

Arthroscopic Reduction of Complex Dorsal Metacarpophalangeal Dislocation of Index Finger

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Abstract: Complex dorsal dislocation of the metacarpophalangeal joint is an uncommon injury, typically caused by entrapment of the volar plate within the joint space. Closed reduction of the dislocation is not effective; instead, open reduction is necessary to release the soft tissues interposed between the metacarpal head and the proximal phalanx. However, an operative risk of digital nerve injury exists because of intricate displacement of the normal anatomy. We successfully reduced a dislocation by arthroscopic release of the entrapped volar plate. The case involved an 11-year-old boy with a complex dorsal dislocation of the metacarpophalangeal joint of the right index finger that had failed closed reduction. This technique allowed for reliable joint reduction, enabling observation of the structures obstructing the reduction; was less invasive; and avoided the risk of neurovascular injury. It is a reasonable method to use when the volar plate prevents reduction of the dislocation.

Complex dorsal dislocation of the metacarpophalangeal (MCP) joint is an uncommon injury, typically caused by entrapment of the volar plate within the joint space. Closed reduction of the dislocation is not effective; instead, open reduction is necessary to release the soft tissues interposed between the metacarpal head and the proximal phalanx. Surgical reduction may use a volar or dorsal approach.¹⁻³ The dorsal approach has a lower risk of digital neurovascular damage¹; however, an operative risk of digital nerve injury exists for either method² because of intricate displacement of the normal anatomy. On the other hand, an MCP joint arthroscopy is a valuable tool that can reduce the risk of neurovascular injury. In addition, arthroscopy uses a small portal that is less susceptible to scarring associated with open procedures. The intra-articular anatomy of the MCP joint is simple, allowing clear arthroscopic viewing and identification of its major structures.⁴ The joint can

become spacious with simple traction, and a keyhole incision allows observation within the joint, which is otherwise not possible with normal vision.

We present a case of complex dorsal dislocation of the MCP joint of the right index finger that we successfully reduced by arthroscopic release of the volar plate entrapment. To our knowledge, this is the first report of a patient treated by arthroscopic reduction of a complex dorsal dislocation of the MCP joint.

Case Description

An 11-year-old boy sustained a forced extension injury of the right index finger while playing baseball. He presented with the index finger locked in hyperextension at the MCP joint. Preoperative radiography showed dorsal dislocation and widening of the MCP joint of the right index finger (Fig 1). We decided to perform MCP joint arthroscopy after an unsuccessful attempt at closed reduction with the patient under intra-articular anesthesia.

Surgical Technique

The patient was positioned supine under an axillary brachial plexus block. We provided 5 kg of traction to the right index finger while placing it in a finger trap (Table 1). Two 5-mm incisions provided portals, 1 on each side of the extensor tendon. We inserted a 1.9-mm, 30° arthroscopic through the radial portal and a probe through the ulnar portal (Video 1). The

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The authors report that they have no conflicts of interest in the authorship and publication of this article.

Received September 11, 2013; accepted November 22, 2013.

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2212-6287/13664

<http://dx.doi.org/10.1016/j.eats.2013.11.008>



Fig 1. Radiograph of right index finger showing dorsal dislocation and widening of MCP joint.

arthroscopic findings showed that the volar plate was detached proximally and positioned on the metacarpal head (Fig 2). During the reduction, we used a probe to push the torn proximal attachment of the volar plate palmarly while also pressing the metacarpal head dorsally (Fig 3). We confirmed MCP joint reduction by the popping sound made during volar plate reduction to the volar side (Fig 4).

Postoperatively, we immobilized the finger in 60° of flexion for 10 days. The patient regained full range of motion 3 weeks after surgery without any complications.

Table 1. Operative Pearls

	Description
Traction	Apply 5 kg only to the affected finger.
Portal	Establish 2 portals, 1 on each side of the extensor tendon.
Reduction maneuver	Push the torn proximal attachment of the volar plate palmarly using a probe; press the metacarpal head dorsally from the volar side.

Discussion

The volar plate is the structure most likely to hinder joint reduction of complex dorsal MCP joint dislocations, involving trapping of the metacarpal head between the volar plate, flexor tendon, and lumbrical muscle.⁵

A cadaveric study, which created MCP joint dislocation by forced extension, found that release of the volar plate allowed easy joint reduction. In contrast, complete release of the superficial transverse metacarpal ligament, flexor tendon, and lumbrical muscles did not allow reduction of the dislocation. Furthermore, releasing the deep transverse metacarpal ligament increased the mobility of the volar plate; however, the increase in mobility was not sufficient to allow reduction.⁶ Various anatomic structures other than the volar plate, including the lumbrical muscle, flexor tendon, first interosseous tendon,⁷ deep transverse metacarpal ligament, and sesamoid,⁸ have been implicated in the complex nature of MCP joint dorsal dislocation; however, cases reporting the role of these structures also required volar plate release or reduction. In our patient we repositioned the joint by arthroscopically returning the volar plate to the anatomic position. This lends support to the fact that the interposed volar plate was the prime factor interfering with the reduction.

Debate regarding the surgical approach to MCP joint reduction is ongoing. The advantage of the volar approach is that it allows direct access to the lesion and repair of the volar plate, decreasing the risk of subsequent instability.³ On the other hand, the dorsal approach provides excellent exposure of the volar plate, as well as access to the osteochondral fragments of the metacarpal head. The main disadvantage of the dorsal approach, however, is the longitudinal splitting of the volar plate to reduce the MCP joint, which is irreparable. Percutaneous techniques for MCP joint reduction have been described as less invasive. One such method involves placing a skin hook on the palmar aspect of the dislocated joint in the skin of the dimple identified by the Kaplan puckering sign, followed by lifting the palmar structures that is caught between the joint.⁹ Another technique involves dividing the volar plate longitudinally underneath the skin and then achieving a closed reduction.¹⁰ These techniques are simple and less invasive; however, the blind operation does not avoid the possibility of neurovascular or cartilage injury.

The arthroscopic technique offers several advantages. First, arthroscopy allowed for reliable joint reduction, enabling observation of the structures obstructing the reduction. Second, we used a small dorsal portal, which was less invasive and avoided the risk of neurovascular injury. In addition, our technique did not

Fig 2. Arthroscopic views from dorso-radial portal. (A) The arthroscopic findings before reduction show the volar plate positioned on the metacarpal head and (B) proximal detachment of the volar plate. The asterisk indicates the base of the proximal phalanx. The arrowheads indicate the volar plate.

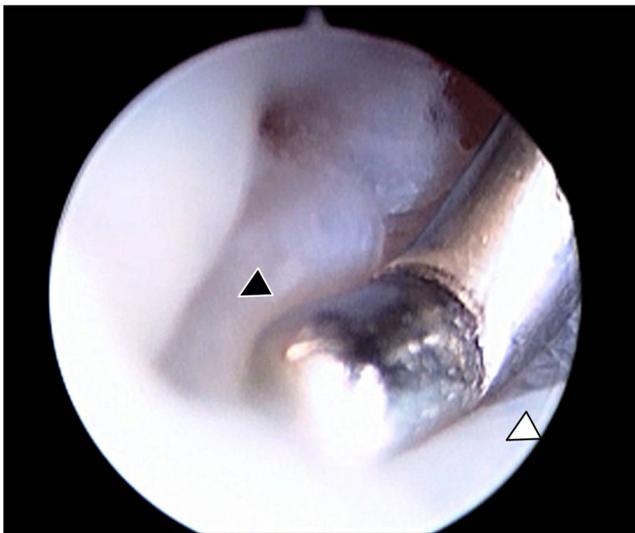
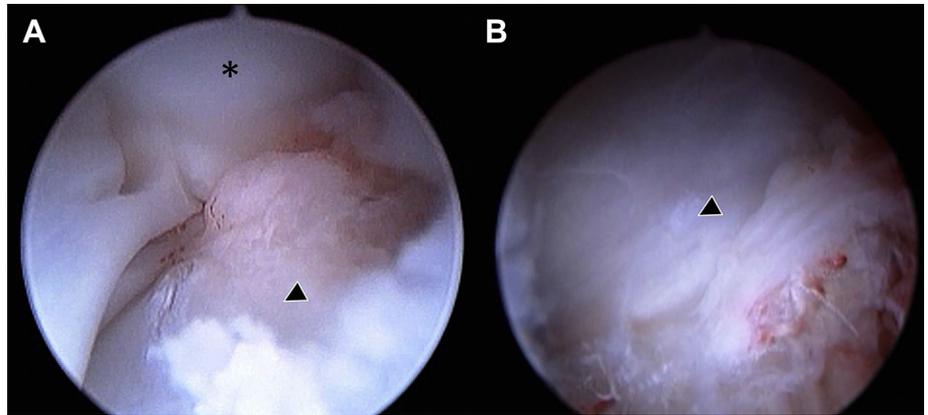


Fig 3. During the reduction, a probe pushed the torn proximal attachment of the volar plate palmarly. The black arrowhead indicates the torn volar plate. The white arrowhead indicates the metacarpal head.

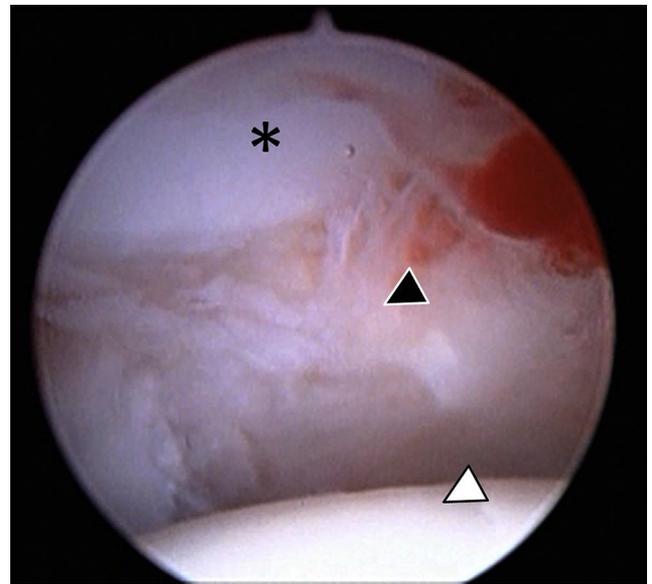


Fig 4. Arthroscopic findings after reduction. The asterisk indicates the base of the proximal phalanx. The black arrowhead indicates the volar plate. The white arrowhead indicates the metacarpal head.

sever the volar plate; therefore it has the potential to reduce the risk of redislocation associated with reducing the MCP joint by splitting the volar plate. These advantages may lead to early pain relief and range-of-motion recovery.

The described technique also has several limitations. First, arthroscopy is not without complications, including scar formation at the portal site and injury to the adjacent branching sensory nerves. Second, the arthroscopic technique does not allow observation of the extra-articular anatomy. Therefore it is still unclear whether this technique is effective when structures additional to the volar plate interfere with reduction.

In conclusion, arthroscopic reduction of complex dorsal MCP joint dislocation is a minimally invasive technique that is safe for the neurovascular bundle, as

well as a reasonable method to use when the volar plate prevents reduction of the dislocation.

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