



A Comparative Study between Conservative and Surgical Treatments of Triangular Fibrocartilage Complex Injury of the Wrist with Distal Radius Fractures

Jemin Im, MD, Sung Jin Kang, MD, Seoung Joon Lee, MD

Department of Orthopaedic Surgery, Konkuk University Medical Center, Seoul, Korea

Background: Triangular fibrocartilage complex (TFCC) injury is common in distal radius fractures. The purpose of this study was to compare the conservative and surgical treatments of TFCC injury of the wrist associated with distal radius fractures.

Methods: A retrospective study was conducted on 39 patients who received treatment for TFCC injury with distal radius fractures. All patients were treated using a volar locking plate for distal radius fractures. Twenty-six patients who received conservative treatment for TFCC through long arm splinting were classified into group 1, and 13 patients who received surgical treatment for TFCC were classified into group 2. The splint was maintained for 6 weeks in both groups. For clinical evaluation, the range of motion (ROM) of the wrist joint, patient-rated wrist evaluation (PRWE) score, Disabilities of the Arm, Shoulder and Hand (DASH) score, and grip strength were measured. Distal radioulnar joint (DRUJ) stability was evaluated through a stress load test and graded between grade 0 and 3 intraoperatively after fixation and at the final follow-up.

Results: In group 1, the average DASH score was 11.1 ± 4.4 , the average PRWE score was 10.2 ± 4.6 , the grip strength was 89.4% relative to the unaffected side, the average ROM of the wrist joint was $65^\circ \pm 7.0^\circ$ for extension, $51.5^\circ \pm 8.1^\circ$ for flexion, $86^\circ \pm 5.1^\circ$ for supination, and $85^\circ \pm 5.2^\circ$ for pronation, and DRUJ stability at the final follow-up was grade 0 in 58.62%, grade 1 in 31.03%, grade 2 in 10.34%, and grade 3 in 0%. In group 2, the average DASH score was 13 ± 5.0 , the average PRWE score was 12.4 ± 3.7 , the grip strength was 87.3% relative to the unaffected side, and the average ROM of the wrist joint was $60^\circ \pm 9.8^\circ$ for extension, $53.1^\circ \pm 7.0^\circ$ for flexion, $85^\circ \pm 5.3^\circ$ for supination, and $86.8^\circ \pm 4.5^\circ$ for pronation. At the final follow-up, DRUJ stability was grade 0 in 66.67%, grade 1 in 25%, grade 2 in 8.3%, and grade 3 in 0%. The 2 groups showed no statistically significant differences in DASH score, PREW score, grip strength, ROM, and final follow-up DRUJ stability.

Conclusions: There were no statistically significant differences in the clinical outcomes between the surgical and conservative treatment groups. Therefore, when normal radiological indices are achieved after treatment of distal radius fractures, DRUJ stability can be obtained by conservative treatment.

Keywords: *Distal radius fracture, Triangular fibrocartilage complex injury, Surgical repair, Conservative treatment, Clinical outcome*

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Correspondence to: Seoung Joon Lee, MD

Department of Orthopaedic Surgery, Konkuk University Medical Center,
120-1 Neungdong-ro, Gwangjin-gu, Seoul 05030, Korea

Tel: +82-2-1588-1533, Fax: +82-2-2030-5009

E-mail: lsjmd@naver.com

Distal radius fractures are relatively common, and triangular fibrocartilage complex (TFCC) injury is a common injury of the soft tissue, which is reported to accompany the fractures in 39% to 84% of the cases.^{1,2)} According to the Palmer classification method, TFCC injury of Palmer type IB is known to cause instability of the distal radioulnar joint (DRUJ).³⁻⁵⁾ Furthermore, unless properly treated, in-

stability of the DRUJ is known to cause chronic pain in the wrist, reduction of grip strength, restriction of the range of motion (ROM) of the wrist joint, or early onset of arthritis. It is also known as a bad prognostic factor for distal radius fractures.⁶⁾ Therefore, a proper treatment of TFCC injury with distal radius fractures is required, and the treatment methods can be largely classified into surgical and conservative treatments.

For TFCC injury of the wrist with distal radius fractures, some researchers recommend open reduction and internal fixation and surgical repair of TFCC in active, young patients.^{7,8)} Other authors have reported that a good prognosis can be obtained by conservative treatment alone if a normal radiological index is obtained after open reduction and internal fixation for distal radius fractures.⁹⁾

Therefore, this study compares surgical treatment and conservative treatment of TFCC injury with distal radius fractures, using clinical indices including ROM of wrist joints, patient-rated wrist evaluation (PRWE) score, Disabilities of the Arm, Shoulder and Hand (DASH) score, grip strength, and DRUJ stability assessed intraoperatively and at the final outpatient follow-up.

METHODS

Subjects

This retrospective comparative study was performed after obtaining approval of the Ethics Committee of Konkuk University Medical Center (IRB No. 2020-05-040) on patients who underwent volar locking plate fixation for distal radius fractures and wrist arthroscopy to evaluate TFCC injury at our hospital between December 2015 and February 2017. All patients provided written informed consent. In order to rule out high-energy injury cases, the study included only patients with a distal radius fracture caused by a fall from standing height. The indications for open reduction and volar locking plating were as follows: volar or dorsal angulation > 15°, an articular gap or step-off > 2 mm, or radial shortening > 3 mm, and metaphyseal bone defect of the distal radius > 50%. The exclusion criteria were as follows: previous wrist operation, an open fracture, a concomitant fracture, inflammatory diseases, development of ulnar-sided wrist pain prior to the distal radius fracture, and DRUJ arthritis. We performed routinely wrist arthroscopy to evaluate the concomitant ligament injury or TFCC injury between December 2015 and February 2017. A total of 39 cases that were confirmed as TFCC Palmer IB tears with wrist arthroscopy were included in this study.¹⁰⁻¹⁴⁾

Surgical repair or conservative treatment of the TFCC was determined by the patient's informed decision. If instability of the DRUJ in the distal radius fracture was predicted through preoperative radiologic evaluation,¹⁵⁾ we explained to the patient that instability of the DRUJ may occur even after plate fixation. In this regard, we also explained that TFCC can be repaired simultaneously during distal radial fracture surgery or TFCC injury can be re-evaluated after conservative treatment and secondary surgery can be planned if DRUJ instability and symptoms such as pain occurs. The disadvantages of simultaneous TFCC repair during distal radius fracture fixation include prolongation of operation time, risk of infection, and cost increase; the advantage is the avoidance of a secondary surgery. Conservative treatment of TFCC injury requires an extension of the treatment period, but as TFCC injury can be resolved naturally, it has the advantage of reducing the operation time, reducing the cost, and avoiding additional surgical incisions. The above options were sufficiently explained to the patient, and surgical repair or conservative treatment was performed according to the patient's decision. Of the total 39 patients, 26 received conservative treatment for TFCC injury by long arm splinting in supination for 6 weeks, and 13 were treated for TFCC through surgical repair.

The group that received conservative treatment for TFCC injury (group 1) consisted of 14 men and 12 women; their average age was 60.4 years (range, 24–72 years) and the average follow-up period was 16 months (range, 10–24 months). The group that received surgical repair (group 2) consisted of 8 men and 5 women; their average age was 46.2 years (range, 21–60 years) and the average follow-up period was 14 months (range, 11–20 months) (Table 1).

Table 1. Demographic and Clinical Characteristics of the Patients

Variable	Group 1	Group 2
Number	26	13
Sex		
Male	14	8
Female	12	5
Age (yr)	60.4 (24–72)	46.2 (21–60)
Follow-up period (mo)	16 (10–24)	14 (11–20)

Values are presented as median (range).

Group 1: conservative treatment, Group 2: surgical repair.

Clinical Outcome

Clinical evaluation was performed by 1 inspector (SJL), using PRWE score, DASH score,¹⁶⁾ grip strength, and ROM of the wrist joint. The ROM of the joint was evaluated in flexion, extension, supination, and pronation. DRUJ stability was also assessed intraoperatively after fixation and at the final outpatient follow-up through the DRUJ stress test and classified as grade 0–3.

Radiologic Evaluation

The radiologic evaluation was also performed by 1 inspector (SJL). The subjects were classified by the AO classification method based on the time of fracture.¹⁷⁾ The radial length,¹⁸⁾ radial inclination, volar tilt,¹⁸⁾ and existence of an ulnar styloid process fracture were used as the radiological indices. The ulnar styloid process fractures were divided into tip or base depending on the anatomical position.¹⁹⁾ The radiologic indices were re-evaluated after operation.

Operative Method

Distal radius fractures were reduced using a volar approach and fixed with a volar locking compression plate (Acumed, Hillsboro, OR, USA) in all study subjects. If DRUJ instability was found after plate fixation, we performed wrist arthroscopy. A TFCC peripheral tear (Palmer IB) was considered to be present if a full-thickness peripheral discontinuity of the TFCC was noted or Hook test and trampoline test were positive (Fig. 1). The DRUJ portal is useful to check for a fovea tear, but we did not use the DRUJ portal due to technical difficulties and time constraints. We planned ulnar styloid fixation based on radiologic findings, including the location of fracture, fracture gap, and percentage of styloid involved.^{20,21)} We performed open direct TFCC repair and ulnar styloid fixation with a distal ulna system (Jeil Medical, Seoul, Korea) and an AO 2.0-mm LCP Distal Ulna Plate (DePuy Synthes, Raynham, MA, USA) for 6 cases with an ulnar styloid base fracture in group 2. Arthroscopic TFCC repair was performed through the transosseous technique²²⁾ for the other 7 cases

without an ulnar styloid base fracture in group 2. In the 2 groups, a long arm splint was applied for 6 weeks and active ROM of the wrist was initiated 6 weeks after surgery.

Statistical Analysis

Differences in the DASH score, PRWE score, grip strength, and ROM were compared between the 2 groups using the Wilcoxon rank sum test (SAS Institute Inc., Cary, NC, USA).

RESULTS

The average DASH score of group 1 and 2 was 11.1 ± 4.4 and 13 ± 5.0 , respectively; thus, group 2 showed a higher

Table 2. Comparison of Clinical Outcomes between the 2 Groups

Variable	Group 1	Group 2
DASH score	11.1 ± 4.4	13 ± 5.0
PRWE score	10.2 ± 4.6	12.4 ± 3.7
Range of motion		
Extension (°)	65 ± 7.0	60 ± 9.8
Flexion (°)	51.5 ± 8.1	53.1 ± 7.0
Supination (°)	86 ± 5.1	85 ± 5.3
Pronation (°)	85 ± 5.2	86.8 ± 4.5
Grip strength (%)	89.4	87.3
DRUJ stress		
0	17	8
1	9	3
2	3	1
3	0	0

Values are presented as mean \pm standard deviation.

Group 1: conservative treatment, Group 2: surgical repair, DASH: Disabilities of the Arm, Shoulder and Hand, PRWE: patient-rated wrist evaluation, DRUJ: distal radioulnar joint.

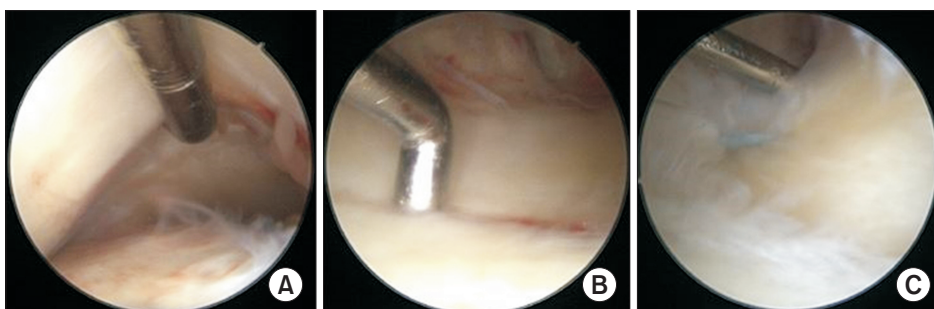


Fig. 1. (A) Hook test through arthroscopic examination. (B) Trampoline test through arthroscopic examination. (C) We performed arthroscopic triangular fibrocartilage complex repair for 7 cases without ulnar styloid base fractures.

value. However, the DASH score and PRWE score did not show statistically significant differences between group 1 and 2. The grip strength of the affected side relative to the unaffected side was 89.4% and 87.3% for group 1 and 2, respectively. Although group 1 showed a higher value, the difference was statistically insignificant. The average ROM of the wrist joint was $65^\circ \pm 7.0^\circ$ for extension, $51.5^\circ \pm 8.1^\circ$ for flexion, $86^\circ \pm 5.1^\circ$ for supination, and $85^\circ \pm 5.2^\circ$ for pronation in group 1; $60^\circ \pm 9.8^\circ$ for extension, $53.1^\circ \pm 7.0^\circ$ for flexion, $85^\circ \pm 5.3^\circ$ for supination, and $86.8^\circ \pm 4.5^\circ$ for pronation in group 2. The differences between the 2 groups were statistically insignificant.

In the stress load test of the DRUJ at the final follow-up, group 1 showed grade 0 in 17 cases (58.62%), grade 1 in 9 cases (31.03%), grade 2 in 3 cases (10.34%), and grade 3 in none of the cases. Group 2 showed grade 0 in 8 cases (66.67%), grade 1 in 3 cases (25%), grade 2 in 1 case (8.3%), and grade 3 in none of the cases. The differences between the 2 groups were statistically insignificant (Table 2). Furthermore, the 2 groups did not show significant differences in the radiological indices, including radial inclination, volar angulation, and ulnar variance after operation.

DISCUSSION

Many authors have recommended surgical repair of the TFCC in distal radius fractures to prevent the adverse effect of instability of the DRUJ and ulnar side wrist pain. They claim that stability of the DRUJ can be achieved even if the joint motion is started 1 week after surgery, given suture of the TFCC or internal fixation of the ulnar styloid process fracture is performed together with the internal fixation of the distal radius fracture. Surgical repair of the TFCC is also recommended for the advantage of fast post-operative rehabilitation.²³⁾ By contrast, authors who recommend conservative treatment have reported that long arm splinting for 1 month after internal fixation of the distal radius fracture with instability of the DRUJ could result in satisfactory outcome without instability, pain, or reduced functionality at 1-year follow-up.²⁴⁾

Many studies have suggested either surgical treatment or conservative treatment based on follow-up observation results with no controls, and injury of the TFCC has been evaluated through a physical examination of the DRUJ alone. In the present study, TFCC injury with a distal radius fracture was diagnosed through wrist arthroscopy and clinical outcomes of surgical treatment and conservative treatment of the TFCC were compared by as-

sessing the PRWE score, DASH score, grip strength, ROM of the wrist joint, and instability of the DRUJ.

The present study has significance in the following aspects. First, it compared the outcomes of surgical treatment of TFCC injury with distal radius fractures and those of conservative treatment as a control. Second, the injury of the ulnar side peripheral TFCC was diagnosed via arthroscopic examination rather than indirectly through radiological indices or physical examination. In other words, the injury of the ulnar side peripheral TFCC was directly diagnosed through arthroscopy, which has the advantage of ensuring diagnostic certainty. This is meaningful because it provides the basis for conservative treatment in the existence of an ulnar styloid process base fracture, DRUJ gap, dislocation of the DRUJ, or instability of the DRUJ, which suggest injury of the ulnar side peripheral TFCC.

This study has limitations. First, there was no specific indications for selecting surgical treatment and conservative treatment groups. The pros and cons of surgical and conservative treatment were explained to patients, and TFCC surgical repair was determined by the patient's informed decision. Second, there was notable difference in the average age between the 2 groups. As TFCC repair was performed according to the patient's decision, the groups were not matched for age, resulting in the age difference between groups. Third, the study was conducted in a retrospective manner and the clinical measurement could have been affected by the skill and experience of the examiner. Last, the number of subjects was relatively small, which needs to be supplemented in future research.

In this study, there were no statistically significant differences in the clinical outcomes between the surgical and conservative treatment groups. This study also showed that stability of the DRUJ can be obtained with splinting treatment alone. Therefore, we think that when treating distal radius fractures, it is crucial to evaluate the possibility of TFCC injury and instability of the DRUJ and to restore the radiological indices through open reduction and internal fixation. And when the radiological indices are recovered after treatment of distal radius fractures, stability of the radioulnar joint can be obtained by long arm splinting.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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