

Technical report

External immobilization of index finger collateral ligament injuries using an improvised frame

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Background: Proximal interphalangeal joint (PIPJ) dislocation is a common injury. Current management of instability after closed reduction is repair of the torn ligament followed by immobilization. Important sequels after prolonged immobilization include stiffness. On the other hand, early motion exercise may cause rerupture. Buddy taping has been used to partially stabilize the injured finger which also allows early gentle motion. However, this technique cannot be applied to collateral ligament injury of a border finger such as the radial collateral ligament of the index or ulnar collateral ligament of the little finger.

Objectives: To describe functional outcomes after application of a frame improvised from a standard disposable syringe in cases of index radial collateral ligament injury.

Methods: We constructed adjustable, customized, mobile frames improvised from standard disposable syringe barrels for stabilizing collateral ligaments of the PIPJ to improve motion and protect the repaired ligament. Two patients with radial collateral ligament injury of the index finger were treated with the improvised frame for 4 weeks after an initial 3-week immobilization with Kirschner wire and a static splint.

Results: The average range of motion of PIPJ after treatment was 0–105° with good radioulnar stability. The lifetime of the improvised frame is approximately 8 days, but it can be replaced easily and inexpensively in most medical facilities.

Conclusions: We introduce an improvised frame, which we call a “Sriracha frame”, as a novel, inexpensive, easy to produce, and effective device that yields good, early joint motion and stability.

Keywords: External immobilization, index finger, proximal interphalangeal joint

Proximal interphalangeal joint (PIPJ) dislocation is a common injury. However, PIP dislocation in the coronal plane is uncommon. PIPJ dislocations can be caused by traffic accidents, household tools, sports, or factory machines. The injured structures are proper collateral ligaments, accessory collateral ligaments, and the volar plate of the PIPJ. General management of this problem includes reduction, repair of the torn ligament, and stabilization for several weeks [1-3]. Stiffness is one of the common sequelae after prolonged immobilization [4]. Early gentle motion exercises can prevent stiffness. However, these exercises can also cause rerupture of a repaired ligament. A practical option for gentle early mobilization is buddy taping with an adjacent uninjured finger. However, buddy taping may cause further

injury of original collateral ligament. One rarely mentioned important issue is injury of the collateral ligament of the outer fingers, such as radial collateral ligament (RCL) of the index finger and ulnar collateral ligament (UCL) of the little finger.

We developed a simple external mobile frame to allow safe healing and retention of normal motion of the injured finger.

Material and method

The study was approved by the Institutional Review Board of Queen Savang Vadhana Memorial Hospital, Thai Red Cross (No. 25/2557). The two patients recruited for this study provided their written informed consent for publication of this study including their clinical photographs.

We report cases of isolated open radial collateral ligament injury of the index finger in 2 patients in 2014. After surgical repair of the collateral ligaments, the patients' fingers were stabilized with two or more Kirschner wires (K-wires) plus splints for 3 weeks.

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Then, the K-wires and finger splints were removed and the patients were instructed how to use a mobile frame improvised from a standard disposable syringe barrel.

The frames were constructed from 20 mL polypropylene syringe barrels. The barrels were cut in a transverse fashion at the dorsal part and at the wedge volar part at the level of the PIPJ that preserves a 5-mm hinge on the radial and ulnar sides. The hinges allow some flexion motion of the finger. In case of a larger size or swollen finger, a longitudinal split at the

proximal part of a syringe may be enlarged. Wrapping the longitudinal cut with a tape will make it stronger.

Patients were followed once a week to ensure the proper use of the frame and motion exercises of the fingers.

Results

The details of both patients are shown in **Table 1**.

Figure 2 shows the use of the improvised frame and **Figure 3** demonstrates final outcomes.



Figure 1. A 20 mL polypropylene syringe was cut in a transverse fashion at the dorsal part and wedge volar part at the level of the PIPJ preserving a 5-mm hinge on both radial and ulnar sides.

Table 1. Demographic data and outcomes after treatment with the improvised frames

Characteristics	Patient A	Patient B
Age	32	57
Sex	male	female
Side	left	left
Mechanism of injury	Open injury from motorcycle accident	Open injury from work
Initial treatment	Direct repair of radial collateral ligament and K-wire fixation	Repair of radial collateral ligament, central slip and K-wire fixation
Started time of using the frame	3 weeks after injury	2 weeks after injury
Overall time of using the frame	4 weeks	4 weeks
Useful life (days)		
1 st frame	8	9
2 nd frame	7	7
3 rd frame	8	8
4 th frame (end of treatment)	5	4
Average lifetime (1 st -3 rd frame)	7.6	8
Stability of PIPJ	0	0
Range of motion of PIP joint at last visit	0-120°	0-90°
Complication	No complication was observed	No complication was observed



Figure 2. The hinges allow flexion motion, but the radioulnar plane is stable.



Figure 3. A 32-year-old man with PIPJ fracture dislocation, after 3 weeks K-wire fixation and a repaired index RCL. The improvised mobile frames were applied for 4 weeks. He could flex and extend his PIPJ with radioulnar protection. The range of motion after treatment was 0–120° with good radioulnar stability.

Discussion

Lateral collateral ligaments of the PIPJ are the primary stabilizers in the coronal plane [5] and injury of these ligaments causes instability of PIPJs. Standard treatments of PIPJ fracture dislocation are 3-4 weeks of immobilization with a splint and followed by protected gentle motion exercises. Some surgeons use suture anchoring to restore the collateral ligament

and claimed this technique allowed active motion at from 2 to 3 weeks, and unlimited motion after 6 weeks [6, 7]. One current method reported by Joyce et al. was the use of a “figure-of-eight” external splint for immobilization of PIP dislocation [8].

Stiffness because of prolonged immobilization is a common complication after treatment of PIPJ dislocation. Early mobilization with partial protection

of the repaired ligament by buddy taping is recommended. Won et al. found buddy taping to be a safe method of treatment for finger injury in patients who seemed to have low compliance [9]. Skin injury, infection, or necrosis are not commonly found after buddy taping. However, such buddy taping cannot be applied to injuries of the outer fingers, such as RCL of the index finger and UCL of the little finger.

We constructed a mobile frame improvised from a standard disposable polypropylene syringe barrel to protect the radioulnar collateral ligament and allow flexion–extension exercises of the PIPJ. The improvised frame, which we call a “Sriracha frame”, named after the town of Sriracha in Chonburi province, Thailand, where Queen Savang Vadhana Memorial Hospital is located, is simple, inexpensive, and effective in stabilizing the PIPJ in the radioulnar plane. It can be readily custom made and replaced at almost any medical facility. The mobile frame is not durable, but lasts about one week depending on use. With a greater range of motion exercise, the “hinge” will fatigue and the frame will not last as long as it will with less motion. The patient can be given one or more backup frames and be instructed how to change them if the hinge becomes broken. The frames can be applied to other fingers where moderate support is indicated.

Limitations of the present study include the small number of cases studied and the relatively short follow up. Further studies that compare the frame with other treatment options should be considered.

Conclusion

We introduce an improvised frame, which we call a “Sriracha frame”, as a novel, inexpensive, easy to produce, and effective device that yields good, early joint motion and stability of the PIPJ after collateral ligament repair. This mobile frame provides stability in the radioulnar plane that allows motion in the dorsovolar plane for an injured PIP joint. It can be used to prevent joint stiffness and protects the repaired ligament.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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