

Boxer's Knuckle in the Professional Athlete*

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ABSTRACT

Injuries to the extensor mechanisms of the fingers can be career-ending in professional athletes if not treated appropriately. We identified 8 professional athletes who underwent 11 direct metacarpophalangeal joint extensor mechanism repairs including centralization of the extensor tendon and sagittal band repair between 1989 and 1994. Success of the operative procedure was determined by the athlete's attainment of full range of motion, return to professional sports, and no need for additional surgical intervention. The metacarpophalangeal joints of the long and little fingers were most commonly involved. The position of the extensor mechanism disruption and the direction of the tendon subluxation varied. Capsular tears were identified in seven joints and none were repaired. At follow-up, each athlete had regained full range of motion and each had returned to professional sport an average of 5 months postoperatively. No patient required additional surgery. In this series, the principal lesion in metacarpophalangeal joint injury was extensor mechanism disruption with a predictable sagittal band tear and either a radial or ulnar subluxation of the central tendon. We recommend centralization of the extensor tendon and sagittal band repair without capsular repair as a treatment of choice for this injury, particularly in the athlete.

Injuries to the hands of professional athletes are very common and include abnormalities in the extensor hood of prominent knuckles, metacarpal fractures, carpometacarpal joint injuries, and injuries to the thumb. Injury to the extensor mechanism of the metacarpophalangeal joint can

be devastating to the athlete, particularly the boxer. The extensor mechanism of the metacarpophalangeal joint comprises the longitudinal central tendon and the sagittal bands, which stabilize the central tendon. The thick joint capsule lies just inferior to this and provides additional protection to the metacarpophalangeal joint.

Complete metacarpophalangeal joint extensor mechanism disruption is usually caused by blunt trauma,^{4,9,13} and typical symptoms are metacarpophalangeal joint swelling, decreased joint extension, central tendon dislocation or subluxation, and a palpable defect at the site of the rupture^{8,9} (Fig. 1). Although any of the fingers can be affected, the most commonly injured finger is the long finger.¹ Its anatomic predisposition and prominence when a fist is made make it particularly susceptible to injury.⁶ Additionally, the metacarpophalangeal joints are forced into acute flexion during a punch, and the overlying extensor mechanism and joint capsule are maximally stretched over the prominent metacarpal head. Depending on the degree of initial trauma and its repetitiveness, a spectrum of injuries to the extensor mechanism may be encountered.^{3-8,13} These include tears in the sagittal bands, either on the ulnar or radial side of the central tendon, and tears longitudinally in the central tendon. If an excessive force causes extreme flexion and ulnar deviation of the joint, a complete rupture of the radial sagittal band with ulnar dislocation of the central tendon can be expected.¹³ Radial dislocations have also been reported.¹ This may or may not be associated with an underlying capsular tear.

Protection and adequate training can prevent metacarpophalangeal joint injury. However, once an injury occurs, prompt surgical intervention is indicated to prevent irreparable damage to the extensor mechanism. Direct surgical repair with realignment of the central tendon is usually adequate and highly successful. Augmentation with local tendon slips is rarely indicated, but, if required, it can be a viable alternative.^{3,11,13}

MATERIALS AND METHODS

Eight professional athletes, six boxers and two hockey players, ages 20 to 28 years were examined by one of the

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Figure 1. Swelling at the third metacarpophalangeal joint of a professional boxer

authors (CPM) between 1989 and 1994. In all athletes the diagnosis of extensor mechanism injury was made and operative treatment was performed. Reviews of the charts and operative reports were completed on all patients. At the time of surgery, the direction of the extensor mechanism disruption, the direction of the extensor tendon subluxation or dislocation, and the existence and location of a capsular tear were noted for each patient. There were a total of 11 injured metacarpophalangeal joints. One athlete had injured four extensor mechanisms. Athletes underwent surgery an average of 3.3 months (range, 1 to 11) after the original injury. The average follow-up was 5.9 years. No patient was given a trial of splinting before the operation. Success of the operative procedure was determined by the athlete's attainment of full range of motion of the affected joint, return to professional sports, and no need for additional operative intervention.

Surgical Procedure

The patient's arm was prepared and draped in a sterile field. A curved incision was marked over the ulnar aspect of the affected joint. Care was taken to avoid the prominence of the metacarpal head (Fig. 2). The arm was then elevated and exsanguinated. A tourniquet was inflated to 250 mm of mercury. A skin incision was made and the superficial veins were cauterized. The sensory branches of the radial or ulnar nerves were identified and protected.

Any overlying scar tissue was then removed and the position of the central tendon and the area of sagittal fiber disruption were noted. The torn edges of the sagittal fibers were debrided and any underlying capsular tears were identified. If a capsular tear was present, its edges were also debrided and no attempt was made to close it (Fig. 3). The central tendon was then centralized over the metacarpophalangeal joint and repaired, followed by repair of the sagittal fibers (Fig. 4). This repair was done with the joint in 60° to 70° of flexion so that no tension was placed on the repair and no limitations of metacarpophalangeal joint flexion would result. Metacarpophalangeal joint flex-

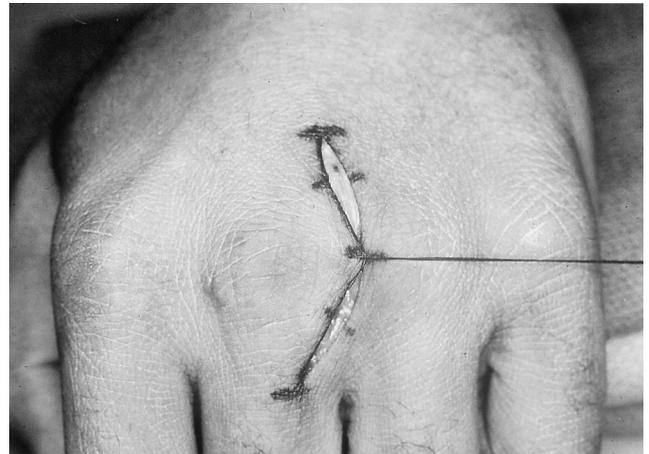


Figure 2. The skin incision for repair of the extensor mechanism. Care must be taken to avoid the prominence of the metacarpal head.



Figure 3. The third metacarpal head is shown exposed through a large capsular tear.



Figure 4. The ulnar sagittal band has been repaired and the extensor tendon centralized over the metacarpal head.

ion had to match that of the adjacent joints when the repair was complete. The tourniquet was deflated and hemostasis was attained. The wound was closed with interrupted nylon sutures. For all patients, a plaster splint was applied to the hand and wrist with the metacarpophalangeal joint in 60° to 70° of flexion.

Postoperative Course

Cast immobilization with the metacarpophalangeal joint in 60° to 70° of flexion was continued for 6 weeks. Active flexion but not extension of the interphalangeal joint was allowed in the first 6 weeks. Punching was not allowed until the hand demonstrated a normal pain-free arc of digital motion as well as normal strength.

RESULTS

A total of 11 extensor mechanisms required repair. Two involved the index finger (18%), four involved the long finger (36%), one involved the ring finger (9%), and four involved the little finger (36%). At the time of surgery, the location of the extensor mechanism disruption or sagittal band tear varied. All joints demonstrated tears of the sagittal band. Four sagittal band tears occurred radially, two centrally, three ulnarly, one both radially and ulnarly, and one centrally and radially. All joints demonstrated subluxation of the extensor tendon. The direction of the extensor tendon subluxation varied. Radial subluxation of the extensor tendon occurred in five fingers and ulnar subluxation occurred in three fingers. Three of the little fingers demonstrated subluxation of the extensor digitorum tendon radially and subluxation of the extensor digiti minimi tendon ulnarly.

Capsular tears were noted in 7 of the 11 metacarpophalangeal joints. Three tears occurred radially, three ulnarly, and one both radially and ulnarly. Four joints had no capsular tear. However, three joints had capsular scarring that was debrided.

At follow-up, each athlete had regained full range of motion of the affected finger. Each athlete returned to his professional sport an average of 5 months (range, 4 to 6) postoperatively, and no patient required additional operative intervention.

DISCUSSION

It has been established that injury to the extensor mechanism and capsule of the metacarpophalangeal joint can be devastating to the professional athlete.^{4,8,9} Surgical intervention with centralization of the extensor tendon and repair of the extensor hood has become the treatment of choice for this injury and has often been described in the literature.^{4,8-12} Repair of the capsular defect, however, remains controversial. Several authors have concluded that a dorsal capsular tear should be surgically repaired, especially in the athlete.^{9,10} A tightly repaired capsule, however, may lead to loss of range of motion. In 7 of the 11 joints described here there were capsular tears. All of the tears were debrided and none of them repaired. After

adequate debridement of the capsule, we were unable to approximate the edges when the joint was flexed 90° without placing undue tension on the repair or without limiting flexion. Since all of our athletes regained full range of motion, became symptom-free, and returned to their sport at an average of 5 months postoperatively, we conclude that repair of the capsule is not required for complete recovery. Additionally, we contend that proper debridement of the capsule followed by repair will lead to excessive tightness of the capsule and subsequent decrease of the range of motion of the affected joint. The athlete unable to completely flex at the metacarpophalangeal joint is vulnerable to future, possibly career-ending, injury.

As with capsular tears, the mechanism of radial subluxation or dislocation of the extensor tendon has not been adequately described in the literature. Koniuch et al.,⁷ in an anatomic study, demonstrated that, although radial sagittal fiber transection frequently produces ulnar tendon dislocation, neither partial nor complete transection of the ulnar sagittal bands produces radial dislocation of the extensor tendons. They concluded that this lack of subluxation or dislocation is due to the tethering effect of intertendinous connections and the ulnar deviation of the resting metacarpophalangeal joint. Further, Araki et al.¹ reported that radial extensor tendon dislocation occurred only when the intertendinous fascia and the ulnar sagittal band were cut. As a result, the unbalanced pull of the radial intertendinous fascia dislocated the extensor tendon to the radial side. All of our patients with ulnar sagittal band disruption had radial subluxation of the extensor tendon. Additionally, they all had capsular tears. This finding may reflect the force of impact as well as the repetitive nature of the injury to the extensor mechanism in our athletes.

Several authors have advocated that nonoperative treatment should be attempted before operative intervention, particularly in cases of acute extensor mechanism injury.^{2,12} However, there is very little evidence of successful nonoperative treatment in the literature. Ritts et al.¹² described two cases of extensor mechanism injury treated with 4 weeks of immobilization of the metacarpophalangeal joint in full extension. Both of these cases were the result of minimal trauma and would, by some authors, be considered atraumatic. Additionally, one patient had only 85° of flexion of the metacarpophalangeal joint at 5 months' follow-up, and the other continued to have tendon translation 21 months after treatment. Carroll et al.,³ in their series of nine extensor tendon subluxations, had five patients for whom nonoperative treatment failed and operative care was required. All patients were initially treated with splinting of the metacarpophalangeal joint in 0° of extension for 6 weeks. Because of the limited success reported for nonoperative treatment, our patients were treated surgically. Nonoperative treatment with splinting may be an option for acute subluxation of the extensor tendon only in patients who are not required to perform repetitive activity. It is our conclusion that most patients will require sagittal band repair and centralization of the extensor mechanism.

The goal of the athlete, trainer, and team physician is to

prevent hand injuries during practice and competition. To do so, safety measures, including proper training, adequate wrapping and gloving of the hand, custom protective devices, and adequate medical supervision, must be employed. The boxer, in particular, must learn to effectively and accurately punch. In doing so, the number of punches can be decreased and highly vulnerable positions of the hand can be avoided. Additionally, punching is allowed only if the hand is pain-free and well protected. Frequent hand examinations by medical professionals for signs of inflammation and injury to the metacarpophalangeal joint are also recommended.

Precise wrapping and gloving of the hand before punching will provide some protection to vulnerable joints. Custom-fit gloves and rubber casts can also be used to provide protection.⁸ Although not allowed in professional bouts, new improved devices contoured to the metacarpophalangeal joints can be used while sparring. We recommend that protective devices and wraps be made of a durable shock-absorbing material such as silicone and be placed on the dorsal and volar aspects of the metacarpophalangeal joint. Dorsal padding will protect the joint from direct contact, and volar padding will prevent hyperflexion of the metacarpophalangeal joint when punching.

Injury to the extensor mechanism and capsule of the metacarpophalangeal joint in the athlete requires careful consideration. Athletes demand full range of motion of the joint as well as adequate strength to successfully participate and avoid injury to the hand. Direct repair of the extensor mechanism without repair of the capsule has been found to be an adequate form of treatment for the

professional athlete. It relieves symptoms, stabilizes the extensor mechanism without the danger of loss of range of motion, and allows for early return to professional sports. Prevention of the injury, however, remains the key to a successful professional career.

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