

# Casting and Splinting Management for Hand Injuries in the In-Season Contact Sport Athlete

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**Context:** Upper extremity injuries are extremely common in contact sports such as football, soccer, and lacrosse. The culture of competitive athletics provides an environment where hand injuries are frequently downplayed in an effort to prevent loss of game time. However, studies have shown that many sport-induced hand injuries do not actually require immediate surgical attention and can be safely treated through immobilization so that the athlete may complete the athletic season. In these cases, appropriate casting and splinting measures should be taken to ensure protection of the injured player and the other competitors without causing loss of game time.

**Evidence Acquisition:** Articles published between 1976 and 2015 were reviewed to capture historical and current views on the treatment of hand injuries in the in-season athlete.

**Study Design:** Clinical review.

**Level of Evidence:** Level 5.

**Results:** Although traditionally many sports-induced traumatic injuries to the hand held the potential to be season-ending injuries, experience has shown that in-season athletes do not necessarily need to lose game time to receive appropriate treatment. A thorough knowledge of converting everyday splints and casts into game day, sport-approved protective immobilization devices is key to safely allowing athletes with select injuries to play while injured.

**Conclusion:** Protective techniques allow for maximum functionality during gameplay while safely and effectively protecting the injury from further trauma while bony healing takes place.

**Keywords:** in-season injury; athletics; hand injury; casting; splinting

Upper extremity injuries are extremely common in contact sports such as football, soccer, and lacrosse. Hand injuries, in particular, are frequently downplayed in an effort to prevent loss of playing time.<sup>11,19</sup> While returning to play with a hand injury is possible, and often expected, inadequate protection can lead to lifelong pain or loss of function. Athletic trainers are tasked with balancing the goals of each individual athlete with the recommendations of the orthopaedic surgeon to find a reasonable way to safely allow injured players to finish a season without causing additional harm to the injured extremity.

## IMPORTANT CONSIDERATIONS FOR THE INJURED ATHLETE

Assessing the stability of an injury is essential for designing an appropriate treatment plan. Athletes require more frequent and detailed follow-up than the general population as their continued participation in a contact sport places the area of injury at increased risk, which could lead to progression of the pathology and the need for operative intervention. Athletes must be aware that playing with an unstable injury is inherently risky and should only be attempted with the understanding that

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the injury may progress, may heal over a longer period of time, may heal malaligned, or may not heal without operative intervention. In some cases, opting for surgery and subsequent rehabilitation in the immediate setting can actually allow the athlete to return to play more quickly than choosing to attempt nonoperative treatment, which may ultimately lead to surgery at a later point in the season.

## IMMOBILIZATION TECHNIQUE

Depending on the type of upper extremity injury, select in-season athletes may be fit with 2 different types of casts or splints: 1 for everyday use and 1 for practice or gameplay. The goal is to maximize function for practice or game activity while maximizing protection and stability for nonsport activities. However, often it is not possible to take a cast on and off of an athlete in the acute setting without losing reduction. In these cases, it is necessary to wait a minimum of 10 days after the injury for sufficient callus to be present before the fracture is stable enough to be removed from its original cast and placed in a temporary cast for game or practice.<sup>2</sup> It should be noted that most athletic associations require any athlete who is medically cleared to participate in a sporting event while wearing a rigid cast or splint to have the entire area covered in no less than 0.5-inch-thick closed-cell slow recovery foam padding to protect both the injured athlete and opponents.<sup>13</sup>

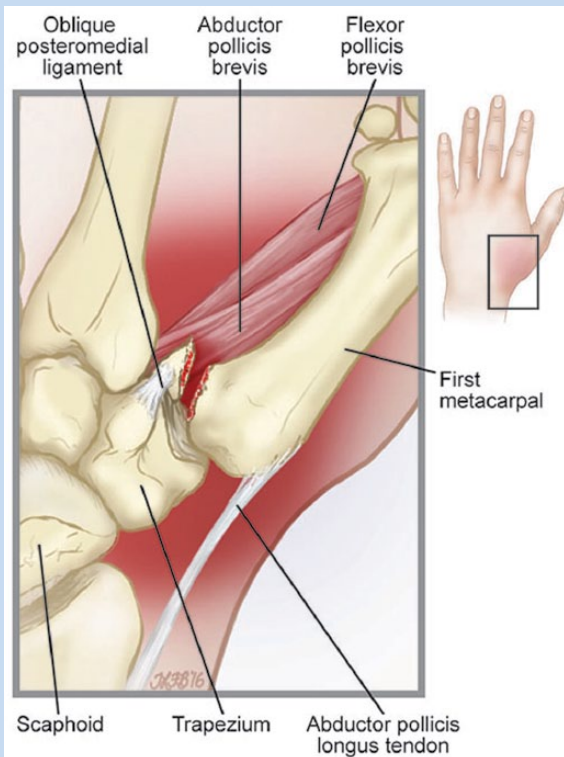
## BONY INJURIES OF THE HAND: THUMB

### Bennett Fracture

Bennett fractures are intra-articular fracture-dislocations of the thumb metacarpal at the carpometacarpal (CMC) joint. The fracture occurs as a result of a force across the long axis of a partially flexed metacarpal (Figure 1).<sup>4,10,19,21</sup>

Because of the location, Bennett fractures can be less visually obvious than other metacarpal fractures, and distortion of the joint and metacarpal may not be evident on gross inspection.<sup>19</sup> After a blow to the hand, swelling and tenderness over the carpometacarpal joint of the thumb can indicate fracture.<sup>4</sup> Plain film radiographs in the posteroanterior (PA), lateral, and oblique views diagnose metacarpal fractures.<sup>16</sup> Occasionally, a computed tomography (CT) scan is needed to better appreciate fracture pattern and fragment displacement.<sup>6</sup> Nonoperative treatment can be used if reduction of the CMC joint can be maintained.<sup>3,16</sup>

When a Bennett fracture occurs during active gameplay, a neoprene thumb spica sleeve may be used for short-term stabilization. Once the fracture is reduced, a long thumb spica cast is applied. In some cases, it may be technically difficult to properly stabilize a Bennett fracture using a cast. Especially in cases of unstable fractures, it may be necessary to operatively fix the injury in the acute setting rather than risking malunion. The clinician applying the cast must evaluate the fracture alignment to decide whether the athlete would benefit from immediate fixation or whether bony healing will likely be satisfactory through immobilization alone. If nonoperative



**Figure 1. Bennett fracture anatomy.** The base of the thumb metacarpal bone fractures, allowing the attachment of the abductor pollicis longus (APL) to displace the metacarpal fragment. The avulsion fragment dislocates at the carpometacarpal joint in a dorsal and radial manner due to the APL and proximally due to the medial thenar muscles. The oblique posteromedial ligament retains the smaller fragment's attachment to the trapezium.

treatment is chosen, the fracture must become “sticky” with early healing before the 2-cast system is employed for definitive treatment. The cast designed for daily use is a typical thumb spica cast that extends beyond the wrist but allows for motion at the MCP joints of the fingers. A mold is applied by abducting the thumb and placing pressure over the lateral aspect of the CMC joint (Figure 2a). This everyday cast should be worn for a minimum of 4 weeks.

The cast designed for game day use is a much shorter thumb spica cast that is applied using similar techniques. A stockinette is applied over the wrist and thumb. This is then covered with cast padding and fiberglass, using extra caution when casting the first web space to avoid bunching the materials (Figures 3a and 3b). A mold is applied to keep the thumb abducted, as described in the Bennett fracture daily use cast (Figure 3c). The final cast does not extend proximally past the wrist crease and, therefore, allows for full flexion at the wrist and at MCP joints of the outer fingers (Figure 3d). While there are risks associated with not including the thumb interphalangeal (IP) joint in the cast, such as trauma to the distal thumb tip, there is no



Figure 2. Thumb spica cast molding positions. Note: Size of arrows indicates relative force applied. (a) Bennett fracture: Thumb is in abduction with ulnar pressure applied at the lateral base of the thumb carpometacarpal joint. (b) Thumb metacarpal shaft fracture: 3-point pressure is applied dorsally over the midshaft and volarly over the metacarpal head to resist the apex dorsal deformity.

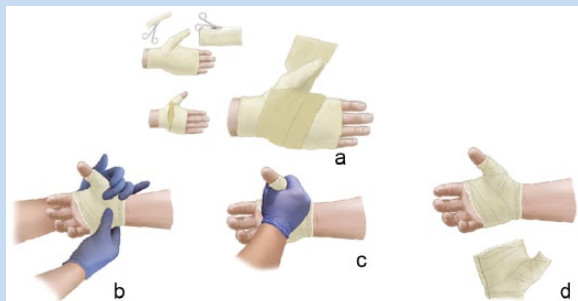


Figure 3. Short thumb spica cast. (a) The stockinette is pulled back to allow free wrist and metacarpophalangeal motion of the fingers. (b) The casting material is checked for potential pressure points. (c) A mold is applied to hold the thumb in abduction. (d) The final cast can carefully be cut and reapplied as needed.

consensus on its inclusion in the cast, as it does limit motion at that joint, which can increase stiffness. Regulation padding should then be applied over this final cast.

### Thumb Metacarpal Shaft Fracture

The thumb metacarpal articulates with the carpal bones on a saddle joint, which allows for increased mobility at the CMC joint.<sup>19</sup> Most metacarpal fractures resulting from sports injury are nondisplaced but may also be prone to angular deformity.<sup>15</sup>

After trauma to the hand, thumb metacarpal shaft fractures can present with swelling of the digit, pain over the point of impact, reduced range of motion, and possible deformity.<sup>4,16</sup> In the vast majority of cases, athletes are removed from gameplay until the presumed fracture can be formally evaluated and immobilized. The standard anteroposterior (AP), lateral, and oblique view hand radiographs are used to confirm metacarpal shaft fractures.<sup>16,19</sup>

Immobilization of stable thumb metacarpal shaft fractures can be achieved using the combination of a short arm thumb spica

cast for daily wear and a shorter, wrist-free, thumb spica cast with padding for gameplay, for a period of 4 weeks, as described for Bennett fracture immobilization. The mold for a stable metacarpal shaft fracture applies 3-point pressure to resist apex dorsal angulation (Figure 2b).

### Thumb Proximal Phalanx Fracture

Fracture of the proximal phalanx typically occurs when a perpendicular force is applied to a flexed thumb.<sup>13</sup> In football, this type of force most often occurs when an athlete attempts to control the ball during a fall or tackle.<sup>3</sup> Fractures are most often oblique or transverse in nature and many remain nondisplaced.<sup>13-15</sup>

Most athletes and athletic trainers will opt to refrain from athletic activity until rigid immobilization can be achieved. Formal radiography with AP, lateral, and oblique views should allow for easy visualization of thumb proximal phalanx fractures.<sup>16,19</sup>

Immobilization of proximal phalanx fractures can be achieved using a technique similar to that used for thumb metacarpal shaft fractures. A longer thumb spica cast should be worn for the majority of the day over a period of 4 weeks and a shorter version that allows for wrist flexion should be used for gameplay. Again, molding the cast over the fracture site can allow for improved support.

### Thumb Distal Phalanx Fracture

Distal phalanx fractures in sport are commonly due to crush injuries, causing transverse or tuft fractures.<sup>16</sup> As stated previously, phalangeal injuries happen most often in players who control the ball.<sup>2</sup>

The nail bed should be examined closely to be sure that any associated laceration is treated appropriately. In some cases, the thumb may have decreased range of motion in the interphalangeal joint secondary to soft tissue edema.<sup>4</sup> Radiographs are used to confirm distal phalanx fracture.<sup>19</sup>

If an acute distal phalanx fracture of the thumb is suspected in an athlete during gameplay, a prefabricated plastic splint covering the entire distal tip of the digit and crossing the IP joint may be applied and affixed using athletic tape.<sup>2,6,19</sup> This

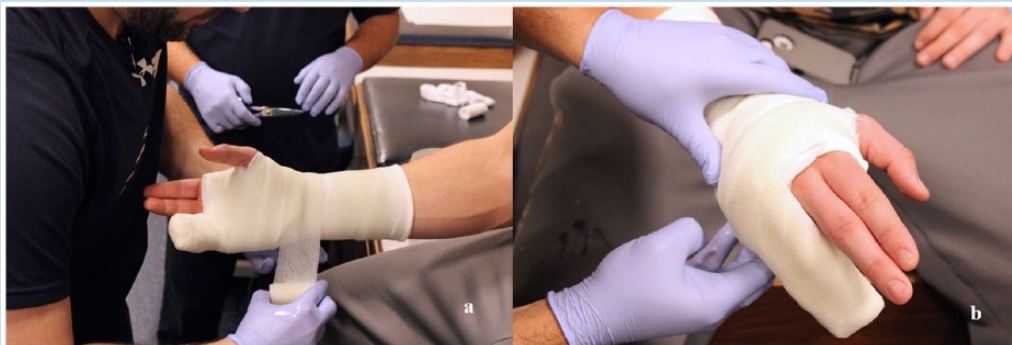


Figure 4. Ulnar gutter cast. See Figure 5 for step-by-step application instructions. (a) The cast is applied, extending distally to encompass the entire tip of the included digits. (b) The hand and wrist are held in the intrinsic plus position. Cast is shown with a dorsal mold at the base of the small finger metacarpal for stabilization of a carpometacarpal fracture-dislocation.

technique will provide adequate immobilization for the 4 weeks required for bony healing of the fracture to occur and allow for immediate continuation of gameplay.

## BONY INJURIES OF THE HAND: NON-THUMB

### Metacarpal Shaft Fracture

Metacarpals are vulnerable to injury due to their relatively narrow structure and the large forces placed on them in contact sports. Approximately 75% of all hand fractures that occur during sport are of the metacarpals.<sup>17</sup> The ring and small finger metacarpals are the most likely to be injured, usually due to striking or blocking.<sup>19</sup>

Although metacarpal fractures produce significant pain and edema in the acute setting, athletes often downplay their injury and only present for medical evaluation due to persistent pain or development of an obvious deformity.<sup>19</sup> Discrepancies in length or rotation should be identified and corrected via reduction techniques. Standard wrist and hand radiographs should always be obtained in any instance where a possible fracture is suspected on examination.<sup>19</sup>

Nondisplaced metacarpal fractures may be treated nonoperatively with continuous rigid immobilization for a period of 4 to 6 weeks. Because of compensatory motion at the CMC joint, mild angulation is better tolerated in the ring and small digits and not acceptable in the index and long fingers. For daily wear, athletes should be placed in a well-padded short arm ulnar or radial gutter cast, which prevents rotation of the distal segment of the fracture (Figure 4a).<sup>6,17</sup> The typical cast is extended distally to encompass the entire tip of the included digits, although in select cases it may be reasonable to end the cast just past the MCP joint to allow for motion at the distal aspect of the digit.<sup>3</sup> When the entire finger is included in the cast, it is recommended to cast or splint the hand in the intrinsic plus position to protect the soft tissues from contracting (Figure 4b).

The game day cast for non-thumb metacarpal fractures is a shorter version of the ulnar or radial gutter cast described for

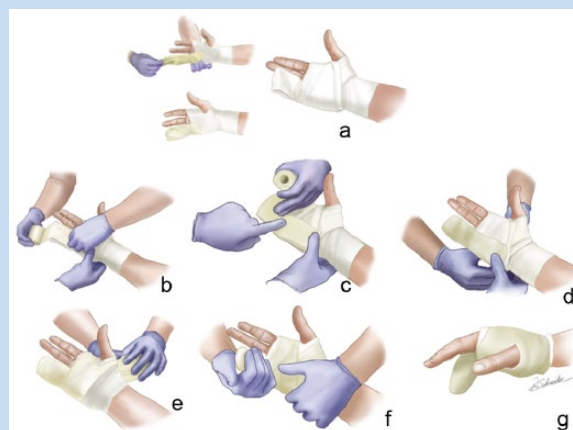


Figure 5. Short ulnar gutter cast for gameplay. (a) With the hand held in the intrinsic plus position, cast padding is applied over the ring and small fingers until the wrist crease is reached. (b) Casting material is then placed lengthwise on the fingers and wrapped proximally. (c and d) An assistant ensures that the strips remain in place. (e) The proximal portion of the stockinette is retracted to allow for full motion at the wrist. (f) Molding may be done depending on the injury. (g) The final cast leaves the thumb free with full motion at the first metacarpophalangeal (MCP) joint and at the MCP joints of the nonencapsulated digits.

everyday use. Initially, the wrist and fingers are held in a neutral position and stockinette is applied over the wrist, hand, and included digits. The stockinette is kept long so that it can be twisted and folded back at the fingertips distally. With the hand held in the intrinsic plus position, cast padding is layered lengthwise over the ring and small fingers (Figure 5a). Cast material is applied last, beginning with several layers placed lengthwise over the fingers before beginning circumferential wrapping (Figures 5b-5e). This often requires an assistant. The final cast restricts all motion of the encapsulated digits while



allowing for freedom of motion at the wrist, the thumb MCP joint, and the MCP joints of the nonincluded digits (Figures 5f and 5g).<sup>18</sup>

### Proximal Phalanx Fracture

Because of their unprotected location in the hand, proximal phalangeal fractures are one of the most common injuries seen in all areas of sport.<sup>7</sup> Typically, patients describe a history of extreme force being applied to an extended digit, often due to impact with a ball or another player.<sup>19</sup> These forces can be bending in nature, resulting in transverse fracture patterns, or torsional in nature, producing oblique or spiral patterns. In the context of athletic activity, crush injuries resulting in highly comminuted fractures are rare.<sup>5</sup>

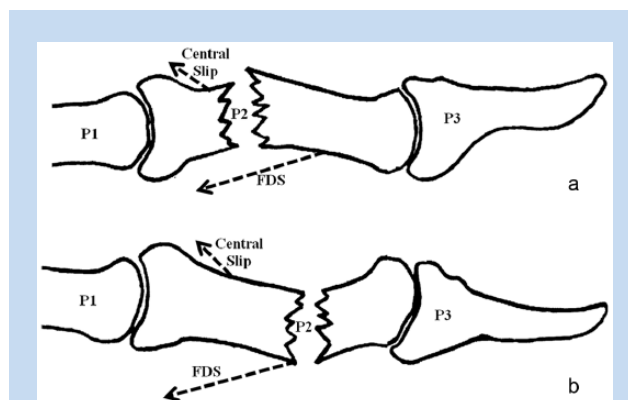
Because of the flexor sheath and intrinsic tendons, proximal phalangeal fractures can present with a wide range of deformity depending on the degree of fracture instability or displacement. Therefore, a thorough physical examination, including radiographs, is essential to proper identification and treatment of these injuries. In the acute setting, athletes with grossly stable injuries may be allowed to return to game play with the effected digit buddy taped. However, the injury should be reassessed to better determine the necessary definitive treatment. A minimum of 2 orthogonal radiographs are needed to identify any loss of height or the presence of a rotational or angular deformity.<sup>7</sup>

The vast majority of proximal phalanx fractures are amenable to nonoperative treatment with immobilization for 4 to 6 weeks. For stable, nondisplaced fractures, the injured phalanx should be buddy taped to the adjacent digit or placed in an extension gutter cast, as described for non-thumb metacarpal fractures. Again, both the everyday and game day casts should encompass a minimum of 2 fingers and hold the hand in the intrinsic plus position.<sup>3</sup> Most athletes are able to quickly return to play after a fracture of the proximal phalanx by padding the splint according to National Collegiate Athletic Association guidelines.<sup>12</sup>

### Middle Phalanx Fracture

In the case of a middle phalanx fracture, patients typically describe a history of a low-energy force being applied to the dorsum of an extended digit, often due to impact with a ball or another player.<sup>2</sup> This force usually results in either a short oblique or a transverse fracture pattern on radiography.<sup>5</sup> Additionally, fractures of the middle phalanx can be subcategorized depending on whether the fracture is located proximally or whether it is located midshaft or distally. This distinction becomes important when deciding the position in which the IP joints should be held and whether the splint should be molded toward the volar or dorsal aspect of the digit.

Middle phalangeal fractures typically present with good relative stability and limited displacement.<sup>5</sup> However, thorough physical examination, including radiographs, is still necessary to ensure proper identification and treatment. In the acute setting, athletes with grossly stable fractures may be allowed to return to game play with the effected digit buddy taped. However, the



**Figure 6.** Fractures of the middle phalanx. Note: Size of arrows indicates relative force applied. (a) Proximal fractures present with an apex dorsal fracture pattern and should be splinted with the proximal interphalangeal (PIP) joint flexed and the distal interphalangeal (DIP) joint in extension, with a mold in the volar direction. (b) Midshaft and distal fractures present with an apex volar fracture pattern and should be splinted with the PIP joint in extension and the DIP joint in flexion, with a mold applied in the dorsal and distal aspect of the splint. FDS, flexor digitorum superficialis; P1, proximal phalanx; P2, middle phalanx; P3, distal phalanx.

injury should be reassessed frequently to determine the necessary definitive treatment. Furthermore, the examiner should assess the integrity of the central slip to rule out the presence of an associated soft tissue injury.<sup>5,9,19</sup>

The vast majority of middle phalanx fractures are stable and therefore amenable to nonoperative treatment with immobilization for 4 weeks. The injured phalanx should be, at a minimum, buddy taped to the adjacent digit continuously. However, some prefer to apply an extension gutter splint to 2 digits for additional support and protection in athletes who intend to return to play before a fracture callus has completely formed. The splint should encompass both proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints and hold them in full extension while allowing for motion at the MCP joint.<sup>5</sup> If the fracture is at the proximal aspect of the middle phalanx, the fracture will angulate into an apex dorsal position because the central slip pulls the proximal fragment into extension and the flexor digitorum superficialis (FDS) pulls the distal fragment into flexion. A mold should be added by applying pressure to the volar aspect of the splint (Figure 6a). If the fracture is in the midshaft or distal aspect of the middle phalanx, the fracture will angulate into an apex volar position because of the overwhelming force from the FDS. A mold should be added by applying pressure to the dorsal, distal aspect of the splint (Figure 6b). Depending on the degree of fine digital movement required for an athlete's specific position, most are able to quickly return to play with a padded, rigid splint.



Figure 7. Prefabricated plastic splint for the treatment of bony injury to the distal aspect of the digit. (a) The splint is fixed with athletic tape and (b) used to hold the distal interphalangeal joint in full extension.

### Distal Phalanx Fracture

The distal phalanx is susceptible to injury in football, especially at the long finger because of its vulnerable position during contact.<sup>5</sup> Fractures are typically a short oblique type pattern due to a rotationally applied force, with a variable degree of comminution depending on the amount of energy applied during a crush-like trauma such as a high-velocity tackle.

In the acute setting, athletes with grossly stable fractures may be allowed to return to game play with the effected digit buddy taped or in a plastic splint. However, the injury should be reassessed frequently to determine definitive treatment.<sup>9,19</sup> The injured digit should always be compared with the same digit on the contralateral side, as some patients may exhibit a nonpathologic bow to the finger that may obscure the assessment of the fracture's alignment.<sup>19</sup> It is also recommended that the clinician examine the flexor and extensor mechanisms and the nail bed for possible injuries that would warrant additional treatment.

For distal phalanx fractures that are stable and nondisplaced, nonoperative treatment with immobilization for 4 to 6 weeks is commonly successful.<sup>2</sup> The injured phalanx, which is naturally splinted by the nail plate, should be held in full extension using a prefabricated plastic splint affixed with athletic tape while allowing for motion at the PIP and MCP joints (Figures 7a and 7b).<sup>9</sup> Aluminum splints should be avoided if the patient wishes to continue athletic activity while immobilized, as they require additional padding to prevent injury to other players on the field. Depending on the degree of fine digital movement required for an athlete's specific position, most athletes are able to quickly return to play while immobilized by minimally padding the plastic splint with a neoprene sleeve covering.

### Small Finger Carpometacarpal Fracture Dislocation

A CMC dislocation that occurs under a high level of force can result in an isolated fracture or in a fracture dislocation of the associated metacarpal (Figure 8).<sup>1,20</sup>

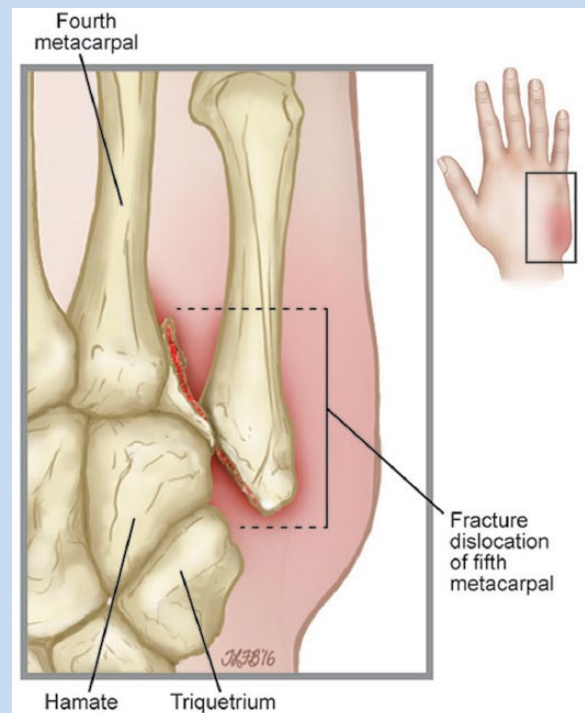


Figure 8. Small finger carpometacarpal (CMC) fracture dislocation anatomy. There are 2 main types of dislocations that occur at the CMC joint, which can be classified as dorsal or volar based on the direction of displacement. Dorsal is most common in both athletic and nonathletic injuries. CMC fracture dislocations occur with the highest frequency at the small finger CMC joint due to the relative ligamentous laxity of the fifth metacarpal compared with that of other CMC joints.

The abnormal angulation of the CMC joint associated with dislocation is easily identifiable; thus, reductions are commonly

attempted at the time of injury to facilitate a prompt return to gameplay. However, an apparent reduction and subsequent buddy taping does not remove the need for a formal evaluation. Hand and wrist imaging, specifically lateral and 35° pronated oblique views, can be helpful to determine whether a dislocation has been fully reduced and for identification of any fractures associated with the dislocation.<sup>8</sup>

Although many fracture-dislocations are somewhat unstable and will most likely require eventual surgical intervention with K-wire fixation, it may be reasonable to attempt nonoperative management in the in-season athlete. In these cases, patients require a minimum of 6 weeks of rigid immobilization of the CMC joint using a short-arm ulnar gutter cast with appropriate mold. Once the dislocation has stabilized or the fracture has become “sticky,” it is reasonable to transition to the 2-cast system. The techniques described in Figures 4 and 5, which utilize 1 cast for everyday wear and a shorter cast for gameplay wear, are the typical treatment for small finger CMC fracture dislocations. Both of these casts should be molded in slight ulnar deviation and wrist extension for added support of the fracture fragment. The game day cast needs to be padded for participation in athletic activities.<sup>6</sup>

### SUMMARY


When protected casting and splinting measures are employed, playing with any type of injury is associated with certain risks, including but not limited to progression of the pathology,

delayed union, malunion, or nonunion. Therefore, every injury must be thoroughly and frequently evaluated to fully understand the extent of the bony damage and the associated stability of the injury. In cases involving a displaced fracture, especially of the metacarpals, athletes may have a better recovery and a more rapid return to play with immediate operative intervention rather than attempting to correct the pathology nonsurgically.

The athlete must understand that there is no guarantee that the injury will be protected in all situations during participation in contact sports and that playing with any injury is inherently risky.

The methods presented do not necessarily apply to all athlete positions or all sports. Because of the varying need for dexterity, each mode of protection must be individually suited to meet each player’s needs. As such, some of the methods described may need adjustment while others simply do not apply. Protected return to play, therefore, requires creativity among the treatment team both on the part of the physician and the athletic training staff.

Although traumatic sport-related hand injuries traditionally held the potential to be season-ending, experience has shown that in-season athletes do not necessarily need to lose game time for appropriate treatment of these types of injuries to occur. A thorough knowledge of converting everyday splints and casts into game day, sport-approved protective immobilization devices is key to safely allowing athletes with select injuries to play while injured.



## Clinical Recommendations

**SORT: Strength of Recommendation Taxonomy Grade**

**A:** consistent, good-quality patient-oriented evidence  
**B:** inconsistent or limited-quality patient-oriented evidence  
**C:** consensus, disease-oriented evidence, usual practice, expert opinion, or case series

Clinical Recommendation	SORT Evidence Rating
Many common sport-induced hand injuries do not require immediate surgical intervention and can be safely treated through immobilization in an effort to prevent loss of game time.	<b>C</b>
It is critical that the athletes, coaches, athletic trainers, and physicians work together to assess the potential risks of playing with an upper extremity injury and agree on a safe, responsible treatment plan.	<b>C</b>
A thorough knowledge of converting everyday splints and casts into game day, sport-approved protective immobilization devices is key to safely allowing athletes with select injuries to play while injured.	<b>C</b>

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