ORIGINAL ARTICLE

# FUNCTIONAL OUTCOME OF ACROMIOCLAVICULAR JOINT RECONSTRUCTION USING SINGLE ENDOBUTTON

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## ABSTRACT

**Objective:** To determine the functional outcome of acromioclavicular joint reconstruction using the single Endobutton technique in patients with Rockwood type III-VI AC joint dislocations.

**Materials & Methods:** The study was a quasi-experimental study carried out at MTI, Khyber Teaching Hospital, Peshawar, from April 2025 to March 2026. The nonprobability consecutive sampling was used and 117 patients were included. The mean age of the patients was 20-60 years, and the Rockwood types of the AC joints were III to VI. Open reduction and coracoclavicular reconstruction with a single Endobutton and TightRope fixation were performed in all patients. The Constant-Murley score was used to evaluate functional outcomes preoperatively and at 6 and 12 weeks postoperatively. Data were analyzed using SPSS version 26 and a repeated measure analysis was used to compare the outcomes over time.

**Results:** The mean Constant-Murley score improved significantly from 38.4 ± 6.7 preoperatively to 64.7 ± 7.2 at 6 weeks and 87.3 ± 5.5 at 12 weeks ($p < 0.001$). The improvements were uniform in all subgroups, with slightly better results in the younger and lower Rockwood grade subgroups. The radiographic results demonstrated a sustained reduction in 93% of patients, with few complications and no hardware failures or neurovascular injury.

**Conclusion:** Single Endobutton fixation provides significant early functional improvement, with a high rate of maintained reduction and a low complication rate. It is cost-effective and less complex and reliable than other methods in the management of Rockwood type III-VI AC joint dislocation. Further long-term comparative studies are recommended.

**Keywords:** Acromioclavicular joint, Coracoclavicular ligament, Endobutton, Rockwood classification, Shoulder reconstruction

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## INTRODUCTION

Acromioclavicular (AC) joint injury is the most frequent shoulder injury and can occur as a direct blow to the lateral shoulder or after high impact trauma like a fall or road traffic accident, especially in young, active people. The available data suggest that AC joint dislocations represent about 9-12% of all shoulder injuries, most of the time in males, and mostly in people who play contact sports or work by manual work.[1]

The AC joint is stabilized by two ligaments: the acromioclavicular (AC) and coracoclavicular (CC). The lateral conoid and trapezoid ligaments and the capsular ligament that extends horizontally are part of the AC joint that are torn in high grade injuries.

In high-grade (Rockwood types IV-VI) dislocations, surgery is most commonly recommended due to increased instability and functional loss associated with complete ligamentous rupture, while type III injuries remain contro-versial regarding surgical management.[2]

The surgical techniques used to reconstruct the AC joint have improved significantly in the past decade to restore both vertical and horizontal stability with minimal morbidity. Anatomical reconstruction of the CC ligament complex is supported by biomechanical and clinical studies, and has outperformed non-anatomical fixation methods with modern devices like cortical button systems and suture-button constructs which provide strong fixation and early functional recovery.[2]

The Endobutton technique, among these, has gained popularity as a reliable approach that approximates native ligament biomechanics with minimally invasive, tensioned fixation between the clavicle and the coracoid process. [3] Recent clinical studies show that Endobutton-based reconstructions, whether single- or double-button designs, result in significant improve-

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ments in validated shoulder scores, including Constant and DASH metrics, and that the procedures maintain reduction well with early return of motion. [4]

Despite promising functional results with suspen-sory fixation systems like the Endobutton, challenges re-main in achieving good long-term outcomes and reduc-ing complications. Postoperative loss of reduction and hardware-related complications remain concerns. Recent large cohort studies suggest that about 25% of AC joint reconstructions with button-based fixation systems expe-rience loss of reduction, and this loss correlates with inferi-or clinical outcomes, including lower Constant scores and greater pain at follow-up, especially when technical issues such as tunnel malposition or premature weight-bearing occur. [5]

Other research shows that while the short-term complication rate after AC joint surgery is generally low, patient comorbidities and procedural factors can signifi-cantly impact adverse events. [6] Additionally, complica-tions such as tunnel widening, ongoing loss of reduction, distal clavicular osteolysis, and persistent pain have been observed after combined CC-AC stabilization procedures, illustrating that even methods meant to tackle both vertical and horizontal instability can still lead to negative radio-graphic and clinical outcomes. [7]

While studies continue to compare isolated coracoclavicular reconstruction to com-bined CC and AC ligament repair, the results are mixed regarding whether adding AC ligament repair reliably en-hances outcomes beyond CC fixation alone.

In this con-text, it is crucial that a careful assessment be conducted of the functional outcomes of specific reconstructive tech-niques, such as the single Endobutton construct, using standardized measures at specified follow-up intervals to determine their efficacy. This will ultimately help to under-stand which methods should be used and improved for AC joint reconstruction. This study aims to assess func-tional outcomes in patients undergoing AC joint recon-struction using the single Endobutton technique. Results will provide valuable information on the technique's effec-tiveness based on local experience.

## MATERIALS AND METHODS

After obtaining ethical approval, this quasi-experimental study was carried out in Orthopedic Department of Khyber Teaching Hospital in Peshawar, Pakistan from April 2025 to March 2026. Consecutive patients with acute AC joint dislocations of Rockwood types III through VI were included using nonprobability sampling.

The sample size of 117 patients was calculated a priori using the WHO sample size calculator. The calculation was based on an expected proportion of 12.5% for an adequate functional outcome, a 7% margin of error, and a 95% confidence in-terval. This ensured sufficient power to detect significant differences in functional scores between follow-up inter-vals.

Patients aged 20 to 60 years who presented with-in two weeks of injury were included. Patients with open wounds, poor local skin conditions, polytrauma or any other comorbidities were excluded to minimize confounding factors that may influence postoperative recovery and functional assessment.

Patients eligible for the study provided written informed consent. Baseline demographics and clinical details, including age, gender, BMI, injury laterality, Rock-wood classification, and the time from injury to surgery, were obtained. To confirm the diagnosis and measure CC distance, bilateral anteroposterior and Zanca view radio-graphs were obtained preoperatively.

All patients were positioned in a beach-chair under general anesthesia and underwent open reduction of the AC joint, followed by anatomical reconstruction of the CC ligaments using a single Endobutton construct with Tight-Rope suture fixation. A standardized surgical technique was used, involving drilling a clavicular tunnel to match the natural locations of the conoid and trapezoid ligament insertions. A TightRope was passed around the coracoid process and through the clavicular tunnels, followed by reduction to restore normal alignment, and then secured with a single Endobutton.

Reduction and proper placement of the implant were confirmed using intraoperative imaging. All patients received a standard postoperative rehabilitation pro-gram, which consisted of four weeks of sling immobilization followed by gradual physiotherapy emphasizing range of motion and strengthening exercises. This method was similar to that used in recent recon-struction studies in which functional outcome was evaluated at 6 and 12 weeks.

Constant-Murley Score was used as a validated functional outcome tool performed preoperatively and at 6 and 12 weeks postoperatively. Pain, activities of daily liv-ing, range of motion, and strength were documented. This follow-up schedule was based on prior studies showing significant improvements in functional scores and radio-graphic stability within similar early time frames. It estab-lished a reliable period for evaluating short-term recovery and reducing follow-up loss.

To assess maintenance of reduction and hardware integrity, we obtained a radiograph at each visit. All out-come assessments were performed by independent clini-cians blinded to preoperative data. Statistical analysis was performed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation or as me-dian with interquartile range, depending on distribution.

Distribution was assessed with the Shapiro-Wilk test. Cat-egorical variables were presented as frequencies and per-centages. Stratified analysis was conducted by age, gen-der, body mass index, Rockwood grade, and duration of injury. We used the chi-square test or Fisher's exact test, as appropriate. A p-value ≤ 0.05 was considered statis-tically significant.

This methodology enabled a thorough evaluation of functional recovery after a single Endobut-ton reconstruction. It also provided a comparison with the current literature on AC joint stabilization techniques and contributed to evidence-based rec-ommendations for clinical practice.

## RESULTS

All 117 patients were followed up after surgery at six weeks and twelve weeks. The group included 83 males (71%) and 34 females (29%), with a mean age of 35.6 ± 9.2 years.

The most common cause of injury was road traffic accident (59%), followed by sports-related trauma (27%) and falls (14%). There was a significant functional limita-tion before surgery with a mean Constant Murley Score of 38.4 ± 6.7.

At 12 weeks, 12% noted further improvement with a mean Constant score of 87.3±5.5. The difference be-tween the Constant scores at the three points was statis-tically significant as verified by re-peated-measures anal-ysis of variance ($p < 0.001$). Please see Figures 1 and 2.

Improvements were found to be consistent across subgroups with stratified analysis. The mean Constant scores in the age group 40 years or less were higher than those for 40 years or more at each post-operative visit, but both groups had statistically significant improvement ($p < 0.001$).

At six weeks postoperatively, there was a no-tice-able improvement in shoulder function, with a mean

**Table No 1: Constant–Murley Score Stratified by Patient Subgroups**

| Subgroup | Subgroup | Preop Mean ± SD | 6 wk Mean ± SD | 12 wk Mean ± SD |
|---|---|---|---|---|
| Age | ≤ 40 years | 36.8 ± 6.3 | 66.1 ± 6.9 | 89.1 ± 4.8 |
| | > 40 years | 41.2 ± 7.0 | 61.9 ± 7.1 | 85.7 ± 5.8 |
| Gender | Male | 38.2 ± 6.5 | 64.3 ± 7.0 | 87.1 ± 5.2 |
| | Female | 38.9 ± 7.1 | 65.7 ± 7.7 | 87.9 ± 6.3 |
| Rockwood Grade | III | 37.1 ± 6.8 | 65.5 ± 7.1 | 89.1 ± 4.8 |
| | IV – VI | 40.5 ± 6.4 | 63.9 ± 7.3 | 85.7 ± 5.8 |

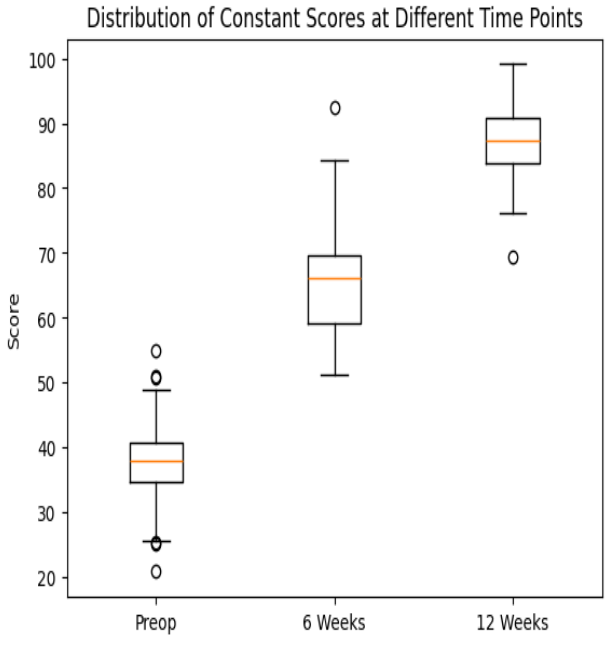


**Fig 1: Boxplot illustrating the distribution and vari-ability of Constant-Murley scores at pre-operative, 6-week, and 12-week time points**

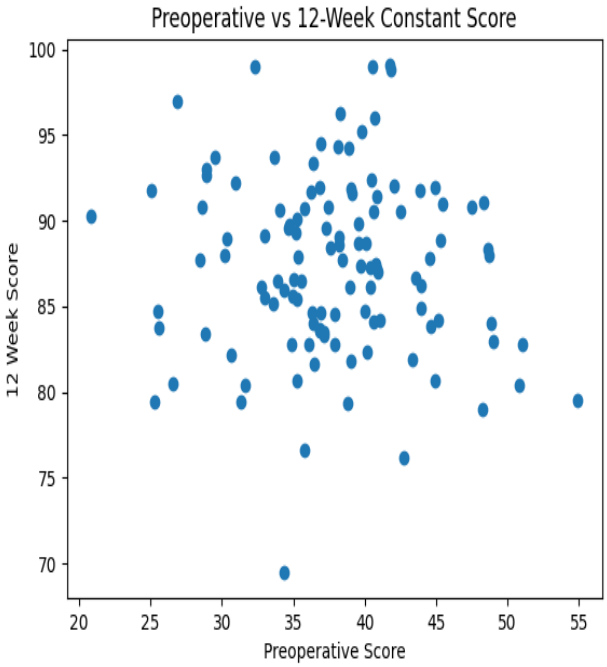


**Fig 2: Scatter plot showing the relationship between preoperative and 12-week Constant-Murley scores**

Con-stant score of 64.7 ± 7.2.

Similarly, no notable differences in score improve-ment were observed between genders. Rockwood grade III injuries had slightly higher scores at 12 weeks than grades IV-VI (mean 89.1 ± 4.8 vs. 85.7 ± 5.8, p = 0.03), but both groups demonstrated significant functional re-covery (Table 1). Radiographic assessment revealed that 93% of patients maintained joint reduction at 12 weeks. 7% showed minor, asymptomatic widening of the coraco-clavicular interval without functional problems. No instanc-es of hardware migration or serious neurovascular compli-cations were noted.

## DISCUSSION

The current study demonstrates significant, pro-gressive improvements in functional outcomes after acro-mioclavicular joint reconstruction with the single Endobut-ton technique. The mean Constant-Murley score improved signifi-cantly from the preoperative period to 6 weeks and further to 12 weeks postoperatively, indicating marked early func-tional recovery. These results suggest that this technique effectively restores shoulder function within a relatively short follow-up period.

Improvements remain consistent across demo-graphic and injury-related groups. Younger patients and those with low-grade injuries showed relatively greater im-provement. The reliability and safety of this approach for high-grade AC joint dislocations are further supported by the high rate of maintained reduction and low complica-tion rates.

The findings of this study are consistent with sever-al recent studies on suspensory fixation for AC joint recon-struction. Gad et al. (2024) reported a significant improve-ment in the Constant score, from 45.3 preoperatively to 92.3 at the final follow-up. [9]

The current study shows similar results. Other studies have likewise shown that Endobutton constructs provide better functional outcomes, stable anatomical re-duction, and signifi-cantly improved Constant scores. [3, 10]

A retrospective study from 2025 confirmed that Endobutton-based reconstruction is reliable for restoring shoulder function and achieving high patient satisfaction.[11] Collectively, these studies indicate that the suspensory fixation system is highly effective in achieving early and midterm functional results, which align with the observa-tions of the current study.

Moreover, the improvement in Constant-Murley Scores observed in this study aligns with the literature on AC joint reconstruction techniques. Both graft-based and button-based reconstruction studies report significant gains in functional scores, often reaching excellent levels during follow-up. [12]

The biomechanical benefits of the Endobutton construct, including stable coracoclavicular fixation and restoration of vertical stability, are key contributors to these outcomes. [13] However, despite positive functional results, loss of reduction and tunnel-related problems re-main major concerns. Loss of reduction rates of up to 25% have been reported in some studies, underscoring the im-portance of surgical accuracy and rehab protocols. [5, 14]

In comparison, the low complication rate in this study further highlights the effectiveness of the single Endobutton technique when performed with appropri-ate methods and patient selection. The findings of this

study underscore the clinical significance of the single Endobutton technique as a reliable approach to high-grade acromioclavicular joint dislocations. The significant improvement in functional results, along with a high rate of maintained reduction and few complications, makes a strong case for its use as a practical alternative to more complex methods.

The single Endobutton technique offers advantag-es such as reduced operative time, lower costs, and lower surgical morbidity compared with double Endobutton or graft-based techniques, which are especially important in resource-limited settings. Recent studies have also shown that suspensory fixation systems provide stable anatomi-cal reconstruction, excellent functional recovery, and sup-port early rehabilitation. [10]

Furthermore, evidence suggests that surgical technique and proper patient selection are more critical for outcomes than the complexity of the constructs, sup-porting the effectiveness of simpler fixation methods such as the single Endobutton technique. [5]

The debate over whether to use a single or double Endobutton continues. Double Endobutton techniques offer greater biomechanical stability and restore the lig-ament's natural anatomy, with studies reporting excellent radiologic and functional results. [3, 15]

Other studies, however, show that this extra complexity does not always benefit clinical results and may even raise technical requirements and the risk of implant-related complications.[16] In contrast, single Endobutton fixation provides comparable functional results, with reduced surgical complexity, shorter operating time and lower costs.[17]

These findings suggest that a single, well-placed suspensory construct is often sufficient to restore function-al stability. This is also reflected in the outcomes of the current study.

Complications after Endobutton fixation are still a concern. Loss of reduction is the most frequently report-ed issue, occurring in about 12-28% of cases in recent studies. [5] This complication is mainly because of technical factors like tunnel malposition and early loading postoper-atively, rather than patient-related factors.

Other complications may include infection, fail-ure of implant, and fracture of the clavicle and coracoid, although these occur less frequently. [16] Nonetheless, the present study reports a low incidence of complication rate and a high proportion of maintained reduction. This em-phasizes the necessity of standardized surgical technique and post-op rehabilitation for successful re-

sults.

The strength of this study lies in its larger sam-ple size, standardized surgical technique, and regular-ly scheduled, predetermined follow-up intervals, which together provide a more reliable evaluation of functional outcomes. Nonetheless, several shortcomings must be considered. Assessment of long-term stability and late complications, which have received increasing attention in recent literature, cannot be performed due to the short follow-up period. [18]

Additionally, the study's single-center design and lack of a control group make the findings less generaliz-able. The absence of detailed radiological correlation pre-cludes a thorough assessment of anatomical outcomes. Even with these limitations, the study provides significant clinical evidence supporting the effectiveness of the single Endobutton technique.

## CONCLUSION

To summarize, acromioclavicular joint reconstruc-tion using the single Endobutton technique demonstrat-ed significant improvements in functional outcomes, in-cluding higher Constant-Murley scores and a high rate of maintained reduction.

The results of the current study are consistent with the available literature, which indicates that Endobut-ton-based reconstruction provides adequate restoration of joint stability and improved shoulder function. This technique offers biomechanical effectiveness and surgical simplicity, making it a cost-effective choice for high-grade AC joint dislocations. Further comparative studies with ex-tended follow-up are recommended to validate these find-ings and establish definitive treatment guidelines.

## REFERENCES


1. Boufadel P, Fares MY, Daher M, Lopez R, Khan AZ, Ab-boud JA. Epidemiology of acromioclavicular joint sep-arations presenting to emergency departments in the United States between 2004 and 2023. Shoulder Elb 2025: 17585732251320015.
2. Wollner G, Luisi S, Hruska F, Pengg F, Koenig FR, Timmel G, Osti M, Bach C, Haider T. More Fixation, Better Outcome? Evaluating the Role of Additional Acromiocla-vicular Ligament Reconstruction in AC Joint Injuries: A Multicenter Analysis. Journal of Clinical Medicine. 2025 Dec 8;14(24):8679.
3. Bansal A, Meena RP, Singh P, Meena UK, Kharalwa R. Functional outcomes of acromioclavicular joint disloca-tion repair using the double Endobutton technique: a ret-rospective study. Int J Res Orthop. 2025;11(5):1167–72. Doi: 10.intjresorthop20252647
4. Kumar R, Khader FA, Harish, Adhiyamaan R.V. Evalua-tion of functional outcomes of complete acromioclavicu-lar joint dislocation treated with the double Endobutton technique in a tertiary care hospital. J Chem Health Risks. 2025 [cited 2026 Feb 20];15(2):1084–101. Available from: https://jchr.org/index.php/JCHR/article/view/7963
5. Fang Y, Wang J, Lv J, Zhang Z, Zhao M, Wu Y, Zhang X, Tian N, Zhu H, Zheng W, Sun L. Predicting reduction loss risk after acromioclavicular joint dislocation treated with the endobutton device. BMC Musculoskelet Disord. 2025 Oct 3;26(1):912. doi: 10.1186/s12891-025-09190-x. PMID: 41044491; PMCID: PMC12495696.
6. Yazdanpanah S, Talaski GM, Smith MS, Gooch BR, Cas-sidy BP, Cuthbert AS, Vanderbeck JL. Low short-term complication rates following acromioclavicular joint sur-gery: a large database study. JSES Reviews, Reports, and Techniques. 2026 Jan 2:100660.
7. Maliwankul K, Kanyakool P, Klabklay P, Parinyakhup W, Boonriong T, Chuaychoosakoon C. Progressive Loss of Acromioclavicular Joint Reduction Correlated with Pro-gressive Clavicular Tunnel Widening after Coracoclavic-ular Stabilization in Acute High-Grade Acromioclavic-ular Joint Injury. Journal of Clinical Medicine. 2024 Jul 29;13(15):4446.
8. Satishkumar B, Mehra AK, Rajulal Yadav R. Study on functional outcome of reconstruction of acromioclavicu-lar joint dislocations type III to type VI using tight rope with endobutton. Int J Orthop Sci. 2020;6(2):107-12
9. Gad HE, Gawish HM, Bayomy ES. Evaluation of the re-sults of acute acromioclavicular joint reconstruction us-ing Double Endobutton technique. The Egyptian Orthopaedic Journal. 2024 Feb 12;59(1):43-8.
10. Boddeti Veera Venkata Satyanarayana D, Santhosh Karunakar DD, Krishnamurthy D, Dky Y. Prospective Analysis Of Functional Outcome Of Acromioclavicu-lar Joint Dislocation Repair Using Double Endobutton Technique. Journal of Contemporary Clinical Practice. 2025;11(12):92–7.
11. Ozmanevra R, Hapa O, Yanik B, Aydemir S, Kilic AI, Fidan E, Gursan O, Ozkan M. Comparison of endobutton and tendon graft techniques in acromioclavicular joint dislocation: Early treatment yields better outcomes. Medicine (Baltimore). 2025 Jun 13;104(24):e42879. doi: 10.1097/MD.0000000000042879. PMID: 40527800; PMCID: PMC12173341.
12. Konstantinou E, Koskiniotis A, Stefanou N, Koutalos A, Athanaselis E, Hantes M, Varitimidis S. Anatomical re-construction of coracoclavicular and acromioclavicular ligaments using an autologous tendon graft provides excellent outcomes in acute acromioclavicular joint dis-location. Knee Surg Sports Traumatol Arthrosc. 2025 Dec;33(12):4364-4371. doi: 10.1002/ksa.70051. Epub 2025 Aug 29. PMID: 40878682; PMCID: PMC12684365.
13. Yang C, Liu G, Lan W, Li L, Wang R, Tang J, Wu H, Hu J. Acromioclavicular joint dislocation with loop double en-dobutton fixation assisted by orthopaedic surgery robot positioning system. BMC Musculoskelet Disord. 2024 Jul 26;25(1):587. doi: 10.1186/s12891-024-07724-3. PMID:39060990; PMCID: PMC11282833.
14. Singh S, Sonu SK, Patel R, Prashant K, Nagar H. Failed Loop Endobutton Acromioclavicular Joint Reconstruc-tion Treated with Duo Figure of 8 FiberTape Augment-ed Autogenic Graft Wrapping Technique: A Case Re-port. J Orthop Case Rep. 2025 Apr;15(4):186-191. doi: 10.13107/jocr.2025.v15.i04.5494. PMID: 40212527; PM-CID: PMC11981503.
15. Ünal H, Yiğit N, Gürhan U, Aydın T, Ceyhan E. Dou-ble-Button Fixation Provides Superior Horizontal Stability in Acute Acromioclavicular Joint Reconstruction: A

Com-parative Radiologic Analysis. Journal of Clinical Orthopaedics & Trauma. 2026 Apr 1.

16. Gupta GK, Halder S, Rani S, Chakraborty R, Kumar A, Kumar T. Comparison of Double Endobutton and Clavicular Hook Plate in Acromioclavicular Joint Dis-ruption: A Systematic Review and Meta-analysis. Ann Afr Med. 2024 Oct 1;23(4):535-547. doi: 10.4103/aam.aam_13_24. Epub 2024 Jun 8. PMID: 39279166; PMCID: PMC11556495.
17. Hu F, Han S, Liu F, Wang Z, Jia H, Wang F, Hu L, Chen J, Wang B, Yang Y. A modified single-endobutton technique combined with nice knot for treatment of Rockwood type III or V acromioclavicular joint dislocation. BMC Muscu-loskeletal Disorders. 2022 Jan 3;23(1):15.
18. Gavril-MT, Cristea V, Cristea S. Advantages and Disad-vantages of the Arthroscopic Procedure in Acromiocla-vicular Separation. J Clin Med. 2025 Oct 10;14(20):7130. doi: 10.3390/jcm14207130. PMID: 41156000; PMCID: PMC12565637.

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Following authors have made substantial contributions to the manuscript as under

| Authors | Conceived & designed the analysis | Collected the data | Contributed data or analysis tools | Performed the analysis | Wrote the paper | Other contribution |
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| Ali A | ✓ | × | ✓ | ✓ | ✓ | × |
| Ullah R | ✓ | ✓ | × | × | × | ✓ |
| Rehman IU | ✓ | × | ✓ | ✓ | ✓ | × |
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Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

**Ethical Approval:**

**This Manuscript was approved by the Ethical Review Board of Khyber Teaching Hospital, Peshawar. Vide No. 379/DME/KMC. Dated: 25 04 2025**