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Long-Term Shoulder Function After Type I and II Acromioclavicular Joint Disruption

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Background: Acromioclavicular joint separations are very common lesions, with the majority falling into Rockwood classification type I and II. It is generally agreed that conservative treatment of these injuries leads to good functional results, although there are some studies that suggest these injuries are associated with a high incidence of persistent symptoms.

Hypothesis: Type I and II acromioclavicular joint disruption significantly impairs long-term shoulder function.

Study Design: Case series; Level of evidence, 4.

Methods: The shoulder function of 23 patients who were treated for type I or II acromioclavicular joint disruption was evaluated at a mean of 10.2 years after injury. The objective and subjective measures of the injured shoulder were assessed using Constant, University of California–Los Angeles Shoulder Scale, and Simple Shoulder Test scores and were compared with results of the uninjured shoulder.

Results: At an average follow-up of 10.2 years, 12 of 23 patients (52%) reported at least occasional acromioclavicular joint symptoms. The average Constant score for the injured shoulder was 70.5 and 86.8 for the uninjured shoulder ($P < .001$). The average University of California–Los Angeles Shoulder Scale score for the injured shoulder was 24.1 and 29.2 for the uninjured shoulder ($P < .001$). The average Simple Shoulder Test value for the injured shoulder was 9.7 and 10.9 for the uninjured shoulder ($P < .002$). The extent of acromioclavicular joint disruption and acromioclavicular joint width did not have any statistically significant influence on the shoulder functional scores.

Conclusion: Type I and II acromioclavicular joint disruptions impair long-term shoulder function in about half of patients 10 years after injury.

Keywords: acromioclavicular joint; shoulder; ultrasound; injury; functional outcome

Acromioclavicular (AC) joint injuries are very common and occur usually in people in their second and third decade, especially in active sporting individuals. Studies have shown that approximately 9% of all shoulder girdle injuries involve damage to the AC joint.⁵ The most common mechanism of injury is a direct fall on the shoulder with the arm at the side in an adducted position. The resulting force drives the acromion downward and medially. This can cause a different extent of AC and coracoclavicular ligament disruptions, which result in a variable extent of AC joint separation. Rockwood et al⁸ described the most widely used classification that correlates with increasing soft tissue injury and comprises 6 different types of AC joint

separation. There is general agreement that type I and II injuries should be managed nonoperatively, but there is very little information concerning the results of such treatment and its effect on later shoulder function. Most studies have reported good early function results with 80% to 90% satisfaction rates^{2,4}; however, some reports suggest that type I and II AC joint injuries may lead to a more chronic disability than previously recognized.^{2,3,6} To the author's knowledge there is no study that reports long-term functional results of conservative treatment of these injuries.

The aim of this study was to objectively evaluate the effect of type I and II AC joint disruption on long-term shoulder function.

MATERIALS AND METHODS

The study included all patients treated for isolated type I and II AC joint separation between January 1995 and December 1996 at the author's institution. A search in the hospital database system for patients meeting these criteria was performed. The author identified and contacted

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28 patients, of whom 25 were willing to participate in the study and were available for follow-up examination. Two of the patients were excluded from the study, one due to accompanying rotator cuff tear and the other due to a later developed cerebrovascular insult. The study group included, therefore, 23 patients with an average age of 38 years (standard deviation [SD], ± 13). There were 4 female patients and 19 male patients.

In all patients both shoulders were evaluated. Patients were questioned regarding possible symptoms such as persistent or occasional pain, painful clicking, or a feeling of instability. The shoulder function was assessed using Constant, University of California–Los Angeles Shoulder Scale (UCLA), and Simple Shoulder Test (SST) scores. In addition, ultrasound examination of both AC joints was performed at the time of follow-up examination, and measurements of AC joint width and the extent of joint separation were obtained. Ultrasound was also used to exclude possible rotator cuff tear in the injured and the contralateral shoulder. There were no ultrasonography reports documenting the initial extent of the injury available. For every AC joint, 5 repeated measurements of joint displacement and joint space were performed. Joint displacement was defined as a vertical distance between the superior edge of the lateral end of the clavicle and the superior edge of the acromion. Joint space was defined as a horizontal distance between the articular surface of the clavicle and the articular surface of the acromion in the AC joint. A mean value of the obtained measurements was calculated for each joint and used for statistical evaluation. A measurement of AC joint space was used to identify possible degenerative joint changes, and a measurement of the displacement was used to confirm the type of AC joint disruption.

A Student *t* test for the paired variables was used to analyze the statistical significance of the observed differences of the normally distributed variables in the injured and contralateral shoulder joints. These variables were AC joint separation, AC joint space, and Constant score. For comparison of variables with a non-Gaussian distribution of values, the Wilcoxon matched-pairs test was used. These variables were UCLA score and SST score. Linear regression was used to test for the influence of the type of displacement and of the AC joint space on the shoulder function scores. All statistical analysis was performed using the Graph Pad InStat software (Graph Pad, San Diego, California).

Treatment

All patients were treated conservatively with sling, relative rest, icing, and oral anti-inflammatory agents, followed by a rehabilitation program composed of exercises for strengthening the scapular stabilizers and rotator cuff muscles. Physical therapy (PT) began at 4 to 6 weeks after injury and lasted 2 to 3 weeks. After PT concluded, patients were instructed to continue with the exercises on their own. No specific protocol was followed, and patients completed the rehabilitation program at different institutions. No patient received any injections of local anesthetic or corticosteroid.

TABLE 1
Comparison of Extent of AC Joint Displacement and AC Joint Space Between Group With Type I Disruption, Group With Type II Disruption, and Uninjured AC Joint^a

	AC Joint Displacement, mm (SD)	AC Joint Space, mm (SD)
Type I AC joint injury	1.9 (± 1.4)	3.2 (± 1.3)
Type II AC joint injury	6.4 (± 3.0)	3.7 (± 1.3)
Uninjured AC joint	2.1 (± 1.6)	3.7 (± 1.7)

^aAC, acromioclavicular; SD, standard deviation.

RESULTS

The average age of the patients in the observed study was 38 years (SD, ± 13) with an average follow-up of 10.2 years (SD, ± 0.7). Twelve of 23 patients (52%) reported at least occasional subjective symptoms, such as pain or painful clicking in the AC joint, that interfered with their everyday activities. All symptomatic patients described their symptoms as mild; no patient reported any limitations in his or her daily activities. None of the patients had sought medical treatment due to persisting symptoms. There were 11 patients who were originally treated for a type I AC joint disruption and 12 patients with a diagnosed type II AC joint disruption. The extent of the AC joint injury was confirmed by the author's measurement by ultrasound of the amount of AC joint displacement. In all patients with a type I AC joint disruption, the measured AC joint displacement was less than 3.5 mm, with an average displacement of 1.9 mm on the injured side and 1 mm on the uninjured side. The average joint displacement in the group with a type II AC joint disruption measured 6.4 mm in the injured shoulder and 2.3 mm in the uninjured shoulder. This difference was found to be statistically significant ($P = .0006$).

The average ultrasonographically measured AC joint space in the unaffected joint was 3.7 mm (SD, ± 1.7) and in the affected joint 3.4 mm (SD, ± 1.3 mm). The observed difference was found not to be statistically significant ($P = .61$) (Table 1).

The average measured Constant score in the unaffected shoulder was 86.8 (SD, ± 16) and 70.5 (SD, ± 22) in the affected shoulder ($P < .001$) (Table 2). In 8 patients, the Constant score was 80 or more; in 10 patients the score was between 60 and 79; and 5 of the patients had a score lower than 60, with the lowest value measured at 44. Linear regression was used to test for the influence of the type of AC joint displacement on the measured Constant score in the injured shoulder. The calculated P value of .33 demonstrated that the type of AC joint displacement had no significant influence on the Constant score of the injured shoulder (Table 3). Linear regression was also used to test the influence of ultrasonographically measured AC joint space width on the Constant score in the injured shoulder. Again AC joint space width did not seem to have any significant influence on the Constant score in the injured shoulder ($P = .41$) (Table 3).

TABLE 2

Average Measured Functional Scores for Injured and Uninjured Shoulder With *P* Values Describing Statistical Significance of Differences Between Groups^a

	Injured AC Joint	Uninjured AC Joint	<i>P</i> Value
Constant Score (SD)	70.5 (±22)	86.8 (±16)	<.001
UCLA Score (SD)	24.1 (±6)	29.2 (±2.6)	<.001
Simple Shoulder Test (SD)	9.7 (±2.3)	10.9 (±1.6)	.002

^aAC, acromioclavicular; SD, standard deviation; UCLA, University of California–Los Angeles.

TABLE 3

P Values for Statistical Significance of Influence of Extent of AC Joint Displacement and AC Joint Space on Measured Functional Scores

	Constant Score	UCLA Score	Simple Shoulder Test
Measured AC joint displacement	.330	.42	.49
Measured AC joint space	.41	.95	.87

^aAC, acromioclavicular; UCLA, University of California–Los Angeles.

Average measured UCLA score in the uninjured shoulder was 29.2 (SD, ±2.6) and 24.1 (SD, ±6) and in the injured shoulder ($P < .001$) (Table 2). In 17 of the patients the UCLA score was more than 20; in 6 patients the score was between 10 and 19; and no patient scored below 10. The observed difference in the UCLA score was found to be statistically significant, with a *P* value of .0002. Linear regression was used to determine the influence of the AC joint space and displacement on the measured UCLA score in the injured shoulder. Neither dependent variable had any significant influence on the UCLA score, with the calculated *P* value for AC joint displacement being .42 and the *P* value for the AC joint space being .95 (Table 3).

The average calculated SST score in the uninjured shoulder was 10.9 (SD, ±1.6) and in the injured shoulder 9.7 (SD, ±2.3) ($P = .002$) (Table 2). Linear regression was used to test the influence of AC joint space and AC joint displacement on the SST value of the injured shoulder. Neither dependent variable had any significant statistical influence on the SST value of the injured shoulder, with the *P* values for the AC joint space and AC joint displacement at .87 and .49, respectively (Table 3).

DISCUSSION

The current data show that type I and II AC joint injuries may impair long-term shoulder function. It seems that

these injuries are not so innocent as previously thought, as they result in at least occasional symptoms years later in around half of the patients with this diagnosis. In this group, 12 of 23 patients (52%) reported occasional subjective symptoms such as pain or a painful clicking related to the injured AC joint. Although in none of the patients were these symptoms so pronounced that they would seek medical treatment, the effect of this rather minor injury on long-term shoulder function was demonstrated by comparison of functional status of the injured and contralateral shoulder by the use of Constant, UCLA, and SST scores. All measured scores were significantly lower in the injured shoulder than in the contralateral shoulder, and all observed differences were statistically significant (Tables 2 and 3). The author is aware that the use of contralateral limb as a control has potential limitations, although patients included in the study had never had any injury or problems with the contralateral shoulder. The patient who suffered contralateral cerebrovascular insult and the patient who had rotator cuff tear in the contralateral shoulder were excluded from the study.

There are just a few reports with similar findings in the literature and, to my knowledge, no report with long-term follow-up. Bergfeld et al¹ reported subjective and objective outcomes in 128 patients who sustained type I or II AC joint separations. The follow-up in this group of patients ranged from 6 months to 3.5 years. A total of 39% of patients with type I AC joint separation and 65% of patients with type II AC joint separation had residual symptoms. Abnormal findings on physical examination were present in 43% of shoulders after type I AC joint separation and in 71% of shoulders with type II AC joint separation. Cox³ reported a similar study of short-term follow-up of 151 patients with type I and II AC joint separation. The symptoms related to AC joint were present in 36% of patients who sustained a type I injury and in 48% of patients who sustained a type II AC joint injury. Positive findings on the physical examination of the AC joint were present in 43% of patients with type I AC joint injury and in 77% of patients with type II AC joint injury. In a more recent study, Mouhsine et al⁶ reported on the results of the conservative treatment in type I and II AC joint dislocations. They examined a group of 33 patients after a mean of 6.3 years follow-up. Persistent symptoms related to the AC joint were experienced by 48% of patients in this group. The mean Constant score at the follow-up was 82. They concluded that the severity of consequences after type I and II AC joint sprains is underestimated. This conclusion is supported also by the study of objective strength deficit after type II AC joint injury that was performed by Walsh et al.⁹ They demonstrated that type II AC joint injuries lead to a significant decrease in horizontal abduction strength at high speeds.

An interesting observation of this study is that the measured AC joint space in the injured AC joint didn't differ significantly from the measured joint space of the uninjured AC joint (Table 1). Linear regression analysis didn't reveal any significant influence of either AC joint space or the extent of AC joint displacement on the final functional

shoulder outcome (Table 3). This is contrary to what the author had expected, since it is well known that with aging the AC joint is prone to the development of degenerative changes with progressive narrowing.⁷ One would expect that an injury would promote the development of such changes. Presumably, due to a relatively young population, a longer follow-up would be needed to demonstrate the development of joint narrowing and other osseous changes associated with advanced AC joint degeneration. It is also possible that the observed group was not large enough to identify differences in AC joint space between the injured and contralateral shoulder. The observed deficit in shoulder function after AC joint injury must be, therefore, a consequence of soft tissue injury involving AC joint ligamentous structures and at least in some cases also AC joint intra-articular disk or cartilage.

It should be mentioned that the present study has several limitations. First its cross-sectional design does not allow for making any conclusions about the development or progression of symptoms over time. It cannot be determined whether the 52% of the patients who were symptomatic at the time of observation had persistent symptoms from the index injury or if these symptoms appeared later. Another limitation is the use of the contralateral limb as a control, as its function may be affected by degenerative cuff tear or several other pathologic conditions. Because of this, 2 of the patients identified with compromised contralateral shoulder function were excluded from the study.

In conclusion, type I and II AC joint disruption is associated with a long-term deficit in shoulder function. After an average 10.2-year follow-up, no significant presence of degenerative changes or joint narrowing could be demonstrated.

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