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Original Research

A Comparison of Acute Versus Chronic Thumb Ulnar Collateral Ligament Surgery Using Primary Suture Anchor Repair and Local Soft Tissue Advancement

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Purpose: To assess patient satisfaction and functional outcomes of primary suture anchor repair with local soft tissue advancement for both acute and chronic thumb ulnar collateral ligament (UCL) injuries.
Methods: We retrospectively reviewed patient charts who had undergone operative UCL repair between 2006 and 2013. Patients who had more than 8 weeks between the time of injury and surgery were classified as having chronic injuries. In both acute and chronic cases, a primary suture anchor repair of the ligament was performed with local soft tissue advancement. For each patient, baseline demographics, operative complications, and associated injuries were recorded along with visual analog scale pain scores; Quick Disabilities of the Arm, Shoulder, and Hand scores; and their return to work or sport status. Comparisons of outcomes and complications were made between the groups (acute vs chronic injuries).
Results: Among the 36 patients who met our inclusion criteria, both the acute (n = 19) and chronic (n = 17) groups were similar with regards to major or minor comorbidities, visual analog scale scores; Quick Disabilities of the Arm, Shoulder, and Hand scores; return to work or sport status; or patient satisfaction.
Conclusions: Patients with both acute and chronic thumb UCL injuries have similarly acceptable functional outcomes, postoperative pain, and satisfaction. Primary suture anchor repair without ligament reconstruction appears to be a safe and effective treatment option for patients' thumb UCL injuries, even in the chronic setting.
Type of study/level of evidence: Therapeutic III.

Injuries to the ulnar collateral ligament (UCL) of the thumb metacarpophalangeal (MCP) joint can occur in both the acute and chronic setting. In acute injuries (skier's thumb), valgus force to the MCP joint can lead to traumatic rupture of the UCL.[1] Repetitive valgus force to the MCP joint can cause ligamentous attenuation, resulting in chronic injury to the UCL (gamekeeper's thumb) which is often followed by the sequela of pain and instability with pinch grip.[2] Chronic UCL injuries can also result from delayed treatment of an acute injury.[3]

A number of operative techniques have been described for the treatment of both acute and chronic UCL injuries. For acute injuries, primary UCL repair techniques using either suture anchors, suture tape augmentation, or pullout sutures have demonstrated good functional outcomes.[4–9] The operative treatment of chronic UCL injuries is often divided into primary repair, dynamic stabilization with tendon transfers, static stabilization with tendon graft reconstruction, and arthrodesis.[10–14] While well described in the acute setting, the outcomes of primary repair of the chronic thumb UCL injury have been less frequently reported in the literature.[13–16] Primary ligamentous repair with local tissue for chronic injuries has been advocated if the MCP joint articular cartilage is adequate and the ligament can be advanced to its insertion on the base of the

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Figure 1. Clinical photograph depicting the subcutaneous branches of the superficial radial sensory nerve.

Figure 3. Clinical photograph showing the ulnar collateral ligament (UCL) avulsed from its insertion on the proximal phalanx.

Figure 2. Clinical photograph showing that once the aponeurosis is reflected volarly and dorsally, the capsule of the metacarpophalangeal (MCP) joint is visible.

Figure 4. Clinical photograph showing a pilot hole for the anchor being drilled at the base of the proximal phalanx. The hole should be positioned at the junction of the volar and middle third of the base of the proximal phalanx.

proximal phalanx.[17] More recently, some authors have advocated for the use of suture tape augmentation for both acute and chronic injuries.[8,18]

For both acute and chronic injuries to the thumb UCL, we perform direct primary repair of the ligament with local tissue and suture anchors. The purpose of this study was to investigate the outcomes of direct, primary repair with local soft tissue of both acute and chronic thumb UCL injuries. We hypothesized that this technique would result in good functional outcomes and high levels of patient satisfaction in both acute and chronic injuries.

Materials and Methods

Institutional review board approval was obtained from the Geisinger Health System for this retrospective investigation. All patients (n = 62) who underwent surgical repair of an isolated thumb UCL injury from January 2006 through July 2013 were identified through our electronic medical record system. All patients were treated by a single hand fellowship-trained surgeon (J.C.K.). Patients with less than 12 months of postoperative follow-up were excluded from our analysis (9 patients in the acute group and 7 in the chronic group), as were patients less than 18 years of age (n = 10). All injuries were isolated, so no patients had ipsilateral injuries to the operative extremity. A retrospective chart review was conducted for all patients who met the inclusion criteria.

The diagnosis of UCL injury was made with a combination of clinical examination, plain radiographs, and magnetic resonance imaging. The thumb MCP joint was stressed in full extension and 30° of flexion and compared to the uninjured contralateral MCP joint. Plain radiographs were obtained in all patients to assess for avulsion fractures and degenerative joint changes. Indications for surgery included lack of a firm endpoint with stress, greater than 30° of laxity, or magnetic resonance image evidence of a complete tear of the proper collateral ligament. In younger patients, athletes, and those with higher functional demands, surgery was offered as first-line treatment for these complete UCL injuries. In the absence of a Stenner lesion, elderly patients and those with lower functional demands were offered a trial of nonoperative treatment for a complete injury, but these were infrequently encountered in our practice.

Surgical technique

The patient is positioned supine on a radiolucent hand table. The affected thumb is examined under anesthesia with a valgus stress applied to the MCP joint with the thumb in both full extension and 30° of flexion. Ligamentous laxity is compared to the contralateral thumb MCP joint, which is examined prior to draping. After Esmarch exsanguination of the limb, a brachial tourniquet is inflated to 250 mmHg. A standard lazy “S” incision is made centered over the dorsal-ulnar border of the thumb MCP joint. We begin the incision just proximal to the MCP joint and end at the proximal aspect of the diaphysis of the thumb proximal phalanx. Careful scissor dissection is begun once the subcutaneous fat is encountered. Care is taken to protect the subcutaneous branches of

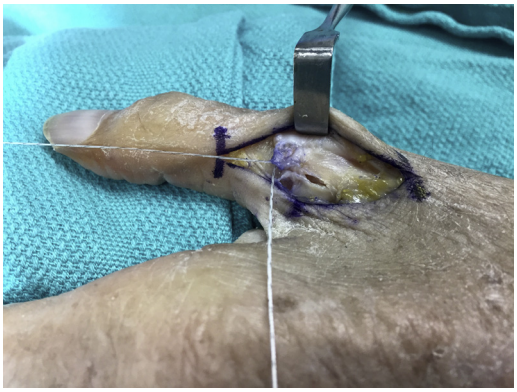

Figure 5. Clinical photograph showing a Kessler suture placed through the dorsal capsular tissue with 1 suture limb.

Figure 7. Clinical photograph showing the capsular closure covered by the aponeurosis repair, in an effort to decrease the likelihood of suture irritation.

Figure 6. Clinical photograph depicting figure-of-8 sutures placed to reapproximate the volar and dorsal capsular flaps, along with imbrication of the volar plate.

the superficial radial sensory nerve (Fig 1). Blunt retractors are used, and attention is paid to avoiding vigorous retraction, which can lead to a postoperative neuropraxic injury.

Deep dissection is continued to the level of the adductor aponeurosis. The aponeurosis is incised longitudinally 3 mm volar to the ulnar edge of the extensor mechanism. Volar and dorsal flaps of the thin aponeurosis layer are created with dissecting scissors. Once the aponeurosis is reflected volarly and dorsally, the capsule of the MCP joint is identified (Fig 2). In the setting of a chronic injury, it can be difficult to distinguish between the proper and accessory collateral ligaments. Frequently, the capsular tissue and avulsed ligament are healed to bone and attenuated, making identification of distinct anatomical structures difficult. Most commonly, the UCL is avulsed from its insertion on the proximal phalanx (Fig 3). A longitudinal incision is made through the capsular tissue centered over the volar one-third of the MCP joint. Volar and dorsal capsular flaps are raised using a 15-blade scalpel. The dorsal capsular tissue should be separated from the extensor mechanism.

Once the MCP joint is exposed, careful inspection of the articular cartilage is performed. A pilot hole for the Micro Quickanchor (Depuy-Synthes) is drilled at the base of the proximal phalanx (or at the collateral recess of the metacarpal head in cases with a proximal tear) prior to anchor placement. The hole should be positioned at the junction of the volar and middle one-third of the base of the proximal phalanx (Fig 4). In cases with significant capsular attenuation, or in patients whose vocation could result in increased valgus stress, a second anchor can be used, placed more volarly to recreate the accessory collateral ligament.

Prior to placing suture through the capsule, the MCP joint is held in 30° of flexion with a slight varus stress applied. The dorsal capsular tissue is grasped with a forceps and advanced to the location of the anchor, allowing the surgeon to visualize where the Kessler suture should begin in order to advance it toward the anchor and maintain appropriate tension. A Kessler suture is placed through the dorsal capsular tissue with 1 suture limb (Fig 5). If a second anchor is used, a Kessler suture is passed through the volar capsular tissues. The operative assistant holds the thumb in 30° of flexion, and a varus stress is applied as the Kessler suture limb is tied to the other suture post in the anchor. Figure-of-8 sutures are then placed to reapproximate the volar and dorsal capsular flaps with a 4-0 Fiberwire (Arthrex), along with imbrication of the volar plate (Fig 6). A 4-0 undyed Vicryl suture is used to close the adductor aponeurosis in a similar fashion. It is important to ensure that the knots from the capsular closure are covered by the aponeurosis repair, thus reducing the likelihood of their irritation (Fig 7). The tension of the repair is examined for a final time by applying a valgus stress to the MCP joint with the thumb in both full extension and in 30° of flexion.

The tourniquet is then deflated, and hemostasis is obtained with a bipolar cautery. After saline irrigation of the wound, the skin is closed with interrupted 4-0 nylon horizontal mattress sutures. A well-padded plaster thumb spica splint is placed immediately after the UCL repair. Sutures are removed between 10 and 14 days postoperatively and the patient is converted to a thumb spica cast with the interphalangeal joint free for an additional 2 to 3 weeks. At 6 weeks postoperatively, the patient is allowed to begin active MCP joint range-of-motion and is fitted with a custom, removable thumb spica orthosis. Pinch, grip, and strengthening activities are started 6 to 8 weeks after repair, with unrestricted activities permitted 12 weeks after repair.

Data collection

Baseline demographics were recorded for each patient, including age, gender, hand dominance, date and mechanism of injury, time from injury to treatment, associated avulsion fractures, location of ligamentous avulsion, presence of articular cartilage injury, medical comorbidities, and tobacco use. Patients whose time from injury to surgery was less than 8 weeks were classified as having acute injuries, whereas those whose injury occurred greater than 8 weeks prior to operative intervention were classified as having chronic injuries. For each patient, operative details were recorded, including the number of suture anchors used, specific treatment of the avulsed fracture, and use of Kirschner wire fixation

Table 1
Baseline Demographics and Injury Characteristics for Patients With Acute and Chronic UCL Injuries

Demographics and Injuries	Acute (n = 19)	Chronic (n = 17)	*P* Value
Mean age in years, n	29.2	35.6	.14
Male, n (%)	10 (53%)	11 (65%)	.54
Mean length of follow-up in months, n (range)	42.5 (12–82)	38.1 (12–78)	.58
Dominant hand, n (%)	10 (53%)	11 (65%)	.54
Tobacco use, n (%)	5 (26%)	1 (6%)	.10
Mechanism of injury			-
Sporting activities, n (%)	10 (53%)	7 (41%)	
Fall, n (%)	4 (21%)	7 (41%)	
Motor vehicle accidents, n (%)	3 (16%)	2 (12%)	
Other, n (%)	2 (10%)	1 (6%)	
Stenner lesion, n (%)	2 (10%)	1 (6%)	.62
Associated avulsion fracture, n (%)	7 (37%)	2 (12%)	.08
Proximal phalanx, n (%)	6 (32%)	2 (12%)	
Metacarpal head, n (%)	1 (5%)	0 (0%)	
Location of UCL avulsion			.94
Proximal, n (%)	1 (5%)	1 (6%)	
Distal, n (%)	18 (95%)	16 (94%)	
MCP joint articular cartilage injury, N (%)	5 (26%)	8 (47%)	.20

MCP, metacarpophalangeal; UCL, ulnar collateral ligament.

Table 2
Outcomes After Primary Repair of the UCL in Patients With Acute and Chronic Injuries

Outcomes	Acute (n = 19)	Chronic (n = 17)	*P* Value
Patients with completed outcome measures, n (% of total patients)	16 (84%)	14 (82%)	.88
Visual analog scale pain score (0–10)			
Pain at rest	0.13	0.28	.52
Pain with activities of daily living	0.47	0.64	.72
Able to return to previous occupation, n (%)	16 (100%)	13 (93%)	.30
Able to return to preinjury level of sports or performing arts, n (%)	16 (100%)	13 (93%)	.30
Patient satisfaction, n (%)			.89
Very satisfied	14 (87%)	12 (86%)	
Satisfied	2 (13%)	2 (14%)	
Neither satisfied nor dissatisfied	0 (0%)	0 (0%)	
Dissatisfied	0 (0%)	0 (0%)	
Patients who would have the surgery again, n (%)	16 (100%)	14 (100%)	-
*Quick*DASH score (range)	3.18 (0–18)	3.57 (0–16)	.42
*Quick*DASH work module score (range)	3.84 (0–13)	0	.10
*Quick*DASH sports or performing arts module (range)	3.37 (0–13)	6.94 (0–25)	.31

QuickDASH, Quick Disabilities of the Arm, Shoulder, and Hand.

across the MCP joint. Major and minor complications were recorded for each patient. Major complications were defined as repair failure, infection, or reoperation. Minor complications were neuropraxia or trigger thumb.

Patients were contacted by telephone to obtain functional outcome and patient satisfaction scores. We recorded visual analog scale pain scores; Quick Disabilities of the Arm, Shoulder, and Hand (*Quick*DASH) scores; and information related to return to work and return to sport status. The *Quick*DASH has been used previously used to evaluate outcomes following surgical repair of UCL injuries.[19,20] The minimally clinically important difference for *Quick*DASH scores in upper-extremity patients has been reported to be approximately 7 to 14.[21,22]

Statistics

Descriptive statistics were reported for categorical variables as the frequency with percentage, while continuous variables were reported as the mean with standard deviation. The chi-square test or Student *t* test was used to determine statistically significant differences in percentage-based or mean characteristics at baseline between the acute and chronic groups. Differences with a *P* value <.05 were considered statistically significant. Our primary outcome measure was the postoperative *Quick*DASH score at the time of final follow-up. With no statistically significant differences noted between the 2 groups with respect to postoperative *Quick*DASH scores, we performed a post hoc power analysis. Given the sample sizes and proportions for this study design, power was 25% (alpha = 0.05).

Results

A total of 36 patients met the inclusion criteria: 19 in the acute group and 17 in the chronic group. Table 1 outlines the baseline demographics for all patients included in our analysis. The average follow-up times were 3.5 years in the acute group and 38.1 months in the chronic group. Table 1 also illustrates the baseline injury information for patients in both groups. The mean time from injury to surgery was 13 days (range, 4–37 days) for patients in the acute group and 18.6 months (range, 2.4–188 months) for patients in the chronic group ($P = .04$).

Outcomes

Outcomes following surgery are presented in Table 2. Overall, 16 (84%) patients in the acute group and 14 (82%) patients in the chronic group completed functional outcome measures and patient satisfaction scores. The mean postoperative *Quick*DASH scores were 3.2 in the acute group and 3.6 in the chronic group ($P = .42$). Both groups were similar with respect to postoperative visual analog

Table 3
Complications After Primary Repair of the UCL in Patients With Acute and Chronic Injuries

Complications	Acute (n = 19)	Chronic (n = 17)	*P* Value
Complications, n (%)	5 (26%)	3 (17%)	.53
Major			
Repair failure, n (%)	0 (0%)	1 (6%)	
Infection, n (%)	0 (0%)	0 (0%)	
Reoperation, n (%)	0 (0%)	0 (0%)	
Minor			
Ulnar digital nerve neuropraxia, n (%)	5 (26%)	0 (0%)	
Trigger thumb, n (%)	0 (0%)	1 (6%)	

scale pain scores, patient satisfaction, and return to work or sport status, as noted in Table 2. All patients in the acute and chronic groups stated that they would undergo surgical treatment again given the option to do so.

Complications

Major and minor complications for both groups are presented in Table 3. Major or minor complications between the 2 groups were similar, as noted in Table 3 ($P = .53$). There was 1 major complication (reinjury) in the chronic group. This patient was an 18-year-old male who sustained a chronic UCL injury and reinjured his thumb UCL less than 1 year after treatment during a football game. He refused further operative intervention. No other patient had evidence of recurrent instability as determined by physical examination with valgus stress at the time of the final in-person follow-up. Four patients (21%) in the acute group had a postoperative neuropraxic injury to the ulnar digital nerve to the thumb. This resolved by 6 weeks postoperatively in all 4 patients. There were no infections and no patient underwent reoperation.

Discussion

Both acute and chronic injuries to the thumb UCL can cause pain and instability with pinch grip. Primary ligament repair with suture anchors for treatment of acute UCL injuries is well described and has shown good functional outcomes and high patient satisfaction.[6] However, disagreements remain on the success of primary ligament repair for chronic injuries.[14,15] Of the patients who completed outcome measures in this study, 36 (100%) acute and chronic patients reported being satisfied, with 14 (87%) acute and 12 (86%) chronic patients being very satisfied with their outcome. Similarly, Zeman et al[6] found that 98% of the 45 patients with acute UCL injuries repaired with a proximal suture anchor were satisfied with their result and would choose to undergo surgery again. The results of similar techniques for chronic UCL injuries have been reported less frequently but with comparable results.[16]

We noted high levels of return to work or sport, with 100% of acute UCL patients reporting a return to previous occupations or the preinjury level of sports participation, compared with 93% of chronic UCL patients. Recent investigations propose augmenting primary repair with suture tape, as it may be a stronger repair and expedite a return to activity.[9,23,24] In a study assessing the return of athletes to sports after primary UCL repair augmented with suture tape, 100% of patients returned to sports.[9] Those who sustained in-season injuries returned to activity in under 5 weeks, which is earlier than previously recommended.[9] Additional studies are required to assess the balance between a potential earlier return versus implant costs.

We found similarly low rates of complications for primary repair in both acute and chronic UCL cases. Only 1 case experienced repair failure and instability, which was sustained during a football game 1 year after treatment. Patients experienced limited minor complications as well. After primary repair, 26% of acute cases developed neurapraxia and 1 chronic case developed trigger thumb. Neurapraxia is common with repairs and consistent with most postoperative findings.[16,25,26] Christensen et al[16] reported that 31% of chronic UCL injury patients had numbness of the thumb at an average of 25 years of follow-up. Likewise, a study assessing acute UCL tears in 127 patients over 10 years found neurapraxia was the most common surgical complication.[23]

Limitations of our study include its retrospective design, which relies on the accuracy of documentation in the electronic medical record. However, these data are from an institution with detailed electronic medical records, which made them easily verifiable. Additionally, this specific data set was limited and may not be generalizable to a larger population or replicable in further studies. While our primary endpoint was *Quick*DASH scores, our series is limited by a lack of objective postoperative range-of-motion measurements. In addition, we did not obtain preoperative *Quick*DASH scores for all patients. All patients were treated by a single surgeon (J.C.K.), and these results may not be generalizable to all surgeons. Additionally, despite similarities between the 2 groups with respect to patient-reported outcome measures, our study design was likely underpowered to detect statistically significant differences between these 2 groups based on our post hoc power analysis.

Patients with both acute and chronic injuries to the thumb UCL have similarly good functional outcomes, postoperative pain, and patient satisfaction after treatment with primary repair of the ligament with local tissue and suture anchors. Primary suture anchor repair without ligament reconstruction or suture augmentation appears to be a safe and effective treatment option for patients' thumb UCL injuries, even in the chronic setting.

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