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Functional Outcomes and Discomfort Following Different Treatment Modalities for Rockwood Type III Acromioclavicular Joint Injuries

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ABSTRACT

Objective: There is no consensus for the optimal treatment method for Rockwood type III acromioclavicular (AC) injuries. The aim of the study is to compare treatment methods in terms of functional scores and patient discomfort.

Materials and Methods: In this retrospective cohort study, patients with Rockwood type III AC joint injuries treated either conservatively or surgically between 2022 and 2024 were evaluated. Patients were categorized based on treatment modality (conservative vs. surgical) with an exploratory subgroup analysis comparing hook plate and suture-button fixation within the surgically treated cohort. The QuickDASH scores and results of a questionnaire evaluating overall discomfort rates, activities provoking discomfort, and presence of persistent pain were compared between the groups after a 12-month follow-up period.

Results: A total of 53 patients (age 39.2±12.7, 79.2% male) were evaluated. A total of 21 patients (39.6%) were treated conservatively and 32 (60.4%) surgically, including 15 with hook plate and 17 with suture-button fixation. Conservative and surgery groups showed no statistically significant differences in median QuickDASH scores (p=0.235) or questionnaire results (p>0.05) at 12 months postoperatively. In the exploratory subgroup analysis, no significant differences could be detected between median QuickDASH scores of hook plate and suture-button groups (p=0.165); however, patient-reported overall discomfort was higher in the hook plate group (60% vs. 23.5%, p=0.036).

Conclusion: In Rockwood type III AC joint injuries, no statistically significant differences in functional outcomes were observed between conservative and surgical treatments. Exploratory subgroup analysis suggested an association between hook plate fixation and higher rates of patient-reported discomfort compared with suture-button fixation.

Keywords: Acromioclavicular joint injuries, Fracture fixation, internal, Patient-reported outcome measures, Shoulder injuries, Treatment outcome

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INTRODUCTION

Acromioclavicular (AC) joint injury refers to injuries that can damage the AC and coracoclavicular (CC) ligaments following high- or low-energy trauma.[1,2] This injury accounts for 10–40% of all shoulder injuries and is more common in young individuals who engage in active sports.[3] It is important for young adults to return to sports and work as early as possible.[4] For this reason, various treatment methods have been defined to restore the function of the AC joint.[5]

Injuries ranging from sprains to complete tears of the AC and CC ligaments are present. The Rockwood classification,[6] established in 1984, guides orthopedic surgeons in the treatment of AC joint injuries based on injuries of the AC and CC ligaments, the degree of clavicular displacement, and the direction of displacement as determined by direct X-rays.[7] Reviewing the current literature, it is widely accepted that conservative treatment is suitable for type I and II injuries, and type IV to VI injuries should be treated surgically.[8-10]

Rockwood type III AC joint injuries are defined as rupture of both ligaments (AC and CC), and there is displacement of 25–100% compared to the contralateral CC distance.[3,6,7] Although there are efforts to guide treatment,[11] there is a controversy on whether Rockwood type III AC injuries should be treated conservatively or surgically. While some authors state that conservative treatment is more successful in terms of cosmetic appearance, long-term clinical outcomes, and complications in type III AC joint injuries, other authors argue that surgery should be performed because it allows the CC distance to return to normal, enables early rehabilitation after surgery, and yields good early clinical outcomes.[3,10-13]

In the surgical treatment of AC joint injuries, suture-button[3,10,14] and hook plate[3,10,15] are the most preferred methods. The suture-button system is more frequently preferred in athletes due to reasons such as causing less tissue damage, not requiring implant removal, and mimicking the flexibility of normal ligaments.[14] The hook plate system's ability to provide a more stable reduction is its most important advantage, while its tendency to cause subacromial irritation and the need for implant removal constitute its limitations.[16] While there is ongoing debate in the current literature regarding the application of surgical or conservative treatment in type III AC joint injuries, there is also no agreement on the choice between hook plate or suture-button.[5,15,17-20]

The primary objective of this retrospective cohort study was to evaluate differences in patient-reported outcomes between conservative and surgical management of type III AC joint injuries. A secondary, exploratory objective was to assess patient-reported outcomes between suture-button and hook plate fixation within the surgically treated cohort. It was hypothesized that treatment modality would be associated with differences in patient-reported outcomes and discomfort.

MATERIALS AND METHODS

This study was conducted after obtaining ethical approval from Ankara Etlik City Hospital Clinical Research Ethics Committee (date: 06.08.2025, decision no: AEŞH-BADEK1-2025-335). The requirement for informed consent was waived due to the retrospective nature of the study. This study was performed following the ethical framework of the Declaration of Helsinki.

In this retrospective cohort study aiming comparison of different surgical treatment modalities, the patient information of those who presented to our hospital's orthopedics and traumatology department due to AC joint injuries from September 2022 to September 2024 was retrospectively reviewed. Inclusion criteria were type III AC joint injury, age 18–65, diagnosis and treatment in the acute phase (first 3 weeks) after injury, and a minimum follow-up period of 12 months. Criteria for exclusion were: Presentation later than 3 weeks, history of fracture in the ipsilateral extremity, surgical treatment with methods other than suture-button or hook plate, vascular or nerve damage after injury, additional surgical interventions (like revision or wound debridement), previous treatment for any shoulder conditions, additional diseases that could affect the evaluation of questionnaires (neuromuscular disease, psychiatric disease, speech and communication difficulties, rheumatological disease), patients who did not want to participate in the study, or patients who did not attend their 1-year follow-up appointment. Fifty-three patients were enrolled after exclusion. Figure 1 demonstrates the study flowchart.

Surgery and Treatment Protocol

The treatment and follow-up of all patients included in the study were performed by orthopedic and traumatology specialists experienced in trauma at a training hospital or by their assistants under specialist supervision. Treatment decisions were based on routine clinical judgment considering patient characteristics and injury-related factors; however, due to the retrospective design, these factors could not be systematically quantified.

Conservative Treatment

Patients who underwent conservative treatment were followed up with a simple arm sling. As the patients' pain decreased, passive and then active joint movement was initiated. Patients were instructed to use their current bandage or arm sling for at least 4 weeks. All patients undergoing conservative treatment were informed that deformity or swelling may remain in the AC joint and that chronic dislocation may lead to persistent pain, instability, and osteoarthritis in the AC joint.

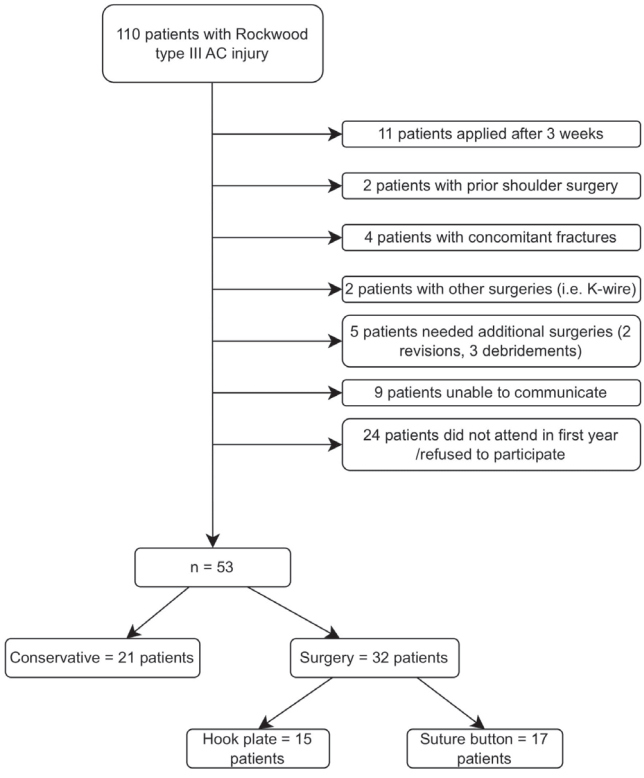

Figure 1. Study flowchart.

Suture-Button Fixation

All patients were administered 1 g of cefazolin under general anesthesia while in the supine position, followed by a 5–6 cm incision over the AC joint. After reduction of the AC joint under direct visualization, an entry site for a suture-button (Aleda, Ankara, Türkiye) was created using a 4.0 mm drill bit from the clavicle toward the base of the coracoid. Using a passing pin, the button was passed through the clavicle and coracoid. After ensuring that the implant had passed through the coracoid, the strands of the suture-button were pulled tight. After a fluoroscopy check, a locked knot was tied, and the surgery was completed. The patients' shoulders were immobilized with a sling for 3–4 weeks after surgery (Fig. 2).

Hook Plate

After administration of 1 g of cefazolin to all patients, under general anesthesia, in the supine position, a 5–6 cm incision was made over the AC joint. The AC joint was exposed and anatomically reduced. After reduction, an anatomical hook plate (Zimed, Gaziantep, Türkiye) was placed in the subacromial space. It was then fixed to the clavicle using cortical and locking screws. After the reduction of the AC joint, the position of the plate and hook, and the screw lengths were checked under fluoroscopy, and the surgery was completed. All patients were encouraged to use an arm sling for 4–6 weeks after surgery. No routine or elective implant removal was performed, and all hook plates remained in situ throughout the follow-up period, including at 12 months (Fig. 3).

Outcome Measures

Patients were invited for a 1-year follow-up visit, and for those who were admitted, besides the QuickDASH score,[21,22] a simple questionnaire was performed. This questionnaire consisted of three questions:

- Do you have any discomfort due to the injury?
- What provokes this discomfort the most?

1. Tasks requiring shoulder motion

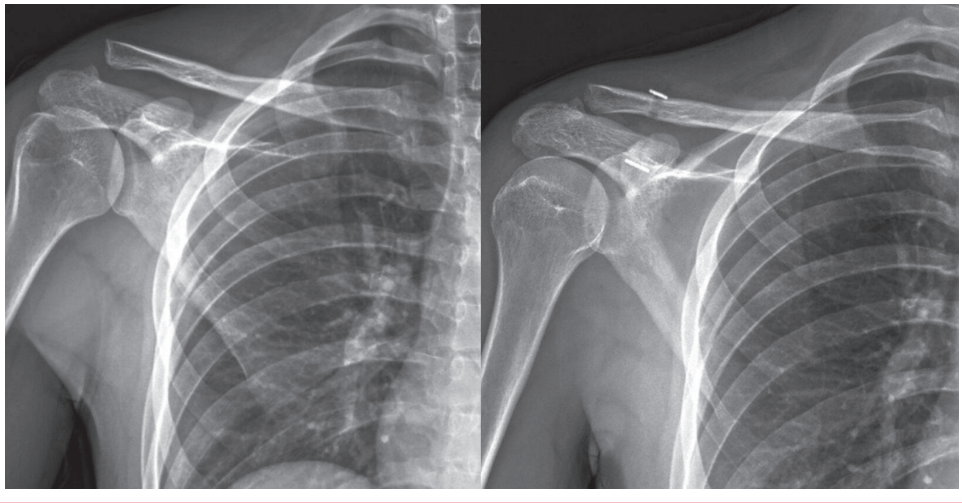

Figure 2. Pre-operative and post-operative X-rays of a 34-year-old male who presented with Rockwood type III acromioclavicular injury, treated with suture-button.

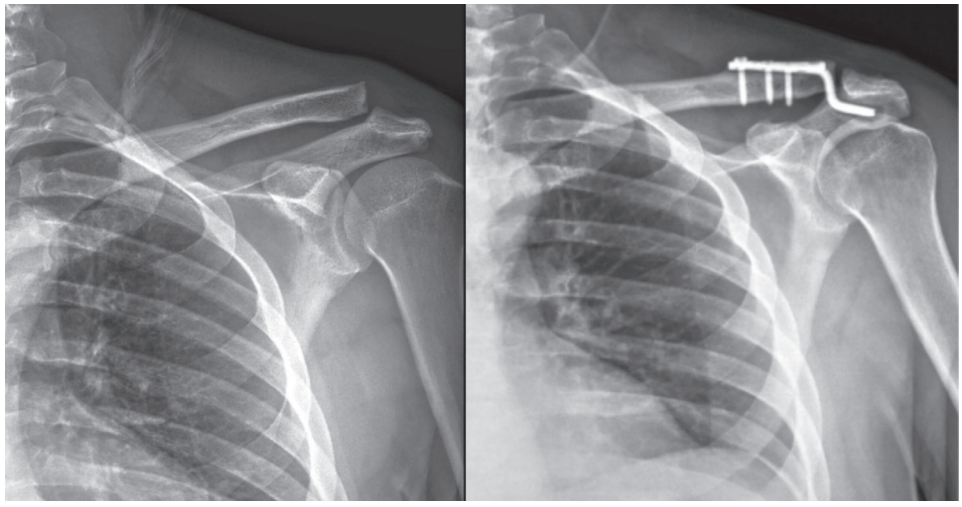

Figure 3. Pre-operative and post-operative X-rays of a 45-year-old male presented with Rockwood type III acromioclavicular injury, treated with hook plate.

2. Lifting heavy things
3. Lying on the injured side

- Did you apply to the hospital due to pain in the last 3 months?

The demographic characteristics of all patients (age, sex, and body mass index [BMI]), dominant side, involvement of the dominant side, QuickDASH scores, and questionnaire results were compared between the conservative and surgical treatment groups to assess baseline comparability and potential confounding effects. In addition, in surgically treated patients, the same parameters, as well as time from injury to surgery, were analyzed and compared between the hook plate and suture-button groups. Subgroup analyses comparing hook plate and suture-button fixation were performed in surgically treated patients and were considered exploratory, without pre-specified hypotheses. Selection bias is possible due to the retrospective design and surgeon preference for treatment modality. To reduce this effect, baseline characteristics were compared and found to be similar between groups.

Statistical Analysis

Statistical analyses were done using the Statistical Package for the Social Sciences (SPSS) 26.0 (SPSS Inc., Chicago, Illinois, USA). Normality of the data was analyzed with the Shapiro–Wilk test. Age and BMI conformed to normal distribution, while time to surgery and QuickDASH score did not. Numerical data were reported as mean ± standard deviation or median (Q1-Q3), and frequency and percentage were reported for categorical data. Differences between numerical values were compared by an independent sample t-test and Mann–Whitney U test. Chi-square test or Fisher's exact test was used for categorical data. Potential confounders, including age, sex, BMI, and dominance-related variables, were assessed by comparing baseline characteristics between groups. Multivariable adjustment was not performed due to the limited sample size. No a priori sample size calculation was performed due to the retrospective nature of the study. $p<0.05$ was accepted as statistically significant.

RESULTS

A total of 110 patients were assessed for eligibility. After applying the inclusion and exclusion criteria, 53 patients (age 39.2±12.7, 79.2% male) were included in the final analysis. Demographic data were presented in Tables 1 and 2. 21 patients (39.6%) were treated conservatively, and 32 patients (60.4%) were treated surgically (15 patients with a hook plate and 17 patients with a suture button). No significant difference could be found in terms of demographic data between conservative and surgery-treated groups and between surgery types ($p>0.05$).

The mean QuickDASH score of the study cohort was 0 (0–18.2). 19 patients (35.8%) had discomfort in the injured shoulder. Among these patients, 12 (63.2%) reported that this discomfort was provoked by tasks requiring shoulder motion, 1 (5.3%) by lifting a weight, and 6 (31.5%) by lying on the injured side. 7 patients (13.2%) were admitted to the hospital in the last 3 months due to pain from the injury site.

Thirty-three patients had the injury on their dominant sides (62.3%). No statistically significant difference could be detected in terms of QuickDASH scores ($p=0.795$) and questionnaire results ($p>0.05$) between patients with dominant and non-dominant side injuries.

Conservative Versus Surgery

No significant difference could be detected in terms of QuickDASH score (p=0.235) and questionnaire results (p>0.05) (Table 1).

Hook Plate Versus Suture Button

An explanatory analysis was performed among the surgically treated patients. Median time from injury to surgery was 3 (1–5) days. No significant difference could be detected between hook plate and suture button groups in terms of time to surgery (p=0.165) (Table 2).

No significant difference could be detected between QuickDASH scores of hook plate and suture button groups (p=0.165). However, overall discomfort was reported to be higher in the hook plate group (60–23.5% – absolute difference: 36.5%, p=0.036). No statistically significant differences were detected between groups for the remaining questionnaire items (p>0.05).

Table 1. Comparison of demographic data and study results between conservatively and surgically treated groups

	Conservative (n=21) (%)	Surgery (n=32) (%)	p
Age	39.5±14.4	39±11.6	0.895 [1]
Sex (male)	17 (81)	25 (78.1)	0.804 [2]
Body mass index	25.7±4	27.4±4.4	0.167 [1]
Dominant hand (right)	17 (81)	26 (81.3)	0.978 [2]
Injury to dominant side	14 (66.7)	19 (59.4)	0.592 [2]
Median QuickDASH score (Q1-Q3)	0 (0–11.4)	0 (020.5)	0.235 [3]
Discomfort?	6 (28.6)	13 (40.6)	0.371 [2]
Activity provoking discomfort			
Shoulder motion	4 (66.7)	8 (61.5)	
Lifting weight	0 (0)	1 (7.7)	0.902 [4]
Lying on the same side	2 (33.3)	4 (30.8)	
Admission in the last 3 months	2 (9.5)	5 (15.6)	0.690 [4]

[1] Independent samples t-test; [2] Chi-square test; [3] Mann–Whitney U test; [4] Fisher's exact test.

Table 2. Comparison of demographic data and study results between hook plate and suture button groups

	Hook plate (n=15) (%)	Suture button (n=17) (%)	p
Age	39.5±11.4	38.5±12.1	0.811 [1]
Sex (male)	13 (86.7)	13 (76.5)	0.659 [2]
Body mass index	27.2±5.9	27.6±2.8	0.834 [1]
Dominant hand (right)	11 (73.3)	15 (88.2)	0.383 [2]
Injury to dominant side	9 (60)	10 (58.8)	0.946 [3]
Time to surgery	2 (1–3.5)	3 (2–7)	0.165 [4]
Median QuickDASH score (Q1-Q3)	18.2 (0–20.5)	0 (0–9.1)	0.168 [4]
Discomfort?	9 (60)	4 (23.5)	0.036 [3]
Activity provoking discomfort			
Shoulder motion	5 (55.6)	3 (75)	
Lifting weight	1 (11.1)	0 (0)	0.175 [2]
Lying on the same side	3 (33.3)	1 (25)	
Admission in the last 3 months	3 (20)	2 (11.8)	0.645 [2]

[1] Independent samples t-test; [2] Fisher's exact test; [3] Chi-square test; [4] Mann–Whitney U test

DISCUSSION

Rockwood type III AC joint injuries continue to be a subject of debate, both regarding the choice between conservative and surgical management and the optimal surgical technique. In this study, we revisited this frequently investigated topic – typically evaluated in terms of complications and functional outcomes – from the perspective of patients' subjective complaints. As a result, we were unable to determine the superiority of surgical treatment over conservative treatment. However, we found a higher discomfort rate in patients who underwent hook plate surgery compared to those who underwent suture-button fixation.

Dislocations of the AC joint, which are mainly caused by the disruption of static stabilizers (AC and CC ligaments),[18] mostly occur due to direct lateral impact on the adducted shoulder,[23,24] and are commonly seen in young males[25] that involve in sports or traffic accidents.[26] Yearly incidence of AC joint injuries is 19.3/100,000,[25] and a substantial ratio of these injuries present at a late stage.[27]

Among the classification systems for guiding treatment and reporting purposes, the most widely used is the Rockwood classification.[11,24] For Rockwood types I and II, conservative treatment (with a simple arm sling) is the main choice of treatment, and surgery is often recommended for types IV to VI to avoid long-term complications.[24] However, treatment modality for type III is controversial, and the choice of treatment mainly depends on the surgeon's preference. Surveys among orthopedic surgeons about the management of these injuries reveal that the global trend is to follow these injuries conservatively.[28,29]

Conservative treatment of type III AC injuries, such as milder ones, includes a simple arm sling for 3–4 weeks and then allowing active arm motion. In a study comparing brace and sling immobilization, no significant difference was found between the two modalities.[30] Our opinion is that a sling is a simpler method to comply with the patients, therefore arm sling was preferred for conservative treatment.

In our study, we could not detect a statistically significant difference in terms of median QuickDASH scores and questionnaire outcomes between conservative and surgery groups. Many studies reported good outcomes following conservative treatment for type III AC injuries. A meta-analysis investigating 10 studies comparing conservative and surgical treatment showed that conservative treatment showed similar outcomes compared to surgical treatment, with fewer complications.[31] Similarly, in a recent multicenter randomized controlled study by Tauber et al.,[32] surgical treatment yielded slower functional recovery compared to conservative treatment. There are several studies reporting less persistent pain[33] and better overall outcomes[5] with surgical treatment, although the latter[5] included type V injuries, which were not included in our study. Although not statistically significant, persistent pain (demonstrated by admission to hospital due to pain in the last 3 months) (9.5–15.6%) and overall discomfort (28.6–40.6%) appeared less in the conservatively treated group.

There are several surgical techniques for the treatment of AC joint injuries. The most widely used methods include hook plate and suture-button fixation, which were evaluated in our study. One of the most remarkable findings of our study was that hook plate fixation resulted in significantly more discomfort than suture-button, although no statistically significant difference was detected in terms of QuickDASH scores and other questionnaire results. This finding is consistent with existing studies.[5,15,17-19] The focused issues about the inferior results of hook plate fixation in the literature is need for secondary surgery and subacromial osteolysis.[20] While our study did not specifically investigate the reasons behind the inferiority of hook plate fixation, we believe that placing a hardware component directly within the joint may contribute to a certain degree of irritation. Cosmetic concerns and chronic alterations in the AC architecture are areas for future research. It should be noted that suspensory loop devices, such as suture-button needs a correct tunnel placement in order to prevent complications.[34]

The QuickDASH score is an adaptation of the DASH score and one of the most common scoring systems in shoulder disorders. Unlike the Constant–Murley score, it is solely dependent on patients' answers and does not involve examination findings. Therefore, it can be considered a good indicator for the impact of the pathology on the patient's comfort,[21,22] therefore complying with the aim of our study. However, the main issue about this scoring system is that it has a high ceiling effect – i.e., diminished ability to discriminate between high levels of function.[35] Therefore, in addition to the QuickDASH score, a questionnaire that aimed to investigate the most prevalent complaints about follow-up of AC joint injuries (persistent pain, presence of discomfort, and the activity that provoked the discomfort) was applied to the patients, and it allowed us to reveal that the hook plate group had a higher discomfort rate than the suture-button fixation group.

In addition to its retrospective design, this study has several limitations. First, this was a single-center study, which may limit the generalizability of the findings to other clinical settings. Given the relatively small sample size, the study may be at increased risk of Type II error, particularly for functional outcome measures. Borderline P-values observed in some comparisons raise the possibility that clinically meaningful

differences may not have been detected due to insufficient statistical power. Furthermore, patients were treated and followed by multiple surgeons, which may have introduced variability in treatment selection; however, this also enhances the external validity of the results within a real-world clinical context. The lack of standardization in treatment choice may have allowed residual confounding to persist despite comparable baseline characteristics. Another limitation is the absence of radiological measurements. Radiological assessment was beyond the scope of this study, and it should be noted that parameters such as CC distance would be expected to be greater in conservatively treated patients, as no reduction was performed. The absence of routine hook plate removal may have contributed to higher patient-reported discomfort and should be considered when interpreting comparisons with other series in which elective plate removal is standard practice. Finally, the three-item questionnaire used to assess discomfort is an institution-specific, non-validated tool, and its psychometric properties, including validity and reliability, are unknown. Therefore, results derived from this questionnaire should be interpreted with caution. Although no validated instrument specifically addressing this aspect of discomfort in AC joint injuries is currently available, this limitation should be considered when interpreting the findings.

CONCLUSION

In patients with Rockwood type III AC joint injuries, no significant differences were observed in QuickDASH scores or overall patient discomfort between conservative and surgical treatment groups. However, among the surgical techniques, patients treated with hook plate fixation reported a higher rate of overall discomfort compared to those who underwent suture-button fixation. Despite this difference in subjective discomfort, no statistically significant difference in functional outcomes as measured by QuickDASH scores was detected between the two surgical methods.

Ethics Committee Approval: This study was approved by the Ankara Etlik City Hospital Clinical Research Ethics Committee (Date: 06.08.2025, Decision no: AEŞH-BADEK1-2025-335).

Informed Consent: The requirement for informed consent was waived due to the retrospective nature of the study.

Conflict of Interest: None declared.

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