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Original article

## Traumatic avulsion of the flexor digitorum profundus tendon. Jersey finger, a 29 cases report

*Avulsion traumatique distale du tendon fléchisseur profond des doigts. Évaluation fonctionnelle à propos de 29 cas*

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### ABSTRACT

Traumatic avulsion of flexor digitorum profundus (jersey finger) is an uncommon injury. Our study aimed to describe functional outcomes of jersey fingers after surgical treatment. From January 2004 to 2014, we performed surgery on 32 patients who had jersey finger. Twenty-six of these patients were male and 6 were female with a mean age of 37.2 years (range 16–68). Of the 32 cases, 11 were sports injuries, 16 presented on the ring finger and 13 on the little finger. Using the Ledy and Packer and Smith classifications, 16 of the injuries were type I, 4 were type II, 5 were type III, 7 were type IV. The mean time between injury and surgery was 6.8 days (range: 0–32). The surgical techniques used were anchor, pull-out, or an association of both these techniques. Prior to the patient discharge, functional outcomes were evaluated. Twenty-nine patients were evaluated in total and three patients were lost. Of the 29, the average time between surgery and discharge was 36.6 months ranging from 4.5 to 118 months. According to the Buck-Gramcko classification, six patients had an excellent result, six had a good result, seven had a satisfactory result and ten a poor result. The mean Quick DASH score immediately to prior discharge was 5.66 (range: 0–56.82). Twelve complications were reported on nine patients. No infections were reported. Rapid diagnosis and rapid surgical treatment led to restoration of full range motion.

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### RÉSUMÉ

La rupture du tendon flexor digitorum profundus à son insertion distale (*jersey finger*) est une lésion rare. Notre étude a porté sur l'évaluation fonctionnelle des *jersey fingers* traités chirurgicalement. De janvier 2004 à janvier 2014, 32 patients (26 hommes, âge moyen : 37,2 ans [16–68]), 11 accidents sportifs, 16 atteintes du 4<sup>e</sup> doigt et 13 du 5<sup>e</sup> doigt) ont été opérés d'un *jersey finger*. Le groupe comprenait 16 types I de la classification de Ledy et Packer, quatre types II, cinq types III et sept types IV. Le délai moyen entre le traumatisme et la chirurgie était de 6,84 jours (0–32). Les techniques chirurgicales utilisées étaient multiples (ancrage, *pull-out*, association des deux). Au dernier recul, une évaluation fonctionnelle a été réalisée. Vingt-neuf patients ont été revus au dernier recul de 36,6 mois soit 3,1 ans (de 4,5 mois à 9,8 ans), trois patients ont été perdus de vue. Six patients avaient une récupération complète avec un résultat excellent selon la classification de Buck-Gramcko, six un bon résultat, sept un résultat moyen et dix un mauvais résultat. Le score Quick DASH au dernier recul était de 5,66 (0–56,82). Douze complications ont été notées chez neuf patients sans aucune complication septique. Le diagnostic précoce du *jersey finger* permet une prise en charge chirurgicale rapide entraînant un excellent résultat fonctionnel en termes de mobilités et de douleur.

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## 1. Introduction

In hand post-traumatic tendinous tear, flexor tendons are only injured in 30% of cases. The extensor tendon, which is less strong and more exposed, are injured far more frequently [1]. Distal avulsion of the flexor digitorum profundus (FDP) tendon is a very rare injury caused by forced hyperextension of the distal interphalangeal (DIP) joint whilst in active flexion. This injury is called jersey finger or rugby finger [2–5]. This leads to a rupture of the FDP tendon at its physiologically weakest point, the insertion into the distal phalanx [6]. Jersey finger is a common injury amongst rugby and American football players and occurs more commonly in the ring finger (75% of the cases) but can occur in any digit [1,6–8].

The pathognomonic finding in the physical examination of jersey finger is the inability to actively flex the DIP joint [8]. On radiographs, distal stumps can often be identified if they are attached to a bony fragment. Boyes et al. [1] described the first case series in 1960. In 1977, Leddy and Packer [6] created a classification based on the presence or absence of a bony fragment, the localisation of the distal tendon stump and the associated flexor digitorum superficialis (FDS) rupture. A type I injury is described as a tendon retraction into the palm with vinculum ruptures. In type II injuries, the FDP tendon is retracted to the level of the proximal interphalangeal joint with vincula preserved. In type III injuries, retraction to the level of the A4 pulley of the middle phalanx is seen; these injuries are defined by the associated large bony fragment incarcerated within this crucial pulley. In contrast to type I injuries, both vincula are usually intact in type III injury patterns. Smith et al. [9] have extended the Leddy and Packer classification, adding a fourth type of injury [10–14]. This includes a rupture of the FDP tendon insertion with secondary tendon retraction into the finger or palm and a distal phalanx fracture with a large avulsion fragment incarcerated at the A4 pulley.

Unlike the treatment of extensor tendon injuries such as in the mallet finger, surgical treatment of jersey finger must occur promptly after the injury. In the literature, surgery within 10 days of the injury, defined as the acute phase, has been linked to better results [15,16]. Chronic injuries secondary to delayed patient presentation or diagnosis are managed non-surgically or if symptomatic DIP arthrodesis on a case by case basis after careful consideration of specific patient factors [7,15,17,18].

Currently, there are many different surgical techniques for jersey finger without bone fracture. These are: suture anchor [19–22], pull-out [6], combination of button anchor techniques. Surgical techniques with mini fragment plates [23,24], mini fragment screws [11,23,24] or wires [3,9] are used for jersey finger presenting with bone fracture. Cadaver studies [22] compared these different techniques but no clinical study has confirmed the superiority of one technique.

The aim of this study was to describe the functional outcome of surgically treated jersey fingers in a cohort of patients. The principal hypothesis was that early surgery, which is within ten days of injury, led to better functional outcomes.

## 2. Patients and methods

This retrospective study was performed between January 2004 and 2014 at the Department of Orthopaedic Surgery in an emergency hand surgery center. Patients who had jersey finger surgery were included and were all operated on by three experienced hand surgeons. Thirty-two patients were included (twenty-six males and six females) with a mean age of 37.2 years (range: 16–68 years). Nineteen patients were manual workers.

**Table 1**

Patients' description.

Patients	32
Sex ratio (female/male)	6/26
Age (years) (min-max)	37.2 (16–68)
Traumatism	Sports: 11 Others: 22
Finger	4: 16 5: 13 3: 1 2: 1 1: 1
Dominant hand	16
Manual worker/work injury	19/7
Fracture of P3	14
Type	Leddy et Packer I: 16 Leddy et Packer II: 4 Leddy et Packer III: 5 Smith IV: 7

Of the thirty-two, seven of the initial traumas were work injuries, nine were rugby injuries, two were a result of riding accidents and two were a result of crushing. The cause of the other cases was unknown. The injury involved the patient's dominant hand in sixteen cases, the ring finger in sixteen cases, the little finger in thirteen cases, the index finger in one case, the thumb in one case and the middle finger in one case (Table 1).

Fourteen cases were associated with a distal phalanx fracture, with four transversal fractures, five osseous avulsion and five complex articular fractures. Using the Leddy and Packer and Smith classifications; sixteen were type I, four were type II, five were type III and seven were type IV (Table 1).

Patients were reviewed for an inability to actively flex the DIP joint after injury, with or without ecchymosis or local pain. Physical examination and finger radiographs revealed the inability to flex the DIP joint in twenty-four cases. Ultrasonography was used in seven cases and MRI used in one case.

The mean time from injury to surgery was 6.8 days (range: 0–32 days). The mean time elapsed between injury and diagnosis was 8.9 days (range: 0–32 days) for type I, 4.5 days (range: 1–15 days) for type II, 2 days (range: 0–3 days) for type III and 7.4 days (range: 0–24 days) for type IV. Twenty eight patients had surgery in the acute phase with only four having surgery more than ten days after injury.

The experienced hand surgeons chose the ideal surgical method for the injury. A transosseous suture was used in thirty patients and a direct repair in two patients. A dorsal button technique or pull-out was used in nineteen patients [25–27], suture anchor technique for three patients, a combination of anchor and pull-out for two patients, a combination of pull-out and interosseous wire for two cases with a comminuted fracture, a combination of pull-out and mini screw for two patients, a mini screw alone for one patient and a combination of interosseous wire with anchor for one patient (Table 2).

In twenty-nine cases, a dorsal block splint or Duran splint [28] was made so that the end of the splint extended 2–3 cm beyond the fingertip. The wrist was positioned with 40° of flexion, the metacarpophalangeal (MCP) joints maximally flexed (70 to 90°) and the interphalangeal joints in the neutral position. This blister splint was custom made for each patient and used for six weeks. One patient with a transosseous wire and two patients with a mini screw for distal phalanx fracture had a finger splint for four weeks.

The postoperative motion protocol used depended on multiple factors, such as the quality of the tendon repair, the stability of the fixation and patient specific factors. The two patients with a transosseous wire have had no postoperative physiotherapy. Twenty patients have had a Duran protocol rehabilitation [28] with three weeks of passive motion, followed by three weeks of

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