Structural Restoration of the Medial Collateral Ligament Using Cubital Tunnel Retinaculum in Stiff Elbow Instability

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To the Editor: Instable elbow results from overuse and trauma. It brings pain and weakness to patients.[1] There are three major considerations in treating this disease: central bone stability, lateral ligament stability, and medial ligament stability.[2] The medial ligament includes the anterior, posterior, and transverse bundles.[3] Its injury usually results from a valgus force and leads to medial instability, heterotopic ossification (HO) formation, and reduced elbow performance score, especially in elbow stiffness.[4] Worse still, the persistent instable state eventually causes ulnar nerve irritation and irreversible motor and sensory loss.[5] Therefore, it is very important and urgent to restore normal medial collateral ligament (MCL) structure and elbow stability. There is no consensus as to the standard protocol for elbow stability reconstruction, especially for the medial ligament. For acute ligament injury and ligament rupture, impaired ligaments can be reattached using either anchor or transosseous sutures.[6] For chronic ligament injury and large ligament defects, either tendon graft or flexor-pronator fascia patch has been proven to be effective for providing sufficient elbow stability.[7] These solutions have their own deficits. Direct suture or anchor suture may lead to secondary rupture due to high tension. Tendon graft causes damage to the donor site. Fascia patch cannot provide enough mechanical strength and may compromise muscle power. Therefore, this study proposed a new technique using cubital tunnel retinaculum (CTR) with suture anchor to rebuild normal MCL architecture in elbow stiffness patients.

The study was conducted in accordance with the *Declaration of Helsinki* and was approved by the Ethics Committee of Shanghai Jiao Tong University Affiliated Sixth People's Hospital. Informed written consent was obtained from all patients before their enrollment in this study. The inclusion criteria of this study were as follows: (1) elbow range of motion (ROM) <100°, (2) moderate size of MCL defects or potential MCL defects from surgical release intraoperatively, and (3) MCL repair using CTR. The exclusion criteria were as follows: (1) complete MCL preoperatively or no MCL removal intraoperatively, (2) cubitus valgus or varus, or (3) severe bony instability or malformation.

Eight patients (three males and five females) who received elbow open arthrolysis and MCL repair using CTR in 2017 were retrospectively analyzed. The average age of these patients was 33 years (range: 23–52 years), and the average restriction time was 20 months (range: 11–41 months). In all cases, five patients injured their left sides and three patients injured their right sides. Previous treatments included open reduction and internal fixation in five cases and cast immobilization in three cases. No patient received previous elbow arthrolysis in another institution. Preoperative extension was 40° in average (ranging from 20° to 60°). Preoperative flexion was 90° in average (ranging from 60° to 110°). The mean ROM was 50° (ranging from 30° to 70°). Preoperative average supination was 49° (ranging from 30° to 90°). Preoperative average pronation was 60° (ranging from 30° to 90°). The Mayo Elbow Performance Score (MEPS) was 71 in average (ranging from 65 to 80). Five patients displayed ulnar nerve symptoms by showing ring and little finger numbness. Grip strength varied in all patients, from 20.5 kg to 35.5 kg (26.4 kg in average). HO was evaluated using the X-rays according to the Hastings grading system. Two patients displayed Grade II HO, and one patient displayed Grade III HO. The others showed no positive HO radiographically.

A combined medial and lateral approach or the original approach was used in the previous surgeries. The ulnar nerve was exposed, released, transposed subcutaneously, and protected by a sterile gauze. In this process, CTR was carefully dissected. Then, the olecranon fossa was exposed, and abnormal callus, spur, or ectopic bone was removed. In addition, the posterior capsule was removed. Triceps muscle was split and separated bluntly to improve elbow flexion. In some patients, posterior MCL (PMCL) was released to restore elbow ROM. Valgus stress test was used to evaluate medial elbow stability. Positive findings, such as persistent pain and increasing opening angle of the medial elbow, implicated the occurrence of an instable elbow. Moderate instability refers

Access this article online
Quick Response Code:
Website: www.cmj.org
DOI: 10.4103/0366-6999.244115

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Received: 25-07-2018 **Edited by:** Xin Chen
How to cite this article: Qian Y, Liu WJ, Wang W, Fan CY. Structural Restoration of the Medial Collateral Ligament Using Cubital Tunnel Retinaculum in Stiff Elbow Instability. Chin Med J 2018;131:2608-10.

to valgus laxity <10°, and severe instability refers to valgus laxity ≥10°. In this study, the insufficient stability was confirmed by valgus stress test, and therefore, PMCL was reconstructed in all patients. After proper elbow release, the moderate PMCL defect (at least 10 mm in length) could not be sutured directly under proper tension. Therefore, CTR was used to repair the defect. A caliper was used to measure the CTR size. It was 20 mm long, 10 mm wide, and 2 mm thick in average. Its size ranged within a limited area due to different conditions. The origin of CTR at the posterior and distal most site of the medial epicondyle was kept, and the other end at the posteromedial site of the olecranon was cutoff [Figure 1a]. The isometric point from elbow extreme flexion to extension in the medial epicondyle was located. A bone channel was drilled using 2.0-mm Kirschner wire. Then, a suture anchor (Smith and Nephew, Andover, MA, USA) was placed into the bone channel at the isometric point for repairing MCL. The CTR was folded obliquely and sutured using the anchor for the PMCL defect [Figure 1b]. During this process, the elbow was positioned in a 90° angle to achieve appropriate tension. The CTR was used as a patch and PMCL was reconstructed to restore medial stability. For the lateral side, a classic Kocher approach was performed. The extensor carpi ulnaris and anconeus were split and revealed. The lateral collateral ligament was cutoff in four patients and repaired using suture anchor. It was left untouched in the other four patients. Drainage was placed before suturing muscles, subcutaneous layer, and skin, respectively. A distal radius-positioned hinged external fixator (Orthofix, Lewisville, TX, USA) was also applied in all patients to strengthen elbow motion and stability.

On day 1 after surgery, all patients were required to start active and passive elbow motion training under the assistance and supervision. All the patients should achieve extension of 0° and flexion of 130° under active and passive motion. They received X-ray examination to confirm elbow structural restoration on postoperative day 1. Patients took celecoxib (100 mg, twice per day) for HO prevention for 6 weeks. We screened the elbows after fixator removal to see any fracture or HO occurrence. During follow-up visits, ROM, MEPS, elbow stability, radiographic results, nerve symptoms, and complications were evaluated. The preoperative and postoperative ROM and MEPS were compared using the paired *t*-test.

The follow-up time was 12.3 months in average (ranging from 10 to 14 months). Patients were evaluated every 2–3 months. At final follow-up, the average extension improved from 40° to 11° (ranging from 0° to 20°, $P < 0.05$). The average flexion improved from 90° to 129° (ranging from 120° to 135°, $P < 0.05$). The average supination improved from 49° to 77° (ranging from 45° to 90°, $P < 0.05$). The average pronation improved from 60° to 79° (ranging from 60° to 90°, $P < 0.05$). The ROM increased from 50° to 118° (ranging from 105° to 130°, $P < 0.05$). All patients displayed elbow stability at final follow-up. The average MEPS increased

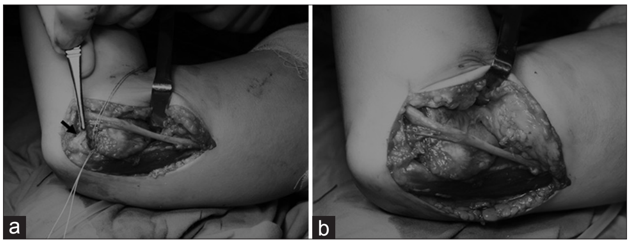

Figure 1: Cubital tunnel retinaculum (black arrow) was dissected at the distal end of the olecranon (a). Suture anchoring cubital tunnel retinaculum for posterior medial collateral ligament reconstruction (b).

from 71 to 96 (ranging from 85 to 100, $P < 0.05$). The X-rays from all patients were evaluated. Only one patient displayed Grade I HO recurrence without functional restrictions radiographically. Two patients had recurrent mild ulnar nerve symptoms by Amadio score. The average score was 8.8 (ranging from 8.0 to 9.0). The severity could not interrupt their daily life. For grip strength, all patients showed significant regain of power grip, from 26.4 kg to 34.0 kg (ranging from 28.5 kg to 43 kg, $P < 0.05$).

MCL is composed of anterior MCL, posterior bundle, and transverse ligament. In stiff elbow, the thickened tissue sometimes is injured itself or prevents surgeons from debriding HO inside the MCL structure. Furthermore, it significantly restricts elbow flexion activity in elbow stiffness. Therefore, it is vital to restore medial elbow stability and normal ROM by reconstructing MCL using an effective and innocent method. In this study, we repaired PMCL to restore MCL and elbow stability because the CTR was adjacent to PMCL anatomically and was comparable to PMCL in size and elasticity. PMCL repair in combination with suture anchor showed satisfactory outcomes in elbow stability among these patients during follow-up period.

It is easy to suture ruptured MCL directly for insignificant defects. However, for moderate MCL defects, surgeons have to use autologous grafts. Schwab *et al*.[8] performed anterior oblique ligament transplantation. Nevertheless, this technique is scarcely used now due to the inaccurate isometric positioning of the weakened ligament in comparison with its original location. More importantly, it compromises elbow functional motions as the elbow becomes stiffer. Chen *et al*.[7] performed flexor-pronator fascia patch transfer in the reconstruction of MCL in patients with elbow stiffness. This technique was generally effective to the patients because most patients showed relatively stable and functional elbow activity. However, it compromised the grip strength as they showed a significant decrease in power grip postoperatively, about 5 kg loss in average. At present, palmaris longus tendon is often used for MCL repair. However, it caused extended operation time and increased operative morbidity because it could risk the median nerve during tendon exposure.[9] Triceps tendon fascia was used to repair MCL defect and proved to be sufficient in some studies. Nevertheless, the fascia graft was not appropriate since it might lead to HO and could not support long-term stability due to its atrophy and contraction.[10] In other cases, surgeons also used tendon grafts from contralateral arm or lower limb. However, the results were far from satisfactory due to extensive damage to the donor sites, including pain, vast scars, and vascular and neural injuries.

There are some limitations in this study. First, the sample size was relatively small. Second, the study was retrospective without control groups. Third, the mechanical property of CTR was lacking. In the future, we will compare biomechanical characteristics between CTR and other grafts. In conclusion, CTR is appropriate for repairing moderate MCL defects and restoring medial elbow stability. It helps patients regain functional elbow motion and grip strength with postoperative functional rehabilitation in elbow stiffness.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Ring D. Editorial comment: Traumatic elbow instability and its sequelae. Clin Orthop Relat Res 2014;472:2035-6. doi: 10.1007/s11999-014-3599-5.

2. Hausman MR, Lang P. Examination of the elbow: Current concepts. J Hand Surg Am 2014;39:2534-41. doi: 10.1016/j.jhsa.2014.04.028.
3. Floris S, Olsen BS, Dalstra M, Søjbjerg JO, Sneppen O. The medial collateral ligament of the elbow joint: Anatomy and kinematics. J Shoulder Elbow Surg 1998;7:345-51. doi: 10.1016/S1058-2746(98)90021-0.
4. Lee YS, Alcid JG, McGarry MH, ElAttrache NS, Lee TQ. Effect of olecranon resection on joint stability and strain of the medial ulnar collateral ligament. Orthopedics 2008;31:648. doi: 10.3928/01477447-20080901-39.
5. Thompson WH, Jobe FW, Yocum LA, Pink MM. Ulnar collateral ligament reconstruction in athletes: Muscle-splitting approach without transposition of the ulnar nerve. J Shoulder Elbow Surg 2001;10:152-7. doi: 10.1067/mse.2001.112881.
6. Lee YC, Eng K, Keogh A, McLean JM, Bain GI. Repair of the acutely unstable elbow: Use of tensionable anchors. Tech Hand Up Extrem Surg 2012;16:225-9. doi: 10.1097/BTH.0b013e31826cef1c.
7. Chen S, Yan H, Wang W, Zhang M, Hildebrand KA, Fan CY. Reconstruction of medial collateral ligament defects with a flexor-pronator fascia patch in complete open release of stiff elbows. J Shoulder Elbow Surg 2017;26:133-9. doi: 10.1016/j.jse.2016.09.030.
8. Schwab GH, Bennett JB, Woods GW, Tullos HS. Biomechanics of elbow instability: The role of the medial collateral ligament. Clin Orthop Relat Res 1980;146:42-52.
9. Vastamäki M. Median nerve as free tendon graft. J Hand Surg Br 1987;12:187-8. doi: 10.1016/0266-7681(87)90010-6.
10. Olsen BS, Søjbjerg JO. The treatment of recurrent posterolateral instability of the elbow. J Bone Joint Surg Br 2003;85:342-6. doi: 10.1302/0301-620X.85B3.13669.