Original Article

Opponensplasty

Outcome of Hand Function after Extensor Indices Proprius Opponensplasty

1. Kamran Khalid 2. Farrukh A Khalid 3. Moazzam N Tarar

1. Asstt. Prof. of Plastic Surgery, 2. Senior Registrar of Plastic Surgery, 3. Prof. of Plastic Surgery, Jinnah Burn & Reconstructive Surgery Center, Jinnah Hospital, Allama Iqbal Medical College, Lahore

ABSTRACT

Objective: To assess the functional improvement in the hand after opponensplasty.

Study Design: Descriptive study

Place and Duration of Study: This study was conducted at Plastic Surgery Department Jinnah Hospital, Lahore from October, 2005 to March, 2015.

Materials and Methods: A total of 40 patients with loss of opposition of thumb were included in the study. Their opposition was lost either due to median nerve or both median and ulnar nerve injury or directly damaged thenar muscles. Patients in whom there is restricted range of thumb motion or scarring in the route of tendon transfer were excluded from the study. After taking informed consent Extensor Indices Proprius tendon transfer was done. Post-operatively cast was given for 4 weeks and protective splintage was applied for another 2 weeks. Improvement in the hand function was recorded at conclusion of study.

Results: Four patients lost follow-up. Out of 36 patients, 26 (72%) patients showed good results, 6 (17%) showed fair results and 4 (11%) showed poor results. 25 patients (69%) had good Kapandji score, while 7 (20%) had fair and 4 (11%) had poor score. Mean DASH score was 24. Overall patient's satisfaction was very good. Most of the patients hand function improved significantly.

Conclusion: Our study results strongly suggest Opponensplasty with Extensor Indices Proprius is an excellent procedure for restoring opposition in patients with median or both median and ulnar nerve injury at wrist.

Key words: Opponensplasty, EIP transfer, loss of opposition, distal median nerve injury, DASH score, Kapandji score.

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INTRODUCTION

The human hand is specially adapted for the prehensile functions of pinch and grip.[1,2] The thumb imparts such precision, efficiency and diversity to these functions of hand. Importance of thumb lies in its position and ability to oppose other digits (opposition).[3,4] Opposition is a complex movement consists of palmar abduction, pronation, and adduction of thumb. The motor branch of the median nerve innervates the abductor pollicis brevis (APB), opponens pollicis, and superficial head of the flexor pollicis brevis (FPB).[5, 6]

Loss of opposition is a major disability.[1,7] It is the most significant presenting complaint of median nerve palsy patients. Other causes include combined median and ulnar nerve, brachial plexus injuries, traumatic injury to muscles and tendons and some neurological conditions.[8-11] Opponensplasty is a type of tendon transfer which is done to restore the opposition of the thumb [10] and is required for pinch grip and other fine functions of the hand.[12,13] Several procedures are employed to achieve opposition.

Steindler performed the first opponensplasty in 1919 by transferring the radial slip of flexor pollicis longus (FPL) to the dorsal base of the thumb proximal phalanx.[14] Several more options have since been developed for opposition transfers including extensor indices proprius (EIP)[8,15] flexor digitorum superficialis (FDS)[13,16,17] and palmaris longus (PL).[18]

In our study we used the technique of EIP transfer for thumb opposition. We are presenting a series of 40 patients who underwent EIP transfer for restoring opposition of the thumb. The study was conducted to assess the functional improvement in the hand after opponensplasty.

Correspondence: Dr. Kamran Khalid,
Asstt. Prof. Jinnah Burn & Reconstructive Surgery Center, Jinnah Hospital /Allama Iqbal Medical College, Lahore
Cell No.: 0321-4426322
E-mail: drkamrankhalid@hotmail.com

MATERIALS AND METHODS

This study was conducted at Plastic Surgery Department, Jinnah Hospital, Lahore. The study period was from October 2005 to March 2015. Patients with median nerve injury at wrist, patients with both ulnar and median nerve injury at wrist and traumatic loss of thenar muscles directly resulting in loss of opposition were included. Those patients with restricted range of thumb movement, scarring and wound in the route of tendon transfer and absent or damaged extensor indices

proprius tendon were excluded. During this period 40 extensor indices proprius (EIP) opponensplasties were performed on 40 patients. An informed consent was taken, under general anesthesia and tourniquet control EIP tendon was identified through a small incision over the metacarpophalangeal joint of the index finger. EIP was transected through this incision, which is ulnar to the Extensor digitorum communis (EDC) tendon. The distal end was reef with the EDC tendon. EIP tendon was then retrieved; the route of the tendon was identified by traction over the distal end, 2-3 small incisions were made along the course of tendon. A small incision is then made in the area of the pisiform and the tendon passed subcutaneously around the ulnar border of the forearm. It is most important at this time to develop subcutaneously a large enough tunnel so that the entire muscle bulk of the extensor indicis proprius lies against the subcutaneous border of the ulna. After the tendon was brought out through the small incision in the area of the pisiform, a subcutaneous tunnel was made across the palm of the hand to the area of the metacarpophalangeal joint of the thumb and the tendon is passed through the tunnel into this incision. The abductor pollicis brevis (APB) tendon was identified. EIP was woven with the APB and the capsule of MCP joint under maximum tension with thumb in maximum palmar abduction.

Wrist was immobilized in a neutral position with thumb in maximum palmar abduction. Cast was applied for 4 weeks. After the removal of cast, physiotherapy was started (Figs. 1-3). Protective splint was applied for another 3 weeks.[19] Motor and sensory re-education was done along with physiotherapy. Monthly follow-up was done. The average follow-up was 27 months (range, 6 to 58 months). The difference between the Active abduction angle (AAA) and Resting abduction angle (RAA) is the Active range of abduction (ARA) of the thumb. An evaluation score of 5 was allocated to ARAs greater than 45°, score of 4 to ARA between 41-45°, score of 3 to ARA between 36-40° and a score of 0 to ARAs less than 35°. Opposition tendon transfer that re-stores adequate abduction and rotation would enable pulp-to-pulp pinch and those with limitation would achieve only pulp-to-side or key pinch. An evaluation score of 2 was allocated to pulp-to-pulp pinch and a score of 1 for key pinch. Pinch strengths were measured with a handheld pinch gauge Baseline® Mechanical Pinch Gauge (TheraTek Medical Inc., Seattle, Washington). The average of 3 consecutive measurements was used to calculate the pinch power as a percentage of that of the normal opposite hand. Pinch strengths were graded good when greater than 50%, fair when between 21% and 50%, and poor when less than 20% of the unaffected hand. Evaluation scores of 3, 2, and 0 were allocated to good, fair, and poor pinch strengths, respectively.

RESULTS

There were 35 male and 05 female patients. 30 of the hands were dominant and 10 non-dominant. The mean duration of injury was 20.5 months (range 06 to 35 months). The average age at the time of surgical repair was 25 years (range 07 to 52 years). There were no wound complications like infection or wound dehiscence. There was no tendon avulsion or tendon rupture. Four of the patients lost follow up either due to change of address or phone number and one died due to some other cause. Sixteen patients had ARA greater than 45°, 10 patients had ARA between 41°-45°, 6 patients had ARA between 36°-40° and 4 patients had ARA less than 35°. Thirty four patients had pulp to pulp pinch while 2 patients had pulp to side or even no pinch at all. In 25 patients the pinch strength was good, 7 patients had fair while 4 patients had poor pinch strength. Eighty four percent of the patients were satisfied with their results, while 16% were not (Table 1).

Table No.1: Outcome evaluation of thumb opposition

Outcome	Evaluations system result[20]	Kapandji Score	DASH Score
Good	72%	69%	30.5
Fair	17%	20%	28.0
Poor	11%	11%	36.0
Mean			24.0

DISCUSSION

This procedure is known since 1956, well before Burkhalter who was credited with the technique, he rediscovered it in 1973. It was first done by Santiago Chouhy-Aguirre of Buenos Aires.[8] This transfer is an easy and quick procedure, may be performed either early or late in the management of peripheral nerve injury, without reducing flexor strength and without major morbidity of the donor finger. The donor site is usually preserved after combine median and ulnar nerve injury. There are no late complications and the over-all return of opposition of the thumb is satisfactory. Burkhalter[8] published his series of sixty five cases with 88% excellent or good results. The etiologies of these patients were fire arm injury or lacerated wounds as compared to our patients with majority of electrical injury patients.

Mehta et al[21] did 25 EIP opponensplasty in combined median and ulnar nerve palsy in leprosy patients and had good results in these cases. They revealed some difficulty of EIP being short in some case to reach its new insertion and had proximal interphalangeal joint contractures in few cases. We didn't encounter the problem of EIP being short and we feel proper release of muscle is the key and complication of proximal interphalangeal joint contractures may be avoided by stump repair.

Anderson et al[22] did EIP opponensplasty in 39 patients with variable aetiology and did adjuvant procedures in 29 cases. The results were similar to our study with 88% excellent and good results and 12% fair and poor result.

Andrew et al[3] did Abductor digiti quinti-opponensplasty (Huber's procedure)[23] in 15 patients with 80% excellent or good result, had claimed advantages of intrinsic muscle which has good amplitude and direction of pull, automatic correction of tension of muscle and good cosmetic appearance of the hand than other opponensplasties. The aetiologies of these cases were lacerations of median nerve alone or neurological diseases. This is a good option but for our indications of combined ulnar and median nerve injury patients and with electrical injury to hand this is not a valid option.

Palmaris longus (PL) tendon known as Camitz procedure[24] with flexor retinaculum pulley is also another option; Jung et al[9] did this in 11 cases of post carpel tunnel syndrome palsied thumb with good results, the author did a modification of standard Camitz (PL) opponensplasty by making a pulley in ulnar side remnant of flexor retinaculum. It is good option but has limitations in high median nerve palsy, electrical injury or lacerations of wrist with flexor tendon injury.

Median nerve injury spares Flexor digitorum superficialis of ring finger (FDS-R) (Bunnel's procedure)[25,26] which is used by Anderson et al[27] in their study in 116 patients out of 166 and used EIP in the rest; he showed good results using FDS-R in less pliable hands and good results with EIP in supple hands. The ulnar nerve injury along with median nerve injury rules out this option.

Many other options like Flexor carpi radialis[28], Extensor carpi ulnaris to extensor pollicis brevis[29], Brachioradialis[1,30] were used at different times with varying degree of success.

The limitations of this study are the pre-operative pinch strength and DASH scores availability for comparison with the post-operative results. Secondly we initially did not follow Burkhalter's instructions on EIP insertion in patients with combine median and ulnar nerve injury which result in thumb MCP joint hyperextension in some cases which was later corrected.

CONCLUSION

Our study results strongly suggest opponensplasty with Extensor Indices Proprius is an excellent procedure, either performed as definitive procedure or as an adjuvant with nerve repair/graft. The main usefulness of the procedure at the present time seems to be in the median nerve injury and in the combined median and ulnar nerve injury, either high or low. The extensor indicis proprius has satisfactory amplitude, strength, and does not require a tendon graft to obtain satisfactory opposition of the thumb. The procedure is quick and easy to learn with minimal donor site morbidity.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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