

## ORIGINAL ARTICLE

# Treatment of type III acute acromioclavicular joint dislocations according to the Rockwood classifications with AO hook plate

A. Lázaro-Amorós\*, X. Cardona-Morera de La Vall and X. Gómez-Bonsfills

Orthopaedic Surgery and Traumatology department, Clínica MC-Mutual, Barcelona, Spain

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### KEYWORDS

Acromioclavicular joint dislocation;  
Hook plate;  
Internal fixation

### Abstract

**Purpose:** Assess the short term functional and radiological results of using the AO hook plate in type III acute acromioclavicular joint dislocations.

**Materials and methods:** During the 2006-2008 period, we performed 70 interventions due to injuries (fractures and dislocations) of the clavicle, 26 of them being acute or chronic acromioclavicular joint dislocations. We analyzed the results of 11 acute cases treated with an AO hook plate. This group had an average age 38 years, 6 cases due to traffic accidents and 5 were related to accidents at work. The plate was withdrawn at an average of 9 weeks (range 6-12 weeks).

**Results:** The functional outcome of the series according to the Constant test of acute AC joint dislocations was a mean of 94 with the score on the VAS of 2.1. Average time to surgery for acute joint dislocations was 9 days. All the patients, except for one, had subacromial physical discomfort during physiotherapy with the abducted arm that disappeared after removing the plate. We observed a case of loss of reduction after removal of plate and did not observe any other significant complications.

**Conclusions:** Surgical treatment of acute AC joint dislocations with AO hook plate, without reconstruction of the coracoclavicular ligaments, offers good results. We observed few complications, allowing the patients to return to work early without sequels.

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\*Corresponding author.

E-mail: alazaro@mc-mutual.com (A. Lázaro-Amorós).

**PALABRAS CLAVE**

Luxación  
acromioclavicular;  
Placa gancho;  
Fijación interna

### Tratamiento de las luxaciones acromioclaviculares agudas de tipo III de la clasificación de Rockwood con placa gancho AO

**Resumen**

**Objetivo:** Valorar los resultados funcionales y radiológicos a corto plazo de la utilización de la placa gancho AO en el tratamiento quirúrgico de las luxaciones acromioclaviculares (AC) agudas de tipo III.

**Material y método:** Durante el período 2006-2008 se han realizado 70 intervenciones por lesiones (fracturas y luxaciones) de la clavícula, 26 de ellas luxaciones AC agudas o crónicas. Hemos analizado los resultados de las luxaciones agudas tratadas con una placa gancho AO.

La serie constaba de 11 luxaciones AC de tipo III, con una edad media de 38 años. En 6 casos ocurrieron por accidente de tráfico y en 5 casos ocurrieron por etiología laboral. La media de la retirada de la placa fue a las 9 semanas (rango de 6-12 semanas).

**Resultados:** Los resultados funcionales de la serie según el test de Constant fueron de 94 puntos de media y la escala analógica visual fue de 2,1. El tiempo medio hasta la cirugía de las luxaciones agudas fue de 9 días. Todos los pacientes, menos uno, presentaban molestias subacromiales durante la fisioterapia y que desaparecieron al retirar la placa. Hemos observado un caso de pérdida de reducción tras la retirada de la placa y no hemos observado otras complicaciones significativas.

**Conclusiones:** El tratamiento quirúrgico de las luxaciones AC agudas con la placa gancho AO, sin la reconstrucción de los ligamentos coracoclaviculares, ofrece un buen resultado. Hemos observado pocas complicaciones y ha permitido la reincorporación laboral de los pacientes sin secuelas.

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**Introduction**

The treatment of acromioclavicular (AC) joint dislocations continues to be a point of controversy. According to Rockwood,<sup>1</sup> type I and II injuries should receive conservative treatment. Type IV to VI injuries should be considered for surgery. However, type III lesions continue to generate controversy.

The results of 2 meta-analyses<sup>2,3</sup> point more towards a conservative treatment than a surgical one, considering that this approach provides equal or better functional results, fewer complications, and a faster reincorporation to work or recreational activities. Following the analysis of 3 randomised prospective studies with intervened patients,<sup>4,6</sup> Ciccarelli et al<sup>3</sup> concluded that surgical treatment would be indicated in patients with professions requiring physical labour or that require movements that are repetitive or over the head.

Surgery is justified for restoration of joint stability and congruency, and to avoid the long-term development of painful sequelae and reduced strength in the affected extremity.<sup>7-12</sup> Several different procedures have been used for surgical treatment, such as the Bosworth technique, Kirschner AC needles, Weaver-Dunn<sup>13</sup> and coracoclavicular PDS tape, among others. The objective of this review is to evaluate the results of treating type III acute AC joint dislocations with a hook plate in comparison with other techniques and the conservative treatment, as well as to determine the need for reconstructive coracoclavicular ligament surgery, surgical complications, and functional and radiographic results.

**Material and methods**

During the 2006-2008 period, 70 clavicle injuries were intervened on (fractures and dislocations), 26 of which were acute or chronic AC dislocations. Seventeen cases (12 acute and 5 chronic) were treated with an AO hook plate (Synthes-Stratec Medical, Switzerland), which have modular hooks 15 to 18mm deep and 6 to 8 orifices for screw placement. The rest of the cases were treated by other surgical procedures (Weaver-Dunn, Kirschner needles, and PDS tape).

In acute type III AC joint dislocations, only the plate was used and the AC ligaments were reconstructed without any other surgical manipulation of the coracoclavicular ligaments. In chronic dislocations, as well as using the hook plate and AC ligament reconstruction, the clavicle was also fixed to the coracoid through a second surgical procedure (Tight Rope<sup>®</sup> was used in 3 cases, Cork Screw<sup>®</sup> in one, and a PDS tape in one).

For analysis of the results, we evaluated only the group of patients with acute type III dislocations, this being the most homogeneous subset, allowing a better evaluation of the results of the technique (fig. 1). Of the 11 cases in the study, 10 were men and one was a woman. The mean age was 38 years (range: 20-51 years). In 6 cases, the injury was produced by traffic accidents, and 5 were due to work-related aetiologies (falls from height landing on the shoulder). None of these patients presented with previous injuries to the shoulder in question. Ten performed physically demanding activities and one was sedentary (table 1).

Acute dislocations were operated on with a mean delay of 9 days (range: 0-27 days) after the trauma. The surgical procedure was performed under plexular anaesthesia in the beach chair position with the extremity exposed. We applied antibiotic prophylaxis in accordance with standard procedures.

A longitudinal incision was made over the AC joint with minimal muscular dissection and no damage to the articulation. The AC ligaments were reconstructed when allowed, although the coracoclavicular ligaments did not receive reconstruction in any of the cases. Following plate placement, the stability of the clavicle and subacromial hook was tested and the extremity was mobilised. During the surgery, scarring was kept to a minimum and we avoided individualising the structures surrounding the clavicle that could threaten its stability.

Mean hospitalisation time was 48 hrs. The arm was kept at rest in a sling for 2 weeks, and physical therapy was commenced immediately, according to pain tolerance. Mobility was restricted in abduction and antepulsion above horizontal (90°) in patients with subacromial discomfort.

We used anteroposterior radiographs for preoperative and postoperative AC joint observation (fig. 2), which provided enough information for evaluation of the reduction loss in the clavicle, AC joint deterioration, and the presence



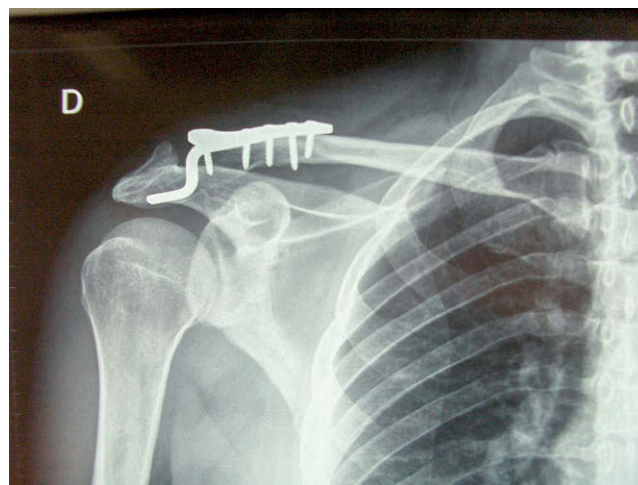
**Figure 1** Acromioclavicular type III dislocation, according to the Rockwood classification system.

of subacromial erosion due to the presence of the hook. The mean time to plate removal was 9 weeks (range: 6-12 weeks). The follow-up period was a mean of 6 months (range: 4-12 months).

## Results

The functional evaluation score using the Constant test<sup>18,19</sup> at the last follow-up exam was 94 points, and the visual analogue scale was 2.1 (table 1).

Mean time to complete reincorporation into physical activity was 4.5 months (range: 2-9 months). No sequelae or incapacities for returning to work activities were registered. All of the patients save one had discomfort in abduction and antepulsion greater than 90° during physical therapy, which disappeared after removing the plate. The plate of the patient who had no discomfort was removed after 12 weeks; one of the objectives of the early removal was to



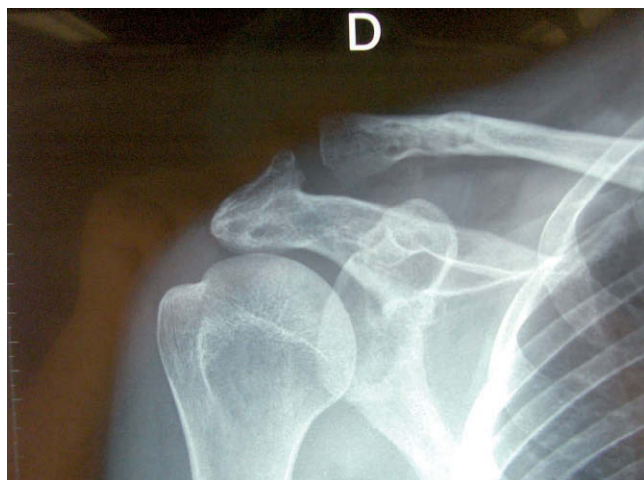
**Figure 2** Reduction of an acromioclavicular type III dislocation with an AO hook plate.

**Table 1** Summary of the results

Case	Age	Sex	Occupation	Type of accident	Time OMR (days)	VAS Scale	Constant Test <sup>*18,19</sup>
No. 1	33	M	Chef	Traffic	54	2	96
No. 2	24	M	Construction worker	Occupational	41	2	88
No. 3	36	M	Cook	Traffic	85	2	94
No. 4	28	M	Mechanic	Traffic	73	1	96
No. 5	44	M	Cleaner	Occupational	60	3	91
No. 6	53	F	Food handler	Occupational	69	2	93
No. 7	41	M	Technician	Occupational	89	0	100
No. 8	37	M	Grocery bagger	Traffic	35	3	95
No. 9	50	M	Maintenance	Occupational	64	3	94
No. 10	20	M	Technician	Traffic	56	2	92
No. 11	51	M	Architect	Traffic	82	3	93

VAS: visual analogue scale; M: male; OMR: time to osteosynthesis material removal in days; F: female.

\*Constant test: scale for measuring functional results.



**Figure 3** Loss of reduction following the removal of the AO hook plate in an acromioclavicular type III dislocation.

avoid consecutive complications in the presence of the hook. In 10 of the 11 cases, no loss of reduction was observed following plate removal. The loss of reduction in the one case was partial (fig. 3), no increase was observed in the final follow-up radiograph, and there were no clinical repercussions or delays in the patient's reincorporation to occupational activities.

We did not register any septic complications or osteosynthesis failures due to screw removal, loss in reduction of the subacromial hook, or medial fractures in the plate borders.

The final follow-up radiograph showed no calcifications of the coracoclavicular ligaments, articular diastasis, AC osteoarthritis, or erosions in the inferior face of the acromion.

## Discussion

A conservative treatment of acute AC dislocations is the standard procedure for type I and II dislocations on the Rockwood classification system.<sup>1</sup> In type IV to VI dislocations, a surgical approach is clearly indicated due to the high residual instability and potential complications that can be caused by the positioning of the clavicle. The controversy surrounding treatment of type III dislocations continues today. The meta-analyses,<sup>2,3</sup> in spite of inclining towards a conservative treatment, make note of their limitations. Certain weak points stand out, such as the wide range of surgical techniques, distinct scales to measure functionality, and the existence of only 3 randomised prospective studies in the literature.<sup>2,3</sup>

We have used several different treatment methods for this type of dislocation, including the conservative approach, as is the standard practice in the field. This has allowed us to observe that post-treatment discomfort was very common in the sub-group of patients with physically demanding professions. Other authors who have used the conservative method and long-term follow-up have come to the same conclusions.<sup>7,8</sup>

The appearance of localised pain due to the progressive deterioration of the AC joint is frequent, and the grade of dislocation and external cutaneous deformation can also be observed to increase. In some of these cases, it was necessary to perform a resection of the distal end of the clavicle or a secondary stabilisation<sup>7,8</sup> as a palliative treatment. This experience in the treatment of type III AC joint dislocations has led us to suggest that surgery is the first option in these cases, in accordance with other authors.<sup>9-11</sup>

The ideal surgical procedure to be used in these cases remains an unresolved question. Published studies that take into account the various available techniques<sup>6,10-12</sup> present similar functional results, but differ in type, percentage of complications, and other aspects that we consider to be very important. In our study we have attempted to find a reliable treatment that would allow for an early start of physical therapy and reincorporation to work activities. We believe that the AO hook plate presents advantages over other procedures, although perhaps not with respect to other hook plates with similar characteristics.<sup>14-17</sup> We consider that other procedures, such as Weaver-Dunn or coracoclavicular PDS tape, are more demanding and less reproducible.<sup>13</sup> Other, more complex procedures, such as the Bosworth technique or fixation with Kirschner AC needles, present more complications and higher percentages of loss in reduction following the removal of material.<sup>4-6</sup>

As with other techniques (Bosworth or Kirschner needles), the plate presents the inconvenience of requiring removal.<sup>10-12</sup> It has the advantage of lower material failures, allows the optimisation of the scarring process and an early and safe start to physical therapy, and with it, allows for an early removal of the material in the case that the plate might present an added risk for redislocation.<sup>10,12</sup> Furthermore, the use of a plate reduces the potential complications inherent to prolonged maintenance.<sup>12,20,21</sup>

We consider it to be of great importance to perform a careful dissection and preservation of the trapezius and deltoid muscle insertions in the clavicle while removing the plate. Koukakis et al<sup>12</sup> point out that if an early treatment is applied to dislocations and the scar is preserved upon plate removal, the percentage of redislocations is low, and thus consider that suturing the coracoclavicular ligaments is made unnecessary. The low incidence of losses of reduction in our study leads us to concur with this affirmation.

The patients treated with hook plates in various studies present similar functional results and complications.<sup>12,22,23</sup> Some used a longer follow-up period than in our study, but this does not imply significant variations in the results obtained.

In our study, almost all of the patients presented with subacromial discomfort, which is a slightly higher percentage than reported by other authors using the same surgical technique.<sup>12,16</sup> Upon analysis of the characteristics of these studies, we have found no motive to justify this discrepancy. In those groups where the plate was not removed early, the incidence of subacromial erosion, disassembly, and material breakup increased significantly.<sup>11,12</sup> Along this same line, advanced age and osteoporosis contraindicate the use of this technique.<sup>12,21</sup>



The occupational environment makes follow-up and the objective evaluation of results difficult in these cases, as other authors have also highlighted.<sup>4,6</sup> The time to recuperation and reincorporation to regular occupational activities in our group was higher than in other studies.<sup>9-11</sup>

To conclude, we consider that our short-term follow-up and the occupational activity of our patients present a potential risk for future instabilities. The low incidence of complications in our study could be due to the fact that we only included 11 patients, the early removal of the plate, and the short follow-up period. We believe that the use of the hook plate is a reproducible, technically undemanding procedure that offers good results in acute AC dislocations and avoids the need for reconstruction of the coracoclavicular ligaments.

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