

# Clinical Results After Conservative Management for Grade III Acromioclavicular Joint Injuries: Does Eventual Surgery Affect Overall Outcomes?



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**Purpose:** To compare the clinical outcomes in patients with grade III acromioclavicular (AC) joint injuries in whom nonoperative therapy was successfully completed and those who had nonoperative therapy failure and who proceeded to undergo surgical reconstruction. **Methods:** Forty-nine patients were initially treated nonoperatively for grade III AC joint injuries with physical therapy. Patients completed questionnaires at initial presentation and after a follow-up period of 2 years. Outcome measures included the Short Form 12 Physical Component Score; American Shoulder and Elbow Surgeons score; Quick Disabilities of the Arm, Shoulder and Hand score; and Single Assessment Numeric Evaluation score. Failure of nonoperative treatment occurred when a patient underwent AC reconstruction before final follow-up. **Results:** Forty-one patients with a mean age of 39 years (range, 18 to 79 years) were included. In this cohort, 29 of 41 patients (71%) successfully completed nonoperative therapy whereas 12 of 41 (30%) had nonoperative therapy failure at a median of 42 days (range, 6 days to 17.0 months). Of the 41 patients, 39 (95.3%) were contacted to determine treatment success. Of the 12 patients who had nonoperative therapy failure, 11 (92%) had sought treatment more than 30 days after the injury. Subjective follow-up data were available for 10 of 12 patients (83.3%) who had nonoperative therapy failure and for 23 of 29 patients (79.3%) who were successfully treated nonoperatively. The mean length of follow-up was 3.3 years (range, 1.8 to 5.9 years). Although there were no statistically significant differences in outcome scores between groups, those who sought treatment more than 30 days after their injury showed decreased postoperative Single Assessment Numeric Evaluation scores ( $P = .002$ ) and Short Form 12 Physical Component Scores ( $P = .037$ ). **Conclusions:** According to our results, (1) a trial of nonoperative treatment is warranted because successful outcomes can be expected even in patients who eventually opt for surgery and (2) patients who presented more than 30 days after their injury were less likely to complete nonoperative treatment successfully. **Level of Evidence:** Level III, retrospective comparative study.

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Injuries to the acromioclavicular (AC) joint represent up to half of all shoulder girdle injuries in contact athletes.<sup>1-4</sup> These injuries most commonly occur after a direct, high-energy impact to the lateral shoulder with the humerus adducted. Dislocation and superior displacement of the distal clavicle occur in cases that involve complete disruption of both the AC joint capsule and the coracoclavicular (CC) ligaments. Controversy still exists regarding the optimal treatment strategy for patients with grade III injuries.

The classification of AC joint injuries was originally described by Rockwood<sup>5</sup> according to injury severity. Grade I and II injuries represent ligamentous strain and partial tearing of supporting ligaments, respectively, with minimal displacement of the distal clavicle. These injuries are most often treated conservatively with excellent results.<sup>6-12</sup> Grade III through VI injuries

represent complete disruption of both the AC joint capsule and the CC ligaments. In these cases the distal clavicle may be displaced superiorly (grades III and V), posteriorly (grade IV), or inferiorly beneath the coracoid (grade VI).

Although surgical management is typically indicated for patients with grade IV through VI AC joint injuries, many surgeons recommend early operative management for grade III AC injuries in high-level athletes and manual laborers, in addition to patients who have become chronically symptomatic.<sup>13-18</sup> However, surgical intervention carries inherent risks to the patient, including the possibility of loss of reduction, clavicle fracture, wound infection, osteomyelitis, nerve injury, heterotopic ossification, osteoarthritis, stiffness, and hardware failure. Furthermore, surgical reconstruction of grade III AC joint injuries is associated with increased medical costs and a longer duration of sick leave when compared with nonoperative management.<sup>19</sup>

Therefore the purpose of this study was to compare the clinical outcomes in patients with grade III AC joint injuries in whom nonoperative therapy was successfully completed and those who had nonoperative therapy failure by proceeding to surgical reconstruction. We hypothesized that there would be no differences in the clinical outcomes scores between these treatment groups.

## Methods

Institutional review board approval was obtained before the initiation of this study.

### Study Population

Between March 2006 and February 2012, all patients with grade III AC joint injuries who presented to the senior surgeon (P.J.M.) were assessed for inclusion in our study. Although nonoperative treatment was intended for most patients, acute surgery was discussed with patients who participated in high-demand recreational activities, who were overhead laborers, or who were unhappy with the physical limitations imparted by the injury or deformity. After a thorough clinical evaluation, each patient was counseled regarding the decision to pursue operative or nonoperative management for the injury. We excluded 12 patients who elected to undergo acute surgery. Seven of these 12 patients were athletic and elected to undergo acute surgery to avoid physical limitation or deformity and accelerate their return to sporting activities. Five patients had major concomitant pathologies such as clavicle fractures ( $n = 2$ ), massive rotator cuff tears ( $n = 1$ ), or severe glenohumeral osteoarthritis ( $n = 2$ ). In addition, patients were excluded if they were aged younger than 18 years or lived out of the country and sought treatment at home.

### Data Collection

All data were collected prospectively and retrospectively analyzed. These included demographic data, prior surgical procedures, treatment history, mechanism of injury, concomitant pathologies, adjuvant treatments, any complications, and further surgical procedures. Patients completed a shoulder questionnaire during the initial clinic visit that included the American Shoulder and Elbow Surgeons (ASES) score; Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) score; Short Form 12 Physical Component Score (SF-12 PCS); and Single Assessment Numeric Evaluation (SANE) score. Two years after treatment, patients completed the same questionnaire with the addition of questions regarding satisfaction with surgical outcomes (scale from 1 to 10, where 10 indicates very satisfied), pain, and activity modification. If patients did not complete the survey, they were contacted by phone and encouraged to do so. If they were not willing to complete the survey, then patients were asked if they had undergone any additional surgical procedures on their shoulder and this information was noted.

### Nonoperative Treatment

All patients underwent formal physical therapy 2 to 3 times per week for a period of at least 6 weeks using a phasic approach according to recommended guidelines. Phase progression was dictated by patient tolerance and evidence of improved scapulohumeral kinematics.

In phase 1 (0 to 3 weeks), patients were offered a sling for comfort and functional taping for pain reduction.<sup>20</sup> Cryotherapy was also advised for further pain management. Passive and active-assisted range-of-motion exercises were begun according to patient tolerance. Scapular setting exercises were begun immediately to prevent adaptive shortening of the pectoral muscles. Exercises such as glenohumeral internal and external rotation and elevation in the scapular plane to shoulder level were recommended. Progression to phase 2 typically occurred approximately 3 weeks after the initiation of physical therapy.

In phase 2, passive and active-assisted range-of-motion exercises were continued in addition to stretching of the pectoralis major and minor muscles. Postural strengthening exercises, such as bilateral-band external rotation, and scapular retraction exercises were initiated and continued according to patient tolerance. Light strengthening of the rotator cuff, deltoid, serratus anterior, and each division of the trapezius muscle was also begun.

In phase 3, patients progressed to an individualized strengthening program tailored to the demands of their work and sporting activities. In high-demand laborers or athletes, strengthening of the deltoid and upper trapezius muscles was specifically emphasized. Overhead athletes

were prescribed a comprehensive program that emphasized rotator cuff strength and endurance; scapular control; and strength of the pectoralis major, latissimus dorsi, and deltoid muscles. Patients were allowed to return to sports when full range of motion was obtained without pain or guarding. Patients typically returned to their normal activities after approximately 6 to 12 weeks; however, patient compliance with the physical therapy regimen was not monitored.

### Surgical Treatment

In this cohort, nonoperative treatment failure was defined as the subsequent progression to surgical management, which consisted of anatomic CC ligament reconstruction. Initial diagnostic arthroscopy was performed in all patients to identify and address any concomitant intra-articular injuries. Anatomic CC ligament reconstruction was performed according to the original procedure described by Carofino and Mazzocca.<sup>21</sup>

### Postoperative Rehabilitation

An abduction sling was applied immediately after surgery and was discontinued between 4 and 6 weeks postoperatively. Passive range-of-motion exercises were performed during this time frame. Active and active-assisted range of motion was begun at approximately 6 weeks postoperatively, whereas strengthening was delayed until at least 8 weeks postoperatively according to patient progress and tolerance. Patients were typically cleared for full activities at approximately 4 months postoperatively. Modifications to this protocol were necessary depending on concomitant pathologies or injuries that were encountered during the surgical procedure.

### Statistical Analyses

All preoperative outcomes scores were normally distributed; however, the postoperative outcomes scores were not normally distributed as evidenced by the one-sample Kolmogorov-Smirnov test. Descriptive statistics (mean, standard deviation, range) were calculated using standard formulas. Bivariate (yes/no) comparisons were performed using the Pearson  $\chi^2$  analysis or Fisher exact test. Preoperative to postoperative improvements in outcomes scores were determined using nonparametric paired-sample comparisons. Comparisons of differences in outcomes scores between treatment groups were also performed using the Mann-Whitney *U* test or Kruskal-Wallis test. A contingency table was used to calculate the relative risk for failure of nonoperative treatment for the entire cohort and for patients who sought treatment more than 30 days after the initial injury. Statistical analyses were performed using IBM SPSS Statistics software (version 9.0; IBM, Armonk, NY). Two-tailed *P* < .05 was deemed significant.

**Table 1.** Demographic Data of Both Groups (N = 41)

	Completion of Nonoperative Treatment (n = 29)	Failure of Nonoperative Treatment (n = 12)	<i>P</i> Value
Age at treatment, mean ± SD, yr	39.3 ± 14.8	38.3 ± 12.7	.844
Male gender, n	27 (93%)	9 (75%)	.508
Athletes or overhead laborers, n	26 (89.7%)	11 (91.7%)	> .99
BMI, mean ± SD, kg/m <sup>2</sup>	25.5 ± 2.1	23.8 ± 3.4	.130
Injured dominant shoulder, n	16 (55.2%)	4 (33.3%)	.306

BMI, body mass index.

## Results

Forty-one patients (36 men and 5 women) with a mean age of 38 years (range, 18 to 79 years) were initially treated nonoperatively for grade III AC joint injuries and met the inclusion criteria for this study. Patients presented to the clinic a median of 9 days after the injury (range, 1 day to 9.6 years); 17 of the 41 patients (41.6%) presented more than 30 days after the initial injury. Only 1 patient (2.3%) had undergone a prior operation (distal clavicle excision) on the injured shoulder, which was healed at the time of AC injury. Patient demographic data are summarized in Table 1.

Twenty-nine patients (70.7%) successfully completed nonoperative treatment and did not proceed to AC reconstruction. Two-year subjective data (mean, 3.5 years; range, 1.9 to 5.9 years) were available for 23 of these 29 nonoperative patients (80%). Of the 6 patients who did not complete an outcomes questionnaire, 4 patients indicated by phone interview that no further surgical procedures had been performed on the index shoulder.

Twelve patients (29.2%) had nonoperative treatment failure and underwent AC joint reconstruction at a median of 5.4 months after injury (range, 3 to 27 months). These patients presented to our clinic at a mean of 263 days after their AC injury (range, 5 days to 26 months). The reasons for failure are summarized in Table 2. Of the 12 patients who had nonoperative treatment failure, 11 (91.7%) initially presented more than 30 days after the date of injury. One patient who presented acutely, who was not a high-demand athlete or overhead laborer, was not happy with the nonoperative option and sought surgery elsewhere at an outside institution against the advice of the senior surgeon (P.J.M.). Therefore, 11 of the 12 patients who had nonoperative treatment failure underwent AC reconstruction. Two-year subjective data (mean, 2.7 years; range, 1.8 to 4.2 years) were available for 10 of these 12 operative patients (83.3%). Concomitant pathologies identified at the time of surgery are summarized in Table 2.

**Table 2.** Characteristics of Patients Who Had Nonoperative Treatment Failure

Patient No.	Surgical Indications	Time From Injury to Surgery, d	Concomitant Pathologies	Further Surgery
1	Pain, dysfunction	220	Type 1 SLAP tear	
2	Pain, instability	55	None	
3	Night pain, pain with overhead work	141	None	
4	Pain, instability	163	Type 1 SLAP tear	
5	Pain, dysfunction	53	Degenerative type 2 SLAP tear, partial-thickness SSP tear	
6	Weakness, dysfunction, slight pain	644	Anterior labral fraying, partial-thickness SSP tear	
7	Pain, dysfunction	830	Anterior and posterior labral fraying	
8	Night pain, pain with overhead work	581	Degenerative type 2 SLAP tear	ORIF with hook plate for clavicle fracture 26 d postoperatively
9	Pain, instability	164	Type 1 SLAP tear	
10	Pain, deformity	93	None	Painful hardware surgically removed 357 d postoperatively
11	Pain, activity limitation with sports	375	Tenosynovitis of long head of biceps tendon	
12	Pain, dysfunction, difficulty sleeping; surgery sought elsewhere	511	Unknown	

ORIF, open reduction–internal fixation; SSP, supraspinatus tendon.

After AC joint reconstruction, 1 patient sustained a clavicle fracture and subsequently underwent revision. Another patient had painful hardware removed approximately 1 year after AC reconstruction. No other surgical complications occurred. The outcomes data from patients who underwent surgery at an outside institution were not collected. Outcomes data from the patient who sustained a clavicle fracture were not included in the final comparative analysis, because these data would reflect the outcome of fracture fixation with revision AC reconstruction. Therefore, 2-year follow-up data (mean, 2.7 years; range, 1.8 to 4.2 years) were available for each of the remaining 10

patients who had nonoperative therapy failure and who underwent eventual AC joint reconstruction.

For the entire cohort, all outcomes measures showed statistically significant improvements when compared with their initial treatment baselines ( $P < .05$ , Table 3). Overall, at a mean of 3.3 years, there were no statistically significant differences in outcomes scores between patients who successfully completed nonoperative treatment and patients who had nonoperative therapy failure and who underwent AC joint reconstruction ( $P > .05$ , Table 4). However, in contrast to those patients who had nonoperative therapy failure, those who successfully completed nonoperative treatment

**Table 3.** Preoperative and Postoperative Clinical Outcome Scores for Entire Cohort

	Baseline Assessment	Final Follow-up	P Value
Mean timing (range)	-8 d (-87 to -1 d)	3.3 yr (1.8-5.9 yr)	
Mean score (range)			
SF-12 PCS	43.2 (27.2-60.9)	55.4 (42.9-61.4)	< .001*
SANE	48 (12-85)	89.6 (49-100)	.001*
ASES	62.4 (5-93.3)	95.1 (52-100)	< .001*
QuickDASH	37.7 (4.5-88.6)	4.3 (0-41)	.003*
Median patient satisfaction (range)	NA	9 (7-10)	

ASES, American Shoulder and Elbow Surgeons; NA, not applicable; QuickDASH, Quick Disabilities of the Arm, Shoulder and Hand; SANE, Single Assessment Numeric Evaluation; SF-12 PCS, Short Form 12 Physical Component Score.

\*Statistically significant.

**Table 4.** Comparison of Mean Clinical Outcome Scores Between Patients Who Successfully Completed Nonoperative Treatment and Those Who Had Nonoperative Treatment Failure

	Successful Nonoperative Treatment	Failure of Nonoperative Treatment	P Value
Patients, n	23 of 29 (79.3%)	10 of 12 (83.3%)	
Mean follow-up (range), yr	3.5 (1.9-5.9)	2.7 (1.8-4.2)	
Mean score (range)			
SF-12 PCS	56.0 (52.4-61.4)	53.8 (42.9-57.8)	.517
SANE	92.7 (65-100)	87 (49-98)	.140
ASES	95.5 (51-100)	97.1 (91.6-100)	.120
QuickDASH	4.5 (0-41)	6.8 (0-25)	.344

ASES, American Shoulder and Elbow Surgeons; QuickDASH, Quick Disabilities of the Arm, Shoulder and Hand; SANE, Single Assessment Numeric Evaluation; SF-12 PCS, Short Form 12 Physical Component Score.

reported a decreased intensity of sports participation when compared with their preinjury level of intensity ( $P = .025$ ). Patients who presented to the clinic more than 30 days after the date of injury showed significantly decreased postoperative SANE scores ( $P = .002$ ) and SF-12 PCSs ( $P = .037$ ).

### Discussion

The most important finding in this study was that patients with grade III AC joint injuries who had nonoperative treatment failure and who underwent subsequent AC joint reconstruction had similar outcomes scores when compared with those who successfully completed nonoperative treatment after a mean follow-up period of 3.3 years. At the time of final follow-up, patients who underwent eventual AC joint reconstruction were more likely to return to their preinjury intensity level of sports participation. Patients who presented to the clinic more than 30 days after their initial injury were more likely to have nonoperative treatment failure and exhibited significantly decreased mean postoperative SANE scores and SF-12 PCSs when compared with the rest of the cohort.

In a recent consensus statement published by the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS), a trial of nonoperative treatment was recommended for 3 to 6 weeks in all patients with grade III AC joint injuries.<sup>22</sup> This recommendation was based on the difficulty in evaluating scapular motion during the acute phase of the injury and the success of nonoperative treatment in most cases. In patients with persistent pain and abnormal scapular motion after the initial 3 to 6 weeks of conservative therapy, operative management was suggested.

Several studies have shown good results after nonoperative management for patients with grade III AC joint injuries.<sup>23-25</sup> Larsen et al.<sup>23</sup> conducted a prospective randomized study of acute AC joint dislocations in 41 patients treated surgically and 43 patients managed nonoperatively. Initial clinical results were improved in the group treated nonoperatively. However, after a 13-month follow-up period, there were no significant differences between the 2 groups. The authors concluded that most patients should be managed nonoperatively, although surgical intervention should be considered for patients with heavy work requirements. Smith et al.<sup>19</sup> conducted a systematic review including 6 retrospective studies that investigated the outcomes after operative and nonoperative management for grade III AC joint injuries. There were no statistically significant differences between the nonoperative and operative treatment groups with respect to strength, pain, throwing ability, loss of reduction, ossification of the CC ligaments, or osteoarthritis of the AC joint. The operative group did have a

longer duration of sick leave compared with the nonoperative group. Cosmetic appearance was improved in the patients who received surgical intervention. These results are similar to those found in our study: patients who had nonoperative treatment failure and who required subsequent AC joint reconstruction had similar outcomes to those who successfully completed nonoperative management.

The AC joint plays an important contributory role in scapulothoracic kinetics. Disruption of the AC joint may lead to scapular dyskinesia, which has previously been implicated as a cause of shoulder pain and dysfunction after grade III AC joint injuries, even after conservative management.<sup>26-29</sup> Therefore, in our study, in patients who presented more than 30 days after their initial injury, scapulothoracic dysfunction may have already developed, potentially increasing the risk of nonoperative failure. Thorough examination of patients who present more than 30 days after the initial injury should be performed to identify evidence of scapular dyskinesia or other concomitant pathologies that may adversely affect the clinical outcomes after nonoperative management for grade III AC joint injuries.

Although delayed presentation may allow for the development of scapular dyskinesia before the initiation of treatment, Carbone et al.<sup>26</sup> and Oki et al.<sup>29</sup> showed that scapular dyskinesia may also occur in patients who successfully completed nonoperative treatment. This evidence corroborates the results of our study because patients who did not proceed to AC joint reconstruction were less likely to return to their preinjury level of sports participation, suggesting that some amount of shoulder dysfunction may have still been present despite the completion of appropriate physical therapy. Concomitant intra-articular injuries may also occur in up to 30% of patients who sustain an AC joint dislocation<sup>30</sup>—the inability to address these injuries through nonoperative measures may also predispose these patients to less optimal clinical outcomes.

Weinstein et al.<sup>25</sup> compared the clinical outcomes in 44 patients who were managed surgically for either acute or chronic AC joint dislocations. Good or excellent results were obtained in 96% of patients who underwent early reconstruction and in 76% of patients who underwent delayed reconstruction; however, this difference was not statistically significant. The results of early reconstruction were significantly improved when compared with those of reconstructions performed greater than 3 months after the date of injury. Rolf et al.<sup>16</sup> also found improved results in the early-reconstruction group regarding the Constant score, maintenance of reduction, complications, and patient satisfaction when compared with the delayed-reconstruction group.

The decision to pursue operative management should be weighed against the high rate of complications

associated with AC reconstruction. Complication rates of AC joint reconstruction as high as 27.1% have been reported, including hardware failure, graft ruptures, adhesive capsulitis, damage to the brachial plexus and axillary nerve, and coracoid and clavicle fractures.<sup>24,31,32</sup> The information from our study should provide a foundation on which future studies could be designed to evaluate the effects of a standardized treatment approach for patients with grade III AC joint injuries.

### Limitations

Several limitations apply to this study. First, it may have been underpowered to detect differences among variables affecting clinical outcomes because of low patient numbers. According to the sample sizes and standard deviations obtained for ASES scores, our study was capable of detecting a difference of more than 11 points in the ASES scores between treatment groups with 80% power. Second, patient compliance with nonoperative therapy may not have been uniform for all patients. Third, scapular dyskinesis was not evaluated systematically at the time of initial treatment owing to pain and guarding as a result of the injury, especially in acute cases. However, scapular motion was assessed postoperatively at the time of follow-up visits as tolerated by patients. Finally, the outcomes measures used in this study have not been specifically validated for AC joint injuries; however, they have been widely used in the literature.<sup>15,33,34</sup>

### Conclusions

According to our results, (1) a trial of nonoperative treatment is warranted because successful outcomes can be expected even in patients who eventually opt for surgery and (2) patients who presented more than 30 days after their injury were much less likely to complete nonoperative treatment successfully.

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