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Results of treatment for acute and chronic extensor pollicis longus tendon ruptures

EIP tendon transfer in chronic EPL ruptures

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Abstract
Aim: In this study, we aimed to observe the results of primary tendon repair in acute EPL tendon ruptures and the results of EIP tendon transfer for chronic EPL tendon ruptures.
Material and Methods: The study included patients diagnosed and operated for EPL tendon rupture and followed-up in our clinic between January 2012 and December 2020. Patients were separated into two groups according to the surgical procedure. Group A consisted of 13 patients who had EIP tendon transfer, and group B consisted of 18 patients who underwent primary EPL tendon repair. Preoperative and postoperative functional results of the groups were compared.
Results: Group A had EIP tendon transfer surgery; ten patients were male (76.9%), and three were female (23.1%). The injury was on the right side in 69.2% of the patients and on the left side in 30.8% of the patients. All patients in group B had primary tendon repair. In group B, 14 patients (77.8%) were males, and four were female (22.2%). The mean q DASH score was 66.53±10.99 for group A and 55.66±7.78 for group B. Postoperative q DASH score was 22.76 for group A, and 11.10 for group B. The joint range of motion was similar in both groups.
Discussion: In acute EPL tendon ruptures, primary tendon repair is the first treatment to be chosen, while in chronic EPL tendon ruptures, EIP tendon transfer may be the first treatment option given our clinical results.

Keywords
Tendon transfer, Rupture, Thumb

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Introduction

Extensor pollicis longus tendon injuries constitute an important part of hand injuries [1]. EPL tendon inserts into the distal phalanx of the thumb, extends the distal phalanx and helps with the extension of the metacarpophalangeal joints and, can be injured by a sharp, penetrating, or blunt trauma; however, spontaneous rupture is also possible. Vascular supply to the tendon is diminished over the Lister tubercle, which is the riskiest location for the spontaneous rupture of the tendon [2]. Spontaneous EPL ruptures are usually seen in rheumatoid arthritis, steroid treatment and also after distal radius fractures. The exact mechanism of EPL rupture has not been clarified yet. The treatment option for acute EPL tendon injuries is primary repair, but for chronic ruptures several methods were described, for example, tendon grafting and tendon transfers. However, it is not always possible due to neglected late representing cases and tendon retraction. EIP transfer is the most commonly preferred, gold standard surgical treatment in these cases [3]. In this study, we wanted to observe the results of primary tendon repair in acute EPL tendon ruptures and the results of EIP tendon transfer for chronic EPL tendon ruptures.

Material and Methods

This study included a total of 31 patients who applied to University of Necmettin Erbakan Faculty of Medicine Orthopedics and Traumatology clinic with EPL tendon injury between January 2012 and December 2020. Patients were diagnosed with EPL tendon injury by physical examination, x-ray, and magnetic resonance imaging. Thirteen patients in group A had EIP transfer. Eighteen patients in group B had primary tendon repair. Disabilities of arm, shoulder, and hand (DASH) score was used to measure treatment effectiveness both preoperatively and postoperatively. In addition, we measured the range of motion of the thumb, flexion and extension restriction degree, metacarpal, and interphalangeal range of motions with a goniometer to assess the functional effectiveness.

Imaging

The patient's first evaluation was performed with clinical examinations followed by x-ray imaging. Patients with non-pathological x-ray findings were examined with MRI and were diagnosed with EPL tendon rupture.

Surgical technique

Chronic EPL tendon injury patients constituted group A, thus were not eligible for primary tendon repair. The loss of extension in the thumb was recorded visually before the surgery (Figure 1).

Regional block anesthesia was administered, and surgery was performed under a tourniquet. A longitudinal incision was made on the first metacarp. The distal end of the injured EPL tendon was found and injured ends were debrided.

EIP tendon was found, and the tendon was incised and separated following the second incision on the distal end of the second metacarp. The third incision was made on the proximal end of the EIP tendon, EIP was released and transferred to its new place subcutaneously (Figure 2).

EIP tendon was transferred to EPL tendon using the Puvertaft method, while checking for an excursion (Figure 3). The hand was splintered while the thumb was in extension and the wrist was in the neutral position.

Patients in group B had primary tendon repair. Modified Kessler core suturation and epitendinous suturation were used for the repair. Patients used hand splints after the surgery for 30 days. Physical therapy was initiated one week after the surgery. Patients were followed for 20 weeks.

Ethical Approval

The study was approved by the Ethics Committee of University of Necmettin Erbakan Faculty of Medicine (protocol no 2021/3550).

Statistical analysis

The data obtained from the research were transferred from the excel file to the database created in the SPSS (Statistical Package For Social Sciences) 18.0 package program, and statistical analyzes were performed with this program.

Arithmetic mean±standard deviation and median (minimum, maximum) were used to express the descriptive statistics, while numbers and percentages were used for the categorical data.

Compliance of numerical data with normal distribution was examined using visual (histogram graph) and analytical methods (Kolmogorov-Smirnov/Shapiro Wilk tests). In the comparison of the two groups, Student's t-test was used when numerical data were normally distributed, and the Mann-Whitney U test was used for the data that were not normally distributed.

Since it was determined that the Sollerman function test scores of the patients were normally distributed, the dependent groups Student's t-test was used for comparisons between the operated and healthy sides. Since preop q DASH, postoperative q DASH, and Geldmacher scores did not show normal distribution, the comparisons made for the preoperative and postoperative side operated at two different time periods and for the healthy side were compared using the Wilcoxon paired-sample test.

A p-value of <0.05 was considered statistically significant.

Results

Both patient groups were able to use their hands in their daily activities without any problems.

Group A included a total of 13 patients with EPL tendon injuries. Ten of the patients were male (76.9%), and 3 were female (23.1%). The mean age of the patients was 50.23±10.65 (29-67) years. Nine patients (69.2%) had a right-sided injury, while 4 (30.8%) had a left-sided injury; 61.6% of the patients had a chronic extensor tendon injury, 23.1% had blunt trauma, and 15.3% spontaneous tendon rupture (Table 1).

Two patients in group A had complications (14.4%). One patient had tendon adhesion, and one patient had hyperemia around the incision. A detailed description of the patients' functional outcomes in group A is shown in Table 2.

Q DASH scores of patients in group A were 66.53±10.99 (42.3-82.6) preoperatively and 23.68±8.68 (14.4-47.3) postoperatively. The difference between preoperative and postoperative scores was statistically significant ($Z=-3.18$; $p<0.001$).

Postoperative Geldmacher mean score was 18.77±2.38 (min:16; max:22) for group A and 20.62±1.50 (min:18; max:22) for the uninjured side in the same group. The difference between healthy and injured sides was statistically significant ($Z=-2.36$; $p=0.01$).

Table 1. Patients demographic data

		Group A	Group B
Gender (M/F)		10 (76,9%) / 3 (23,1%)	14 (77,8%) / 4 (22,2%)
Age		50,23±10,65 (29-67)	41,17±14,60 (19-65)
Side (Right / Left)		9 (69,2%) / 4 (30,8%)	14 (77,8%) / 4 (22,2%)
Mechanism of injury	Penetrating trauma	8	16
	Blunt trauma	3	2
	Spontaneous rupture	2	0



Figure 1. Preoperative picture of a patient with loss of extension of the thumb

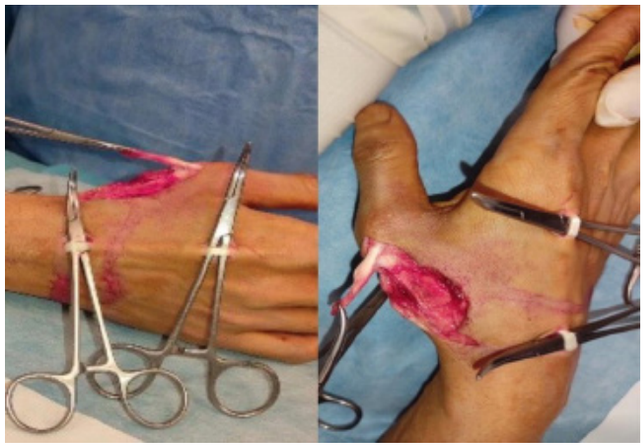


Figure 2. Locating EIP tendons proximal and distal ends



Figure 3. Early postoperative picture after tendon transfer

Table 2. Results of functional outcomes of Groups A and B

	Group A	Group B
Preop Q Dash Score	66,53±10,99 (42,3-82,6)	55,66±7,78 (43-69)
Postop Q Dash Score	23,68±8,68 (14,4-47,3)	13,52±7,49 (7-33,3)
Sollerman Function Score	64,77±5,48 (57-73)	67,50±6,48 (52-76)
Healthy side Sollerman Score	69,77±2,68 (65-73)	71,28±2,56 (67-76)
Geldmacher score	18,77±2,38 (16-22)	19,44±2,89 (12-22)
Healthy side Geldmacher score	20,62±1,50 (18-22)	21,11±3,30 (10-24)

In group A mean sollerman hand function test score was 64.77±5.48 (min:57; max:73) postoperatively, while the score was 69.77±2.68 (min:65; max:73) for the uninjured side.

Differences between two groups were statistically significant (t=-2.60; p=0.023); GA (-9,17 – -0,82)

In group B, 14 patients (77.8%) were male and 4 (22.2%) were female. The mean age for group B was 41.17±14.60 (19-65) years. Fourteen patients had a right-sided injury (77.8%), and four had a left-sided injury (22.2%). The trauma mechanism in 88.9% of cases was sharp penetrating injury, while in 11.1%, it was blunt trauma (Table 1). Only 2 patients (11.1%) had complications. One patient had a rupture of the repaired tendon, and one had adhesion. A detailed description of patients' functional outcomes in group B is given in Table 2.

Q DASH score of patients was 55.66±7.78 (43-69) preoperatively and 11.15±7.49 (7-33,3) postoperatively. Preoperative scores were significantly higher than postoperative scores (Z=-3.72; p<0.001).

In group B, the mean Geldmacher score was 19.44±2.89 (min:12; max:22) postoperatively and 21.11±3.30 (min:10; max:24) for the noninsured side. There was no statistically significant difference between the injured and noninjured sides (Z=-1.95; p=0.05).

In group B, the mean postoperative Sollerman functional test score was 67.50±6.48 (min:52; max:76), while it was 71.28±2.56 (min:67; max:76) for the non injured side. Differences between the groups were statistically significant (t=-2.28; p=0.036); GA (-7,27 – -0,28).

Discussion

Functional outcomes comparable with the uninjured side can be achieved by primary tendon repair. While EIP tendon transferred patients were able to use their thumbs independently in their daily activities. Primary repair is the most common surgical treatment for acute EPL tendon injuries. However, in chronic cases, end-to-end repair is not possible due to the shortening of the tendon and muscular retraction on the proximal stump. EIP tendon is superficial, easy to harvest with a small incision, and works synergistically with EPL; thus, EIP is considered the most suitable tendon for transferring to EPL tendon. EPL plays a significant role in thumb function [4]. Although the most common reason of EPL ruptures in our study was pentran trauma, spontaneous late ruptures can also be seen after recurrent microtraumas, Tenosynovitis spontaneous EPL tendon ruptures were seen in two patient in our study [5]. Non-traumatic rupture of the EPL tendon is rare [6]. Many treatment

modalities, including grafting and tendon transfers, have been described in cases where primary repair cannot be performed. One of the methods is palmaris longus (PL) tendon grafting. Although Al-Qattan and Mohrij et al. recommended PL tendon grafting in their research, the method has disadvantages; there are two different tendon anastomosis sites, and the graft is avascular [7]. Other possible tendons available for EPL transfer are extensor indices proprius, extensor carpi radials longs, extensor policies breves, abductor policies longs, and extensor digit minimi. Extensor indices proprius tendon has the most compatible excursion and orientation; thus, it is the gold standard tendon for transfer operations [8-11].

The most common argument against EIP tendon transfer is the extension weakness in the second finger after the surgery. Lemmen et al. study did not report any difference in range of motion, but there was a %38 loss of motor power. There was no difference in MCP joint range of motion in operated and non-operated sites [12]. Matter V et al. reported a mean independent extension force of 11 N vs. 5.6 N and dependent force of 20 N vs. 10.9 N in the second finger and contralateral side at 41-month follow-up after EIP tendon transfer [13]. In accordance with this study, we compared the strength and range of motion of the second metacarp to non operated sight for group A patients, we did not see any functional limitations.

Conclusion

Primary end-to-end repair is the gold standard the surgical modality in acute EPL tendon injury. Especially in neglected chronic EPL tendon injuries where primary repair is not possible, EIP tendon transfer is one of the upcoming treatment options and reveals good functional outcomes without donor site morbidity.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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