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REVIEW

Z-plasty lengthening of the flexor digitorum profundus at the wrist (zone 5) for the treatment of jersey finger
Anatomical study and evaluation of advancement obtained

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KEYWORDS
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Summary *Aim:* The aim of this study was to conduct an anatomical evaluation of advancement obtained from Z-plasty lengthening of the flexor digitorum profundus at the wrist (zone 5) for the treatment of jersey finger.
Introduction: The avulsion of the flexor digitorum profundus from its distal insertion, or jersey finger, is an injury commonly missed in the accident and emergency department. Typically, after 3 weeks, the retracted tendon stump prevents direct reinsertion of the tendon. Sawaya et al. have proposed a treatment involving a zone 5 Z-plasty lengthening on the fourth finger. We conducted an anatomical study to evaluate the tendon advancement that could be obtained in the long digits using this method.
Method: Tendon avulsion was recreated in 17 fresh cadaver hands by severing the flexor digitorum profundus from its distal insertion. A 3-, 4- or 5-cm Z-plasty was performed at the wrist and, after section of the vinculum breve, the advancement was measured with wrist extension at 0°.
Results: A total of 68 tendon reconstructions were performed. The mean advancement obtained was 1.5 cm (max: 2.5 cm; min: 0.5 cm), 2.3 cm (max: 3.2 cm; min: 1.3 cm) and 2.5 cm (max: 3.5 cm; min: 1.7 cm) for 3-, 4- and 5-cm Z-plasties, respectively. Tendon advancement in the ring finger and middle finger was limited by the lumbrical (2 cases) or by synovial adhesions in the carpal tunnel (16 cases). There was no such limitation for the index finger.

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Discussion: Advancement of the flexor digitorum profundus by a 4-cm Z-plasty at the wrist seems to be a useful technique for reinsertion of a retracted tendon. The best results were obtained in the index finger. This technique could be considered as an alternative to palliative surgery or a tendon graft. In the other fingers, the fact that advancement was limited due to Verdan's quadriga effect and synovial adhesions highlights the significance of the relationship between the tendons themselves and with their environment on the physiology of finger flexion.

Introduction

Avulsion of the flexor digitorum profundus (FDP) from its distal insertion at the third phalanx (P3) is an injury that is often missed: according to Mansat[1] and Gaston,[2] only 50% of cases receive a positive clinical diagnosis in the accident and emergency department. The literature on zone 1 injuries includes several retrospective case series involving small populations.[1–7] These are mainly clinical cases, but the conclusions reached are the same: tendon reinsertion in the days following the injury is the only way of obtaining the best functional outcomes.[6] On the other hand, few articles discuss treatment when direct repair is impossible.

The key prognostic factor is whether or not the vinculum longus remains intact.[1] The extent to which the tendon is devascularised determines the degree of urgency. At 3 weeks, a tenosynovial inflammatory reaction occurs in zone 2, 'no man's land'. This leads to tendon adhesions or even the rupture of the previously intact vinculum longus. The progressive ischaemia of the tendon stump and the associated process of retraction will also limit the possibilities of surgical advancement/reinsertion. As such, using the Leddy and Parker classification (Table 1), jersey finger types I and IV should be treated within 7–10 days of injury. A type II or III injury can wait up to 3 weeks, or even up to 3 months.[8]

After this time, only a tendon graft can restore active flexion. Depending on the complaint and the patient's functional needs, palliative treatment may be offered: abstention, resection of the FDP, capsulodesis, arthrodesis, etc. However, results obtained with these techniques remain limited.

In 2011, Professor Pelissier[11] and his team in Bordeaux presented a clinical case study of a zone 5 Z-plasty lengthening of the FDP for delayed presentation of a jersey finger in a fourth finger. The tendon advancement obtained was 2 cm and the functional outcome was satisfactory. In view of the quadriga effect described by Verdan,[12] this procedure would theoretically have repercussions on the flexion of adjacent fingers that might limit its use in practice. This anatomical study measures the FDP advancement obtained in the long digits through 3-, 4- and 5-cm Z-plasties.

Table 1 Leddy and Parker[8] classification completed by Smith[9] (type IV) and Al-Qattan[10] (types V and VI).

Type I	FDP retracted to the palm (restricted by lumbrical insertion) Rupture of both vinculae
Type II	Retraction of FDP to proximal interphalangeal joint Vinculum longus remains intact
Type III	Avulsion of FDP blocked by a bone fragment preventing retraction of the tendon past the A4 pulley
Type IV	Avulsion of FDP blocked by a bone fragment, tendon separated from bone fragment
Type V	Avulsion with bone fragment within a comminuted fracture at base of P3
Type VI	Open avulsion fracture

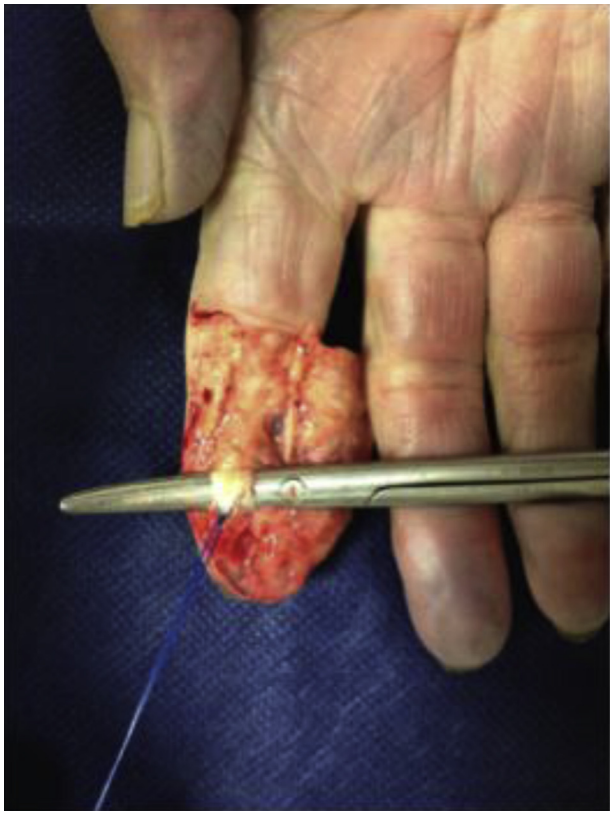

Photo 1 The distal extremity of the FDP was identified and placed on a traction suture before being cut close to the bone.