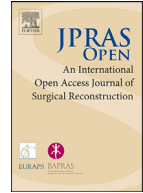




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## Case Report

# FDP avulsion: A washer technique

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## ARTICLE INFO

### Article history:

Received 17 October 2020

Accepted 4 November 2020

Available online 21 November 2020

### Keywords:

FDP avulsion

Jersey finger

Bony avulsion

Avulsion

Fragment

Washer

## ABSTRACT

**Background:** Flexor digitorum profundus (FDP) avulsion injuries occur following forced hyperextension of the distal interphalangeal joint (DIPJ).

**Methods:** We highlight a case report of FDP avulsion injury fixed using a single hole of a plate in combination with a cortical screw to act as a washer. A search and discussion of the literature is included.

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## Introduction

FDP avulsion injuries were classified by Leddy and Packer (1977),<sup>1</sup> the mechanism being of forced hyperextension of the DIPJ whilst being actively flexed. A variety of operative techniques have been described in the management of this injury. These include the use of minifragment screws,<sup>2</sup> interosseous sutures,<sup>3</sup> mini-plates,<sup>4</sup> hook plates,<sup>5</sup> suture anchors<sup>6</sup> and K-wires. Bunnell described the use of a dorsal button<sup>7</sup> for non-bony avulsion. In this case, we present the ORIF of a Leddy and Packer type II avulsion. This case is of interest because a rarely described method of cutting a single hole of a plate was used in combination with a cortical screw.

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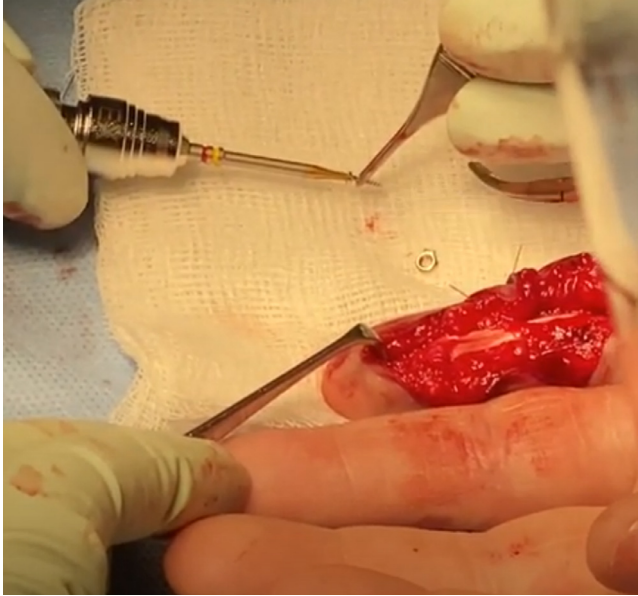
**Figure 1.** Lateral radiograph demonstrating the bony fragment (red arrow) just proximal to the PIPJ.

## Case

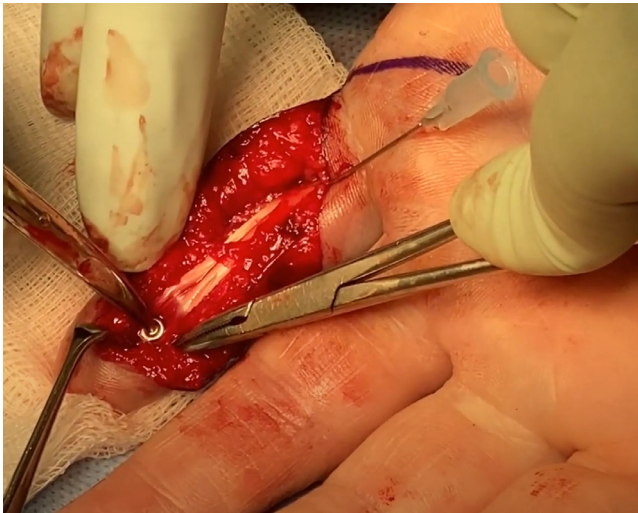
A 32-year-old man presented two days after a hyperextension injury with a bony FDP avulsion of his left little finger. Radiographs revealed a small volar cortical avulsion fragment at the level of the proximal interphalangeal joint (PIPJ) ([Figure 1](#)). Under wide awake local anaesthetic no tourniquet technique, the tendon was explored via a Bruner approach. The avulsed fragment was found to be still attached to the tendon, and was caught within the distal end of the A2 pulley. As it had retracted proximally, it was found to have nearly completely torn through the A4 pulley. Difficulty was had pulling the tendon distally through the A4 pulley, and so the A4 pulley was completely released. Once the bony fragment was reduced, a 25 gauge (orange) needle was placed into the fragment and distal phalanx, grasped with an artery clip, and placed against a ruler to act as a depth gauge. A 1.3 mm cortical screw (Depuy Synthes) was used, with a single hole of a plate cut to act as a washer ([Figures 2](#) and [3](#)). Dynamic testing of the repair and the range of motion was checked on the table, and it was found to be clinically stable. The position of the screw and washer was checked on the table. The pulley was repaired with 4–0 Prolene. The patient was placed in a dorsal blocking splint, and referred to hand therapy within 5 days for early active range of motion exercises. On follow up after 6 weeks, the patient had a healed fracture, with an intact FDP and full flexion. Unfortunately, the patient did develop a flexion contracture, which is at present being treated by the therapists.

## Discussion

Following a literature review, the use of washers is well documented in tendon rupture of the biceps tendon,<sup>8</sup> lower limb and shoulder.<sup>9</sup> Two articles describe the use of washers in the use of FDP avulsion<sup>4,10</sup> but in these cases, the plates were used biomechanically as a plate, that is, with two or more screws and holes. Either the fragment was large enough for consecutive holes of a plate, or the distal portion of the plate was serving as a *buttress* on the intact distal phalanx. We believe our



**Figure 2.** The screw and washer are prepared.



**Figure 3.** The screw and washer are set in place.

technique is unique in that a single hole of a plate is cut as a washer, and thus we have modified the use of a plate in this context to serve a different biomechanical function entirely.

The authors propose that this technique is particularly useful in bony Leddy Packer Type II injuries. In these injuries, the volar cortical fragment is small enough to retract through the A4 pulley. If using a Mini Fragment screw alone such a small fragment is highly prone to disintegrating on tightening the screw. It is also possible to drive the screw head into the bone, losing purchase.<sup>11</sup> The numerous biomechanical advantages of using a washer are particularly useful in this context. Washers serve to spread the load of the screw evenly across the fragment, preventing disintegration by reducing

the concentration of force. Using a washer made from a plate ensures that the contact surface of the screw on the plate is maximised, avoiding the point loading that would occur when the convex screw head abuts directly onto the cortical surface of the bone. Disintegration is also prevented because the washer serves to prevent intrusion of the screw head into the cortical surface. Screws with washers generate significantly more compressive force than those without washers.<sup>11</sup> Finally, washers also serve to improve overall stability of the compressive site by preventing lateral motion and unsteadiness.

### Statement of funding

There are no sources of funding to declare, this article was written for free by all authors for academic interest.

### Statement of human and animal rights

Additional informed consent was obtained from the patient for which photographs are included in this article.

### Statement of informed consent

The patient signed a written consent form for the publication of this article and use of photographs for educational purposes.

### Declaration of Competing Interest

All authors have no conflict of interest to declare.

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