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Surgical Management of Acute Acromioclavicular Type 3 Separation: A Systematic Review and Meta-analysis of RCTs

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Abstract **Objectives:** A common 12% of shoulder injuries are acromioclavicular (AC) joint injuries, particularly in young athletes and manual laborers. It's still debatable how to handle grade III injuries. Surgical procedures restore anatomy but increase the risk of complications, while non-surgical techniques offer less complications but run the risk of persistent insatiability. With an emphasis on patient safety and functional outcomes, this systemic review evaluates the clinical outcomes of surgical versus non-surgical treatments. **Research hypothesis:** Surgical treatment leads to superior long-term functional outcomes compared to non-surgical management in Grade III AC joint dislocations. Tightrope fixation provides better joint stability and fewer complications compared to other surgical techniques. **Methods:** Following PRISMA guidelines, a systematic search for randomized controlled trials (RCTs) was carried out in the Cochrane, Web of Science, and PubMed databases. The inclusion criteria were satisfied by six RCTs with 345 patients that compared surgical and non-surgical management, as well as Tightrope fixation versus other surgical techniques. We extracted and examined data based on demographics, joint stability, functional outcomes, interventions, and complication rates. **Results:** A meta-analysis showed no discernible difference between non-surgical and surgical methods in terms of functional outcomes [MD=-0.24 [-4.49, 4.00] 95% CI, P= 0.11]. However, when compared to different types of surgical procedures, tightrope fixation showed better functional outcomes with fewer problems [MD=8.34 [5.67, 11.02] 95% CI, P= 0.48]. The rates of postoperative complications [RD= 0 [-0.11, 0.11] 95% CI, P= 0.22] and joint displacement [MD=-2.15 [-5.89, 1.59] 95% CI, P= 0.35] did not significantly differ between surgical techniques. **Conclusion:** For grade III AC joint dislocations, the functional results of surgical and non-surgical approaches are similar. Among surgical options, tightrope fixation yields the best outcomes. Patients' activity levels and cosmetic preferences should be taken into account while making a personalized treatment decision. Given the study limitations of the small sample size, which restricts the generalizability of findings, future large-scale RCTs with longer follow-up periods are necessary to establish more definitive treatment guidelines and further evaluate the clinical significance of Tightrope fixation over other surgical techniques.

Key Words Acromioclavicular joint dislocation, Grade III AC joint separation, Tightrope fixation, Shoulder injuries, Joint stability, Functional outcomes, Randomized controlled trials (RCTs)

INTRODUCTION

Acromioclavicular (AC) joint dislocations are common, particularly among active individuals, accounting for approximately 9% of all shoulder injuries [1,2]. Despite their high incidence, managing high-grade AC separations remains a subject of debate. The lack of standardized treatment protocols and the absence of robust, evidence-based guidelines contribute to the uncertainty about the best treatment approach, especially regarding the potential for chronic shoulder pain [3,4]. Additionally, clinical recommendations concerning the timing of surgery, surgical indications, and fixation methods continue to differ [5].

Research indicates a significantly higher incidence rate among young athletes engaged in contact sports, as well as in manual laborers. Moreover, ACJ injuries are about five times more common in men than in women [6]. Similarly,

According to Sim et al, 53% of injuries were linked to sports activities such as cycling, football, martial arts, ice hockey alpine skiing, and snowboarding with males accounting for 82% of these injuries [3].

In 1984, Rockwood first described his six-part classification system for AC joint separations [7]. His classification of Acromioclavicular dislocation is based on the direction as well as the degree of clavicular displacement [8]. In fact, grades I and II are considered mild and are commonly recommended for conservative management [9,10].

For Type III injuries, conservative treatment is generally preferred for patients with lower physical activity levels, underlying health conditions, or complications. However, surgical intervention is typically recommended for professional athletes or highly active individuals. As a rule, surgical management is the first choice for Type III injuries and those of higher grades [11,12]. In cases where there is minimal to no displacement (Rockwood Grades I and II), conservative management is typically sufficient, with or without splint support. Surgical options, however, are often necessary when displacement occurs, particularly in young athletic patients. These options include open reduction with methods such as temporary pinning, coracoclavicular (CC) screw fixation, hook plate, or ligament reconstruction [13,14,15]. Recent evidence suggests that for most acute Type III injuries, including those in athletes involved in contact sports, initial conservative treatment is recommended. Surgical intervention should be considered if there is significant horizontal instability, in high-performance athletes (such as throwing athletes), or when initial conservative treatments fail to address persistent pain or instability [16].

The management of Type III AC joint injuries has been debated for years, and few studies have conclusively shown that surgical treatment provides superior outcomes [17,18,19]. Although several treatment methods are available for managing high-grade AC separations, none have emerged as the definitive standard of care. These methods include CC screw fixation, suture fixation, Kirschner wire or hook plate (HP) fixation, as well as newer cortical fixation techniques like suture button constructs (SBCs) [20,21,22,23,24]. Despite the availability of these techniques, complication rates, such as hardware failure, migration, under-correction, loss of reduction (LOR), and fractures of the coracoid and clavicle, remain high [21,22,24].

The TightRope technique (Arthrex, USA) is a minimally invasive method that stabilizes the AC joint by enhancing the coracoclavicular (CC) complex with a high-strength suture. An alternative open procedure is the clavicular hook plate (AO), where the plate is fixed with screws on the superior surface of the clavicle, and the hook is transarticularly secured at the lower surface of the acromion [25]. Recent studies suggest that compared to the clavicular hook plate, the arthroscopic TightRope loop titanium button offers a minimally invasive, safe, and effective solution for treating AC joint dislocations, yielding promising clinical outcomes [12]. The TightRope technique is advantageous due to its minimally invasive nature, lower complication rates, and superior clinical results [26].

On one hand, those who support non-operative procedures argue that patients frequently achieve outstanding clinical outcomes and regain painless shoulder function, yet some individuals may experience the risk of chronic instability and pain [27,28].

Currently, the management of Grade III dislocations is determined by the surgeon's preference, the patient's age, and activity level. Studies in the scientific literature have shown comparable outcomes between surgical and non-surgical treatments. While non-operative methods lower the risks of postoperative complications, some individuals may continue to experience lingering pain and cosmetic irregularities. Surgical procedures, on the other hand, are associated with higher complication rates but can facilitate the anatomical restoration of the scapular girdle [29].

The management of acromioclavicular dislocation grade III remains a subject of ongoing debate within the orthopedic community, reflecting the complexity and variability of treatment approaches for this specific injury grade. While several studies have examined the effectiveness of surgical versus non-surgical management, findings remain inconsistent due to differences in patient populations, follow-up durations, and surgical techniques. Additionally, the role of Tightrope fixation compared to other surgical methods is not well-established. This systematic review seeks to fill the research gap by evaluating functional and cosmetic outcomes of different treatment approaches and comparing the clinical outcomes of patients undergoing operative and non-operative management following grade III acromioclavicular dislocation. This review aims to provide valuable insights into the efficacy, safety, and patient outcomes associated with these treatment modalities by analyzing the existing evidence.

METHODS

Search Design

This study adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency, reproducibility, and methodological rigor.

Search Strategy and Study design

A comprehensive literature search was conducted in PubMed, Web of Science, and Cochrane databases using the following search terms: (Acromioclavicular dislocation OR AC joint dislocation OR AC separation) AND (Type 3 OR Grade 3) AND (Acute OR recent) AND (Surgical management OR surgical treatment OR surgery OR operative treatment). A total of 480 articles were identified (275 from PubMed, 168 from Web of Science, and 37 from Cochrane). After removing duplicates, 369 articles were screened, of which 6 studies were included. Eligible studies were randomized controlled trials (RCTs) published in English without time frame limitations, reporting outcomes relevant

to the research objectives, such as functional outcomes, complication rates, recurrence, and patient satisfaction. Studies were removed based on several predefined criteria, including those employing interventions misaligned with the research focus, displaying methodological inconsistencies, or appearing in languages other than English. Additionally, studies were excluded if they involved patients who lost follow-up before assessment, lacked pertinent data, or employed inappropriate studies such as meta-analyses, systematic reviews, economic analyses, animal models, in-vitro studies, cadaver studies, narrative reviews, editorials, case series, or case reports.

Moreover, exclusion criteria extended to studies involving participants with chronic conditions or comorbidities that could influence treatment results, those including participants younger than 18 years to maintain consistency within the adult population, and studies with inadequate follow-up durations potentially compromising the evaluation of long-term results. The inclusion criteria aimed to identify studies addressing patients with Grade III AC joint dislocations and reporting essential findings, such as functional performance, complication rates, and patient satisfaction. These criteria aimed to reduce potential confounding factors and ensure the inclusion of studies providing the most relevant and reliable data for comparing treatment strategies.

The randomized controlled trials (RCTs) included in this review were carefully chosen to minimize potential biases. However, certain biases may persist due to the selection process. These biases include selection bias resulting from variations in inclusion and exclusion criteria across the studies, potentially affecting the generalizability of the findings. Publication bias may also be present, as studies with positive results are more likely to be published, which could distort the overall conclusions. The limited number of included studies and the lack of diversity within the sample may also contribute to performance and detection biases.

Sampling

The sample size of 345 patients across six RCTs was deemed sufficient to provide adequate statistical power for comparing surgical and non-surgical interventions. Incorporating multiple studies enhanced the generalizability of the findings by reducing the influence of individual study biases. Patient demographics, including age, gender, and activity level, were examined to evaluate their potential impact on treatment results. These variables were systematically collected and analyzed to assess their effect on functional outcomes, complication rates, and recurrence. The inclusion of diverse patient populations aimed to strengthen the reliability and applicability of the findings to the general adult population affected by Grade III AC joint dislocations.

Data extraction

Four reviewers (M.H., R.M., J.A., and W.M.) independently performed a thorough screening of all identified studies to evaluate their eligibility for inclusion, with any discrepancies adjudicated through discussion with a fifth reviewer (A.G.). Data extraction was systematically conducted to capture critical study characteristics, including authorship, year of publication, geographic location, study design, sample size, and length of follow-up. Detailed patient demographic and clinical variables, such as age, sex, body mass index, underlying conditions (e.g., preexisting injuries or comorbidities), and symptom duration, were meticulously recorded. Data related to surgical interventions were extracted, encompassing the type of procedure, surgical techniques, fixation methods, and postoperative rehabilitation protocols. Outcomes of interest included measures of postoperative joint stability, functional outcomes (e.g., range of motion, return to activity), complication rates, patient-reported outcomes, and follow-up duration.

Handling of Missing Data & Reporting Bias

At multiple stages, data reliability and completeness were accounted for, including addressing missing data. Particular attention was given to studies not reporting on several relevant descriptors, including functional outcomes, complication rate, or recurrence rate. Qualitatively, those studies with missing important data were discussed, but they did not feature in individual analyses. Furthermore, sensitivity analyses were conducted to determine the influence that restricting analysis to studies with more available data had on global results.

Significant analysis of risk of bias was performed utilizing the Cochrane risk-of-bias tool to analyze risk of bias and ensure the studies did not demonstrate selective outcome reporting, which met the criteria that there would be no bias based on blinding, allocation concealment, sequence generation, and outcome data completeness. This study included only RCTs to reduce the risk of study selection bias. However, since only studies published in the English language were included, we cannot rule out language bias. Finally, because only statistically significant results are more likely to be published, it can still be a problem of publication bias. The systematic review was conducted with a broad search strategy, followed by a reference review of included studies to address potentially omitted relevant studies. Potential solutions Despite the above measures, there could still be the problem of missing data, underreporting or overreporting, and to deal with that, the below measures can be adopted. Hence, it would be necessary for future studies to extend the current one by including more high-quality RCTs, encompassing studies published in other languages, and searching for unpublished sources of data.

Statistical Analysis

Cochrane Review Manager 5.3 was used to perform a meta-analysis of the selected studies. For dichotomous outcomes, the pooled OR with 95% CI is given among groups. While mean difference (MD) was used for continuous outcomes. Random mode was used in order to reduce heterogeneity. The heterogeneity assumption was checked using the I^2 test. A leave-one-out sensitivity test

was applied to solve any resulting heterogeneity. In terms of values, we interpreted the I-square as follows: not significant for 0-40%, moderate heterogeneity for 30-60%, and substantial heterogeneity for 50-90%, following the Cochrane Handbook chapter nine. A funnel plots were used to assess publication bias.

RESULTS

Data Collection

A comprehensive search of three databases (PubMed, Web of Science, and Cochrane) until 2nd Nov. 2024 yielded 480 studies. After removing duplicates, thirty-six studies were available for the Title and abstract screening phase. Subsequently, a full text screening was done on 14 studies. Finally, six randomized controlled trials have met our inclusion criteria (Figure 1).

Characteristics of Included Studies

Total six randomized controlled trials were included in our meta-analysis in the form of two comparison groups (Medical vs Surgical approaches) and (Tightrope fixation vs other surgeries). The total number of patients are 164 in the first group and 181 patients in the second group. The summary features of the included studies can be found in (Table 1). Moreover, the baseline characteristics of the encompassed studies are available in (Table 2).

Primary outcome

Constant score (Functional outcome)

Surgical vs non-surgical approach in acromioclavicular joint dislocation type III: The pooled mean difference showed a lower achieved constant score in the surgical group compared to the non-surgical group [MD= -0.24 [-4.49, 4.00] 95% CI]. However, no significant statistical difference was reported between the surgical and non-surgical groups [P= 0.91] (Figure 2). The pooled result was heterogeneous (I^2= 55%, P= 0.11). Hence, a sensitivity test is conducted and reduces the heterogeneity after excluding Joukainen et. al. 2014 (I^2= 46%, P= 0.17) (Figure 3). A funnel plot of constant score in the surgical group compared to the non-surgical group is shown in (Figure 4).

Different Surgical approaches (Tightrope fixation vs other surgeries) in acromioclavicular joint dislocation type III

The pooled mean difference showed a higher constant score in the tightrope group compared to the other surgeries group [MD=8.34 [5.67, 11.02] 95% CI]. A significant statistical difference was noted between the Tightrope fixation and other surgical procedures [P< 0.00001]. The pooled result was homogenous (I^2= 0%, P= 0.48) (Figure 5). A funnel plot of constant score in the tightrope group compared to the other surgeries group is shown in (Figure 6).

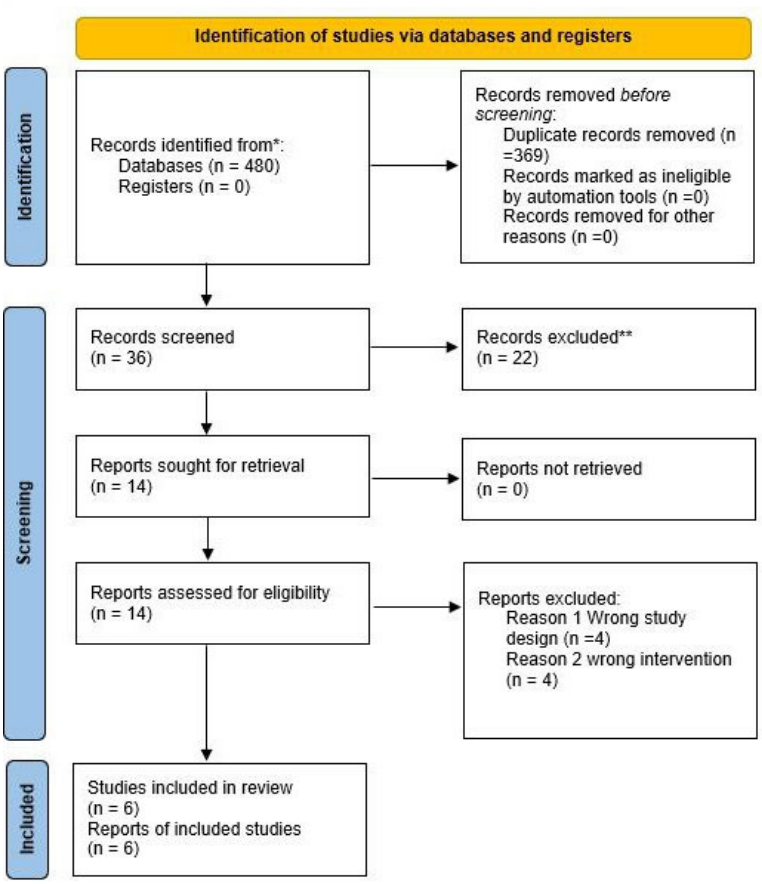

Figure 1: PRISMA flow diagram, PRISMA: Preferred Reporting Items for Systematic Review and Meta-Analysis

Table 1: Summary of the included studies

Study ID	Country	Study Design	Total Participants	Intervention	Primary Outcome	Follow-Up	Main Conclusion
Jouklainen 2014	Finland	RCT	25	In the operative treatment group, the ACJ was reduced and fixed with 2 transacromial Kirschner wires and an AC ligament suture. The Kirschner wires were extracted after 6 weeks. Nonoperatively treated patients received a sling for a couple of weeks.	Constant score (CS)	18–20 years	Nonoperative treatment was shown to produce more prominent or unstable and radiographically wider ACJs than with operative treatment. But clinical results were equally good in both groups at 18–20 years follow-up. Both treatments showed no statistically significant radiographic elevations of the lateral clavicle when compared to the contralateral side.
Windhamere 2021	Sweden	RCT	124	Operative treatment: took place in the operative treatment group, all patients were given the preoperative antibiotics, consisting of a single dose of 2g of cloxacillin or 600 mg of clindamycin intravenously. 30-60 minutes before surgery. Under general anesthesia, the patients were positioned in the beach-chair position and a skin-incision was made. The lateral clavicle and AC joint were visualized and cleared of meniscal remnants.	Constant score (CS)	24 months	The primary outcome was the Constant score. This study does not support routine surgery for Rockwood type III ACJ dislocations. Major healthcare providers are needed to define whether unique subgroups of patients would benefit from surgery, including elite athletes, overhead workers, or severe type V dislocations.
Tauber 2023	Germany	RCT	85	A total of 85 patients with acute Rockwood type 3 ACJ dislocations were allocated randomly to receive either nonsurgical or surgical treatment. A total of 100 patients were treated as allocated, and 8 patients made an early crossover from nonsurgical to surgical treatment, leaving 47 patients treated surgically and 31 patients nonsurgically. In center 1, a mini-open double TightRope (Arthrex) stabilization was performed in 18 patients and 16 were treated conservatively. Center 2 used an arthroscopic double TightRope technique in 12 patients and 18 patients underwent conservative treatment.	Constant score (CS)	24 months	No follow-up time points that were significant difference in Constant score between the surgically and nonsurgically treated patients. Radiographic analysis showed not only an inferior coracoclavicular distance at all follow-up points for surgical treatment but also a higher incidence of postoperative osteoarthritis and heterotopic ossifications, without any negative clinical correlation.
Pongmadsak 2018	Thailand	RCT	44	The patients were randomized to either clavicular hook plate or TightRope fixation within one month after injury.	Constant score (CS)	NA	The TightRope fixation is more effective than the clavicular hook plate fixation for acute acromioclavicular joint dislocation (Type III to V) as evidenced by a higher Constant Shoulder Score three months post-surgery. However, clavicular hook plate fixation shows a greater daily limit of pain reduction.
Cai2017	China	RCT	69	An approximately 7-cm long incision was made and the ACJ joint was exposed subsequently. When the AC joint was reduced and temporarily fixed, clavicular hook plate was positioned with the hook dorsally under the acromion and to the clavicle with screws. Because the trapezoid and conoid ligaments act separately to stabilize the AC joint, focus was on anatomical reconstruction of these structures. After the reduction of dislocation, X-ray was used. The detached structures were repaired using absorbable sutures and the incision was closed in layers after rinse.	Constant score, VAS	12 months	The length of incision was significantly shorter in Group A than that in Group B. The blood loss of surgery was significantly less in the Group A. Significant difference could be found between the two groups regarding the Visual Analog Scale scores one day after surgery, at the 3- and 12-months follow-up. There were no differences according to the improvement of the Constant–Murley score, Oxford Shoulder score between the groups.

Table 1: Continue

Study ID	Country	Study Design	Total Participants	Intervention	Primary Outcome	Follow-Up	Main Conclusion
Darabos2015	Croatia	RCT	68	Surgery comprised minimally invasive EC fixation using the AC TightRope implant in the TR group or the Bosworth screw in the BS group. Patients received single shot antibiotics before surgery. All patients were under general postasthesia and in the beach chair position during the operation.	Constant score, Oxford Shoulder score, DASH score	6 months	MRI could be a useful method to evaluate quality of repair of CC ligaments. The minimally invasive approach used in this study showed similar radiological and clinical efficacy in the treatment of acute Rockwood type III ACJ dislocation, but AC TightRope fixation provided patients with significantly more treatment satisfaction and less inconvenience than the Bosworth screw fixation.

RCT: Randomised Controlled Trial; ACJ: Acromioclavicular Joint; UCLA: University of California at Los Angeles Shoulder Rating Scale; SST: Simple Shoulder Test; AC: Acromioclavicular; NA: Not Applicable; CC: Coracoclavicular; TR: TightRope; BS: Bosworth screw; DASH: Disabilities of the Arm, Shoulder and Hand; MRI: Magnetic Resonance Imaging

Table 2: Baseline Characteristics of Participants

Study ID	Groups	Participants	Age	Male	Dominant side affected	Shoulder Site Right	Shoulder Site Left
Joukanien 2014	Nonsurgical	9	54 ± 8.8	NA	NA	7	2
Joukanien 2014	Surgical	16	53 ± 7.8	NA	NA	14	2
Windhamre 2021	Non-surgical	31	40 (18–63)	19 (61%)	15 (48)	NA	NA
Windhamre 2021	Surgical	30	39 (21–57)	17 (57%)	17 (57)	NA	NA
Tauber 2023	Nonoperative	30	34 ± 8.7	34 (87%)	16 (41%)	NA	NA
Tauber 2023	Treatment Operative	30	39.3 ± 11.3	33 (85%)	21 (54%)	NA	NA
Pongsamakthari 2018	Tight Rope Technique	22	37.2 ± 11.5	16 (72.7%)	13 (59.1)	NA	NA
Cai2017	Clavicular Hook Plate	42	39.6 ± 9.6	17 (70.3)	14 (63.6)	NA	NA
Cai2017	Tight Rope Technique	39	42.80 ± 11.88	NA	NA	15 (38%)	24 (61%)
Cai2017	Clavicular Hook Plate	39	41.49 ± 11.29	NA	NA	16 (41%)	23 (59%)
Darabos2015	Tight Rope	34	37.25 ± 11.17	NA	NA	19 (56%)	15 (44%)
Darabos2015	Bosworth	34	41.18 ± 14.1	34 (100%)	NA	34 (100%)	0 (0%)

SD: Standard Deviation; NA: not applicable

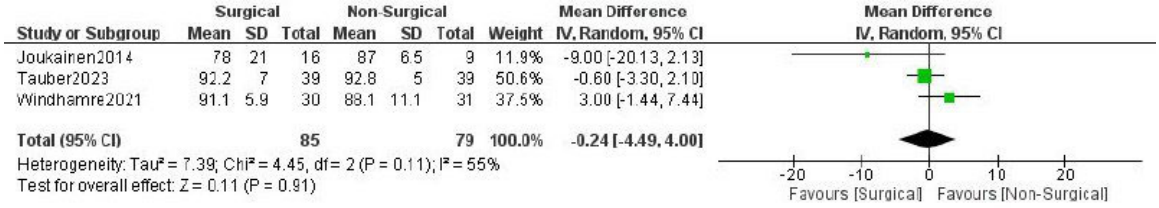

Figure 2: Forest plot illustrating Constant Score Comparison – Surgical vs. Non-Surgical

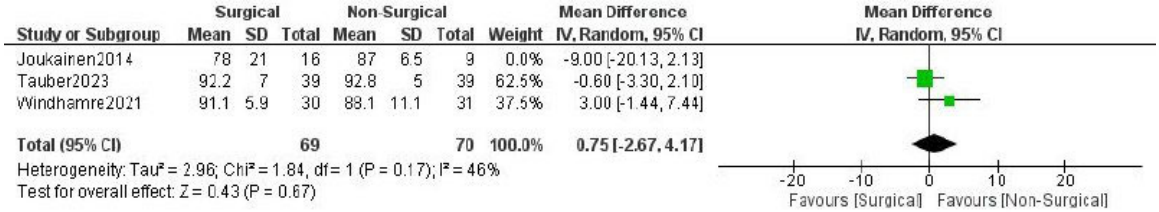

Figure 3: Forest plot shows the Sensitivity Analysis for Constant Score Outcomes

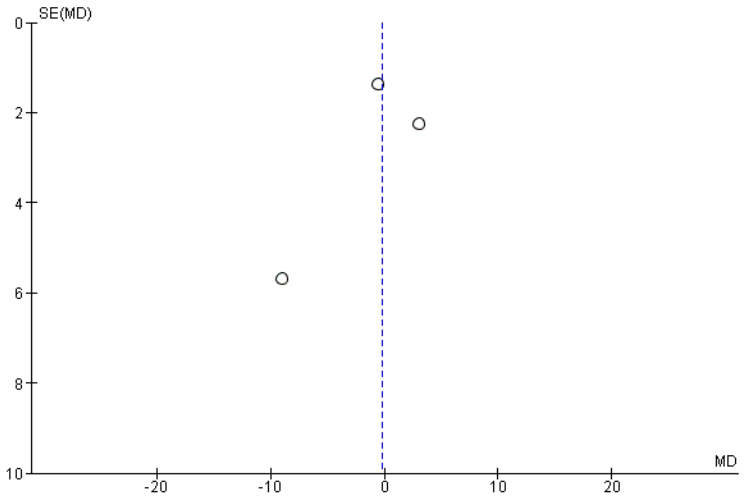

Figure 4: Funnel plot of constant score in the surgical group compared to the non-surgical group

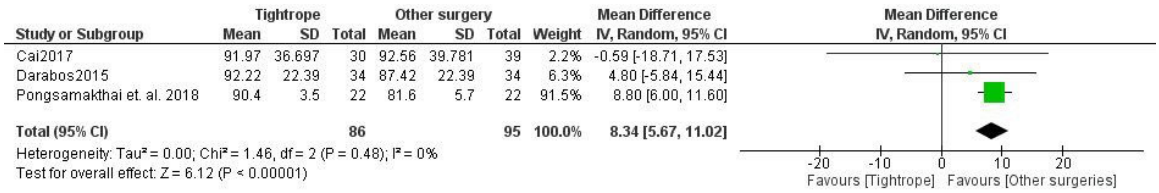

Figure 5: Forest plot illustrating Constant Score Comparison – Tightrope Fixation vs. Other Surgical Techniques

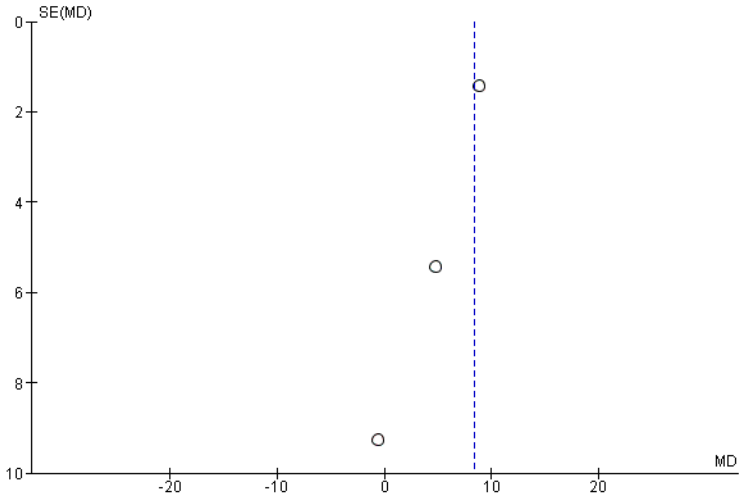

Figure 6: Funnel plot of constant score in the tightrope group compared to the other surgeries group

Secondary outcomes

Joint displacement distance (Postoperative joint stability)

Different Surgical approaches (Tightrope fixation vs other surgeries) in acromioclavicular joint dislocation type III: In 2 out of 3 studies, The pooled mean difference showed a lower postoperative joint stability in the tightrope group compared to the other surgeries group [MD= -2.15 [-5.89, 1.59] 95% CI]. There was no significant statistical difference between the Tightrope fixation and other surgical procedures groups in the joint displacement distance outcome [P= 0.26]. Remarkably, the pooled result was homogenous (I^2= 0%, P= 0.35) (Figure 7). A funnel plot of postoperative joint stability in the tightrope group compared to the other surgeries group is shown in (Figure 8).

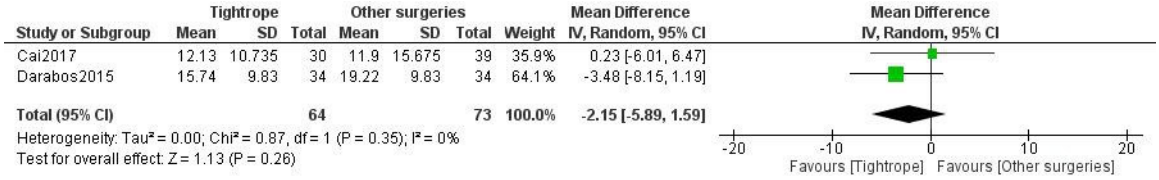

Figure 7: Forest plot of Postoperative Joint Displacement – Tightrope vs. Other Surgical Approaches

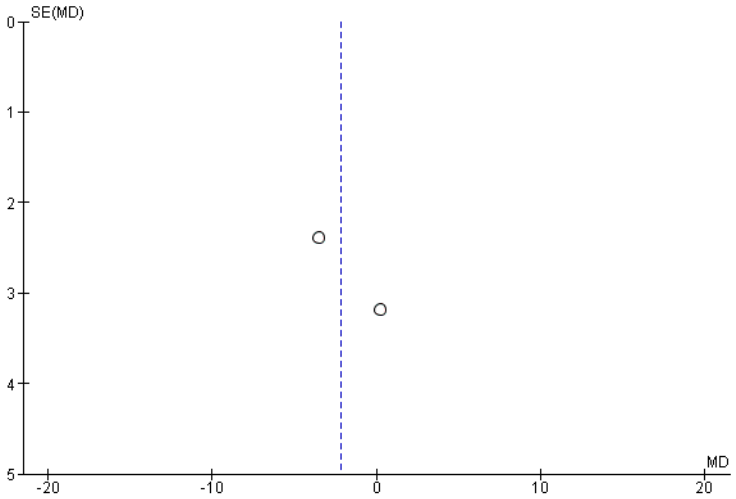

Figure 8: Funnel plot of postoperative joint stability in the tightrope group compared to the other surgeries group

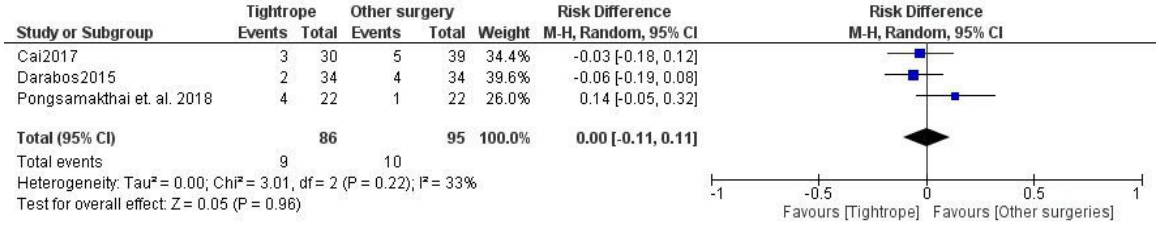

Figure 9: Forest plot of Complication Rates Among Surgical Methods

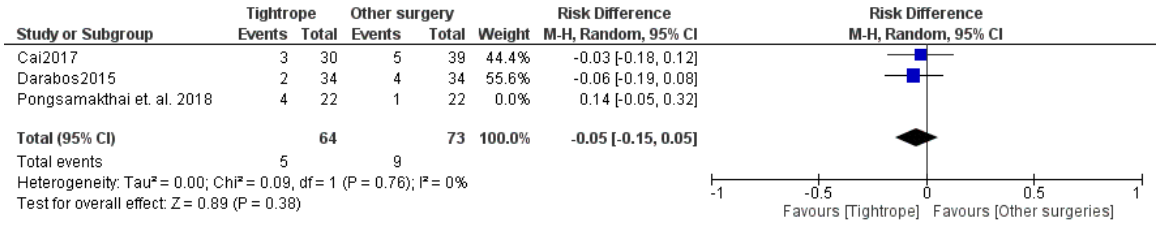

Figure 10: Sensitivity test of Complication Rates Among Surgical Methods

Complications

Different Surgical approaches (Tightrope fixation vs other surgeries) in acromioclavicular joint dislocation type III: The pooled risk difference analysis of complications reported no difference between both the Tightrope fixation and other surgical procedures groups in postoperative complications [RD= 0 [-0.11, 0.11] 95% CI]. Our result showed no significant statistical difference among groups [P= 0.96]. Our pooled result showed low heterogeneity (I^2= 33%, P= 0.22) (Figure 9) which was resolved after excluding Pongsamakthal *et al* (I^2= 0%, P= 0.76) (Figure 10). A funnel plot of postoperative complications in the tightrope group compared to the other surgeries group is shown in (Figure 11).

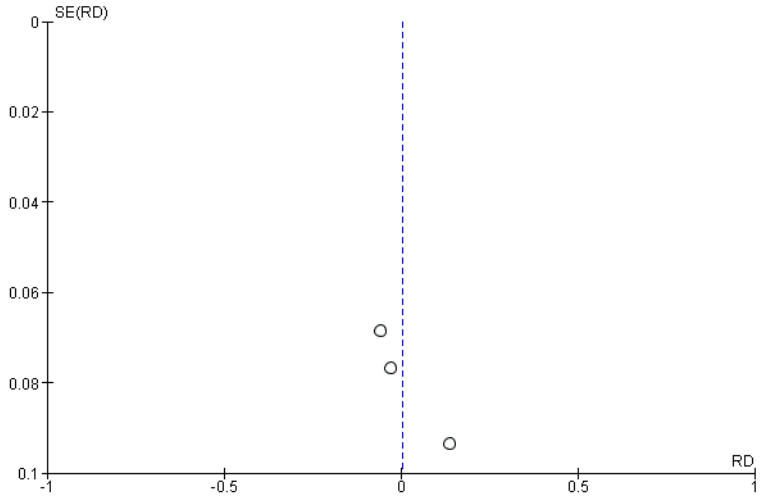

Figure 11: Funnel plot of postoperative complications in the tightrope group compared to the other surgeries group

Figure 12: Risk of Bias Assessment

Risk of Bias Assessment

The three included RCTs in the surgical vs non-surgical comparison exhibited a high to moderate overall risk of bias, indicating a low level of methodological approach. However, the three included RCTs in the tightrope vs other surgeries comparison showed a low risk of bias. The detailed risk of bias assessment of the included studies is shown in (Figure 12).

DISCUSSION

This study aimed to compare the clinical outcomes between surgical and non-surgical approaches while evaluating the effectiveness of Tightrope fixation compared with other surgical techniques for managing grade III acromioclavicular (AC) joint dislocations. The results revealed no statistically significant difference in functional outcomes, as assessed by the Constant score, between the surgical and non-surgical treatments. This could be due to patient adaptation, rehabilitation protocols, or study variability. Tightrope fixation has a notable advantage over other surgical methods in enhancing functional outcomes (MD = 8.34 [5.67, 11.02], $P < 0.001$). These findings are due to the fact that Tightrope fixation provide dynamic stabilization and allows for early mobilization and speedy recovery since it is considered a minimally invasive procedure which indicate that although surgical intervention may not consistently surpass non-surgical management, the selection of the surgical technique plays a critical role in determining the overall treatment outcome.

The analysis of various studies offers valuable insights into the variability of outcomes associated with different treatment approaches. Joukainen *et al.* [30] conducted a long-term investigation comparing the non-operative and operative treatments for Rockwood type III AC dislocations. They discovered that non-operative management led to more prominent or unstable AC joints than the operative method; however, both treatment modalities demonstrated equally favorable clinical outcomes after 18 to 20 years of follow-up.Comparing the findings of our study on the management of Rockwood Type III acromioclavicular dislocations with those of Korsten et al. and Windhamre, our findings align with those of Windhamre [31], who reported that both non-operative and operative treatments resulted in excellent functional outcomes after a 24-month follow-up, thereby calling into question the routine use of hook plates for managing these dislocations.

However, our results contrast with Korsten *et al.* [32] systematic review, which suggested better functional and subjective outcomes in the surgical group. This discrepancy may be due to differences in patient selection, as our included RCTs featured a mix of high-demand athletes and less active individuals, whereas Korsten et al.'s review had a broader patient population.

Further underscoring the significance of selecting the appropriate surgical technique, studies by Pongsamakthai *et al.* [33] and Cai *et al.* [25] demonstrated that Tightrope fixation yields superior functional outcomes and fewer complications than hook plate fixation. Similarly, Nie *et al.* [34] conducted a meta-analysis contrasting clavicular hook plate (CHP) fixation with tight rope (TR) fixation and discovered that the latter resulted in comparable complication rates, lower pain scores, and improved functional recovery. Their results support our conclusion that tight-rope fixation, which minimizes the need for implant removal while preserving joint stability, is a successful and less invasive substitute for hook plates. Furthermore, the study pointed out that although implant migration is an issue with Tight-Rope, functional outcomes are not greatly impacted by it.

Our results are consistent with recent studies assessing the efficacy of various surgical approaches for dislocations of the Grade III acromioclavicular (AC) joint. Tight-Rope (TR), hook plate (HP), suture anchors (SA), tendon grafts (TG), and EndoButton (EB) are five surgical methods that were compared in a systematic review and network meta-analysis by Yan *et al.* [35]. According to their findings, Tight-Rope and EndoButton were better at reducing pain and had less complications than hook plates, while SA had the biggest improvement in Constant-Murley scores. This confirms our findings that, when compared to alternative surgical approaches, tight-rope fixation is linked to superior functional outcomes and fewer problems.

Some studies were excluded from the statistical analysis due to methodological discrepancies. Ye et al. [36] studied the effectiveness of autogenous semitendinosus tendon grafts implanted via the endobutton technique for treating Rockwood type III acromioclavicular dislocations. The findings revealed that this approach produced enhanced short-term outcomes, surpassing those of the hook-plate method, and reduced the incidence of complications, including persistent discomfort and acromial osteolysis. The proposed approach is a promising alternative that can decrease the incidence of long-term complications. In contrast, Shui et al. [37] compared percutaneous minimally invasive repair (PMIR) of AC joint dislocations using cannulated screws guided by ultrasound navigation (PMIR-UN) with C-arm navigation (PMIR-CN). Their findings showed that both techniques yielded similar functional and radiographic results, demonstrating the viability of PMIR-UN as a viable alternative, particularly in settings with limited access to C-arm fluoroscopy.

The exclusion of studies, such as those by Ye et al. [36] and Shui et al. [37], highlights gaps in the current research. Addressing these gaps through future studies could provide more comprehensive insights into the effectiveness of various surgical techniques and approaches for treating grade III AC joint dislocations.

The decision to undergo surgical or non-surgical treatment for Grade III acromioclavicular (AC) joint dislocations is complex and individualized, while surgery may offer superior cosmetic outcomes and improved joint stability in select patients, it also presents a risk of increased recovery time, infection and implant failure. Conversely, conservative treatment allows for shorter rehabilitation times but may lead to persistent instability or cosmetic deformities. For athletes, treatment should prioritize return-to-play timelines, rehabilitation, and re-injury risk. While non-surgical management allows faster recovery, it may not provide sufficient joint stability for high-impact sports. Surgical options like Tightrope fixation are recommended for contact sports athletes, overhead athletes, and those concerned about cosmetic outcomes. Rehabilitation should focus on progressive strengthening and proprioception training, with close monitoring for complications such as hardware irritation or stiffness. In cases of acute AC joint injuries, initial stabilization is critical for trauma and emergency specialists. Surgery should be considered for severe displacement, functional instability, younger active patients, and cases with adequate follow-up care. Early management includes sling immobilization, physiotherapy, and patient education. Surgeons should anticipate delayed cases where conservative treatment fails, leading to persistent instability. Nevertheless, Surgical treatment is more expensive due to hospital stay, implants and rehabilitation, while non-surgical treatment is cheaper but requires longer follow-up care. These variations underscore the importance of individualized treatment decisions, taking into account patient age, activity level, cosmetic concerns, pain tolerance, and willingness to accept potential surgical risks should be considered when establishing the most suitable treatment strategy.

The strengths of this study are rooted in its thorough analysis of existing literature, offering a detailed comparison of outcomes across various treatment approach. This study constitutes a systematic review and meta-analysis and did not require ethical approval. On the other hand, all studies included in this review complied with the ethical standards outlined in their original publications.

Variability in surgical techniques, rehabilitation protocols, follow-up durations, and sample sizes among the included studies further complicates the ability to draw definitive conclusions. The limited number of included RCTs (six) may influence the generalizability of these findings. Clinicians should interpret these results with caution because further large-scale studies are needed to validate these outcomes across diverse patient populations and healthcare settings. Additionally, the exclusion of studies by Ye et al. [36] and Shui et al. [37], which examined tendon grafting techniques and differing surgical approaches, underscores the necessity for further research with standardized methodologies to address these gaps.

These findings can guide clinicians in making informed decisions regarding managing grade III AC joint dislocations. By understanding the advantages of Tightrope fixation and the appropriate circumstances for its use, surgeons can tailor their approach to achieve optimal patient outcomes.

Ultimately, surgical and non-surgical treatments are essential for managing grade III acromioclavicular (AC) joint dislocations. Treatment options should be tailored to meet the individual needs of each patient and a shared decision between the patient and the physician should be made considering the patient's choices, preferences and cost.

Limitations

Several limitations were encountered and might directly affect the findings interpretation. Despite the conduction of a comprehensive research, the strict inclusion and exclusion criteria limited the number of randomized control trials to six, the relatively small number of studies included restricts the generalizability of the findings. In order to include only high quality trials, their small number might result in a selection bias and a reduced statistical power. The significant heterogeneity between studies approaches created the difficulties in comparing results and generalizing the findings. Furthermore, brief follow-up periods may impede the assessment of long-term outcomes such as functional recovery and joint stability. To address these limitations, further research is needed to validate these findings and improve treatment plans. This research should involve large-scale multicenter studies with standardized procedures and long-term monitoring. Additionally, future studies should explore cost-effectiveness and innovative approaches, including minimally invasive techniques, to enhance patient care and outcomes.

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CONCLUSIONS

This systematic review and meta-analysis was made on grade III acromioclavicular joint dislocation treatment and assessed no significant difference between surgical and conservative management options in terms of functional outcomes, although Tightrope fixation demonstrated superior joint stability and fewer complications among surgical options. Surgeons should consider Tightrope fixation for active patients, particularly athletes and those requiring high joint stability, while conservative treatment may be suitable for individuals with lower physical demands or cosmetic concerns. Patients prioritizing faster recovery and fewer complications may benefit from non-surgical management, whereas those seeking optimal joint stability and anatomical restoration should consider surgery. Thus, treatment recommendations should be tailored by clinicians according on patient-specific criteria including age, level of activity, and functional demands. Future research should prioritize long-term follow-up studies comparing Tightrope fixation with other surgical techniques, evaluating the durability of outcomes and complication rates. Additionally, studies should focus on the effectiveness of minimally invasive procedures and incorporate validated patient-reported outcome measures to assess functional recovery, pain, and satisfaction, ultimately guiding more personalized treatment strategies.

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