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Practice Forum

Use of a bivalve finger fracture orthosis for a new treatment protocol of a PIP comminuted fracture and dorsal dislocation

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As therapists and physicians, we often need to work with our patients to cater treatment accordingly. These authors describe how they modified a treatment protocol for a patient that sustained a proximal interphalangeal joint comminuted fracture and dorsal dislocation, but refused surgery. Their modification allowed the patient to return to full activities. — Victoria Prigane, *PhD, OTR, CHT, CLT*, Practice Forum Editor.

Introduction

Injuries involving the combination of a proximal interphalangeal fracture and dorsal dislocation are puzzling to many, despite the currently known surgical repairs and orthosis methods. These types of fractures are typically treated with either a surgical or conservative approach. Surgical treatment is required if the fracture is unstable and involves more than 40% of the articular surface.[1] Conservative therapy approaches include the use of an extension block orthosis and/or Buddy tapping if the fracture is stable and involves less that 30% of the articular surface.[1] The main challenges in treating these patients include resolving pain, swelling, stiffness, and instability. Additional challenges include preventing degenerative arthritis and prolonged disability with damage in the osseous, articular and soft tissue components.[2]

The purpose of this report is to present a modification to the traditional comminuted fracture and dorsal dislocation protocol with the use of a bivalve finger fracture orthosis. The reason for the modification was because the patient that attended our clinic with this particular diagnosis chose not to have surgery as suggested by the surgeon and he agreed to follow a conservative protocol instead. Therapy goals involved with the use of this low profile orthosis included early motion, decrease edema, minimizing PIP flexion and extension contractions, diminishing tendon adhesion, minimizing secondary deformities, decreasing pain and increasing patient compliance to orthotic use.

Anatomy and classification

Although the proximal interphalangeal joint (PIP) is a stable joint due to its articular and ligamentous structure, it is also one of the most commonly injured joints in hand. The PIP is surrounded by the joint capsule composed by the volar plate, true and accessory collateral ligaments, and the extensor mechanism. Stability is provided dorsally by the extensor tendon slip and lateral bands. Ulnarly and radially, the joint is statically stabilized by the accessory and true collateral ligaments, and conjoined lateral bands. Palmarly, the main static stabilizers are the volar plate, flexor tendons, and fibro-osseous flexor sheet. The articular congruency of the condyles, volar plate, and the accessory ligament act as dynamic restrains with hyperextension injuries; these structures contribute to lateral stability and prevention of dorsal dislocation.

Proximal interphalangeal joint injuries range from ligament sprains to unstable irreducible fracture dislocations. The level of injury depends on the direction and force of the trauma, joint position, eccentric muscular contraction that affects the load on ligaments and tendons, and incongruence of bony fractures.[3] Dorsally directed joint dislocations are the most common types of dislocations. These injuries result from PIP joint hyperextension that disrupts the volar plate, as well as one or both the true and accessory collateral ligaments from their insertion at the base of the middle phalanx. A more complex injury occurs from a fracture of the volar lip of the middle phalanx that may or not be reducible.[4]

There have been many classifications that summarize the effect of these injuries, but we will cite one in particular. Eaton and Littler[5]

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Fig. 1. Orthosis applied on patient, allowing therapist to check for motion, sensation and circulation.

Fig. 3. Thermoplastic material wrapped dorsally from ulnar to radial side overlapping at the top.

categorized dorsal dislocation injuries into three types. Type I injuries, also known as hyperextension injuries, are defined by a partial volar plate avulsion with intact collateral ligaments. Type II injuries, or dorsal dislocation injuries, are characterized by total volar plate and complete collateral ligament rupture. Type III injuries, or fracture dislocation injuries, include a fracture of the volar lip of the middle phalanx and complete ligament disruption.

Treatment is chosen based on the categories listed. Eaton and Littler type I and II usually involve closed treatment with dorsal block pinning or a dorsal blocking orthosis with a Buddy tape use to the adjacent digits for 4–6 weeks. Type III usually require extension block orthosis, extension block pinning, traction orthosis, the "S" Quatro technique, force coupled methods, external fixators, volar plate advancement arthroplasties, or ORIF procedures.[3]

A 51 y/o right-hand-dominant gentleman who worked in construction and real estate sales, as well as #1 ranked tennis player in a mayor metropolitan city was playing baseball with his son at his yard when the baseball struck his left ring finger into hyperextension. The patient was seen in our clinic and was diagnosed by the hand surgeon with an impacted comminuted fracture of the volar half of the base of the middle phalanx of the left ring finger with dorsal subluxation of the middle phalanx. There was no instability to stress of the radial or ulnar collateral ligament with the PIP joint in slight flexion. The patient showed an Eaton and Littler type III injury.

Bivalve finger fracture orthosis

Because our patient opted to not have surgery, we modified the protocol using a bivalve finger fracture orthosis, which is a finger based circumferential orthosis that allows DIP and MP motion while providing static reduction of the middle phalanx volar fracture lip, as well as allowing ligamentous healing (Fig. 1). The surgeon determined the exact degree of PIP flexion while evaluating the anatomic reduction and stabilization of the fracture fragment using fluoroscopy. After the fabrication of the orthosis, the finger position was evaluated under X-ray to ensure joint stability. The orthosis was constructed around the digit overlapping at the dorsal side. Constant pressure was provided by the use of rivets and straps

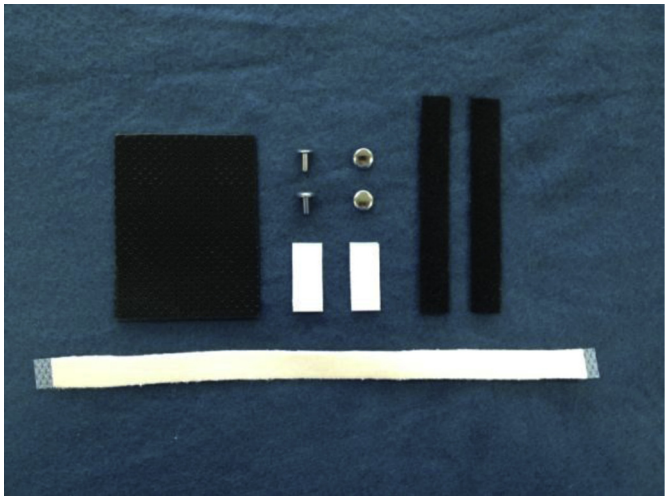

Fig. 2. Materials.

Fig. 4. Orthosis finished with 2 straps that wrap around the middle first and second phalanges from dorsal to radial side.