considerable mobility of the fourth and fifth carpal and metacarpal joints allows such a great flexibility of the ulnar portion of the hand that a small deformity in these metacarpal joints is functionally insignificant.

There are three uncommon reasons for manipulation of a boxer’s fracture. First, if the angulation is severe (greater than 70°), then the healing fragment may create enough of an angle to prohibit full extension of the flexor tendon to the finger. This will result in a clawing effect at the PIP joint and will require reduction of the fracture. Second, a rotational deformity of this metacarpal (or any metacarpal) will require orthopedic correction with surgery. A rotational injury can be identified clinically if the fingers of the patient overlap during flexion. Finally, if the person’s vocational or cosmetic demands are such that a residual hand defect is unacceptable, then closed reduction or percutaneous pinning should be performed.

Treatment of a boxer’s fracture involves immobilization in a splint for 3 to 4 weeks. In the past, an ulnar gutter splint was the most commonly used method for immobilization. Recently, however, Green and Rowland recommended that a volar splint or a combination of both anterior and posterior splints should be applied. The key to good healing with this fracture is maintenance of the fourth and fifth metacarpophalangeal (MCP) joints at a position with 70° to 90° of flexion. This sharp flexion will actually help reduce the angulation of the fracture. Flexion also maintains the MCP collateral ligaments at their maximal length so that no function is lost during immobilization. After removal of the splint in 3 to 4 weeks, regular activity may be resumed within a few days.

Fractures of the shaft of the fifth metacarpal can be treated like a boxer’s fracture, except that the acceptable angulation is only 30° to 50°. The general rule is that the farther the
Fracture is located from the metacarpal neck, the lower the acceptable amount of angulation (Figure 6, right). Fractures at the base of the fifth metacarpal, while less common, will require orthopedic pinning to achieve satisfactory stability.

The advantage of splinting a fifth metacarpal fracture rather than circumferential casting is that splinting eliminates many of the risks associated with a circumferential cast. Patients who are involved in altercations and sustain this injury are frequently intoxicated. Should the patient be noncompliant with instructions on care of a circumferential cast, neurovascular supply to the extremity may be compromised. This is particularly true if the patient falls asleep while intoxicated and allows the arm to hang down shortly after the circumferential cast has been applied.

In evaluation of any fifth metacarpal injury, special care must be given to anyone who has a concomitant laceration near the fifth MCP joint. An attacking clenched fist may contact the mouth of the other fighter and the fifth MCP joint space may be entered by a tooth. Since the MCP joint is superficial, joint injury is easily incurred. If not immediately identified, a septic arthritis of the MCP joint may ensue, with potential problems of osteomyelitis and residual osteoarthritis. All lacerations over the fifth MCP joint should be considered to be human bites until proven otherwise and aggressively treated with early orthopedic evaluation, frequently including operative exploration and débridement. A low threshold of suspicion is necessary since many of these patients will have no recollection of the injury or will deliberately lie about the nature of the injury.

CONCLUSIONS

The five hand fractures that are discussed in this article are common injuries that will be seen in an office setting. By understanding those circumstances for each problem that will require orthopedic intervention or specialized treatment, the family physician can totally treat the majority of these fractures. The factors that are likely to be more difficult complications include displaced or irreducible fractures, intra-articular fracture with large fragments, comminuted fractures, and those with associated neurovascular or tendon injury.

Accepted for publication June 23, 1994.
Correspondence to Family Practice Residency Program, Saint Margaret Memorial Hospital, 815 Freeport Rd, Pittsburgh, PA 15215 (Dr Schaffer).

REFERENCES