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Comparison of Surgical Techniques Used in Treating Acromioclavicular Dislocation in Patients Participating in Sports: A Systematic Review

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Abstract

Introduction: The acromioclavicular joint is a superficial diarthrodial joint that surrounds the medial articular facet of the acromion and the distal portion of the clavicle. Due to its anatomy and biomechanics, it is highly susceptible to trauma and in young men who play contact sports, acromioclavicular dislocation is common. This article aimed to systematically review the literature and compare the surgical techniques used in the treatment of acromioclavicular dislocation in patients who practice sports. **Methods:** This systematic review was conducted according to the International Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines. Eligible studies for this systematic review included articles in English or Spanish published between 2013 and 2023, which mention the occurrence of acromioclavicular dislocation during sports practices. Additionally, only studies that addressed the surgical treatment of acromion-clavicular dislocation and contained original data on the topic were included. **Results:** We found 144 eligible studies after searching the LILACS and PubMed databases. Based on the inclusion and exclusion criteria and the reviewers' consensus, we selected four studies for the systematic review. 133 patients with AC joint displacement were evaluated. **Mean Age**: approximately 31.90 years. 81.92 of these injuries occurred during sports practice. **Surgical Procedures Used**: titanium

plates fixation (49 patients), arthroscopy (24), single tunnel technique (30) and coracoid sling technique (30). The results of the visual analog scale and Constant-Murley scores varied between the techniques used. Twenty-two complications after surgical treatment were identified. **Conclusion:** A significant variability of operative techniques can be used in the surgical approach of acromioclavicular dislocation, such as arthroscopy, single tunnel, coracoid sling and titanium plates. Although it presented excellent functional results compared to the other three techniques evaluated by this review, using titanium plates is not the gold standard since other techniques not assessed by this work may be more effective.

Keywords

Acromioclavicular Joint, Shoulder Dislocation, Surgical Procedure, Postoperative Complications, Postoperative Care

1. Introduction

The acromioclavicular (AC) joint is a superficial diarthrodial joint surrounded by hyaline cartilage, which surrounds the medial articular facet of the acromion and the distal portion of the clavicle. It is responsible for joining the shoulder girdle to the axial skeleton, and is stabilized by the joint capsule, the acromioclavicular and the coracoclavicular ligaments. Due to its anatomy and biomechanics, it is highly susceptible to trauma [1].

Injuries to this joint represent 9% of all shoulder injuries and account for 40% to 50% of shoulder injuries after sports events. Epidemiologically, men are affected five times more than women [2]. In young men who play contact sports such as rugby and martial arts, AC dislocation is common [3] [4] [5] [6]. According to previous research, the lesion has an estimated annual incidence of 1.8 per 10,000 inhabitants [7].

The dislocation mechanism is usually associated with a direct collision in the superolateral region of the shoulder in adduction, in which, depending on the intensity of the trauma, it displaces the acromion medially and inferiorly in relation to the clavicle. Another important cause, although indirect, is the fall from a height with an extended arm or elbow: the impact causes the dislocation of the AC joint and rupture of the coracoclavicular ligament, as the head of the humerus moves inferiorly to the acromion, resulting in vertical and horizontal instability [4] [8].

Acromioclavicular dislocation can be classified into six types, according to Rockwood *et al.*, based on the degree and direction of clavicular displacement, and depending on the classification, the therapy can be conservative or surgical [9]. Generally, the conservative approach with sling, analgesia, ice, and physiotherapy is indicated for grade III lesions or lower. However, suppose the displacement is >75%, the initial approach is ineffective, and the patient fits the

profile of a high-performance worker or athlete surgical reconstruction can be recommended, as these cases are associated with pain and function limitation. In the case of type IV - V lesions, surgical intervention is the first choice for stabilization and reduction of the AC joint [8]. In addition, because this is a rare lesion pattern, with only 12 cases reported in the literature, the Rockwood type VI acromioclavicular joint injury will not be addressed in this review [10].

A randomized study by the European Society of Sports Traumatology compared the postoperative outcome of both modalities in 73 athletes aged 29 to 35 years, with high-grade acromioclavicular dislocation (grade IV - V) for 24 months. For athletes with high-grade injuries and throwing athletes, the double-suture-button system anatomical fixation method is more effective than clavicular hook plate fixation [5].

Thus, the purpose of this study is to evaluate the main surgical techniques described in the literature used in treating acromioclavicular dislocation in patients participating in sports and to indicate the most appropriate surgical treatment through the analysis of parameters such as average follow-up, postoperative outcomes and complications.

2. Methods

2.1. Literature Search Strategy

This systematic review was conducted according to the guidelines of the International Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA). Searches were conducted in Pubmed and Lilacs electronic databases between June and July 2023. The descriptors "acromioclavicular joint", "joint dislocations", and "sports" were used according to the Medical Subject Headings to obtain well established information during the research.

2.2. Eligibility Criteria

The studies included in this systematic review were selected using the following criteria: articles in English or Spanish from 2013 that mention the occurrence of acromioclavicular dislocation during sports practices. In addition, only studies addressing the surgical treatment of acromioclavicular dislocation and containing original data on the subject were included. Thus, abstracts, case reports, expert opinions, qualitative studies, editorials, review articles, congress presentations, biomechanical, pilot, cohort and cross-sectional observational studies, and those involving pediatric patients, individuals undergoing cancer treatment, and those who underwent non-surgical treatment for acromioclavicular dislocation were excluded.

2.3. Qualitative Evaluation

Two independent evaluators analyzed each article according to the inclusion and exclusion criteria, classifying them as eligible for the final evaluation or not. The International PRISMA checklist was used to evaluate the quality of the articles.

2.4. Data Extraction

Data were extracted from the body of the text, tables, and figures of all articles included in this study.

2.5. Steps for Selection

The steps for the selection of articles were organized according to the criteria of the International PRISMA. Initially, the articles were searched in the Pubmed and Lilacs databases using the proposed descriptors and the Boolean operator "AND". Then, the duplicate studies were removed and the remaining articles were evaluated by reading the title and the abstract, leading to a systematized database. In the next step, the studies were considered eligible for systematic review after the complete reading of each article, which was stored in a second database. In the inclusion stage, the studies were discussed to find convergent and divergent points with the current literature, to produce a critical summary with the information provided by the included articles.

3. Results

We found 144 potentially eligible studies after searching the LILACS and PubMed databases. Of these, one article that was duplicated has been removed. In addition, 20 references that dealt with animal studies were excluded from the selection, in addition to two studies that were not in English or Spanish, and 22 articles that did not address acromioclavicular dislocations caused by sports practices. Furthermore, 32 studies were removed from the database formed because they lacked original data on the topic. Of the remaining 67 studies, 52 were closed. Thus, 15 remaining articles were selected for the formation of a second database, which was analyzed by two independent evaluators.

After a thorough review of the articles, three were excluded due to prohibited access, three were removed because they did not address the surgical approach to acromioclavicular dislocation and five were discarded due to insufficient epidemiological data. Finally, four articles were selected for the review. **Figure 1** shows the process of selecting articles according to the PRISMA procedure.

In the selected studies, 133 patients with AC joint displacement were evaluated. These lesions occurred in patients between the ages of 18 and 64 years, with an average of 31.90 years. Of these, 96 were men, 37 were women, and 81.92 of these injuries occurred during sports practice. According to the classification of Rockwood *et al.*, 40.6 patients had grade III lesions, 39.76 had grade IV lesions, and 52.64 had grade V lesions (**Figure 2**). In addition, the duration of patients' follow-ups differed significantly among the studies, ranging from 3 to 50.1 months [3] [12]. Regarding the surgical procedures used, 49 patients were treated using titanium plates fixation [3] [13], 24 underwent arthroscopically-assisted techniques to stabilize the coracoclavicular joint [12], 30 were treated using the single tunnel technique [14] and another 30 were treated using the coracoid sling technique [14].

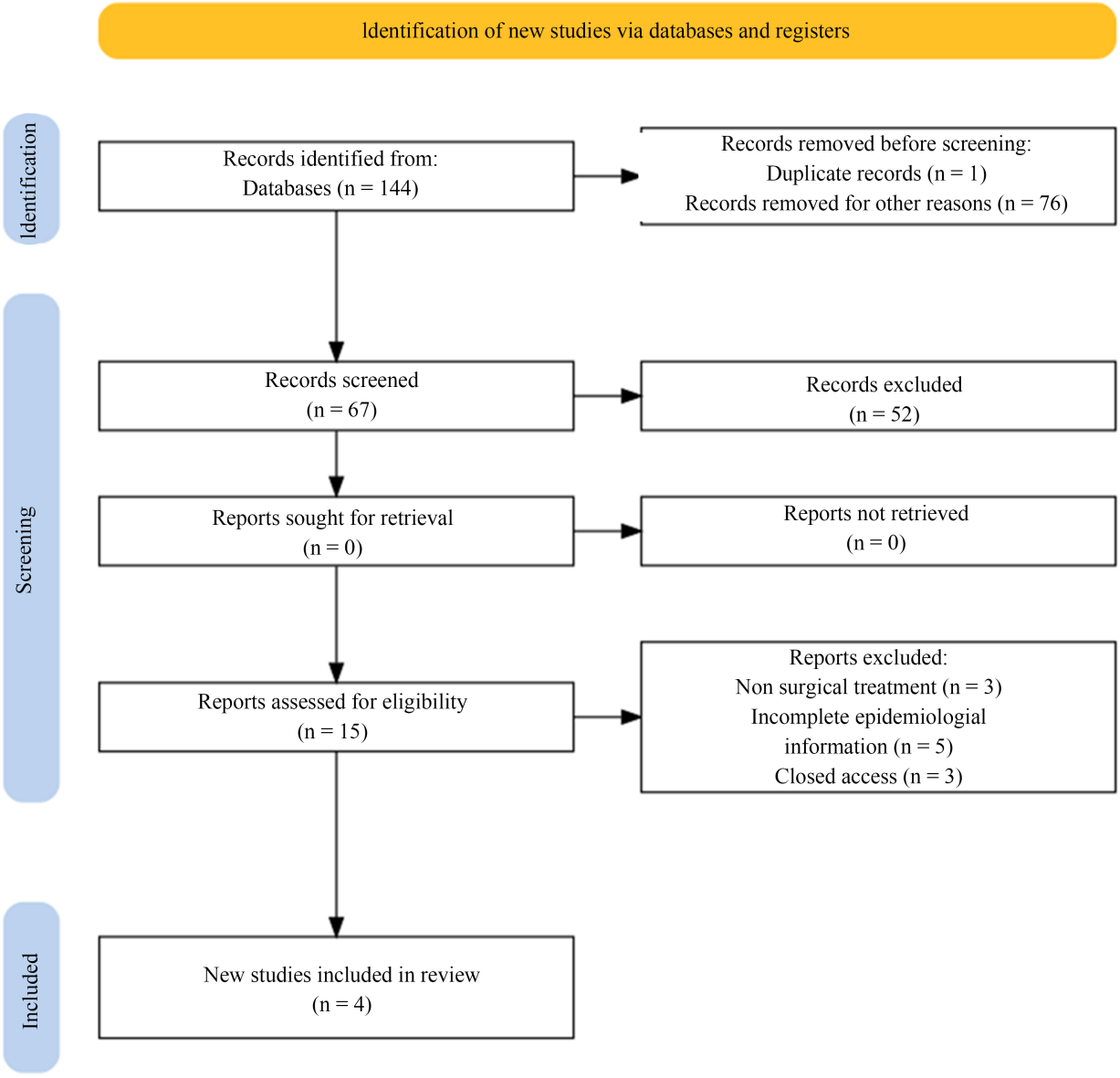

Figure 1. Preferred reporting items for systematic reviews and Meta-Analyses (PRISMA) flow diagram [11]. From the initial 144 records, 4 studies were included.

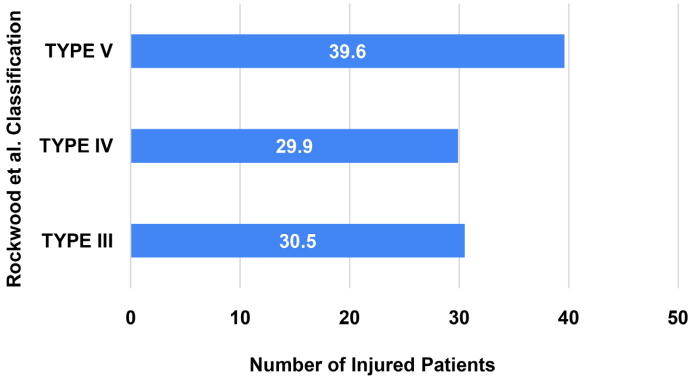

Figure 2. Number of injured patients according to the classification of Rockwood *et al.*

There was a decrease on the visual analog scale (VAS) and an increase on the Constant-Murley scores among patients who were treated with fixation of clavicular titanium plates [13]. Regarding those who underwent arthroscopic treatment, 91% returned to full employment and 86% to sports practice after 1 year [12]. Moreover, after the same period, the Constant-Murley score increased by 10 points [12]. In addition, 25 of the 30 patients who underwent the single tunnel technique returned to their activities within 4.2 months [14]. However, 19 patients who underwent the coracoid sling technique were able to return to normal activities in 5.1 months [14].

In this systematic review, 22 complications after surgical treatment were identified, including: six cases of infection [13] [14], two algodystrophies [12], two osteolysis [12], three device failures [12], one fracture [12], three patients reported deficit in lateral rotation [12], two cases of loss of displacement reduction [14] and three grade II dislocations [14]. **Table 1** presents a summary of the characterization of these studies.

4. Discussion

The statistical analysis revealed a clear distinction between sexes and underlying causes of acromioclavicular dislocation involvement. When examining the entire population assessed in four different studies (133 patients), with a mean age of approximately 31.90 years, it was notable that men were more frequently affected, accounting for approximately 72.18% of the total sample analyzed (**Figure 3**). The main causes of AC displacement in the patients in the studies evaluated were: sports-related etiologies accounted for approximately 61.59% of the cases, followed by traffic incidents (24.03%) and other varied causes (14.38%), including occupational and domestic accidents, as reported in the studies (**Figure 4**). These findings establish a direct correlation with what has been described in other previous articles, which show that AC displacement is more common in young men and is mainly caused by sports activities and traffic accidents [2] [15] [16].

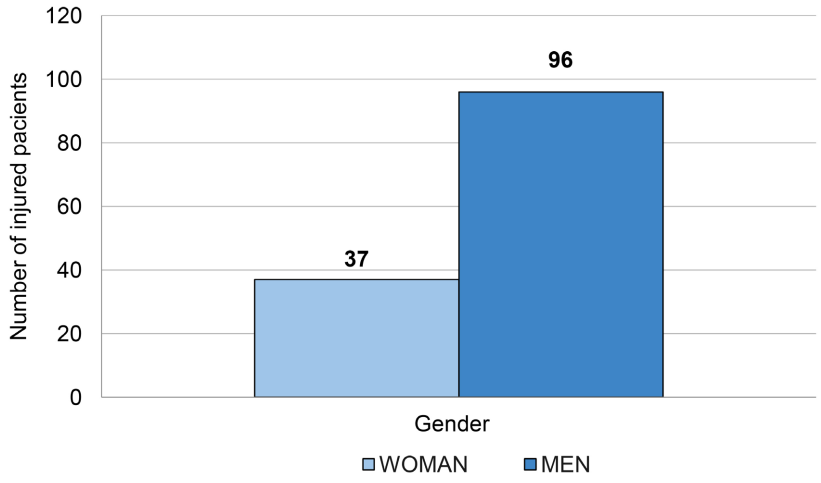

Figure 3. Gender-based difference of injured patients.

Table 1. Summary of articles included.

Author	Year	Country	Average follow-up	Type of injury (n)	Case procedure (n)	Postoperative outcomes	Complications (n)
Turgut *et al.* [13]	2022	Turkey	6 months and 2 days	Types III, IV and V (30)	Fixation of titanium plates	Visual Analog Scale: −5.6 Constant-Murley: +53.6 Deployment errors (0) Plate break (0) Movement limitations (0)	Infection (2)
Steinbacher *et al.* [3]	**2014**	**Spain**	**4 years, 2 months and 3 days**	**Type III**	**Fixation of clavicular titanium plates (19)**	**Visual Analog Scale: 1.8 Constant-Murley: minimum of 83 Movements equal to the contralateral joint: after 5 weeks Back to sports: 6 months Titanium plate removal: 16 weeks**	**No complications were reported.**
Barth *et al.*[12]	2015	France	From 3 months to 1 year	Types III, IV and V	Arthroscopically-assisted techniques (24), 92% in double button and 88% reinforced by biological graft	Anterior passive elevation of 111˚: 6 weeks Lateral rotation: average of 50˚ Back to work: 52% Back to sports: 8% Constant-Murley: +26 QuickDASH subjective incapacity: −32	Algodystrophy (2) Osteolysis (2) Device failure (3) Fracture of the coracoid process (1) Deficit in lateral rotation (3)
Peng *et al.* [14]	2022	China	2 years	Types IV and V	Single tunnel technique (30) Coracoid sling technique (30)	Single tunnel: Return to activities in 4.2 months Coracoid sling: Return to activities in 5.1 months Visual Analog Scale: similar results Constant-Murley: Single tunnel showed superior results	Coracoid sling technique: Loss of reduction (2), type II dislocation (3) and infection (2) Single tunnel technique: infection (2)

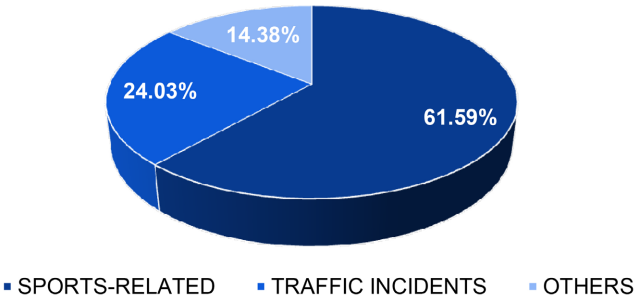

Figure 4. Main causes of AC dislocation in the patients evaluated.

In addition, the analyzed studies used three main scores to evaluate the post-operative results of patients, including the Constant-Murley score, VAS and QuickDASH. The Constant-Murley Score is an instrument used to assess the general function of the shoulder through four aspects: two subjectives (pain and activities of daily living) and two objectives (range of motion and strength). Sub-

jective components can receive up to 35 points and objectives 65 points, which can result in a maximum score of 100 points [17]. Among the patients evaluated by this review, 30 individuals who were treated using clavicular titanium plates fixation showed an increase of 53.6 (31.5 - 85.1) points on this scale [13], 14 patients had a score ≥ 90 and another 5 had a score between 83 and 89 [3]. Liu *et al.* described similar results in a study that evaluated the clinical and radiological outcomes of patients with AC displacement treated with the clavicular hook plate, who had an increase in the Constant-Murley score from 72.6 before surgery to 87.6 at final follow-up [18]. Another group of patients treated with the same technique had a mean score of 94.59 points in a study published by Dursun *et al.* [19]. In addition, 24 patients evaluated by this review that underwent arthroscopy showed an increase from 61 to 87 points on this scale 1 year after surgery [12]. Similar results were found by Cavinatto *et al.*, who evaluated the functional outcomes of fourteen patients after arthroscopy, who had a mean Constant-Murley score of 94.79, ranging from 82 to 100 after 6 months post-operatively [20].

The VAS is a validated subjective visual measure for acute and chronic pain, based on the evaluation of a handwritten mark on a 10 cm line between two extremities, *i.e.*, "no pain" and "worst pain" [21]. The 11-item QuickDASH, a modified version of the original DASH (Disabilities of the arm, shoulder, and hand) questionnaire aims to evaluate the outcomes of musculoskeletal disorders of the upper limbs [22]. Of the patients treated with fixation of titanium plates submitted to evaluation using the VAS, 30 showed a drop of 5.6 points (7.4 - 1.8) [13] and another 19 obtained a score equal to 1.8 [3]. In a study comparing the use of hook plates and endo-buttons, Unal *et al.* reported that the group of patients treated with hook plates had a VAS score of 70.4 on average at the end of the first month, which decreased significantly to 18 at the end of the third month post-operatively [23]. Finally, among the 24 patients treated arthroscopically, QuickDASH decreased from 41 to 9 after 1 year [12]. Loriaut *et al.* described even better results in a study evaluating patients who underwent the same technique for acute AC dislocation. The 39 patients had a mean QuickDash score of 1.7 at the final follow-up, which lasted an average of 42.3 months [24].

This study covered high-grade lesions (III - V), referred for surgical treatment, except for grade III lesions, for which the optimal treatment (conservative or surgical) is controversial [25]. In this regard, the findings of this review support the notion that there are a variety of surgical techniques available for the surgical treatment of acromioclavicular displacement [1]. Because of the number of options and structures involved [26], each procedure retains its competencies, domains and problems [27] [28].

Regarding the most effective technique for treating acromioclavicular dislocation, titanium plates offered better results. As an example, this technique achieved satisfactory and functional postoperative and evolutionary results, and increased evaluation scores and lower intra and postoperative complications compared to the other methods studied (arthroscopy, single tunnel, and coracoid sling). How-

ever, references indicate that other techniques, such as the suture button, are preferable to the titanium plate in terms of CC distance and clinical outcome, despite the fact that scores and pain relief are the same [19] [23].

The new methods of minimally invasive surgery offer a great variety of methods to choose from. In addition, the arthroscopic approach reduces damage in noble and interconnected structures [14]. However, the amount of intra and postoperative problems resulting from this technique is noteworthy, especially with regard to loss of reduction, infections, dislocations and osteolysis, regardless of the maneuver used [20] [29].

This study has some limitations, such as: the scenario of few published articles related to this topic contributes to the low number of patients evaluated by this review. In addition, the increasing number of surgical approaches that have emerged in recent years makes the definition of a gold standard technique for the treatment of AC dislocation in patients who practice sports, in general, a difficult task. However, the main contribution of this article is to show that this comparison is necessary and the evaluation of the impact of different surgical techniques in specific sports could be a potential area for future studies.

5. Conclusions

Sports practice is associated with >50% of the cases of AC joint dislocation, which predominantly affects young men. Among the six types of dislocation according to the Rockwood classification, type IV and V lesions are mandatorily treated using the surgical approach. Thus, a great variability of operative techniques can be used in such situations, as arthroscopy, single tunnel, coracoid sling and titanium plates. Although it presented excellent functional results compared to other techniques evaluated by this review, using titanium plates is not the gold standard, since other techniques not assessed by this work may be more effective.

In recent years, however, new minimally invasive surgical techniques, particularly the arthroscopic approach, have gained ground in the treatment of these patients. Despite offering advantages over open surgery in terms of morbidity and infection risks in the operating room, postoperative complications are possible with this technique.

It is essential to evaluate the best surgical technique used in the treatment of acromioclavicular dislocation in order to preserve the motor capacity of patients, especially those involved in sports practices. Thus, the adequate follow-up of these individuals is of paramount for maintaining or adapting the lifestyle prior to the incident since this has economic, emotional, and social implications in the patient's life.

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Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Arliani, G.G., Utino, A.Y., Nishimura, E.M., Terra, B.B., Belangero, P.S. and Astur, D.C. (2015) Acromioclavicular Dislocation: Treatment and Rehabilitation. Current Perspectives and Trends among Brazilian Orthopedists. *Revista Brasileira de Ortopedia*, **50**, 515-522. https://doi.org/10.1016/j.rboe.2015.08.003

[2] Mazzocca, A.D., Arciero, R.A. and Bicos, J. (2007) Evaluation and Treatment of Acromioclavicular Joint Injuries. *The American Journal of Sports Medicine*, **35**, 316-329. https://doi.org/10.1177/0363546506298022

[3] Steinbacher, G., Sallent, A., Seijas, R., Boffa, J.M., Espinosa, W. and Cugat, R. (2014) Clavicular Hook Plate for Grade-III Acromioclavicular Dislocation. *Journal of Orthopaedic Surgery* (*Hong Kong*), **22**, 329-332. https://doi.org/10.1177/230949901402200312

[4] Sirin, E., Aydin, N. and Mert Topkar, O. (2018) Acromioclavicular Joint Injuries: Diagnosis, Classification and Ligamentoplasty Procedures. *EFORT Open Reviews*, **3**, 426-433. https://doi.org/10.1302/2058-5241.3.170027

[5] Müller, D., Reinig, Y., Hoffmann, R., Blank, M., Welsch, F., Schweigkofler, U. and Stein, T. (2018) Return to Sport after Acute Acromioclavicular Stabilization: A Randomized Control of Double-Suture-Button System versus Clavicular Hook Plate Compared to Uninjured Shoulder Sport Athletes. *Knee Surgery, Sports Traumatology, Arthroscopy: Official Journal of the ESSKA*, **26**, 3832-3847. https://doi.org/10.1007/s00167-018-5044-x

[6] Skjaker, S.A., Enger, M., Engebretsen, L., Brox, J.I. and Bøe, B. (2021) Young Men in Sports Are at Highest Risk of Acromioclavicular Joint Injuries: A Prospective Cohort Study. *Knee Surgery, Sports Traumatology, Arthroscopy: Official Journal of the ESSKA*, **29**, 2039-2045. https://doi.org/10.1007/s00167-020-05958-x

[7] Chillemi, C., Franceschini, V., Dei Giudici, L., Alibardi, A., Salate Santone, F., Ramos Alday, L.J. and Osimani, M. (2013) Epidemiology of Isolated Acromioclavicular Joint Dislocation. *Emergency Medicine International*, **2013**, Article ID: 171609. https://doi.org/10.1155/2013/171609

[8] Pereira-Graterol, E., Álvarez-Díaz, P., Seijas, R., Ares, O., Cuscó, X. and Cugat, R. (2013) Treatment and Evolution of Grade III Acromioclavicular Dislocations in Soccer Players. *Knee Surgery, Sports Traumatology, Arthroscopy: Official Journal of the ESSKA*, **21**, 1633-1635. https://doi.org/10.1007/s00167-012-2186-0

[9] Marcheggiani Muccioli, G.M., Manning, C., Wright, P., Grassi, A., Zaffagnini, S. and Funk, L. (2016) Acromioclavicular Joint Reconstruction with the LARS Ligament in Professional versus Non-Professional Athletes. *Knee Surgery, Sports Traumatology, Arthroscopy: Official Journal of the ESSKA*, **24**, 1961-1967. https://doi.org/10.1007/s00167-014-3231-y

[10] Balai, E., Sabharwal, S., Griffiths, D. and Reilly, P. (2020) A Type VI Acromioclavicular Joint Injury: Subcoracoid Dislocation in a Patient with Polytrauma. *Annals of*

the Royal College of Surgeons of England, **102**, e1-e3.
https://doi.org/10.1308/rcsann.2020.0157

[11] Haddaway, N.R., Page, M.J., Pritchard, C.C. and McGuinness, L.A. (2022) PRISMA2020: An R Package and Shiny App for Producing PRISMA 2020-Compliant Flow Diagrams, With Interactivity for Optimised Digital Transparency and Open Synthesis. *Campbell Systematic Reviews*, **18**, e1230.
https://doi.org/10.1002/cl2.1230

[12] Barth, J., Duparc, F., Baverel, L., Bahurel, J., Toussaint, B., Bertiaux, S., Clavert, P., Gastaud, O., Brassart, N., Beaudouin, E., De Mourgues, P., Berne, D., Duport, M., Najihi, N., Boyer, P., Faivre, B., Meyer, A., Nourissat, G., Poulain, S., Bruchou, F. and Société Française D'Arthroscopie (2015) Prognostic Factors to Succeed in Surgical Treatment of Chronic Acromioclavicular Dislocations. *Orthopaedics & Traumatology, Surgery & Research*: *OTSR*, **101**, S305-S311.
https://doi.org/10.1016/j.otsr.2015.09.002

[13] Turgut, M.C., Semis, H.S., Yamak, K. and Çelebi, F. (2022) Evaluation of Patients with Acromioclavicular Joint Separation Treated Using the Clavicular Hook Plate. *Ortopedia, Traumatologia, Rehabilitacja*, **24**, 73-78.
https://doi.org/10.5604/01.3001.0015.8264

[14] Peng, L., Zheng, Y., Chen, S., Yang, S., Liu, J., Cheng, C., Zhang, G. and Deng, Z. (2022) Single Tunnel Technique versus Coracoid Sling Technique for Arthroscopic Treatment of Acute Acromioclavicular Joint Dislocation. *Scientific Reports*, **12**, Article No. 4244. https://doi.org/10.1038/s41598-022-07644-z

[15] Nordin, J.S., Olsson, O. and Lunsjö, K. (2020) Acromioclavicular Joint Dislocations: Incidence, Injury Profile, and Patient Characteristics from a Prospective Case Series. *JSES International*, **4**, 246-250. https://doi.org/10.1016/j.jseint.2020.01.009

[16] Gorbaty, J.D., Hsu, J.E. and Gee, A.O. (2017) Classifications in Brief: Rockwood Classification of Acromioclavicular Joint Separations. *Clinical Orthopaedics and Related Research*, **475**, 283-287. https://doi.org/10.1007/s11999-016-5079-6

[17] Vrotsou, K., Ávila, M., Machón, M., Mateo-Abad, M., Pardo, Y., Garin, O., Zaror, C., González, N., Escobar, A. and Cuéllar, R. (2018) Constant-Murley Score: Systematic Review and Standardized Evaluation in Different Shoulder Pathologies. *Quality of Life Research*: *An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, **27**, 2217-2226.
https://doi.org/10.1007/s11136-018-1875-7

[18] Liu, G., Hu, Y., Ye, F., Huang, F. and Yu, T. (2022) Clavicular Hook Plate for Acute High-Grade Acromioclavicular Dislocation Involving Rockwood Type V: Clinical and Radiological Outcomes and Complications Evaluation. *International Orthopaedics*, **46**, 2405-2411. https://doi.org/10.1007/s00264-022-05498-8

[19] Dursun, M., Altun, G. and Ozsahin, M. (2023) Surgical Treatment of Acromioclavicular Dislocation: Hook Plate versus Suture Button. *Acta Ortopédica Brasileira*, **31**, e252916. https://doi.org/10.1590/1413-785220233101e252916

[20] Cavinatto, L.M., Iwashita, R.A., Ferreira Neto, A.A., Benegas, E., Malavolta, E.A., Gracitelli, M.E.C., Silva, F.B. de A., Assunção, J.H. and Helito, P.V.P. (2011) Tratamento artroscópico da luxação acromioclavicular aguda com âncoras. *Acta Ortopédica Brasileira*, **19**, 141-144. https://doi.org/10.1590/S1413-78522011000300005

[21] Delgado, D.A., Lambert, B.S., Boutris, N., McCulloch, P.C., Robbins, A.B., Moreno, M.R. and Harris, J.D. (2018) Validation of Digital Visual Analog Scale Pain Scoring with a Traditional Paper-Based Visual Analog Scale in Adults. *Journal of the American Academy of Orthopaedic Surgeons. Global Research & Reviews*, **2**, e088.
https://doi.org/10.5435/JAAOSGlobal-D-17-00088

[22] Gummesson, C., Ward, M.M. and Atroshi, I. (2006) The Shortened Disabilities of the Arm, Shoulder and Hand Questionnaire (QuickDASH): Validity and Reliability Based on Responses within the Full-Length DASH. *BMC Musculoskeletal Disorders*, **7**, Article No. 44. https://doi.org/10.1186/1471-2474-7-44

[23] Unal, O.K. and Dagtas, M.Z. (2020) Comparison of the Results of Hook Plate and Endo-Button Used in the Surgical Treatment of Acromioclavicular Joint Separation. *Cureus*, **12**, e11987. https://doi.org/10.7759/cureus.11987

[24] Loriaut, P., Casabianca, L., Alkhaili, J., Dallaudière, B., Desportes, E., Rousseau, R., Massin, P. and Boyer, P. (2015) Arthroscopic Treatment of Acute Acromioclavicular Dislocations Using a Double Button Device: Clinical and MRI Results. *Orthopaedics & Traumatology, Surgery & Research: OTSR*, **101**, 895-901. https://doi.org/10.1016/j.otsr.2015.09.024

[25] Li, X., Ma, R., Bedi, A., Dines, D.M., Altchek, D.W. and Dines, J.S. (2014) Management of Acromioclavicular Joint Injuries. *The Journal of Bone and Joint Surgery*, **96**, 73-84. https://doi.org/10.2106/JBJS.L.00734

[26] Filho, R.B., Freitas, M.M., Nunes, R.H.R., Tenor Junior, A.C., Costa, M.P.D. and Roberto, R.A. (2021) Acromioclavicular, Coracoclavicular and Medial Coracoclavicular Ligaments Assessment in Acromioclavicular Dislocation. *Revista Brasileira de Ortopedia*, **56**, 777-783. https://doi.org/10.1055/s-0040-1719088

[27] Mendes Júnior, A.F., Mota Neto, J.D., Dias, D.M., Simoni, L.F., Loures, E.A. and Labronici, P.J. (2019) Functional and Radiological Outcomes of the Surgical Treatment of Acute Acromioclavicular Dislocation with Anchors Associated with Clavicle and Scapula Fixation. *Revista Brasileira de Ortopedia*, **54**, 649-656. https://doi.org/10.1055/s-0039-1697020

[28] Moura, D.L., Reis E Reis, A., Ferreira, J., Capelão, M. and Braz Cardoso, J. (2017) A Combined Technique for Acromioclavicular Reconstruction after Acute Dislocation—Technical Description and Functional Outcomes. *Revista Brasileira de Ortopedia*, **53**, 67-74. https://doi.org/10.1016/j.rboe.2017.03.008

[29] Vieira, L.A.G., Visco, A., Fernandes, L.F.D. and Cordero, N.G.G. (2009) Tratamento artroscópico da luxação acromio-clavicular pelo método "tight rope" (arthrex®). *Revista Brasileira de Ortopedia*, **44**, 52-56. https://doi.org/10.1590/S0102-36162009000100008