

Acute Total Ulnar Collateral Ligament Injuries of Thumb – Primary Repair with Mini Soft Suture Anchor (JuggerKnot™)

Akutní poranění postranního ulnárního vazy základního kloubu palce – primární ošetření suturou pomocí měkké mini kotvy (JuggerKnot™)

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ABSTRACT

PURPOSE OF THE STUDY

We aimed to investigate the functional outcomes and complications of a new approach, the primary UCL repair using JuggerKnot™ Soft Anchor–1.0 mm Mini (Zimmer-Biomet).

MATERIAL AND METHODS

This study included a total of 12 patients with acute UCL injury who were operated with primary repair with JuggerKnot™ Soft Anchor–1.0 mm Mini between January 2012 and September 2016. All patients were operated on using the same surgical technique. The thumb pinch and grip strengths, articular range of motion, and Glickel functional score were recorded for all patients. The pinch grip strength and articular range of motion were compared with the intact side. Early and late postoperative complications were recorded.

RESULTS

The mean follow-up time was 22.2 months (range 6–54 months). The grip strength and the pinch strength were 94.3% and 92.27%, respectively, of the contralateral side. Articular range of motion attained the same level as the contralateral side in all patients at the final visit, and no patient suffered from any complication. The patients returned to work at a mean of 5.45 weeks, and the Glickel score was good in 1 patient and excellent in the remainder 11 patients.

CONCLUSIONS

Surgical repair using the JuggerKnot™ Soft Anchor–1.0 mm is an effective alternative treatment method for acute total ulnar collateral ligament (UCL) rupture.

Key words: ulnar collateral ligament, acute total injury, thumb, soft suture anchor, JuggerKnot™.

INTRODUCTION

Ulnar collateral ligament (UCL) is the most important stabilizer protecting the thumb against valgus stress (22). Its injuries are typically seen as a result of valgus overloading after falls on an open hand or sport trauma (15). Patients usually present to emergency department with pain and swelling on the ulnar aspect of the thumb.

The diagnosis is made by valgus loading, which demonstrates thumb angulation over 35° upon extension (Fig. 1–2) and over 15° upon 30° flexion compared to the contralateral side (12). Plain films are useful for differentiating bone avulsion accompanying the injury. Injuries most commonly occur from the level of proximal phalanx where the ligament has distal attachment (16).

Plaster immobilization is the preferred treatment for partial UCL rupture whereas conservatively managed total rupture may result in permanent instability of thumb as well as arthrosis of the metacarpophalangeal (MCP) joint in the long term (5–7–21). Therefore, surgical repair is recommended as the first-line approach

for total UCL ruptures (20). Surgery is mostly recommended for avulsion injuries (Stener lesion) (15).

Various fixation techniques and materials such as suture anchor, Kirschner wires, and direct repair have been described for primary surgical repair of UCL (7–16–19, 20). All these techniques have their own technical challenges and all are open to some form of complications. Fixation of osseous avulsion fractures with K wires is complicated by pin track infections and osteomyelitis, and repair with anchors with a classical metal and bio-material content may result in complications including foreign body reactions, migration, and chondrolysis (2–9, 10).

The new generation all-soft anchors are suture based anchors entirely composed of polyethylene, which minimize the amount of foreign material in bone by leaving only suture material behind, and are therefore considered least prone to complications. By conducting this study we aimed to assess clinical functional outcomes and



Fig. 1. (A, B) Medial instability of thumb is seen on preoperative X-rays. (C) UCL disruption is seen on (orange arrow) T1 coronal MR sequence.

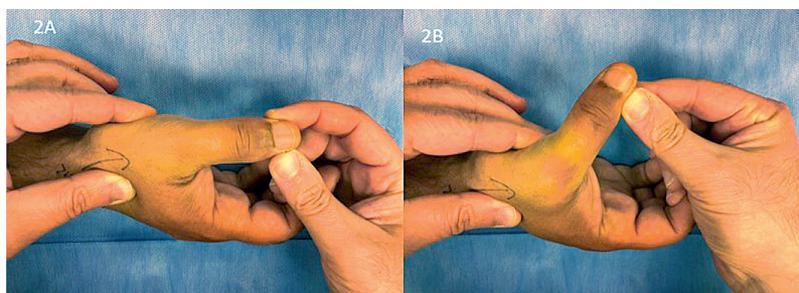


Fig. 2. (A) Medial instability of thumb is seen on clinically. (B) Thumb was angulated approximately 45°.



Fig. 3. (A–D) Gradual angulation was noted on flouroscopy during surgery.

complications of acute UCL repair using an all-soft anchor, the JuggerKnot (Zimmer Biomed, Warsaw, IN).

MATERIAL AND METHODS

We enrolled a total of 12 patients presenting to our hospital with acute UCL rupture, who were operated

with primary repair using JuggerKnot™ Soft Anchor–1.0 mm Mini between January 2014 and September 2016. All patients provided informed consent. Age, sex, information about the injured and dominant sides, and the day from injury to operation were recorded. Plain films of all patients were examined. The presence of avulsion fractures and additional osseous pathologies of hand were recorded. Patients with isolated total UCL rupture were enrolled. Patients with partial UCL rupture and those with a osseous lesion (Stener lesions) accompanying UCL rupture were excluded.

The diagnosis of total UCL rupture was made by history, physical examination, and radiological assessment (Fig. 3). Physical examination indicating pain, swelling, ecchymosis in the first MCP joint in addition to stress films demonstrating valgus angulation over 15° upon 30° flexion were considered sufficient for making the diagnosis of UCL rupture. MR imaging was used to confirm the diagnosis.

All patients were operated on using the same surgical technique. Stability check was done at surgery in all patients. The affected thumb was compared with the contralateral thumb for a functional postoperative assessment. At the final visit, handgrip strength was assessed by a hand dynamometer and pinch strength by a Pinch gauge. MCP joint flexion value at the eighth week and at the final visit, complications, and time to return to work were recorded. At the final control visit, all patients were assessed with a scoring system used for rating functional outcomes of thumb, which was described by Glickel et al. (11).

Statistical analysis

Kolmogorov-Smirnov test was used for distribution of the variables and descriptive statistical analysis. Student's t test was used in analysis of the differences between the groups with normally distributed data while comparison between the non-normally distributed data were analyzed by Mann-Whitney U test. Alpha significance level was accepted 0.05 and all the tests performed were two-tailed tests.

Surgical technique

All patients were prepared under tourniquet, either under general anesthesia or supraclavicular block anesthesia. An S incision with an average length of 4 cm was done to the medial aspect of the MCP joint of the thumb (Fig. 4). The incision was extended until the adductor aponeurosis was reached, and the digital dorsal

ulnar sensorial nerve was exposed and retracted dorsally. In order to expose the ends of UCL and its attachments, the aponeurosis and the joint capsule were opened. The ends of UCL were evaluated, a marking suture was placed to its distal part, and it was retracted. Then, the point where UCL is detached from the base of the proximal phalanx distally is accessed, cleaned, and revived. First, an anchor hole perpendicular to the proximal phalanx was opened with the own drill of the anchor. The soft anchor loaded on an anchor placer was gently driven into the hole with the help of a hammer by taking care to remain it at the same angle. Then, the anchor sender was removed, and the anchor was hoisted from the free strings to make it stuck and seat firmly in the tunnel inside the bone. The stability check was performed after this stage. Pull out was checked. UCL was held with matrix sutures and fixed into the bone with the freed 3.0 sutures. Then, joint capsule and skin were closed with a 4.0 suture. A splint with thumb support holding thumb in neutral position was applied and the procedure was completed. All patients were discharged the next day after the procedure. After edema was resolved, a plastazote splint with short thumb support holding thumb in neutral position and allowing IP joint motion was applied to all patients. Finger IP joint motion was started immediately. At the second week the splint was intermittently removed and MP joint flexion, extension, and adduction were allowed; and at the fourth week the splint was completely removed and finger abduction was allowed.

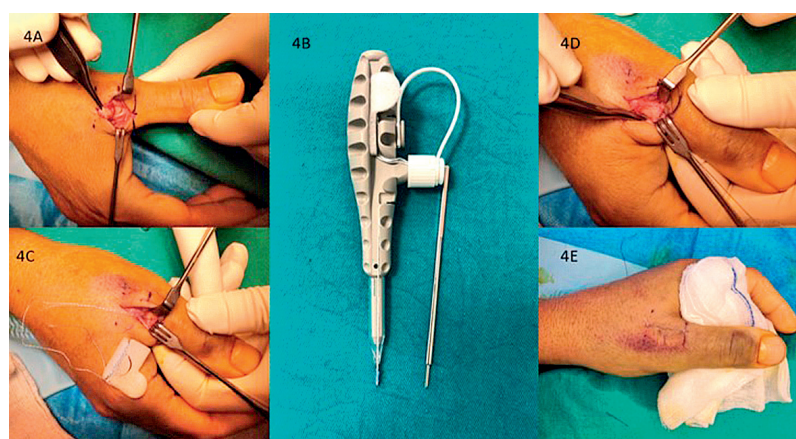


Fig. 4. (A) UCL rupture was seen by dorsomedial incision. All-soft suture anchor (E) was applied on incision of UCL (B). (C) UCL was checked after surgery. (D) Skin closure was provided by absorbable intracutaneous sutures.

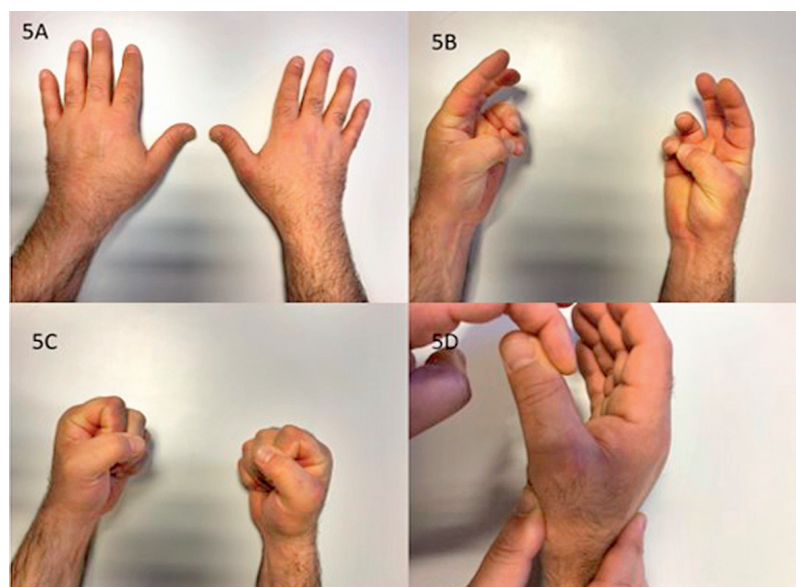


Fig. 5. Last clinical control view of a patient. (A, B) Full abduction and opposition had gained (C) Grip function was similar with other hand. (D) No medial instability was seen at examination.

RESULTS

The age range of the patients was 21–54 years (mean 38.2 years; male/female ratio 8/4). Nine patients had right-sided and 3 patients had left-sided UCL injury (10 dominant, 2 non-dominant). The patients were operated on after an average of 6.2 days (range 2–10 days). The mean follow-up time was 22.2 months (range 6–54 months). All injuries occurred after falling on open hand.

MCP joint flexion degree was on average 43.5° (range 35°–50°) at the 8th week and 45.2° (range 40°–50°) at the final visit (Fig. 5). When compared with the intact side, the tip pinch strength was measured 92.27% and the grip strength was measured 94.3% at the final visit. As for the Glickel functional scores, one patient had a good score and 11 patients had an excellent score. None of the patients was found to have instability at the final visit.

The mean time to return to work was 5.45 weeks (range 4–7 weeks). None of the patients suffered from any complication that would require additional therapy or hospital admission.

Table 1. Results of treatment after last clinical control

Age	38.2 (21–54)
Male/Female	8/4
Time to surgery (Days)	6.2 (2–10)
Mean follow-up time (months)	22.2 (6–54)
Glickel score (Excellent/good)	11/1
Time to return to work (weeks)	5.45 (4–7)
Complication	0

DISCUSSION

Although several studies have reported conservative treatment methods to yield acceptable results for acute total UCL ruptures, Bowers et al. reported conservative treatment to have a failure rate of 50% for acute total UCL rupture (14). Among 26 patients with total UCL rupture, Engel et al. obtained satisfactory results for 16 patients treated surgically whereas 10 patients treated conservatively suffered from pain and instability (8). Persistent instability and associated arthritis following conservative therapy have made primary repair the preferred treatment modality for the management of acute total UCL ruptures. We did not observe persistent instability in any of our surgically managed cases.

Several repair techniques and materials have been reported for UCL ruptures, the major ones including Kirschner wires, intraosseous pull out sutures, suture anchors made of metal or various biomaterials, and suture-free Pushlock anchors (13, 14–17–19).

Several studies have reported UCL repair with anchors, the fixation materials with biomechanically proven efficacy for fixation of soft tissues to bony structures, which are widely used for shoulder surgery. In a 7-patient study where the outcomes of acute UCL rupture repair with Metallic anchor were retrospectively reviewed, Kozin et al. reported a mean of 21% loss in flexion and a mean of 97% loss in pinch strength but a mean of 96% reversal of handgrip strength compared to the contralateral side. One patient had an anchor prematurely detached during surgery, and another one experienced pull-out since the anchor was not properly seated during placement. However, no patient suffered from anchor irritation (16).

A study compared metallic anchor and pull out suture, where 38 patients were applied pull out suture and immobilization together with button, and 35 patients underwent repair with anchor and early mobilization. The pinch strength of the anchor applied patients was improved by 101% while the pull out suture technique provided an improvement of 95% compared to the contralateral side, and the difference between the two techniques was non-significant. MCP joint's range of motion was 97% of the contralateral finger in the anchor groups and 87% in the pull out suture group, and the difference between the two techniques was statistically significant. Three patients in the button group and two patients in the anchor group were administered antibiotherapy due to superficial erythema and infection, and it was stressed that this complication may lead to a reduced final range of motion (14).

Osteolysis and inflammatory reaction due to bioabsorbable anchors used particularly for the shoulder region have been frequently reported, and such reactions have also been reported in the finger region with the use of these materials (9). However, osteolysis and anchor reverse pull-out have been reported with metallic anchors in the finger region (10). JuggerKnot anchor is an all-suture fixation material that does not leave any metallic or composite material inside the bone. No study yet has ever reported a foreign granuloma or inflammatory

reaction with the JuggerKnot anchor, with its diameter as small as 1.0 mm and its structure being considered to have a role in this favorable property (1). We did not experience any similar complication, either.

Biomechanical comparisons between all-soft anchors used for labral fixation and chronic ankle instability and other anchor types have not produced significant differences (4–18). Although there have been no biochemical studies comparing all-soft anchors and other fixation techniques for use in UCL repair, a study comparing the resistive properties of tension band, K-wire, pull out wiring, and all-soft anchors in a mallet finger model with a large osseous fragment revealed that all-soft anchors yielded biomechanical results comparable with other methods although tension band technique was found to be the most resistive implant (6). Under the light of these studies, we may state that all-soft anchors provide sufficient strength for fixation.

There are some limitations of our study. First, our study was conducted in a small sample size. Second, no comparison was made with other treatment methods. On the other side, the strength of our study is that it is the first study to examine the efficacy of this fixation material in UCL injuries.

CONCLUSIONS

Treatment of primary repair of acute total UCL rupture can be difficult and complicated. Treatment with all-soft anchors is an effective treatment with high patient satisfaction and low complication rates. Surgeons may choose these implants safely as an alternative of repair. Larger studies are needed to compare this treatment method with other repair methods.

Level of evidence

Level 4; retrospective, multicenter, case control study

Abbreviations

UCL: ulnar collateral ligament

mm: millimeter

K: Kirschner

MCP: metacarpophalangeal

MR: magnetic resonance

IP: interphalangeal

Availability of supporting data and materials

Data sharing is not applicable to this article, as no data sets were generated or analysed during the study.

Conflict of interest

There is no conflict of interest in this study.

Authors' contributions

BG and AK planned the study and writing. HÇ and EK coordinated the study datas.. BGN and SÇ moderated and analysed the study. AK and SÇ applied the operations and took the photos and coordinated statistics.

Ethical approval

The medical ethics committee of the Istanbul Medipol University.(Istanbul-Turkey) approved this study with 10840098-604.01.01-E.21945 number. Consent to participate was obtained from the participants.

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