Long-Term Functional Evaluation on Tendon Transfer to Restore Extension of the Thumb using Extensor Carpi Radialis Brevis

Wei Yu*, Guang Yang†, Qiang Li‡, Ju Zhang‡, Zhiguang Wu‡, and Zhenxing Wang‡

1Department of Hand Surgery, China-Japan Union Hospital, Jilin University, China
2Department of Thoracic Surgery, China-Japan Union Hospital, Jilin University, China

*Corresponding author: Wei Yu, Department of Hand Surgery, China-Japan Union Hospital, Jilin University, Xiantai Street 126, Changchun 130033, China, Tel: 86 431 89876962, Fax: 86 431 85112355, E-mail: liuzhongling1988@163.com

Abstract

Purpose: To investigate the long-term functional and clinical outcomes of a tendon transfer to restore extension of the thumb using extensor carpi radialis brevis

Methods and materials: From Jun 2005 to Sep 2012, 8 patients with rupture or division of extensor pollicis longus (6 males, 2 females; aged 16-52 years, mean age 30 years) underwent a tendon transfer using the extensor carpi radialis brevis to restore extension of the thumb. All patients were assessed by Geldmacher score system, mobility, pinch and grip strength of thumb comparing to the non-operated hand over an average of 36 months (range, 24–84 months) after the operation.

Result: At an average follow-up of 36 months, all eight patients were able to extend their thumbs fully, and assessed as good or excellent by Geldmacher score system. Average grip strength of the operated hand was equal to that of the contra lateral hand, and tip pinch strengths were 92% of the contra lateral hand. There was no marked loss of extension motion and strength of wrist, and no other postoperative complications.

Conclusions: The procedure of extensor carpi radialis brevis tendon transfer to extensor pollicis longus provides excellent long-term clinical results for restoring extension of the thumb. The procedure is safe, with few complications, which can be an alternate procedure of restoring extension of the thumb.

Keywords
Tendon transfer, Extensor carpi radialis brevis, Extensor pollicis longus

Introduction

Loss of Extensor Pollicis Longus (EPL) function causes a “dropped thumb” deformity, and can not elevate the thumb to the plane of the palm. If EPL tendon is cleanly cut, it can be repaired by direct suture. But the majority of patients with spontaneous closed rupture or division of EPL present some time later, associated with Colles’ fracture [1], rheumatoid arthritis [2], sports related injury [3], and posterior interosseous nerve injury [4]. In such cases direct tendon repair is not feasible and a tendon transfer is usually recommended [5]. The transfer of extensor indicis proprius (EIP) is the most widely used [6]. The use of Extensor Carpi Radialis Longus (ECRL) [7], extensor pollicis brevis (EPB) [8], and abductor pollicis longus (APL) [9] have also been described to reconstruct EPL, respectively. The tendon transfer of Extensor Carpi Radialis Brevis (ECRB) to EPL has been described by Ghee CK in 2009 [10], but the long-term outcomes of the ECRB to EPL transfer are rarely reported. The aim of this study is to observe the long-term functional and clinical outcomes of a tendon transfer of ECRB to EPL to restore extension of the thumb.

Methods and Materials

Between Jun 2005 and Sep 2012, 8 patients with rupture or division of EPL and loss of EPL function due to nerve injury underwent a tendon transfer using ECRB to restore extension of the thumb. There were 6 men and 2 women. The ages ranged from 16 years to 52 years, with a mean of 30 years. In 6 patients the dominant hand was involved. The causes of EPL rupture were three after Colles’ fracture, three associated with posterior interosseous nerve injury, and two associated with rheumatoid arthritis. Before operation the function of ECRB were evaluated. The interval between the date of rupture and the operation was from 2 days to 18 months (mean 5 months). The mean interval between surgery and evaluation was 36 months (range, 24–84 months).

Surgical technique

All surgeries performed under supraclavicular block anesthesia and used a tourniquet. A curved or oblique incision is made on the dorsal carpus with the Lister’s tubercle as center. The radial nerve and its branches are identified and preserved. The tendon of EPL and ECRB are exposed by longitudinally incising the extensor retinaculum of the second and third dorsal wrist compartment, respectively. The distal end of EPL is found. If the transfer is for posterior interosseous palsy and loss of function, EPL tendon can be transected from the wrist and dissected as far distally as possible, then transected, removed from its fibrous sheath. The two tendons are sutured using a Pulvertaft weave, held by 4/0 Ticron sutures under a constant maximal tension until the wrist neutrality and the thumb in full abduction and extension.


Received: March 09, 2015; Accepted: June 02, 2015; Published: June 06, 2015

Copyright: © 2015 Yu W. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
A pulley is created in the distal retinaculum of the second extensor compartment. Immobilization in a plaster cast with the wrist in 20°-25° extension, the thumb in full abduction and extension lasts 4 weeks after the operation.

Follow-up evaluation

All patients assessed between 24 months and 84 months (mean 36 months) after the operation as following:

Patients were asked their opinion as regards pain, strength, range of movement, disability and general satisfaction after tendon transfer operation. A ten-point grading scale was used for the overall result: good, 10 to 7 points; fair, 7 to 4 points; and poor, 4 to 0 points.

Grip and pinch strengths of both hands were measured with an E-Link electric ergometer ((E-Link, Biometrics Ltd; Newport, UK), and then calculated the result expressed as a percentage of the strength of the non-operated hand.

The objective evaluation results were scored using the Geldmacher score system [11]. For the thumb, four functions must be scored: the radial abduction angle, the elevation deficit, the opposition distance and the flexion-extension deficit of the MP and IP joints. The Geldmacher grading scale is: excellent, 24 to 22 points; good, 21 to 17 points; satisfactory, 16 to 10 points; and poor, 9 to 0 points.

Results

There were no postoperative complications, no ulnar or radial deviation deformity and no loss of extension motion and strength of wrist. All 8 patients were able to extend their thumbs fully, and there was no loss of extension motion and strength of wrist. The results of the patient's subjective scored were: 7 patients as good; 1 patient as fair because of the joint stiffness. The strength measurements compared to the non-operative thumb. Grip and pinch strength at the operated thumb averaged 95% (89% to 119%) and 91% (80% to 106%) of that on the non-operative side, respectively. All 8 patients were evaluated as good (6 of 8) or excellent (2 of 8) by Geldmacher grading scale. Table 1 presents the results according to the Geldmacher evaluation score system: the radial abduction angle of thumb was 64° (55° to 73°); the mean elevation deficit of pulp was 1.3cm (0.2cm to 1.8cm); the flexion-extension deficit of the MP and IP joints was 14°(0-30°); the opposition distance from pulp to palm was 0.5cm (0 to 1.4cm); the average score was 20 (18-24), whose function could be assessed as good.

Discussion

The Extensor Pollicis Longus (EPL), produces extension of the interphalangeal (IP), metacarpophalangeal (MP) and trapeziometacarpal (TM) joints of the thumb. At the TM joint the EPL also has an adduction moment. Loss of EPL function causes a deviation deformity and no loss of extension motion and strength of the ECRB to EPL transfer have been rarely reported. Based on 36 months follow-up after operation, our evaluation shows that the subjective opinion of the patients is good except one patient. In this patient the interval time from injury to operation is the longest (18 months). He cannot flex his thumb fully due to the joint stiffness of metacarpophalangeal, and a further operation is refused. Grip and pinch strength of the operated hand are almost equal to that of the contralateral hand, and there is no significant disability of wrist.

Geldmacher evaluation score system can evaluate the whole thumb function after tendon transfer, including the radial abduction angle, the elevation deficit, the opposition distance and the flexion-extension deficit of the MP and IP joints. In our study, all 8 patients are assessed as good or excellent. Although we found some loss of motion range and elevation height of the thumb comparing to contra lateral hand, no patient complained of functional loss in hand.

In conclusion, we consider that the procedure of ECRB transfer to EPL is a simple and reliable procedure with few complications, and it can be an alternate procedure of restoring extension of the thumb.

References