



Original Article

Quad Fiberwire Endobutton Coracoclavicular Reconstruction Technique for Acromioclavicular Joint Dislocation; Surgical Anatomy, Technique and Clinical outcome: A Prospective Study

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ABSTRACT

Background: - Acromioclavicular joint dislocation is a common type of acromioclavicular joint injury, accounting for approximately 9% of shoulder injuries. A gold standard for the reconstruction of the coracoclavicular complex has yet to emerge for the treatment of separation of the acromioclavicular joint. Most of the current techniques not only fail to recreate the original anatomy, but also do not use materials that are strong enough to maintain the reduction during the healing process.

Material And Methodology: - Prospective study was done in Chikkamagalur institute of medical science from March 2023 to October 2025 for the 25 patients who were satisfying inclusion and exclusion criteria and were followed regularly at 1 month, 3 month and 6 months for the patients who were surgically operated with endobutton and fiberwire for acromioclavicular joint dislocation.

Results: - In our study M: F of 4:1 and mean age of 38 years having right side predominance, having functional outcome by CONSTANT score got 1 complication. 14 patients got excellent result, 6 good, 4adequate results.

Conclusion: - Reconstruction of AC joint dislocation using Quadrapled fiberwire with endobutton have excellent result give less complications and rigid fixation with extensive tensile strength allowing physiological motion between clavicle and coracoid, endobutton avoid stress concentration over bone bridge between the two tunnels.

Keywords: Acromioclavicular joint, Endobutton, fiber wire.

INTRODUCTION

Acromioclavicular (AC) joint injuries are among the most common shoulder girdle injuries encountered in orthopaedic practice, accounting for approximately 9–12% of all shoulder injuries and nearly 40–50% of sports-related shoulder injuries worldwide. ¹ These injuries predominantly affect young, active adults, particularly males participating in contact sports and individuals involved in high-energy trauma such as road traffic accidents. The incidence of AC joint dislocation is estimated to be 3–4 cases per 100,000 population annually, with a peak occurrence between the second and fourth decades of life. ² The acromioclavicular joint is a diarthrodial articulation formed between the distal clavicle and the acromion process of the scapula. Stability of this joint depends on both static and dynamic stabilizers. The acromioclavicular ligaments and joint capsule provide horizontal stability, whereas the coracoclavicular ligaments, comprising the conoid and trapezoid ligaments, are primarily responsible for vertical stability. ³ The complex biomechanics of the shoulder girdle permit coordinated scapuloclavicular motion during upper limb movements, making restoration of normal anatomy essential following injury. Acromioclavicular joint dislocations usually result from a direct impact to the lateral aspect of the shoulder with the arm adducted, causing disruption of the acromioclavicular and

coracoclavicular ligament complexes. Sports injuries, falls from bicycles, and road traffic accidents represent the most common mechanisms of injury.² The severity of the injury is commonly classified according to the Rockwood classification system, which categorizes AC joint injuries into six types based on the extent of soft tissue disruption and displacement of the clavicle.⁴ While Rockwood types I and II are generally managed conservatively, types IV, V, and VI require surgical intervention. The optimal management of type III injuries remains controversial and depends on patient-specific factors such as age, occupation, functional demands, and athletic participation.⁵

Globally, more than 150 surgical techniques have been described for the management of AC joint dislocations, reflecting the absence of a universally accepted gold standard procedure.⁶ Conventional surgical techniques, including Kirschner wire fixation, Bosworth screw fixation, Weaver–Dunn reconstruction, tension band wiring, and clavicular hook plating, have demonstrated variable outcomes and are associated with complications such as implant migration, loss of reduction, hardware failure, subacromial impingement, acromial osteolysis, and the need for secondary implant removal procedures.⁷ Recent advances in surgical management have focused on anatomical reconstruction of the coracoclavicular ligaments using minimally invasive techniques and high-strength suture devices. Endobutton fixation combined with FiberWire has emerged as a promising technique because it restores native coracoclavicular anatomy while providing strong, stable fixation that permits physiological micromotion during ligament healing. This technique offers several advantages, including reduced implant-related complications, avoidance of coracoid drilling, preservation of surrounding soft tissues, shorter operative time, and elimination of the need for routine implant removal. Furthermore, biomechanical studies have demonstrated that FiberWire constructs possess tensile strength comparable to or exceeding that of native coracoclavicular ligaments.⁶ In the Indian context, the increasing burden of road traffic accidents and growing participation in recreational and competitive sports have contributed to a rising incidence of AC joint dislocations among young adults. Despite this trend, there remains limited Indian literature evaluating the functional outcomes and complications associated with Endobutton and FiberWire fixation. Most available studies are limited by small sample sizes, short follow-up periods, and heterogeneity in surgical techniques. Therefore, further prospective studies are needed to assess the effectiveness of this technique in restoring shoulder function and maintaining reduction in patients with acute AC joint dislocations. The present study aims to evaluate the functional and radiological outcomes of surgical management of Rockwood type III to VI acromioclavicular joint dislocations using Endobutton and FiberWire fixation and to assess the associated complications following this anatomical reconstruction technique.

MATERIALS AND METHODOLOGY: -

It's a Prospective study of surgical management of 20 patients with Acromioclavicular joint dislocation with single endobutton and Quadrupled fiber wire. This study was conducted in Aralaguppe Mallegowda District Hospital attached to Chikkamagalur Institute of Medical Science from March 2023 to October 2025 with all inclusion and exclusion criteria. Informed written consent was taken from all patients and were followed regularly 1month, 3-month, 6 month and 12 months.

Inclusion Criteria: -

1. Acromioclavicular joint dislocation Rockwood type III to type VI
2. 20 years and above of either sex.
3. Acute injury, less than 4 weeks of duration.
4. Normal range of motion of shoulder before injury.

Exclusion Criteria: -

1. Patient with Rockwood type I and II.
2. Open injuries.
3. Patient with age less than 20 years.
4. Chronic injury more than 4 weeks.
5. Medically not fit for surgery due to comorbidity.
6. Patient not willing for surgery.

Surgical Steps:-

Once the patient was diagnosed with Acromioclavicular joint dislocation, patient was admitted and routine blood investigation were done. With informed and written consent, proper pre-operative planning and physician fitness patient is posted for surgical intervention.

Under General Anaesthesia (12 Patients) or Intersclenae block (8 patients) Patients were put in beach chair position. Parts were scrubbed, painted and draped. A small horizontal incision of 8 cm was taken from lateral end of clavicle, skin and soft tissue dissected. Skeletanization of clavicle was done by elevating the flaps from deltoid and trapezium. Conoid and trapezoid tunnel was made with 2mm drillbit. Conoid was made medial and posterior to the junction of middle and lateral 1/3 clavicle and trapezoid 1 cm anterior and lateral to conoid tunnel. With longitudinal split the coracoid process is

exposed. Using free hand technique the sterial gloves was passed below coracoid from medial to lateral side and was pulled out from lateral side with the help of right angle artery. (Fig 1) Then 4 strands fiber wire is passed below coracoid process by tying the fiber strands to the medial end of glove and pulling it out from the lateral end. Both the ends of fiber wire were then passed through the tunnels made in the clavicle.2 strands were passed through 1 and 3 hole of endobutton and other 2 strands of fiber wire through 2 and 4 hole.(Fig -2) Reduction of acromioclavicular joint was done and secured with endobutton. Acromioclavicular joint was then strengthened with fiber wire. Stability of the joint was checked. Through wash given and wound closed in layers. Sterile dressing done and shifted to post op wards.

Post op protocol: -

- Parental antibiotics was given for 5days then shifted to oral antibiotics till suture removal.
- Dressing changed on post op day 2,7 and 10
- Suture removal was done on day 10.
- Patients were followed up regularly at 1 month,3month, 6months and 1 year.
- Radiological evaluation was done with X-ray of shoulder with clavicle-AP.
- Patient was advised with regularly physiotherapy-pendulum exercise, passive abduction exercise, shoulder muscle strengthening exercise accordingly.
- Each patient was evaluated with CONSTANT and MURLEY SCORING System.



Stress X-Ray



Intra Op Images



8 Months post-op



Implant Failure

RESULTS

Table 1. Demographic and Clinical Characteristics of Study Participants (n = 20)

Variable	Frequency (n)	Percentage (%)
Age (years)		
20–30	5	25.0
31–40	8	40.0
41–50	5	25.0
>50	2	10.0
Mean age ± SD (years)	38.0 ± 7.6	
Gender		
Male	16	80.0
Female	4	20.0
Side involved		
Right	13	65.0
Left	7	35.0
Mode of injury		
Road traffic accident	15	75.0
Sports injury	3	15.0
Fall from height	2	10.0

Interpretation: The mean age of study participants was 38.0 ± 7.6 years. Most patients were males (80%), with a male-to-female ratio of 4:1. The right shoulder was more commonly affected (65%). Road traffic accidents constituted the most frequent mechanism of injury (75%).

Table 2. Distribution of Acromioclavicular Joint Dislocation According to Rockwood Classification (n = 20)

Rockwood Type	Frequency (n)	Percentage (%)
Type III	8	40.0
Type IV	3	15.0
Type V	9	45.0

Test Statistic	Value
χ^2	3.10
p-value	0.212

Interpretation: Rockwood type V injuries were the most common (45%), followed by type III injuries (40%). However, the distribution of injury types was not significantly different across categories ($p = 0.212$).

Table 3. Postoperative Complications Following Endobutton and FiberWire Fixation (n = 20)

Complication	Frequency (n)	Percentage (%)
Superficial surgical site infection	2	10.0
Implant failure	1	5.0
Restricted range of motion	1	5.0
No complications	16	80.0

Interpretation: The majority of patients (80%) had no postoperative complications. Superficial surgical site infection was observed in 10% of patients and resolved with antibiotic treatment. Implant failure and restricted shoulder movements were observed in one patient each (5%).

Table 4. Functional Outcome According to Constant–Murley Score at Final Follow-up (n = 20)

Functional Outcome	Frequency (n)	Percentage (%)
Excellent	11	55.0
Good	8	40.0
Fair	1	5.0
Poor	0	0.0

Interpretation: At the final follow-up, 95% of patients achieved either excellent or good functional outcomes. Only one patient (5%) had a fair outcome, demonstrating that Endobutton and Fiber Wire fixation provides satisfactory functional recovery in acute Rockwood type III–V acromioclavicular joint dislocations.

DISCUSSION

The present prospective study evaluated the functional and radiological outcomes of acute acromioclavicular (AC) joint dislocations managed with Endobutton and Quadrapled FiberWire fixation. A total of 20 patients with Rockwood type III to V injuries were included, with a mean age of 38 years and a male-to-female ratio of 4:1. The findings demonstrated favourable functional outcomes, with 95% of patients achieving excellent or good results according to the Constant–Murley scoring system and a low incidence of complications. In the present study, the mean age of patients was 38 years, with the majority of cases occurring in males (80%). These findings are consistent with the epidemiological characteristics of AC joint dislocations reported in previous studies, which have demonstrated a predominance among young, active males involved in high-energy activities and contact sports. The higher incidence in males has been attributed to greater participation in sports, occupational activities, and road traffic accidents.^{8,9} Road traffic accidents constituted the most common mechanism of injury in the current study, accounting for 75% of cases, followed by sports-related injuries and falls. Similar observations have been reported in developing countries, where increasing vehicular density and high-energy trauma contribute significantly to the burden of AC joint injuries. Li et al. reported that high-energy trauma was the predominant cause of Rockwood type III to V injuries requiring surgical intervention.¹⁰

Regarding the pattern of injury, Rockwood type V dislocations were the most frequently encountered (45%), followed by type III (40%) and type IV injuries (15%). High-grade AC joint injuries often result in significant disruption of both the acromioclavicular and coracoclavicular ligaments, leading to persistent instability and functional impairment if not adequately treated. Surgical intervention is therefore widely recommended for Rockwood type IV, V, and VI injuries and selectively considered for type III injuries in physically active individuals.¹¹ The principal objective of surgical management is to achieve anatomical reduction and restore both vertical and horizontal stability of the AC joint. Conventional procedures such as Kirschner wire fixation, Bosworth screw fixation, Weaver–Dunn reconstruction, and hook plate fixation have demonstrated acceptable outcomes; however, they are associated with substantial complications, including implant migration, loss of reduction, hardware failure, subacromial impingement, osteolysis, and the need for implant removal.¹² Consequently, contemporary treatment strategies increasingly favour anatomical coracoclavicular reconstruction using suspensory fixation devices.

The Endobutton and Quadrapled FiberWire construct employed in the present study provides stable fixation while allowing physiological micromotion across the AC joint during ligament healing. Biomechanical studies have shown that high-strength suture-button devices offer tensile strength comparable to native coracoclavicular ligaments and facilitate maintenance of reduction without the need for secondary implant removal.¹³ Functional outcomes in the present study were encouraging, with 11 patients (55%) demonstrating excellent results, eight patients (40%) showing good results, and one patient (5%) achieving a fair outcome based on the Constant–Murley score. These findings are comparable to those reported by Hu et al., who observed excellent functional recovery and satisfactory radiological outcomes following modified single-Endobutton fixation for Rockwood type III and V injuries.¹⁴ Similarly, Bansod et al. reported excellent outcomes in 50% of patients and good outcomes in 37.5% following Endobutton-assisted reconstruction, with significant

improvements in shoulder function and patient satisfaction.¹⁵ Postoperative complications in the current study were minimal. Two patients (10%) developed superficial surgical site infections that resolved with antibiotic therapy, while implant failure and restricted range of motion were observed in one patient each (5%). Overall, 80% of patients experienced no complications. These findings are comparable to previously published studies demonstrating low complication rates with suture-button constructs. Although loss of reduction and hardware failure remain potential concerns, their incidence is considerably lower than that reported with hook plates and transarticular fixation methods.¹⁵ The favourable outcomes observed in the present study may be attributed to the anatomical placement of the FiberWire construct and the use of an Endobutton over the clavicle, which distributes stress more evenly and reduces the risk of tunnel widening or clavicular fracture. Baker et al. demonstrated that non-anatomical tunnel placement alters clavicular biomechanics and increases cyclic loading on the reconstruction construct, potentially contributing to failure.¹⁶ Therefore, meticulous surgical technique and precise tunnel positioning are essential to optimize outcomes and minimize complications. Despite the encouraging results, the present study has certain limitations. The sample size was relatively small, the study was conducted at a single centre, and the follow-up duration was limited to one year. Additionally, the absence of postoperative computed tomography prevented detailed assessment of horizontal instability and rotational alignment. Larger multicentric studies with longer follow-up periods are required to validate the long-term effectiveness and durability of Endobutton and Quadrupled FiberWire fixation in managing high-grade AC joint dislocations.

CONCLUSION

Acromioclavicular joint injury of type III to VI Rockwood Classification operated with endobutton and quadrupled fiber wire has shown that it has strength similar to coracoclavicular ligaments. Reconstruction of both acromioclavicular and coracoclavicular ligaments is done to recreate the near normal anatomy of AC joint. As coracoid is not drilled, the chances of coracoid fracture and injury to conjoint tendon is nil. Endobutton used helps to avoid the stress concentration over the bony bridge between the canal. Even though this method of single endobutton with quadrupled fiber wire has significant clinical efficacy, improves the function of the shoulder joint, reduces pain, reduces complications and affordable to patients, there are still some shortcomings. This study is single centred, prospective, small number of cases, and a multi-center, large sample case analysis is required to confirm the results of this study. More long-term follow-up results are needed to determine whether there are long-term complications. As there was no postoperative CT in this study, it was not possible to accurately assess the horizontal or rotational instability.

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