

# Novel Surgical Procedure for Half Palmaris Longus Transfer during Opponensplasty of the Thumb for Patients with Carpal Tunnel Syndrome: A Technical Note

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Thumb opposition is an essential movement for daily use of the hand, including precise pinching/grasping and fine and complicated hand movement. Although studies have reported use of several donor tendons for opponensplasty, opponensplasty using the palmaris longus (i.e., Camitz opponensplasty) has been used in patients with loss of opposition function due to longstanding carpal tunnel syndrome. The procedure involves a simple, useful tendon transfer and does not cause functional deficits. To obtain enough length to transfer the tendon to the metacarpophalangeal joint of the thumb, the PL tendon should be obtained with the palmar aponeurosis. However, the palmar aponeurosis is not always available for opponensplasty, as it is occasionally thin and insufficient for elongation of the palmaris longus. An extended skin incision over the palm can cause painful scar formation and postoperative residual pain. This procedure restores the palmar abduction function of the thumb but not opposition function. In the present article, we describe a modification of Camitz opponensplasty that uses a half-split palmaris longus, which is long enough to anchor to the insertion of the adductor pollicis at the metacarpophalangeal joint of the thumb. (J Nippon Med Sch 2021; 88: 149–153)

**Key words:** modified Camitz opponensplasty, palmaris longus, opponensplasty, tendon transfer, technical note

## Introduction

Thumb opposition is an essential movement for the daily use of hand, including precise pinching/grasping and fine and complicated hand movement<sup>1</sup>. Thus, thenar muscle atrophy due to longstanding carpal tunnel syndrome (CTS) results in thumb opposition deficiency and activity of daily living disabilities. Although several donor tendons for opponensplasty have been used<sup>1,2</sup>, the palmaris longus (PL) elongated with palmar aponeurosis is the most frequently used tendon for patients with severe thenar muscle atrophy, as the procedure involves a simple, useful tendon transfer without sacrificing other functional tendons<sup>1,2</sup>. To obtain enough length to transfer the tendon to the metacarpophalangeal (MP) joint of the thumb, the PL should be obtained along with the palmar aponeurosis<sup>1,2</sup>. However, the palmar aponeurosis is not always available for opponensplasty, because it is some-

times too thin or insufficiently long. An extended skin incision over the palm frequently causes painful scarring or postoperative residual pain<sup>1,2</sup>. Furthermore, this procedure provides palmar abduction of the thumb but does not provide opposition of the thumb<sup>1,2</sup>. In the present article, a modified Camitz opponensplasty using the half-split and elongated PL tendon (half-PL transfer) is proposed. This procedure provides the PL tendon enough length to anchor to the insertion of the adductor pollicis at the MP joint. The half-PL transfer is simple and easy to perform, does not sacrifice functional tendons, and does not require an extended skin incision on the palm.

## Indications

The general indication for opponensplasty is thumb opposition deficiency due to longstanding CTS. This procedure is contraindicated in patients with an overly thin or

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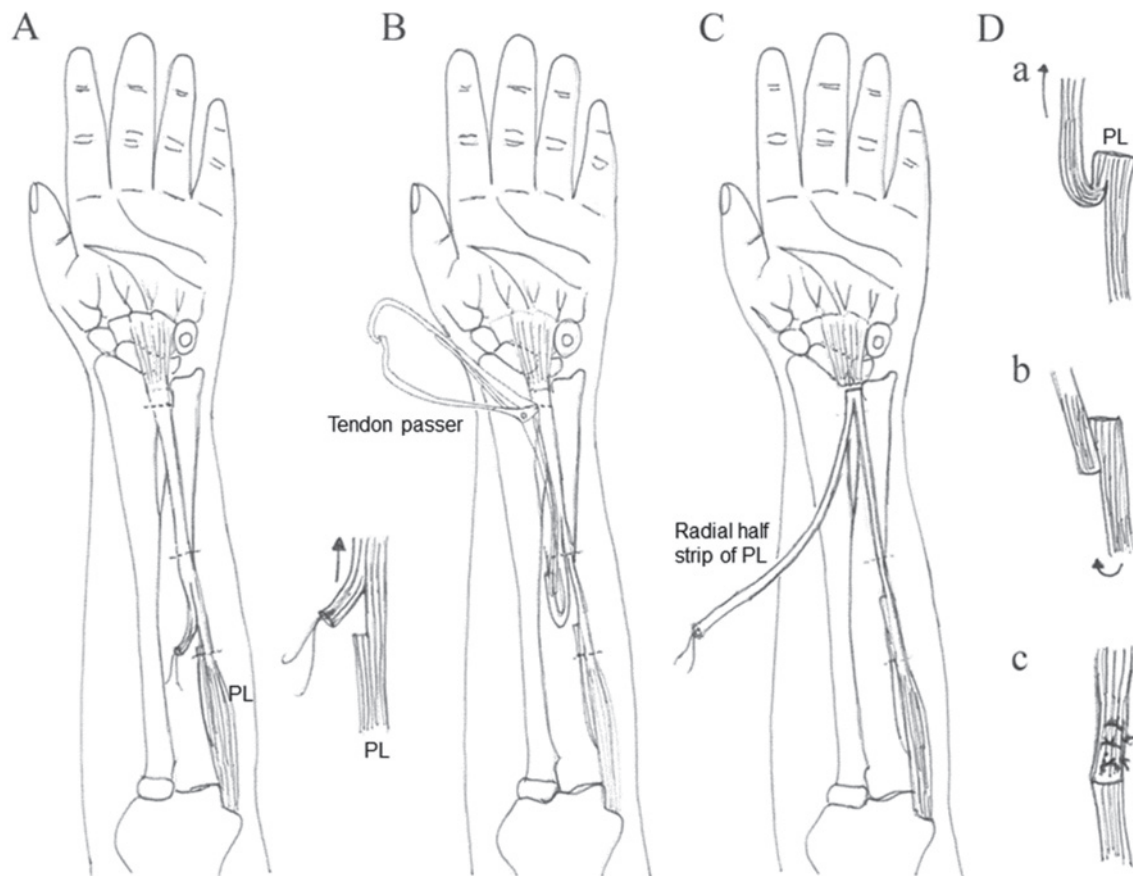


Fig. 1 Surgical technique (1). The palmaris longus (PL) tendon is exposed and split into 2 halves at a distance greater than 6 to 8 cm from the insertion point, which is enough to perform an interlacing suture to the extensor mechanism around the metacarpophalangeal joint of the thumb. The PL is dissected, and a radial half strip of the PL is resected and reflected back to the distal insertion (A). A radial half strip of PL is pulled out from the distal incision of the anterior forearm (B). The insertion of the PL tendon is resected at the wrist (C). The PL is reflected back 1 cm distal to the insertion of the PL at the wrist (D-a,b). The radial half of the PL is piled on the ulnar half of the PL and augmented with 4-0 nylon (D-c). Abbreviation: PL, palmaris longus

defective PL tendon.

### Preoperative Management

Preoperative assessment of PL strength is performed by asking the patient to flex the wrist in neutral deviation against resistance as the examiner simultaneously palpates the tendon. Since several studies have reported absence of the PL in approximately 15% of hands of a healthy population<sup>3</sup>; other opponensplasty procedures should be considered in patients who have thin or defective PL tendons.

### Surgical Technique

The patient is placed in supine position. Local or regional anesthesia is administered in accordance with patient preference, and a pneumatic tourniquet is applied.

Mini-incisions through a 1.0-cm incision in the proxi-

mal wrist crease and anterior forearm are made to expose the PL tendon. The exposed PL tendon is split into two halves at a 6-to-8-cm distance from the insertion point, which is enough to perform an interlacing suture to the extensor mechanism around the MP joint of the thumb. A radial half strip of the PL is resected at the proximal forearm incision and reflected back to the distal insertion (Fig. 1A). The PL tendon is pulled out from the middle forearm incision (Fig. 1B). The insertion of the PL tendon is resected at the wrist (Fig. 1C) and reflected back 1 cm distal to the insertion of the PL at the wrist (Fig. 1D-a, b). The radial half of the PL is piled on the ulnar half of the PL and augmented with 4-0 nylon sutures (Fig. 1D-c).

A mini-incision through a 1.5-cm incision is made over the palmar hand crease, and the transverse carpal ligament is exposed (Fig. 2A). The transverse carpal ligament

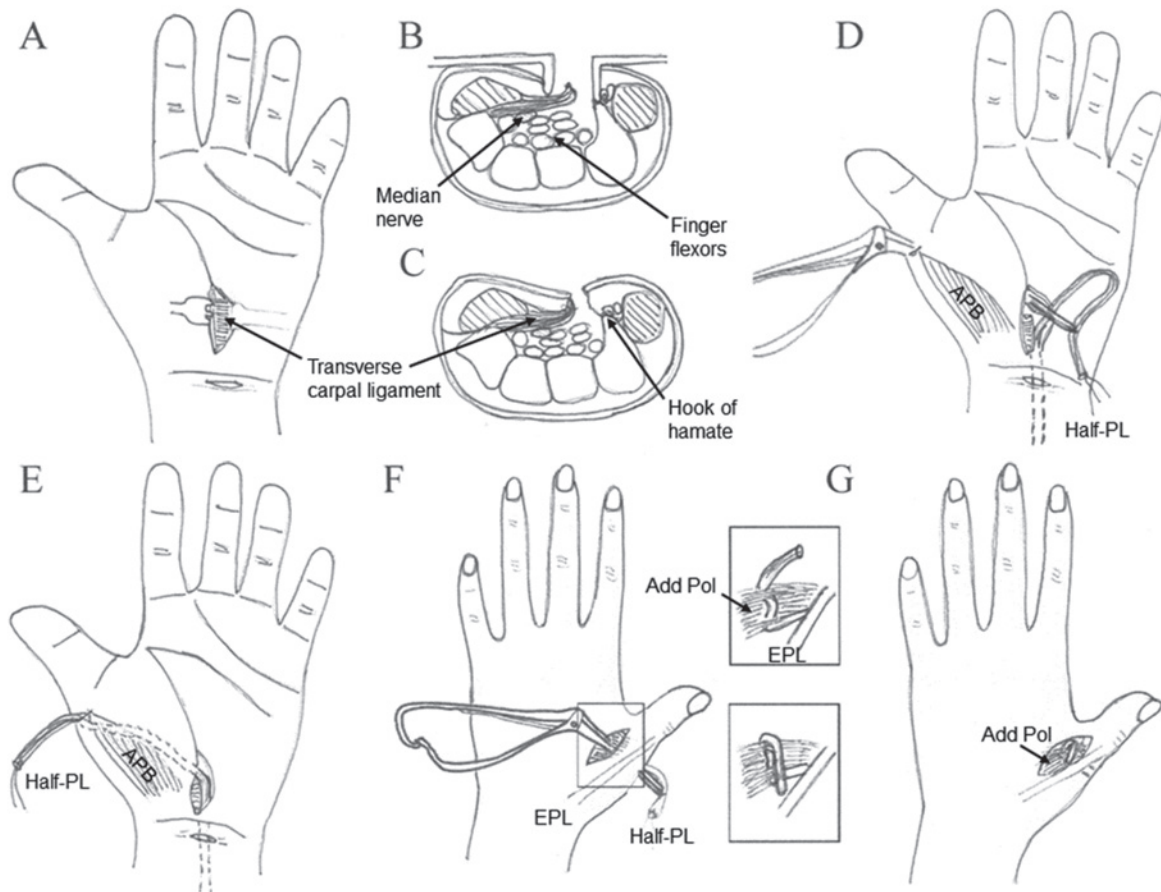


Fig. 2 Surgical technique (2). Mini-incision through a 1.0- to 1.5-cm incision is made over the palmar hand crease (A). The transverse carpal ligament is released from the attachment of the Hook of Hamate, to avoid damaging the thenar branch of the median nerve from the incision made over the palmar hand crease (B). After open release of the carpal tunnel, several horizontal mattress sutures are made between the ulnar margin of the transverse carpal ligament and the radial margin of the subcutaneous tissue of the palmar incision by using 4-0 PDS sutures to create a pulley for the half-PL tendon (C). The half-PL tendon is passed through the palmar incision with a tendon passer at the ulnar side of the transverse ligament (D). The half-PL tendon is passed under the fascia of the abductor pollicis brevis, to prevent bowstringing of the tendon, and pulled out from an incision on the radial side of the thumb at the level of the MP joint (D and E). Another incision is made at the radial side of the metacarpophalangeal joint of the thumb, and the PL tendon is pulled out and sutured to the insertion of the adductor pollicis (F). The half-PL tendon is sutured to the insertion of the adductor pollicis by using interlacing suture with 4-0 polypropylene sutures with the thumb in full opposition during maximum tension in maximal palmar abduction of the thumb (G). Abbreviations: APB, abductor pollicis brevis; Add Pol, adductor pollicis; EPL, extensor pollicis longus; PL, palmaris longus

is released from the attachment of the Hook of Hamate, to avoid damaging the thenar branch of the median nerve (Fig. 2B), and the proximal part of the transverse carpal ligament and the forearm fascia are simultaneously released from the incision at the distal wrist crease. After open release of the carpal tunnel, several horizontal mattress sutures are made between the ulnar margin of the transverse carpal ligament and the radial margin of the subcutaneous tissue of palmar incision with 4-0 polypropylene sutures, to create a pulley for the half-PL tendon (Fig. 2C). The half-PL tendon is passed through the palmar incision by using a tendon passer at the ulnar

side of the transverse ligament (Fig. 2D). The half-PL tendon is passed under the fascia of the abductor pollicis brevis, to prevent bowstringing of the tendon, and pulled out at a mini-incision on the radial side of the thumb at the level of the MP joint (Fig. 2E). Another incision on the ulnar side of the MP joint of the thumb is made, and the half-PL tendon is pulled out (Fig. 2F). The half-PL tendon is sutured to the insertion of the adductor pollicis by using interlacing suture with 4-0 nylon sutures, with the thumb in full opposition during maximum tension in maximal palmar abduction of the thumb (Fig. 2G).

After the tourniquet is released, the incision is closed

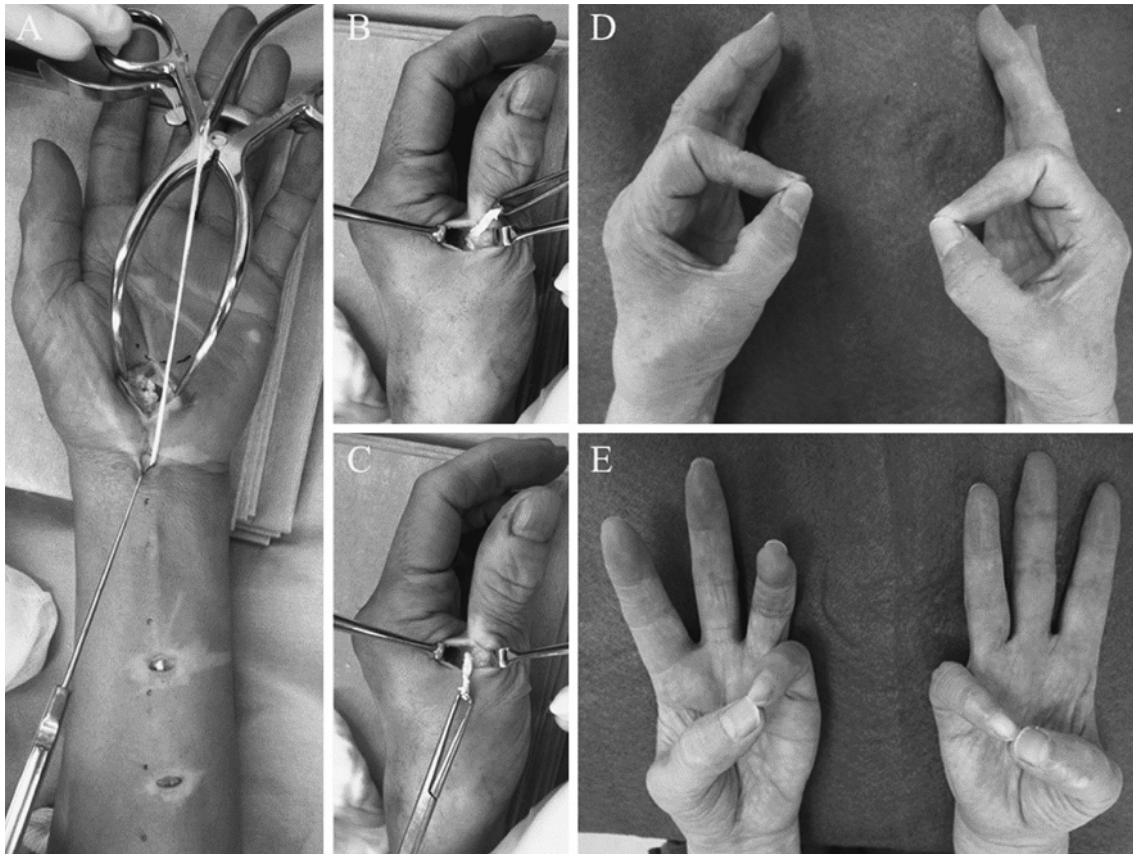


Fig. 3 Case presentation: a 67 year-old woman with severe atrophy of the left hand due to longstanding carpal tunnel syndrome. Intraoperative photograph of the half-PL transfer for opponensplasty. The half-PL tendon is resected at the insertion of the wrist and reflected back to the distal insertion (A). The PL tendon is pulled out from the ulnar side of the metacarpophalangeal joint of the thumb after being pulleyed at the ulnar margin of the transverse carpal ligament (B). The PL tendon is interlaced to the insertion of the adductor pollicis, reflected back, and then sutured to the adductor pollicis (C). Postoperative photographs of the left hand of a patient who underwent half-PL transfer for opponensplasty. The perfect “O” sign of the left hand is nearly identical to that of the right hand (D). After half-PL transfer opponensplasty, thumb opposition to the little finger with the wrist in neutral position is similar in the left and right hands. After half-PL transfer opponensplasty, thumb opposition to the little finger with the wrist in neutral position is similar in the left and right hands (E).

with 4-0 nylon sutures. Cotton gauze is applied over the incision. Then, a thumb spica splint is applied at full thumb opposition.

#### Postoperative Management

Postoperative rehabilitation is encouraged from several days after the tendon transfer. After rehabilitation, the patient’s ability to oppose the thumb to the little finger with the wrist in neutral position is immediately restored. The splint is applied for 3 weeks postoperatively, and rehabilitation exercises, such as active range of motion of the wrist and thumb, are freely performed. Six weeks after surgery, the patients can grip with full strength. Return to heavy manual labor and sports generally starts at 12 weeks after surgery.

#### Case Presentation

A 65-year-old woman with longstanding CTS presented to our hospital for restoration of thumb opposition function. Physical examination revealed complete lack of active left thumb opposition function and thenar muscle atrophy. A half-PL transfer was performed for the opponensplasty. After open release of the carpal tunnel, the half-PL tendon (Fig. 3A) was passed under the fascia of the abductor pollicis brevis and sutured to the insertion of the adductor pollicis (Fig. 3B, C). At the final follow-up, 6 months later, the patient was able to achieve palmar abduction of the thumb and thumb opposition to the tip of the little finger with the wrist in neutral position (Fig. 3D, E).

### Discussion

Camitz opponensplasty is better than other procedures because the PL tendon can be utilized without obvious functional deficit<sup>1-6</sup>. However, conventional Camitz opponensplasty has several disadvantages. Firstly, the extended incision in the palm and wrist involves extensive soft tissue dissection, which increases the risk of iatrogenic injury to the palmar cutaneous branch of the median nerve<sup>2,7,8</sup> and can cause painful scarring of the wrist<sup>5,9</sup>. Prominent bowstringing of the transferred tendon is one of the main shortcomings<sup>4,8</sup>. Another disadvantage is that conventional Camitz opponensplasty has little benefit for thumb flexion and pronation<sup>1,4,7</sup>. Because the movement of the thumb opposition consists of a combination of palmar abduction, pronation, and adduction, Camitz opponensplasty does not restore thumb pronation function against the palm<sup>1,3</sup>.

To address these disadvantages, modified Camitz opponensplasty uses the transverse carpal ligament as a pulley to further improve thumb opposition function<sup>4,7,8</sup>. Moreover, to restore thumb opposition, various techniques have been adopted to anchor the ligament to the radial or dorsal side of the MP joint of the thumb<sup>1,2,10</sup>. However, it is difficult to obtain the PL tendon with the accompanying palmar aponeurosis, as it is not long enough to anchor to the ulnar or dorsal side of MP joint of the thumb to restore thumb opposition.

Our technique has several advantages. Firstly, using the transverse carpal ligament as a pulley improves the line of pull of the transferred PL tendon, which is shifted to the ideal axis for opposition<sup>4,7,8</sup>. Secondly, since the half-PL tendon is long enough to anchor to the insertion of the adductor pollicis at the MP joint of the thumb, the interlacing suture applied to the insertion of the adductor pollicis at the ulnar side of the MP joint restores the pronation and opposition function of the thumb. Our procedure does not involve harvesting the palmar aponeurosis but does require a palm incision, albeit one that is smaller than that used in the conventional Camitz procedure. However, this technique has several disadvantages, among which is the need for an additional skin incision on the anterior forearm. A future biomechanical study should measure the tensile strength of the half-PL tendon. Although additional studies are needed, our proce-

cedure may be an alternative method for restoring thumb opposition in patients with severe CTS.

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**Conflict of Interest:** No conflicts of interest.

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