

Reconstruction of Chronic Collateral Ligament Injuries to Fingers by Use of Suture Anchors

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Aim. To evaluate the effectiveness of suture anchors in the reconstruction of chronic collateral ligaments of fingers.

Methods. We treated 8 patients, 6 with chronic instability of the collateral ligament of the thumb and 2 with the instability of the fifth finger, using the Statak® suture anchor. A stable joint was achieved in each case, with no recurrent instability or pain within a mean of 14 months of the follow up.

Results. Postoperatively, each patient returned to his or her original job, their daily activities, and sports. There was no significant difference on manual stress testing measurements between operated and uninjured fingers. Mean pinch strength and range of motion were 90% (range, 78-104%) and 94% (range, 70-100%), respectively, compared to uninjured fingers.

Conclusion. Suture anchor technique can be recommended as a simple and effective method of repairing the collateral ligament of fingers.

Key words: collateral ligaments; finger joint; joint instability; reconstructive surgical procedures; suture techniques; thumb

Injuries to the collateral ligaments of the fingers are common, and in most cases respond well to conservative treatment. In the acute stage, these injuries are sometimes treated by the application of an elastic bandage and warm soaks. However, more attention to the injured thumb is given only when pain and instability persist, which then usually leads to correct diagnosis. The treatment of the acutely injured ligaments of the finger joints is still controversial. Some surgeons prefer immobilization in a plaster cast, whereas others choose suture of the ruptured or avulsed ligament (1).

For the old injuries, some authors advise repairment of the remaining ligament, some suggest reconstruction by tendon graft or tendon transfer, and some recommend fusion of the joint. Various approaches to surgical repair and reconstruction have been described, such as repair with a pull-out wire and button, dynamic repair with adductor advancement, and tendon graft reconstruction (1-3). These methods are technically difficult and, in some of them, external wires and sutures can complicate postoperative recovery.

We present a series of patients in whom the Statak® suture anchor was used to repair chronically unstable collateral ligament injuries of the finger joints without additional reinforcement.

Patients and Methods

Eight collateral ligaments of fingers in eight patients, six men and two women, were surgically repaired with two 2.4 mm Statak® (Zimmer, Warsaw, ID, USA) suture anchors. The median

age at the time of the injury was 28 years (range, 20-38 years). Two orthopedic surgeons in two different clinics performed the surgeries. Three patients were active soldiers, three were manual laborers, and two were students involved in sports. The inclusion criteria was the presence of a complete collateral ligament tear, as determined by clinical diagnosis and confirmed during surgery. Four patients had ulnar and two had radial collateral ligament injuries of the metacarpophalangeal joint of the thumb, one had radial collateral ligament injury, and one had injury of the ulnar collateral ligament of the proximal interphalangeal joint of the fifth finger. The cause of the injury was a fall from a height in three patients, traffic accident in three patients, and sports trauma in the remaining two. Injuries were chronic in all patients and median time between injury and surgery was 3 months (range, 2-5 months). Preoperatively, all fingers were evaluated with manual stress testing of the joints in extension and flexion. When necessary, intraarticular lidocaine injections were used to facilitate the examination. The absence of firm endpoint in flexion and extension was considered characteristic for diagnosis of a complete rupture of the ligament. After clinical examination, all patients underwent radiographic examination of anteroposterior, lateral, and stress of the involved finger (Figs. 1 and 2).

Surgical Technique

The operations were performed in axillary block anesthesia. In all patients, longitudinal incision at the level of the injured joint was made. For ulnar collateral ligament injuries of the thumb metacarpophalangeal joint, ulnar sensory branch of the superficial radial nerve was identified and protected during surgery. The adductor aponeurosis was severed and ulnar collateral ligament was exposed. For collateral ligament injuries of the proximal interphalangeal joint of the finger, the transverse retinacular ligament was severed and the lateral band was reflected dorsally. The site of the collateral ligament injury was then confirmed. After the dissection of the fibrous ligamentous tissue, we applied traction with a forceps towards bone, while moving the joint to find a new reinsertion point that would do as the optimum tension point during the whole arc of rotation. The suture anchor was

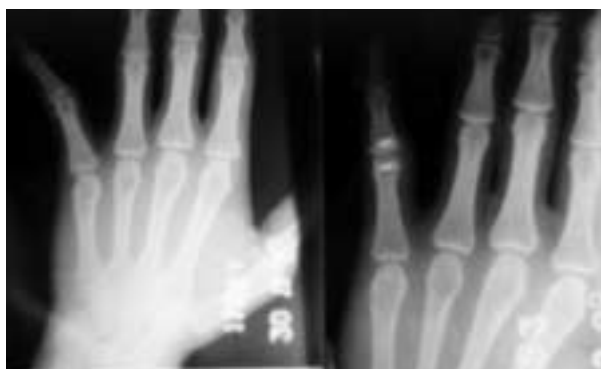


Figure 1. Position of the small finger under manual stress testing before (left) and after surgical operation (right).

then applied to this point. When necessary, we added sutures through the periosteum and ligament.

In chronic ruptures, the intact proximal/distal reinsertion site is expected to present with some degree of degeneration due to chronic inactivity and the spread of the degenerative process originating at the ruptured site. For this reason, we added another suture anchor fixation at the traumatically "intact" site to reinforce the ligament. The position of the anchors was confirmed intraoperatively with image intensifier (Fig. 3). The stability of the anchor was checked by pulling the thread. The cord-like portion of the avulsed end of the collateral ligament was sutured and then fixed by two anchors. The sutures were knotted on the surface of the ligament to ensure that the end of the ruptured proper portion of the collateral ligament was embedded in cancellous bone. The joint was then moved through a range of motion and lateral stress was applied to the joint to confirm the strength of the repaired ligament.

After surgery, the finger was immobilized with a short arm palmar spica splint. Postoperative immobilization positions were 20° flexion of metacarpophalangeal and interphalangeal joints of the thumb, and 30° flexion of proximal interphalangeal and 10° of distal interphalangeal joints of the fifth finger. No percutaneous K-wire fixation was used across the joint. Three weeks after surgery, the splint was removed, and the use of the finger in daily activities was permitted. Active and passive range of motion and strengthening exercises were gradually increased until full, and painless function was achieved.

Results

The median follow-up period was 19 months (range, 13-27 months). The outcome was assessed according to function, range of motion, stability, and pinch grip (Table 1).

Function

Range of daily activities, stiffness, and pain were evaluated according to criteria of Saetta's et al (Table

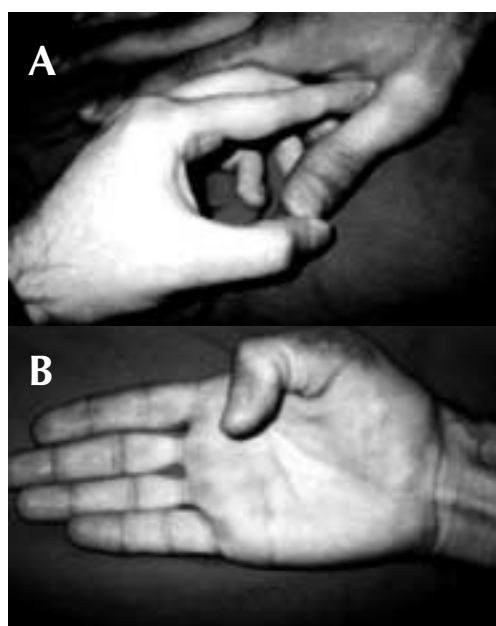


Figure 2. Reconstruction of chronic collateral ligament injuries in digits with suture anchors. **A.** Preoperative manual stress test of the thumb. **B.** Postoperative clinical view of the same thumb.

2) (3). Condition of the finger in seven patients (88%) was graded excellent, and in one patient good.

Range of Motion

Range of motion of the operated finger was compared with opposite nonoperated one by goniometer. Six patients (75%) had full range of motion. Range of motion of a thumb was 80% and of a finger 70%, as

Table 2. Classification of functional disability^a

Grade	Function
Excellent	Return to normal; no pain. Very little or no stiffness of the thumb.
Good	Mild limitation of use; ache on use of thumb (as in writing). Able to unscrew lids off jars and do up buttons. Stable joint. No pain.
Fair	Moderate limitation of use; unable to unscrew lids off jars. Some degree of pain on use of thumb, but not disabling. Change in occupation, to lighter duties, may have been necessary.
Poor	Severe limitation, due to instability, pain or both; inability to pursue former occupation or pastimes.

^aAccording to Saetta et al (3).

Table 1. Details and functional results of the patients with reconstruction of chronic collateral ligament injuries in fingers with suture anchors

Patient No.	Sex	Age (years)	Presurgery interval ^a	Localization	Follow-up (months)	Postoperative function	Postop. ROM	Pinch grip (kg)
1	Male	26	3	1st MP UCL	27	excellent	110°	9.2
2	Male	20	2	5st PIP RCL	25	excellent	90°	5.8
3	Female	32	4	1st MP UCL	23	good	90°	3.8
4	Male	21	3	1st MP UCL	20	excellent	100°	6.4
5	Male	38	3	1st MP RCL	16	excellent	100°	5.8
6	Male	28	5	1st MP RCL	16	excellent	110°	5.6
7	Female	26	2	5st PIP UCL	14	excellent	70°	4.0
8	Male	33	4	1st MP UCL	13	excellent	100°	5.8

^aInterval (months) between trauma and surgery.

^bMP – metacarpophalangeal joint; UCL – ulnar collateral ligament; PIP – proximal interphalangeal joint; RCL – radial collateral ligament; ROM – range of motion.



Figure 3. Suture anchors in the reconstruction of chronic collateral ligament injuries of the fingers. Approximate localization of suture anchors in the thumb.

compared to intact opposite joint. This difference was not significant ($p > 0.05$, Wilcoxon's test).

Stability

The fingers in all patients were tested in full extension and flexion after surgery, and no instability was observed in any case.

Pinch Grip

Pinch grip was measured with a strain-gauge instrument. The mean pinch grip with operated fingers was 5.8 kg (range, 3.8-9.2 kg) or 90% (range, 78-104%) in comparison with uninjured fingers.

All patients were satisfied with the reconstruction. No skin necrosis, infection, or sensory disturbance of the nerves was observed.

Discussion

Our study showed that the repair of the collateral ligaments of digits with suture anchors can be carried out effectively and safely. Collateral ligament injuries of the finger commonly result from forced abduction and adduction of the joint. These injuries are often work-related and occur predominantly in men. The diagnostic criteria for grade III injuries remain debatable (4). We considered the absence of an end point when lateral stress was applied to the joint in the position of slight flexion to indicate a grade III ligament instability. Kato et al (4) advised lateral stress X-ray combined with arthrography in diagnosing grade III injuries.

The treatment for complete ligament ruptures is usually operative and may consist of several operative techniques. Before the report by Nevasier et al (2), no consistently successful method of repair of old ruptures of the collateral ligament had been published. Although the early results of their method were promising, the persistent passive instability may lead to arthrosis. The techniques using pull-out wires or wiring through drill holes, which approximate the avulsed ligament into bone, by tying the wire to a button on the skin, are cumbersome, particularly with the small ligamentous structures in the area of the finger joint. A pressure sore or sensory neuroma under the button, wound infection around the pull-out wire, or joint contracture due to prolonged immobilization may complicate surgery. The patient must visit the hospital periodically for wound care and cannot use

the finger for several weeks until the wire is removed. The initial tension of the repaired ligament may decrease after the subsidence of swelling, resulting in residual joint instability.

Suture anchors are becoming increasingly accepted in a wide range of applications, principally in the fixation of tendons or ligaments to bone (5). The use of anchors for the attachment of soft tissues to bone is gaining increased acceptance in orthopedic surgery. Rehak et al (6) described the use of such anchors in several procedures on the hand, including repair of gamekeeper's thumb, and reported excellent results.

Kato et al (4) reconstructed 18 grade III collateral ligament injuries with the Mitek Gil suture anchor. They reported that the all patients were able to use the fingers in daily activities within 5 weeks after surgery and return to their original job or sport activities within 12 weeks. The average loss of motion was 7°. McDermott and Levin (5) also performed reconstruction of chronic instability of the radial collateral ligament of the thumb metacarpophalangeal joint in five patients. They observed excellent results, although one patient had 5° loss of flexion (with full patient satisfaction). We obtained similar results.

Perhaps the most important aspect of the technique is the placement of the anchor in the correct position. Incorrect placement may lead to continued instability and possible loss of motion if the repair is too tight. Surrounding tissues may be scarred and displaced, making precise localization much more difficult. Image intensifier is useful to perform correct placement. Studies have shown that the ligaments are taut in flexion and relaxed in extension (1). Therefore, it is important to suture the repair with the joint in at least 30° flexion to maximize stability throughout the range of motion. In old collateral ligament ruptures, the original length of the ligament is no longer valid. The ligament shows fibrotic degenerations and its length is generally reduced. Thus, the reinsertion of the ligament to the described site (4) for acute ruptures is not the best choice. Dynamically, we applied traction to the ligament while moving the joint to find a new reinsertion point which would be the optimum tension point during the whole arc of rotation. Then the suture anchor was applied to this point. The second one also applied to the other insertion site to reinforce the ligament.

Kiefhaber et al (7) subsequently reported that the collateral ligament of finger joint was the main restraint against varus and valgus angulation. They found that the failure of the collateral ligament had began with the dysfunction of the palmar fibers of the ligament and then progressed dorsally. They suggested that the collateral ligament was likely to become completely disrupted if there was angulation of 20° or more. Morris et al (8) compared suture anchor system to suture alone in a cadaveric study of the collateral ligament of proximal interphalangeal joint. They found no significant difference between the two groups in the force that needed to be applied to cause failure of the repair.

Biomechanical studies of the suture anchors showed that it possesses sufficient pullout strength for the fixation of ligaments in the hand, and most failures of ligament fixation have occurred due to suture breakage rather than to anchor pullout (9).

St Pierre et al (10) reported that the biomechanical properties after tendon-to-bone healing were approximately equal at 6 and 12 weeks. Based on their findings, we permitted the patients to move the finger 3 weeks after surgery and to use the finger for work or in sports 6 weeks after surgery. During this period, there was no case in which the repaired ligament became loose.

The simplicity of the instrumentation and the minimal dissection required may decrease operative time and expenses. Also, one of the advantages of this new generation Statak[®] suture anchor to others is that pre-drilling is not necessary, as it is a self-drilling device.

In conclusion, the use of the suture anchors for repairing chronic ruptures of the collateral ligaments of fingers is an effective method with excellent clinical results. The procedure is easy to do and has minimal complications. Dissection is kept to a minimum, decreasing morbidity and resulting in less postoperative loss of motion. The bone anchor system also offers advantages in terms of the ease of application and apparent reliability.

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