CORACOCLAVICULAR RECONSTRUCTION USING TENDINOUS GRAFT FOR CHRONIC ACROMIOCLAVICULAR JOINT DISLOCATION

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ABSTRACT

Objective: The aim of this study is to present the radiographic and functional results of patients undergoing treatment for chronic acromioclavicular dislocation with coracoclavicular ligament reconstruction using tendon graft. Method: Between 2007 and 2008, fifteen patients with chronic Rockwood type III through V acromioclavicular joint dislocations underwent reconstruction of the coracoclavicular ligaments using semitendinosus tendon graft. Two patients were excluded due to inadequate follow up. Thirteen patients were followed up clinically and radiographically after a mean of 16 months (range 12-26 months). Clinical evaluation was performed using the UCLA and Constant scores. Preoperative and postoperative radiographs were compared. Results: In this group of 13 patients followed up for at least one year, the Constant score ranged from 60.9 (26-88) in the preoperative evaluation to 87 (60-98) at the last evaluation during the postoperative period ($p < .001$). The mean UCLA score improved from 16.8 points (11-27) to 33 (29-35) points. ($p=0.001$). After 1 year of follow-up, the postoperative radiographic control showed twelve patients (92%) with equal coracoclavicular distance between the affected and unaffected shoulders. No anteroposterior translation in the axial view was present in any of the shoulders operated on. Conclusion: The functional and radiographic results were very satisfactory in patients undergoing reconstruction of chronic acromioclavicular dislocations, with a low recurrence rate. Level of Evidence: Level IV, case series.

Keywords: Acromioclavicular joint. Dislocations. Tendons. Transplants.

Citation: *Assunção JH, Ferreira Neto AA, Benegas E, Malavolta EA, Gracitelli MEC, Silva FBA. Coracoclavicular reconstruction using tendinous graft for chronica-cromioclavicular joint dislocation. Acta Ortop Bras. [online]. 2011;19(5):299-04. Available from URL: http://www.scielo.br/aob.*

INTRODUCTION

Symptomatic chronic acromioclavicular (AC) joint dislocation is seldom discussed in literature and consequently there is no consensus regarding its treatment. Although one of the recommended treatments is distal exeresis of the clavicle[1,2] for the treatment of local arthrosis, the presence of dislocated and unstable clavicle can, with time, produce important disorders in dynamic stabilization, in muscle strength of the shoulder, and in the subacromial sliding mechanism. In type I and II lesions of Rockwood et al.[1], where the clavicle is stable, exeresis of the distal extremity of the clavicle can be used successfully. However, in type III, IV and V chronic AC dislocations, in addition to this procedure, it is also necessary to perform some kind of clavicle stabilization aiming to reestablish the anatomical relationship of the acromioclavicular joint and if possible to replace the torn coracoclavicular ligaments.

The clavicle stabilization method most frequently employed nowadays is coracoclavicular stabilization through subcoracoid ligatures with a wide variety of synthesis materials, including highly resistant non-absorbable threads and Dacron or polyester tape.[3,4] Although they can be resistant and keep the clavicle stable, there is consensus in literature regarding the need to perform reconstruction of the coracoclavicular ligaments in order to definitively reconstitute the local anatomy.

Initially described by Weaver-Dunn, coracoclavicular reconstruction with coracoacromial ligament and its variations is the most used in literature.[5-8] However, biomechanical studies for this reconstruction have recently shown greater mechanical resistance with other types of graft.[9,10]

All the authors declare that there is no potential conflict of interest referring to this article.

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Article received on 4/18/10 and accepted on 7/16//2010.

One of the first uses for this purpose was the tendon of the tensor fasciae latae.[11] However, due to better mechanical resistance as well as vast experience in knee ligament reconstructions, knee flexor tendons (semitendinosus and/or gracile) have been used more recently.[12-14]

The aim of this study is to evaluate the radiographic and functional results of patients that have undergone treatment for chronic AC dislocations with reconstruction of the coracoclavicular ligaments with semitendinosus graft.

CASUISTRY AND METHOD

Fifteen patients with symptomatic chronic acromioclavicular joint dislocation were selected for this study.

The inclusion criteria were: Rockwood degree III, IV and V acromioclavicular dislocation lasting for more than three weeks and symptomatic (pain, loss of muscle strength of the scapular girdle); patients between 18 and 60 years of age.

The exclusion criteria were: patients already submitted to other surgical procedures not related to the acromioclavicular dislocation in the same shoulder, other associated lesions in the same upper limb, failure to agree to take part in the study and inadequate follow-up in the postoperative period.

Of the group of fifteen patients, two were excluded due to inadequate follow-up in the postoperative period, totaling thirteen patients included in the study.

The patients were submitted to surgical treatment between April 2007 and June 2008, with mean follow-up time of 16 months (12-26 months).

Twelve patients were male and one female and the mean age was 33.3 years (20-55 years). Eight had their right side affected and seven the left, while nine patients had the dominant side involved. Nine suffered a fall in road accidents (motorcycle, bicycle and pedestrians run over by vehicle), two experienced simple falls to the ground and two fell from heights. The mean interval between the trauma and the surgical procedure was nine months (2-38). Using Rockwood's classification, 10 patients had type V dislocation and three had type III. (Table 1)

Eight patients (61%) did not have any previous surgical treatment for acromioclavicular dislocation in the acute phase. Five underwent coracoclavicular reduction and stabilization with the use of two anchors, with three patients via the arthroscopic and two via the open approach. (Table 1)

Seven patients received grafts from a tissue bank while the graft was autologous in six. The graft used was the semitendinosus tendon.

All the patients were submitted to radiographic evaluation in the preoperative and immediate postoperative periods, and at 15 and 45 days, three and six months and one year after surgery. The radiographies taken were: 1) anteroposterior (AP) view; 2) axillary view to evaluate the congruence of the acromioclavicular joint in the anteroposterior direction; 3) AP view at 15° of cephalic inclination, with both shoulders on the same film to measure the coracoclavicular distance. The measurement of the dislocated clavicle deviation was expressed in percentage according to the following calculation: ((Coracoclavicular distance from the dislocated side - Coracoclavicular distance from the normal side) x 100) / Coracoclavicular distance from the normal side). (Figure 1)

All the patients underwent clinical evaluation in the preoperative period and postoperatively at six months and one year by a physiotherapist not participating in the study, using the Constant and University of California Los Angeles' (UCLA) evaluation methods. The pre- and postoperative quantitative data were evaluated statistically by the Wilcoxon method.

SURGICAL TECHNIQUE

All the patients were submitted to general anesthesia and placed in beach chair position. A lengthwise incision was made in the shoulder, starting over the clavicle, 35mm medial to the acromioclavicular joint, and reaching up to the apex of the coracoid process; the deltoid and trapezius muscles were detached subperiosteal from the clavicle and their distal extremity (10mm of extension on average) was submitted to exeresis. The tendinous graft used was semitendinosus originating from a tissue bank or taken from the actual patient's contralateral limb. (Figure 2 and 3) The previously prepared

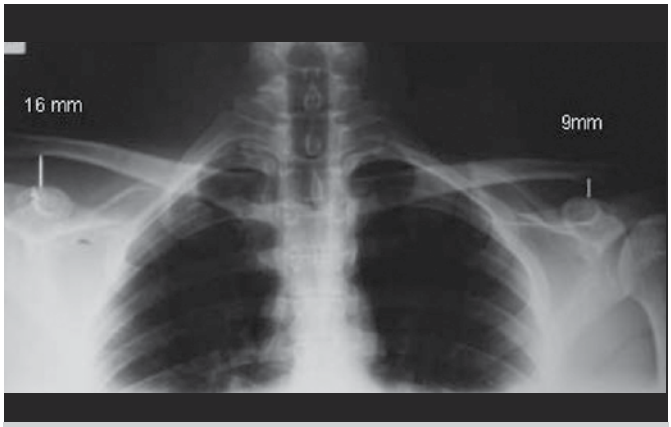

Figure 1. *Anteroposterior radiograph at 15 degrees of cephalic inclination, with measurement of the coracoclavicular distance from both sides. The clavicle on the affected side is 77% further from the coracoid process in relation to the normal side.*

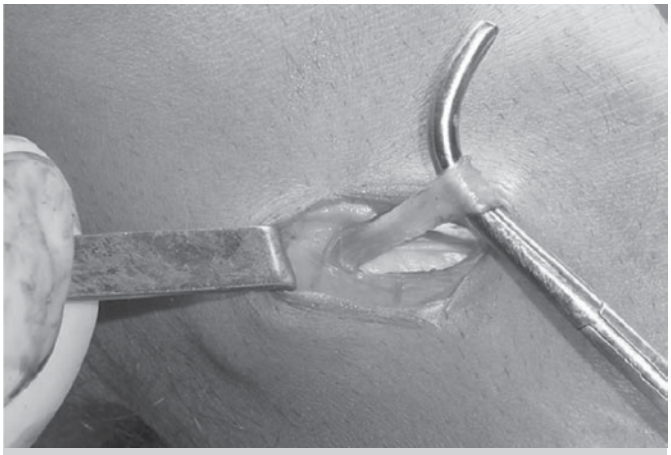

Figure 2. *Identification of the semitendinosus tendon.*

Table 1. *Clinical data of the patients.*

Patient	Sex	Age	Side affected	Dom. side	Trauma mechanism	Trauma-surgery interval	Classification	Previous surgery
1	M	25	R	R	Fall to ground	2	V	Yes
2	M	38	R	R	Fall from motorcycle	2	V	Yes
3	M	33	R	R	Fall from motorcycle	18	V	No
4	M	40	L	R	Fall from motorcycle	4	V	Yes
5	M	21	R	R	Fall to ground	10	III	No
6	M	55	L	R	Fall from height	9	V	No
7	M	32	R	R	Fall from motorcycle	2	V	Yes
8	M	28	R	R	Fall from bicycle	6	III	No
9	M	29	R	R	Pedestrian run over by vehicle	38	III	Yes
10	F	33	L	L	Fall from height	18	V	No
11	M	20	R	R	Fall from motorcycle	5	V	No
12	M	22	L	R	Pedestrian run over by vehicle	2	V	No
13	M	46	L	R	Pedestrian run over by vehicle	2	V	No

graft was then passed, together with four non-absorbable sutures (Ethibond® 5) under the coracoid process.
Five tunnels were made in the distal clavicle: one of the tendinous graft stumps was passed through the central tunnel and the other over the clavicle and through the peripheral tunnels (two anterior and two posterior) to the sutures. (Figure 4) The clavicle was reduced and the sutures tied, reestablishing the anatomical relationship of the acromioclavicular joint or even with slight hyper-reduction. Afterwards the graft stumps were sutured with tendon-tendon stitches. (Figure 5) The deltoid and trapezius muscles were reinserted in the clavicle and the subcutaneous tissue and skin were sutured. (Figure 6)
The patients remained immobilized with a splint for six weeks and started the physiotherapy treatment in the third week, with passive elevation only allowed up to 90°. Starting from the sixth week, the immobilization device was removed and the patients were cleared for active and active assisted movement. Exercises against resistance were only commenced after the twelfth week.

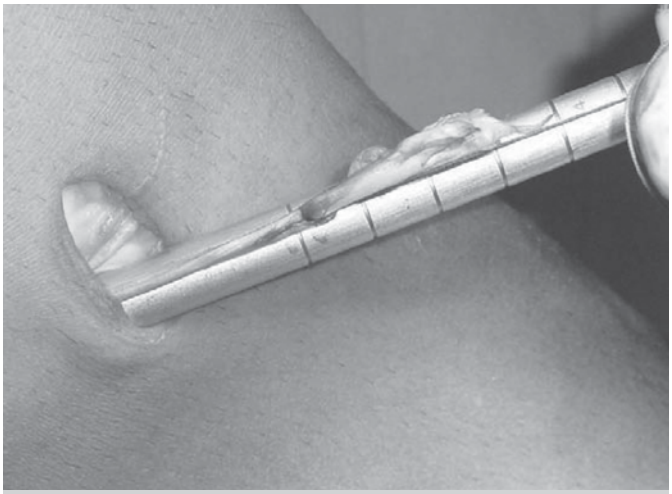

Figure 3. *Removal of the graft with the assistance of a tendon striper.*

RESULTS

In this group of 13 patients, with minimum follow-up of one year, the Constant score ranged from 60.9 (26-88) in the preoperative evaluation to 87 (60-98) in the last evaluation in the postoperative period. The UCLA score went from 16.8 (11-27) in

the preoperative period to 33 (29-35) in the postoperative evaluation. The functional improvement quantified by these scores was statistically significant (p=0.001). (Table 2)

In the physical examination, held one year after surgery, only one patient presented clavicle instability in the anteroposterior and craniocaudal directions.

In the radiographs taken in the preoperative period, the measurement of the coracoclavicular distance from the affected side was, on average, 129% greater than the distance from the normal side. In the radiographs after one year of follow-up it

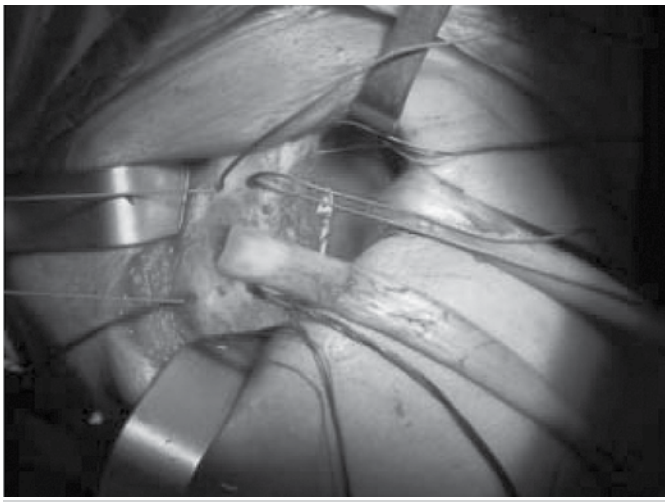

Figure 4. *Passage of the graft through the central tunnel and Ethibond sutures through the peripheral tunnels.*

Figure 5. *Joint reduction, having tied the Ethibond sutures and performed tendon-tendon stitches in the graft.*

was 1.84%, a statistically significant improvement (p=0.001).

In the immediate postoperative radiographs of two patients we found an anatomical reduction of the acromioclavicular joint, the distance from the coracoclavicular space of the affected shoulder was equal to the space of the contralateral shoulder and in 11 patients we found hyper-reduction in the craniocraudal

Figure 6. *Reinsertion of the deltoid and trapezius muscles in the distal clavicle.*

Table 2. *Initial and final scores of the patients.*

Patient	Initial UCLA	Final UCLA	Initial constant	Final constant
1	15	35	58	98
2	15	33	66	95
3	11	35	50	94
4	13	35	62	96
5	15	33	70	93
6	16	35	64	94
7	13	34	26	84
8	27	35	88	95
9	17	29	58	60
10	19	31	64	73
11	26	33	73	93
12	16	29	63	66
13	15	32	50	90

direction with mean value of 50% (10-200%). In the axillary view, the reduction was anatomical in the anteroposterior direction in all patients.

In the radiographic control one year after surgery, we found 12 patients with anatomical reduction both in the craniocaudal and in the anteroposterior direction. Only in patient number 12 was the measurement of the coracoclavicular space on the operated side 45% greater than the normal side, while it was 250% greater in the preoperative period.

We had two complications, one patient with superficial infection in the surgical wound, which was resolved with surgical flushing and the use of antibiotic therapy (patient number 12). The other patient did not use the splint appropriately in the postoperative period and lost the reduction. This patient was submitted to further surgical treatment using the same technique with optimal results. All patients were satisfied with the surgical procedure.

DISCUSSION

Surgical treatment is indicated in chronic dislocations, when symptomatic. In type I and II lesions, where the clavicle is stable, resection of the distal portion of the clavicle alone is sufficient for us to eliminate patients' painful symptoms. In type III, IV and V lesions, besides acromioclavicular joint reduction it is imperative to reconstruct the coracoclavicular ligaments. The most popular technique for this reconstruction is transfer of the coracoclavicular ligament from accordion to clavicle, described by Weaver and Dunn[8] and later by Kanabec et al.[15] Some studies have shown good results with this transfer technique either isolated or with reinforcement using coracoclavicular fixation with screws, bands or high resistance suture threads, even in some cases that had total or partial loss of the reduction in the postoperative period.[5-7]

Biomechanical studies have shown that the isolated transfer of the coracoclavicular ligament presents less mechanical resistance, both in the superior and posterior directions, than in comparison to native coracoclavicular ligaments.[9,16] Some studies have shown that the reconstruction of these ligaments with tendinous grafts has greater mechanical resistance, comparable to that of the coracoclavicular ligaments and superior to the Weaver-Dunn technique associated or not with coracoclavicular fixation.[9,10,17,18]

Aiming to clinically verify the superiority of the reconstruction of coracoclavicular ligaments with tendinous grafts, several authors conducted studies with this technique in the treatment of chronic AC dislocation. In 2001, Jones et al.[11] described a case in which they obtained an optimal result. Later on other studies, with a larger number of cases,[12,19] showed excellent clinical and radiographic results similar to that found in our study. More recently, Tauber et al.[20] carried out a prospective study comparing the Weaver-Dunn technique with tendon reconstruction and obtained superior clinical and radiographic results when using the last technique.

Like Nicholas et al.[19], we performed the reconstruction fixing the graft through a single bone tunnel in the clavicle. However, other authors[12,20,21] preferred to perform this fixation through two tunnels with the objective of reproducing the anatomical orientation of the conoid and trapezoid ligaments. It should be noted that the creation of two tunnels in the clavicle increases the risk of fracture particularly in narrower clavicles or when it is necessary to create larger tunnels for the passage of wider grafts. In our cases we did not have fracture or osteolysis of the clavicle.

We believe, according to some authors,[12,19,20] that ligament reconstruction should be protected with coracoclavicular fixation, which in this study was performed with subcoracoid ligature (non-absorbable threads - Erthibond® 5). Furthermore, as a form of protection, to avoid lengthening of the graft during the healing phase, active flexion-abduction of the operated limb was not allowed for six weeks. We had a case of reduction loss in the first months of the postoperative period, as the patient did not respect the immobilization period. We observed during reoperation that the Ethibond® threads had snapped and the graft was integrated to the clavicle, but lengthened.

We recommend hyper-reduction of the acromioclavicular joint in the craniocaudal direction, since as noticed in other studies,[17,20] during the revascularization phase, the graft, even though protected with a form of acromioclavicular fixation, undergoes lengthening. As verified in our study with 11 patients in the immediate postoperative radiograph we encountered hyper-reduction in the craniocaudal direction, averaging 50% and after one year they all presented anatomical reduction, indicating graft lengthening. This does not apply to the anteroposterior direction, where anatomical reduction should be performed in the intraoperative period.

Our functional and radiographic results were highly satisfactory with this kind of reconstruction in accordance with studies in literature.[12,19,20] Our personal experience with ligament reconstruction in chronic AC dislocations using the Weaver-Dunn technique[8] is not good with high rates of reduction loss (67% - data not published). Coracoclavicular reconstruction with tendinous graft appears to us to be an appealing and viable technique, and is currently the treatment of choice for this pathology in our service.

CONCLUSION

The functional and radiographic result was very satisfactory in patients submitted to reconstruction of chronic acromioclavicular dislocations, with a low rate of recurrence.

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