An alternate graft for staged flexor tendon reconstruction

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Abstract We describe the novel use of semitendinosus as a tendon graft for 2-stage flexor digitorum profundus (FDP) reconstruction. To our knowledge, this is the first reported use of a hamstring tendon graft in this setting. The FDP of two digits were reconstructed in a 30 year-old male who presented 18 years after the original injury. The semitendinosus was chosen as a graft as the traditional grafts were deemed inappropriate. The result of the operation is convincing, and we suggest the semitendinosus tendon to be considered an option for FDP reconstruction.

Keywords Flexor tendon reconstruction · Hamstring tendon graft · Semitendinosus · Staged reconstruction · Tendon graft

Introduction

Flexor tendon reconstruction in the hand involves the use of an autogenous tendon graft to restore function. It is an uncommon procedure today given the advancements made in primary flexor tendon repair. However, reconstruction is indicated in cases of delayed presentation or failure of primary repair.

Palmaris longus (PL) and plantaris are the most common sources of donor tendons for flexor tendon reconstruction [5]. The use of extensor digitorum longus, extensor digiti minimi, extensor indicis proprius, and flexor digitorum longus has also been described.

We report the novel use of a hamstring tendon graft for flexor digitorum profundus (FDP) reconstruction of two digits in a 30 year-old man. This followed an attempt to harvest PL

and plantaris tendons bilaterally—all of which were considered to be of suboptimal integrity in this patient. This appears to be the first reported case of the procedure. We searched MEDLINE and PubMed databases to verify this.

Case Report

A 30-year-old ambidextrous labourer presented to us complaining of reduced function in his right hand since a childhood incident. He described a zone 2 laceration to these two fingers with a knife at age 12, but these were repaired as superficial lacerations only. He never regained composite flexion of the two fingers.

Examination of the patient revealed loss of FDP function in the right long finger and loss of FDP and FDS function in the right ring finger. There was full passive range of motion in all digits. Both the long and ring fingers of the right hand demonstrated a swan-neck posture with hand extension. Grip strength on the right was reduced at 36 kg compared to 48 kg on the left side. Ultrasound confirmed a gap in the FDP tendons of the right long and ring fingers.

After extensive discussion with the patient regarding surgery, including possible outcomes, complications, and the option of no surgery, it was decided to pursue FDP reconstruction.

The patient underwent stage 1 FDP reconstruction of the right long and ring fingers with Hunter (Wright, Arlington, Tennessee) silicone rods. Both FDS were intact and were reattached to the bases of the middle phalanges with 2-0 Ticron (Tyco, Waltham, Massachusetts) around the bone, and the volar plates were tightened at the same time. In the right ring finger, the FDP 1.5 cm distal stump was attached to a 4 mm Hunter rod. The remnant of the FDP tendon was used to reconstruct the A4 pulley over middle phalanx. In the right long finger, the distal FDP stump was attached to a 5 mm

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Hunter rod. Immediate active mobilisation was commenced post-operatively.

The patient was taken to theatre 2 months later for stage 2 reconstruction of the affected fingers. Both the PL and plantaris from both sides were harvested but all tendons were deemed suboptimal as they were less than 2 mm thick. After careful consideration as to whether to reconstruct one of the two fingers by combining the tendons, decision to abandon was made in favour of reconstructing both tendons simultaneously at a later date, shortening the rehabilitation process.

The patient was taken back to theatre 2 months later. The left semitendinosus tendon was harvested with assistance from our orthopaedic colleagues (Fig. 1). Unfortunately, the silicone rod of the ring finger was found to have had dislodged from its insertion at some point between the last operation and the present one. The pseudosheath was thus not found in the ring finger. Only the long finger FDP was reconstructed, and the silicone rod was reattached in the ring finger. This was no doubt very disappointing but we felt it was the option best for the patient.

Rehabilitation of the long finger was commenced immediately, and the FDP graft commenced flexing the interphalangeal joint. The patient was very keen to have the ring finger FDP reconstructed as soon as deemed appropriate. We took him back to theatre 3 months later and harvested the right semitendinosus tendon to reconstruct the FDP to the ring finger (Figs. 2 and 3).

At 6 month follow-up, there was an increased total active motion (TAM) of both digits, increase in grip strength, improved ability to manipulate tools at work and home, almost complete resolution of swan necking, and no lower limb morbidity (assessed using the Lower Extremity Functional Scale [2]). The TAM for the middle finger went from 100 to 250° and the ring finger from 90 to 175°.

Fig. 1 Semitendinosus tendon harvested from left knee

Fig. 2 Semitendinosus tendon before grafting to right ring finger

Discussion

This case raised several challenging issues: two flexor tendons to reconstruct, structurally inadequate conventional graft choices and multiple stages involving intensive post-operative rehabilitation.

Choice of graft site was a key consideration in this patient. With inadequate PL and plantaris tendons, it was felt that other conventional options were unlikely to be more robust. Toe extensors, toe flexors, extensor digiti minimi, and extensor indicis proprius are commonly cited as alternative graft options [5]. However, complications associated with harvesting these tendons are also documented [3].

We chose to harvest the semitendinosus tendon based on its well-documented success in reconstructing the anterior cruciate ligament of the knee and its low morbidity at the donor site [6]. The length of semitendinosus was considered likely to serve the flexor tendon reconstruction of two fingers. The tendon is also of a bigger size and more appropriate for reconstruction in a manual worker who requires strength in their daily work.

Adequacy of tendon grafts for flexor tendon reconstruction has been investigated recently by Jakubietz et al. Criteria for

Fig. 3 Finger cascade post-grafting

adequacy was defined as a minimum length of 15 cm with diameter of 3 mm or, alternatively, 30 cm with a diameter of 1.5 mm. The researchers found less than 50 % of cadaveric PL and plantaris tendons to be adequate for grafting [4].

With a high chance of harvesting an inadequate tendon, efforts have been made to predict tendon size preoperatively. A 2008 study found a statistically significant correlation between the length of extremities and the length of tendons in cadavers [1]. Other researchers have used ultrasound to predict tendon size. Simpson et al compared ultrasound detection of plantaris with the status of the tendon at surgery [7]. The study concluded that the sensitivity for ultrasound detection of a suitable tendon was 95 %. Ultrasound was less accurate with a tendon thickness of less than 2 mm, but this size of tendon was considered to be unsuitable for grafting. Ultrasound may be a useful evaluation, and in some centres is a routine preoperative investigation. Retrospectively, this could have served as a preoperative investigation for the case above, in order to avoid unnecessary harvesting of the PL and plantaris tendons.

It was unfortunate that this case was riddled with complications, but that aside, we describe an alternative to the traditional tendon grafts used for a 2-stage FDP reconstruction with minimal morbidity. In addition, we are assured adequate size and length when using a semitendinosus graft, especially if two digits are involved. In summary, the hamstring tendon should be considered an option for a 2-stage FDP reconstruction.

Informed consent was obtained from the patient prior to commencing work on this case report. Additional informed

consent was obtained from the patient to include images containing potentially identifiable tattoos.

Conflict of Interest Nelson Low declares no conflict of interest.

Eamonn Thomas Fahy declares no conflict of interest.

Jane Frisken declares no conflict of interest.

Nigel Mann declares no conflict of interest.

Statement of Human and Animal Rights This article does not contain any studies with human or animal subjects.

Statement of Informed Consent Informed consent was obtained from the patient prior to commencing work on this case report.

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