



**Case Report**

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# The Ishiguro Technique for the Treatment of Mallet Finger Fracture in Adolescent



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## Abstract

**Introduction:** Mallet finger fracture is a deformity produced by avulsion of the extensor tendon insertion at the base of the distal phalanx. In most of the cases, complete healing and functional restoration can be achieved by conservative treatment. However, when the disrupted part affects more than one third of the particular surface and the extent of the dislocation is more than 1.5mm, then surgical intervention is necessary.

**Aim:** To present our initial experience with the Ishiguro surgical technique for the treatment of avulsion of the extensor tendon injury in 11 children.

**Subject and Methods:** We applied the minimally invasive surgical technique for the treatment of mallet finger fracture in 11 adolescent male children between 2014-2016. The interventions were performed under regional and general anesthesia controlled by fluoroscopy. External fixations of the affected fingers were carried out for 3 weeks, followed by removal of the wires under local anesthesia at 6 weeks post-operative. After the removal of the wires, regular physical therapy was carried out.

**Result:** At 8 weeks follow up investigation all of the 11 children had normal function with full extent of the affected articular motion and without any complaint. We did not observe any extension deficit, though in one of the cases there was infective complication at the pin site, which healed following antibiotic treatment.

**Summary:** Ishiguro technique is an effective, safe and easily learnable procedure for the treatment of mallet finger fracture in the adolescent age group too. In the cases of the 11 children we could achieve good functional results without open surgical exposure.

## Introduction

Mallet finger is the avulsion of the extensor tendon from the base of the distal phalanx with or without bony fragment. It occurs because of the hyper flexion or axial loading of the inter phalangeal joint, most often due to bicycle injuries and ball games. Injuries of the avulsion extensor tendon in adolescents are rare [1].

Treatment options for mallet finger fracture are primary conservative such as splint or cast [2]. Splints or casts immobilize musculoskeletal injuries while alleviating pain and promoting healing. However, these interventions differ in their technique, indications, benefits, and risks. Operative treatment is indicated in case of fractures involving more than one third of the articular surface and/or volar subluxation of the inter phalangeal joint as well as open fractures and when conservative treatment is not successful [1,3]. Reposition and internal fixation is required in the case of unstable phalanx fractures and fractures with extensive

destruction. These methods include: wire, intraosseous wire sutures, extra- and intraosseous compression pin fixation, and mini screw fixation [4-6].

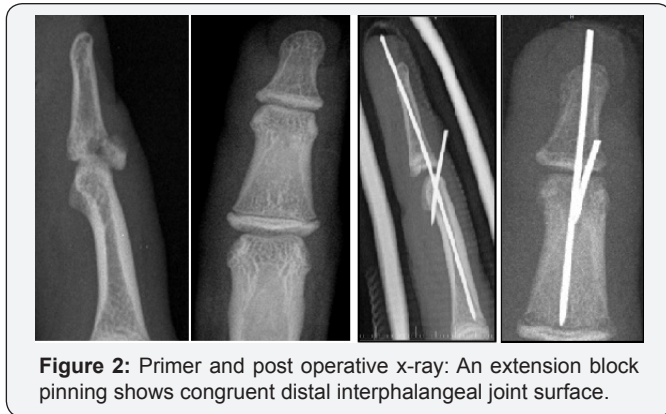
## Patients and Methods



**Figure 1:** 16-year-old boy presenting with a type III mallet fracture in the right middle finger. (lateral view), Post operative control x-ray: An extension block pinning shows congruent reduction of the distal interphalangeal joint.

We reviewed 11 patients who underwent operations for mallet fractures between February 2014 and January 2016. All patients were treated by Ishiguro minimally invasive surgical technique. Indications for surgery included a displaced large fragment involving more than one-third of the articular surface or fractures associated with palmar subluxation of the distal phalanx (Figure 1). Almost half of the procedures were performed under digital block anesthesia 6 pts underwent general anesthesia. Under C-arm image intensifier control, extension block pinning was attempted as described by Ishiguro et al. [3].

The first step of this method, maximal flexion of the distal interphalangeal joint and insertion of the 1 mm extension block K-wire. Second step: extension of the distal phalanx with reduction of the fragment and fixation with 1 mm K-wire (Figure 2).



**Figure 2:** Primer and post operative x-ray: An extension block pinning shows congruent distal interphalangeal joint surface.

After surgery, an aluminum splint was applied to fix the DIP and the PIP joint while active motion of the metacarpophalangeal joint was encouraged. Pin disinfection was performed twice a week. Fracture union was defined as bridging trabeculae and a nontender DIP joint on plain radiographs. Six weeks after the surgery, the K-wires were removed and passive and active exercises of the DIP joint were encouraged.

### Result

There were 10 male and 1 female with an average age of 14, 9 years (ranged, 13-14 years). The right hand was involved in 8 cases and the left hand in 3 cases. Nine injuries occurred in the dominant hand. The fingers affected were 8 middle and 2 ring fingers, and 1 pollex. The injury mechanisms included being struck by a ball in 10 cases, bumping up against a wall in 1 case. There were no compound fractures or open fractures. The average articular surface involvement was 40% (ranged 36-45%). Subluxation of the distal phalanx was observed in 2 of the 11 fractures (18%). The fractures were classified by the Wehbe & Schneider [1] method. There were 10 type IB, 1 type IIB fractures. The mean time from injury to surgery was 2, 8 days (ranged, 0-10 days).

The average follow-up was 10, 9 months (ranged, 2-24 months). The congruity of the articular surface and the degree of

anatomic reduction were confirmed on plain radiographs taken postoperatively and at the last follow-up. There was no cortical breakage of the distal phalanx, we haven't noticed displacement of the fracture fragment during follow-up. According to Crawford's classification, nine patients had excellent results, two had good results, and none had fair or poor results. The DIP joint demonstrated a mean range of 78° (ranged, 70-85°) flexion and 18° (ranged, 0-50) of extension loss. Bone union was achieved in all cases by a mean post operative day of 41 (ranged, 36-46 days). In two cases, infection occurred at the pin site at post operative week four and five, which were resolved by pin removal and dressing. Other complications, such as dermal necrosis, fractures of bone fragments, and nail-plate deformities, were not observed.

### Discussion

There are various options to treat the mallet finger fracture. Brook splint keeps the finger in an extended position that promotes healing in the case of extensor tendon injuries [2]. Although the many variations of percutaneous pinning are simple and effective in mallet finger fracture, they have many potential complications and disadvantages as well. Kirschner-wire related complications are well known: migration of the pins, superficial infections, damage of the physal plates, skin irritation and insufficient biomechanical ability to maintain the reduction without casting or splinting. The advantages of this technique are: the application of wires is a simple, easy, fast, and minimally invasive surgical technique [4,5]. Because of its insufficient stability external fixation is needed as well. Analyzing our cases of paediatric mallet finger fractures treated by percutaneous pinning between 2014 and 2016 (n=11) we found a total complication rate of 18,2% retrospectively. Superficial infection in 2 cases, we didn't find skin irritation, and wire migration. We cut off the nails outside the skin to prevent skin irritation complication.

The intraosseous wire sutures and compression-hooks are dynamic, stabilizing fixation techniques. Their advantage is that they are minimally invasive, thus the perfusion of the bone and the surrounding tissues are spared. The mini screws enable internal fixation allowing stable movement, after which early active movement can be started [3].

Ishiguro's method is easier than open surgery and the closed manipulation reduces the possibility of the fragment becoming comminuted [4,5]. We have found that the extension block technique is an effective and minimally invasive technique and it does not disrupt the remaining extensor mechanism. It is also relatively easy to achieve an adequate reduction and a good fixation with image intensification. It is also quicker than most of the open surgical procedures. It allows an earlier mobilization of the involved joint (as soon as the wires are removed), making it a more suitable procedure for patients who require early use of the hand.

The damage of the articular cartilage may lead to secondary osteoarthritis, as a result, infections and nail deformities may

adversely affect the outcome. After repeated insertion of the dorsal pin due to methodological issues dorsal scarring may occur.

### Conclusion

Ishiguro technique is an effective, safe, and easily applicable procedure for the treatment of mallet finger fracture in the adolescent age group. In this study we could achieve good functional results without open surgery.

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