

# Successful Surgical Repair of Central Slip Rupture in Finger Extensor Tendon

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**Abstract.** *The aim of the present study was to develop a novel effective surgical method to repair boutonniere deformity resulting from central slip rupture of finger extensor tendon. Currently, there are not standard methods available to treat boutonniere deformity. Patients and Methods: In the current study, 8 patients with boutonniere deformity on the left hand were included. All patients had a central slip rupture of the ring fingers. Autologous palmaris longus tendon was used to surgically repair the central slip rupture. Results: We successfully used the autologous palmaris longus tendons in the effective treatment of central slip rupture of the ring fingers resulting in boutonniere deformity on the left hands. Conclusion: To our knowledge, our study was the first illustration for a successful surgical repair of boutonniere deformity which resulted from central slip rupture, using autologous palmaris longus tendon. This method provides an alternative approach for the effective treatment of boutonniere deformity.*

Central slip rupture is common in finger injuries. It usually causes a boutonniere deformity on the hands. Many factors such as trauma, cut and rheumatoid arthritis (RA) may bring about central slip rupture of the extensor tendon of fingers or toes. Central slip rupture at the proximal inter-phalangeal (PIP) joint usually causes boutonniere deformity (1). Patients with boutonniere deformity have significant functional impairment and poor quality of life (2). Boutonniere deformity is a common disorder due to sporting injury to the

finger with sudden bending at the PIP joint in games such as basketball and football (3). It has been reported that 39 out of 67 consecutive patients with injuries to the PIP joint were found to have central slip rupture of the finger extensor mechanism (4). In addition, approximately 50% of patients with RA developed a boutonniere deformity (5).

Several strategies are available to treat boutonniere deformity and no treatment is yet satisfying (6, 7). Finger splinting was shown to be helpful in healing the central slip rupture (8), but use of finger splints in patients with RA hand function problems produced a substantial number of potentially positive and negative consequences (9). Strengthening exercises may be beneficial for patients with RA hand deformity (10). Other studies, however, indicated that exercises did not have significant improvement in boutonniere deformity management (2). Thus, patients with boutonniere deformity seek for surgical treatment. Many surgical treatments such as tenotomy of the extensor tendon, resection-suture of the central slip and re-dorsalisation of the lateral bands have been reported but no standard surgical treatment is available (11, 12). In the current study, autologous palmaris longus tendon was used in the successful surgical repair of central slip rupture in patients with boutonniere deformity.

## Patients and Methods

**Patients.** Eight patients including 5 females and 3 males, with ages ranging from 30 to 70 years, were recruited. All patients signed the Institution Review Board-approved consent forms for the study. When admitted, all patients had painful, swollen and stiff ring fingers on the left hands due to varieties of hand injuries. Diagnosis indicated that the central slip rupture and middle phalanx fracture with small broken bones (approximately 2 mm × 1 mm) occurred in the PIP joint of the ring fingers on patients' left hands, resulting in boutonniere deformities of the ring fingers (Figure 1).

**Surgical repair.** Due to the central slip rupture and middle phalanx fracture, surgical treatments for boutonniere deformities of the ring fingers on the patient's left hands were necessary. The diagram of surgical procedures for repairing the central slip rupture using a

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**Key Words:** Boutonniere deformity, central slip rupture, palmaris longus tendon, finger extensor tendon, surgical repair.

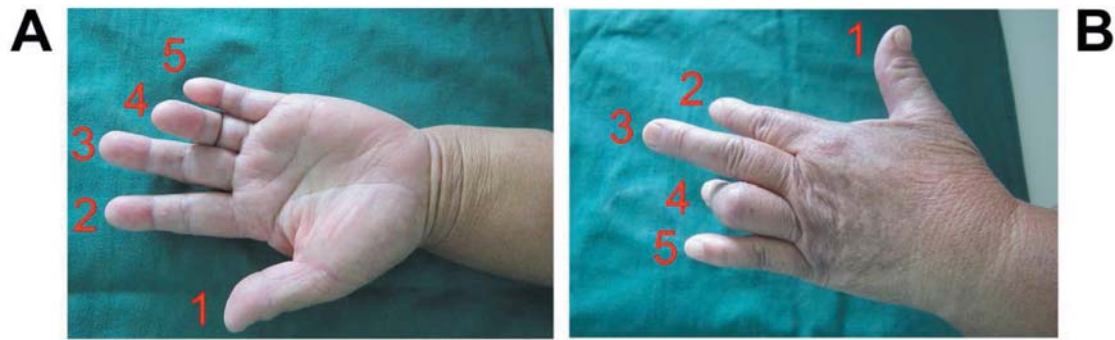


Figure 1. Appearance of representative abnormal ring finger on the left hand on the palm hand view (A) and hand dorsal view (B), showing a boutonniere deformity. 1, Thumb; 2, index finger; 3, middle finger; 4, ring finger; 5, little finger.

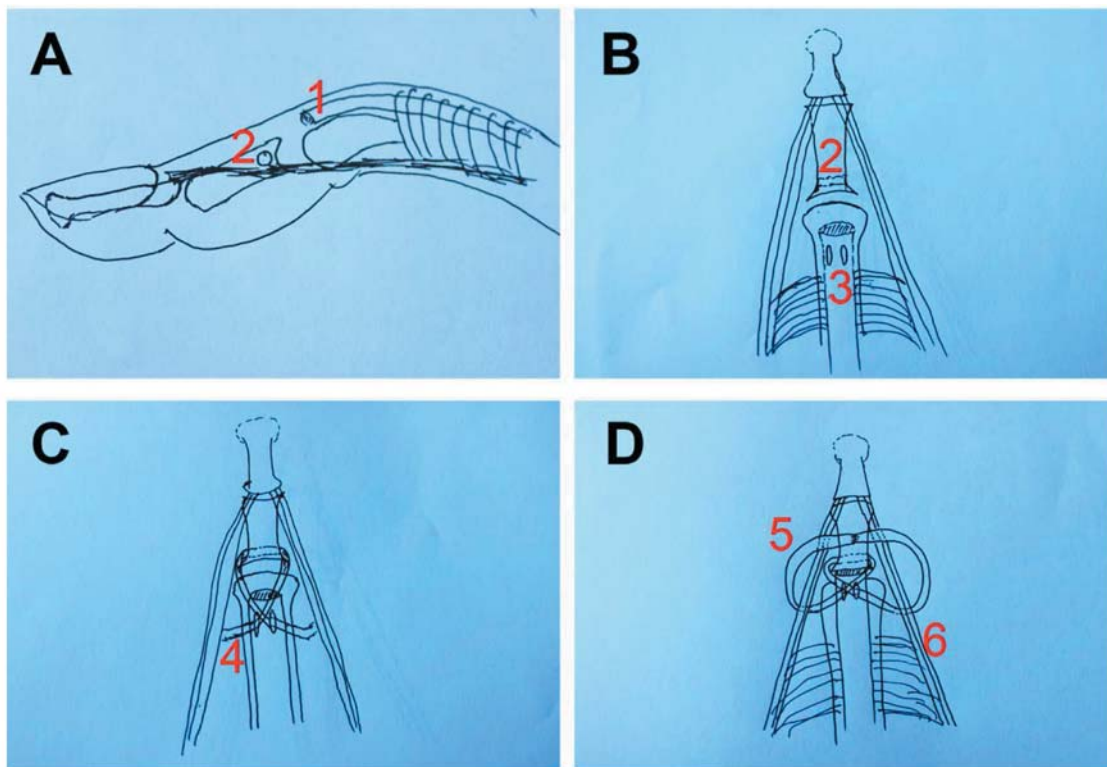


Figure 2. Diagram of surgical procedures for repairing the central slip rupture in the finger extensor tendon of the left hand. In panel A, the central slip rupture and the surgical hole in the proximal side of middle phalanx of the ring finger were shown. In panel B, the surgical hole in the central slip of the ring finger was shown. In panel C, the palmaris longus tendon passed through the surgical holes in the central slip and middle phalanx of the ring finger. In panel D, the palmaris longus tendon went around the lateral bands of extensor tendon on the both sides of the ring finger and was sealed on the two ends. 1, Central slip; 2, middle phalanx and surgical hole; 3, surgical hole in the central slip; 4, palmaris longus tendon; 5, sealed palmaris longus tendon; 6, lateral band.

palmaris longus tendon is shown in Figure 2. Firstly, an autologous palmaris longus tendon with a length of 6 cm was isolated by a transverse incision at the flexor aspect of the left forearm, harvested through a number of small separate flexor incisions and stored in saline solution temporarily. Next, a surgical incision with a length of

4 cm was made on the back of the PIP joint after anaesthesia of the ring finger nerve and the central slip rupture was seen (Figure 2A). Then, surgical holes in both the proximal side of middle phalanx and the central slip of the ring finger were made using an electrical aiguille with a diameter of 2.5 mm (Figure 2B). After cleaning, the

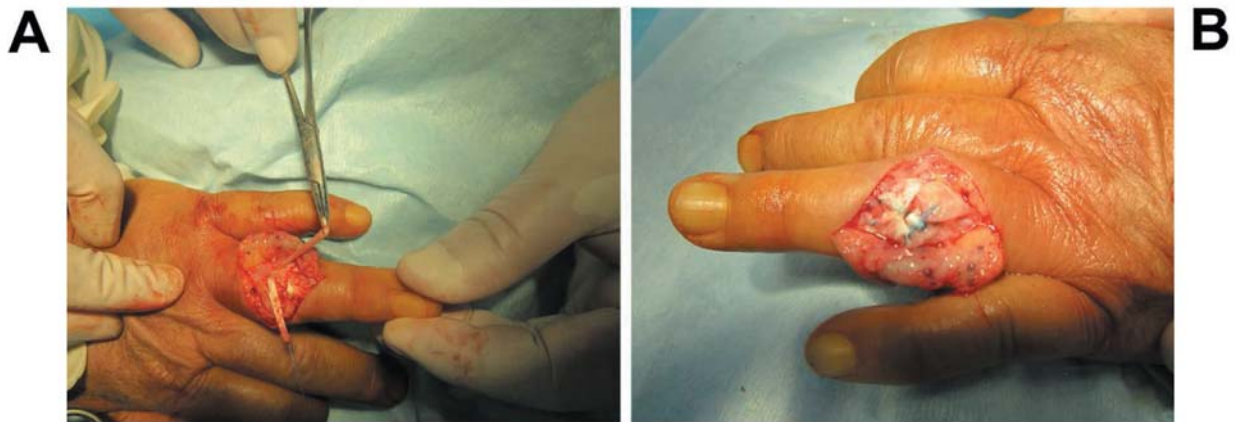


Figure 3. Surgical procedures for repairing the central slip rupture in the ring finger extensor tendon of the left hand. In panel A, the palmaris longus tendon passed through the surgical hole in the central slip of the ring finger extensor tendon. In panel B, the sealed palmaris longus tendon was shown after the surgical repair of the central slip rupture in the ring finger extensor tendon on the left hand.

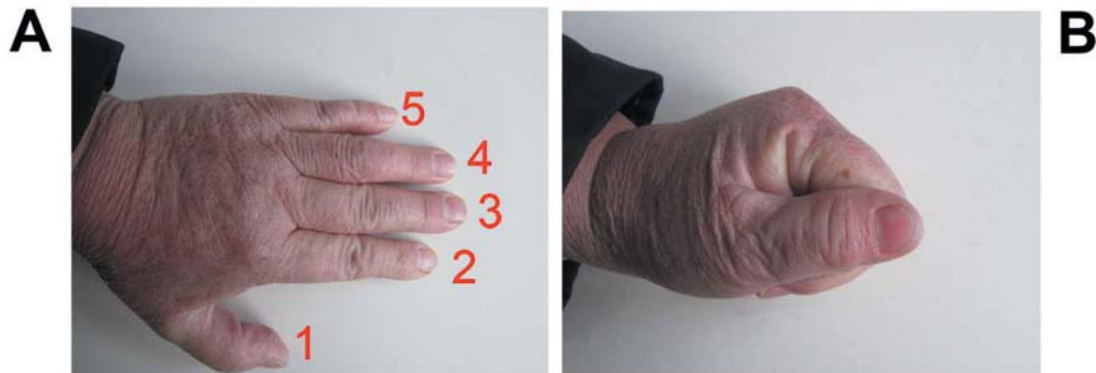


Figure 4. Appearance of representative normal ring finger on the left hand after successful surgical repair of the central slip rupture in the ring finger extensor tendon of the left hand. In panel A, the ring finger on the left hand was normal as in other fingers. In panel B, it is normal to make a fist with the left hand. 1, Thumb; 2, index finger; 3, middle finger; 4, ring finger; 5, little finger.

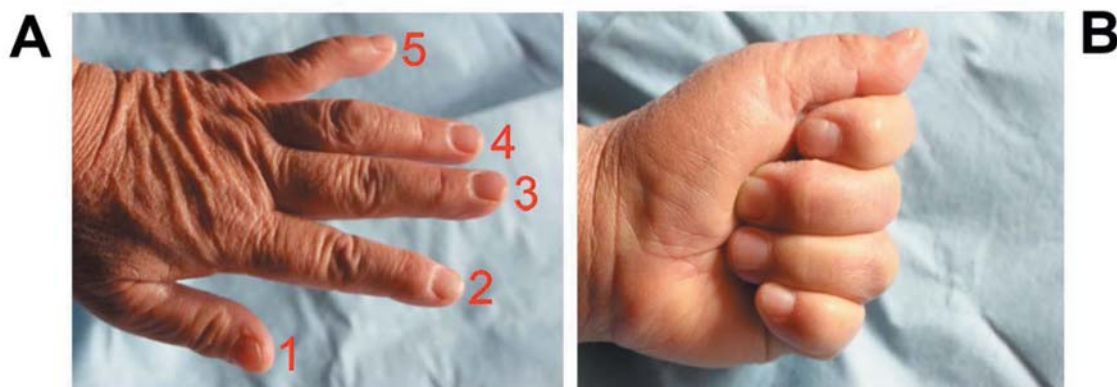


Figure 5. Appearance of representative normal ring finger on the left hand three years after successful surgical repair of the central slip rupture in the ring finger extensor tendon of the left hand. In panel A, the ring finger on the left hand was normal as in the other fingers. In panel B, it is normal to make a fist with the left hand. 1, Thumb; 2, index finger; 3, middle finger; 4, ring finger; 5, little finger.



autologous palmaris longus tendon passed through the surgical holes in the central slip and middle phalanx of the ring finger (Figure 2C). Then, the palmaris longus tendon went around the lateral bands of extensor tendon on the both sides of the ring finger and the lateral bands were dorsally pulled towards to the back of the ring finger by the palmaris longus tendon. After the palmaris longus tendon was sealed (Figure 2D), the patient was asked to test if the PIP joint of her ring finger functions normally. Finally, the surgical incision on the back of the PIP joint was stitched after cleaning.

## Results

Many factors such as sport injuries (3) and RA (5) may cause central slip rupture of finger extensor tendons. Usually the extensor tendon straightens the finger. If there is a central slip rupture the finger is not straightened normally. Thus, these patients have boutonniere deformities of the ring fingers on their left hands (Figure 1).

A palmaris longus tendon is found just below the wrist. Recent studies have discovered that palmaris longus tendons are adequate for tendon grafting and phyltral column construction (13, 14). Autologous palmaris longus tendon was used in the reconstruction of extensor tendon in the rheumatoid wrist (15) and pediatric median nerve injury (16). We reasoned that palmaris longus tendons may be used in the surgical repair of the central slip rupture for the treatment of boutonniere deformity of finger. As shown in Figure 3, the autologous palmaris longus tendons passed through the surgical holes in the central slip and middle phalanx of the ring finger to repair the central slip ruptures.

After surgical repair using autologous palmaris longus tendons, the boutonniere deformities of the ring fingers were cured in that the patients could straighten their ring fingers (Figure 4A) and normally make fists with their left hands (Figure 4B). The follow-up examinations for all patients were carried-out three years after surgical repair. As shown in Figure 5, the patients could use their ring fingers normally. Therefore, the central slip ruptures in finger extensor tendons were successfully repaired surgically using autologous palmaris longus tendons.

## Discussion

The boutonniere deformity is a well-known deformity in the fingers, which usually results from a rupture of the central slip of the extensor tendon (1). The extensor tendon is divided into three parts, one central slip and two lateral bands. Central slip and lateral bands attach to different bones in the finger and act to straighten the finger. If central slip rupture occurs, the finger cannot be straightened normally and thus a boutonniere deformity manifests. An early stage of boutonniere deformity can be treated by use of finger splints (8). However, surgery is necessary when splinting is not effective for late stages of boutonniere deformity (12).

Several surgical treatments such as tenotomy of the extensor tendon, resection-suture of the central slip and re-dorsalisation of the lateral bands have been used in the treatment of boutonniere deformity (11, 12). However, it appears that the treatment of late stages of boutonniere deformity is not satisfactory (12). In the current study, we reported for the first time that autologous palmaris longus tendons were successfully used in the effective treatment of central slip ruptures of the ring fingers resulting in boutonniere deformities on the left hands in patients.

Palmaris longus tendon has many clinical applications in surgical grafting and reconstruction (13-16). Using the patient's own tendon is advantageous, as it does not induce a graft-versus-host disease. There are ethnic variations in the prevalence of the absence of the palmaris longus tendon (17). It has been reported that the strengths of grip or pinch in patients who did not have a palmaris longus tendon were not significantly different from those who had (18). Furthermore, the absence of a palmaris longus tendon did not affect the median nerve function across the wrist (19). Therefore, palmaris longus tendon is a good material for surgical repair of central slip rupture. We have successfully used autologous palmaris longus tendons to treat boutonniere deformities of the ring fingers on the left hands resulting from central slip ruptures. This method may also be used in the effective treatment of boutonniere deformities in the other fingers on both left and right hands.

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