

A Prospective Study of Functional Outcome on an Observational Study of Evaluate Clinical and Radiological Outcomes of Surgically Managed Acromio Clavicular Joint Injury

D.Narender¹, T Parameshwari², Vishali L.G³, Reka Shashank Preetam⁴

¹Associate Professor, Department of Orthopedics, Government Medical College, and General Hospital, Vikarabad, Telangana, India. ²Associate Professor, Department of Orthopedics, Government Medical College, and General Hospital, Jogulamba Gadwal, Telangana, India. ³Assistant Professor, Department of Orthopedics, Government Medical College, and General Hospital, Vikarabad, Telangana, India. ⁴Senior Resident, Department of Orthopedics, Government Medical College, and General Hospital, Vikarabad, Telangana, India.

Abstract

Background: Acromioclavicular (AC) joint disruptions account for approximately 12% of shoulder injuries and significantly affect scapulothoracic and glenohumeral biomechanics, particularly during abduction beyond 90°. While Rockwood Type I and II injuries are treated conservatively, Type III to VI injuries often require surgical reconstruction of the coracoclavicular (CC) and acromioclavicular ligaments to restore joint stability. Although various surgical techniques are available, limited comparative literature exists about their functional outcomes and associated morbidity. The aim is to compare the functional outcomes of AC joint reconstruction using suture anchor technique, endobutton flip technique, and hamstring graft reconstruction in Type III–VI injuries. **Material and Methods:** This prospective comparative study included 24 patients with Rockwood Type III–VI AC joint disruptions. Patients were randomly divided into three groups (n=8 each): Group A underwent open reduction and CC reconstruction using double-loaded suture anchors; Group B underwent endobutton flip technique; Group C underwent hamstring graft reconstruction. All patients received standardised postoperative rehabilitation. Functional outcomes were assessed using the Constant Shoulder Score at 6 weeks, 3 months, 6 months, and 12 months, along with radiological evaluation. **Results:** At one-year follow-up, all patients achieved satisfactory radiological reduction and good functional outcomes. The mean Constant scores were 93.8 in Group A, 91.8 in Group B, and 92.0 in Group C. Complications were minimal, including one subluxation in Group B and one infection and graft-site calcification in Group C. No statistically significant difference was observed among the groups. **Conclusion:** All three techniques provided comparable and satisfactory functional outcomes in AC joint reconstruction, with no single method demonstrating superiority.

Keywords: Acromioclavicular joint dislocation, Coracoclavicular ligament reconstruction, Suture anchor, Endobutton flip technique, Hamstring graft, Constant shoulder score.

Received: 18 January 2026

03 February 2026

Accepted: 23 February 2026

Published: 07 March 2026

INTRODUCTION

Dislocations of the acromioclavicular joint are frequent among athletes. They are responsible for around 12% of shoulder girdle injuries. These injuries are frequently observed in motor vehicle collision events involving men between the ages of two and five. The clavicle's function as an osseous stabilization bar that aids in maintaining the lateralisation of the scapula on the chest wall is enabled by the diarthrodial acromioclavicular joint and its surrounding soft tissues. ACJ injuries often develop from a direct blow to the shoulder or from a direct impact onto the top of the shoulder when the arm is adducted.^[1] Although the treatment of these injuries dates back to Hippocrates and Galen, there still seems to be no consensus on whether surgery is needed or which approach yields the greatest functional benefit with the least morbidity. Surprisingly, little is known about the final mechanical behaviour of the native coracoclavicular ligament complex or the various reconstruction techniques, despite several approaches having been documented for the operative treatment of acromioclavicular joint injuries.^[2]

Data do not well support treatment options for patients with dislocated AC joints. More research is required to ascertain whether there are differences in the treatment of patients with AC joint dislocations about early versus delayed surgical intervention and anatomic versus non anatomic surgical techniques, despite the widely accepted consensus for nonoperative treatment of Rockwood Type I and II lesions, initial nonsurgical treatment of type III lesions, and operative intervention for Rockwood Type IV to VI lesions. SUPPLIES

Address for correspondence: Dr. Reka Shashank Preetam, Senior Resident, Department of Orthopedics, Government Medical College and General Hospital, Vikarabad, Telangana, India. E-mail: ?@gmail.com

DOI:
10.21276/amt.2026.v13.i1.406

How to cite this article: Narender D, Parameshwari T, Vishali LG, Preetam RS. A Prospective Study of Functional Outcome on an Observational Study of Evaluate Clinical and Radiological Outcomes of Surgically Managed Acromio Clavicular Joint Injury. Acta Med Int. 2026;13(1):619-625.

AND TECHNIQUES 24 patients with acromioclavicular joint disruption type III to type VI who were hospitalized in the orthopedic ward at Osmania Medical College for a year and had at least a 12-month post-operative follow-up were included in this prospective research. Every patient with closed AC joint disruption, Types III-VI, meets the inclusion criteria. Age: >18 to <60 years patients with AC joint disruption types I and II, those medically unsuitable for surgery, those with clavicle fractures and limb fractures, and those with ligamentous laxity abnormalities are excluded. Every patient had surgery according to the prescribed regimen.

Outcome was measured using the Constant-Murley score at 6, 12, 24 weeks, and 1 year. Radiological assessment was performed at 6, 12, 24 weeks, and 1 year. The time protocol extends from within 24 hours of injury to 30 days.

Every patient with Type III to Type VI acromioclavicular joint dislocation underwent surgery and received regular follow-up care. All patients who met the study's inclusion criteria provided informed consent. Patients get clinical and radiological examinations as well as primary resuscitation if necessary, temporary immobilisation using a sling support, or a universal shoulder immobiliser. When necessary, analgesics and other symptomatic treatments are used. Anteroposterior and Zanca View 2 shoulder X-rays. Stress X-rays with a weight of five kilograms. standard laboratory tests before surgery. The Rockwood classification for treating acromioclavicular joint injuries was used to categorise each patient. Haemogram, blood sugar level, bleeding, and clotting times, HBsAg, HIV, blood group, urine routine and microscopy, chest radiograph, and electrocardiogram were among the tests performed on each patient. For medical and anesthetic fitness, further pre-operative and metabolic studies were conducted. Hamstring grafts, Free Endobutton, k-wire, and double-looped 5mm suture anchors were used throughout the procedure. The length of the operation, the size of the screws, and the suture anchors used to secure the grafts were all recorded.

MATERIALS AND METHODS

Three groups—Group A, Group B, and Group C—were randomly selected from the total patient population. Group A: Reconstruction of the CC Ligaments was accomplished by K-wire fixation from the acromion to the clavicle and double-loaded 5mm suture anchors secured with a two-holed recon plate. Group B: CC Ligaments were repaired using the Endobutton flip method, with 5.0 Ethibond secured over a recon plate with two holes and K-wires fixed from the acromion to the clavicle. Group C: Hamstring autograft was used to rebuild the CC Ligaments. Group A: Suture anchor approach for coracoclavicular stabilisation.^[3] Every surgery was done in a supine posture while undergoing a supraclavicular block. A cut was made along the acromion and distal collarbone. The severed coracoclavicular ligament was seen upon subcutaneous dissection of the displaced acromioclavicular joint. To verify the bony portion of the base, the fingertip was used to palpate the Coracoid process. Four bundles of sutures were fastened to each of the 5.0mm

diameter suture anchors used in this investigation. A 2.5mm drill bit was used to pre-dill the coracoid base before inserting the suture anchor.



Figure 1: Two bone holes were bored in the distal clavicle, and the anchor's sutures were drawn through each one independently.

A two-hole recon plate was placed over the superior border of the clavicle to secure the sutures attached to the anchor. The sutures were pulled individually through two bone holes drilled in the distal clavicle, 4.5 cm slightly posteriorly (conoid part) and 3 cm slightly anteriorly (trapezoid part) from the lateral end of the clavicle. To improve horizontal stability, the capsule's ligamentous sleeve was then sutured. Detachments of the deltotracheus were fixed. To sustain reduction, two K-wires, each measuring two millimetres, were run from the acromion to the lateral end of the clavicle. Layers of wound closure occurred. After six weeks, the K-wires were removed regularly.

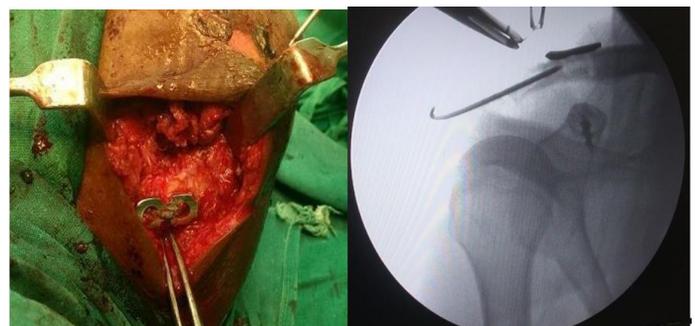


Figure 2: Two K wires of 2 mm were run from the acromion to the lateral end of the clavicle, and sutures were fastened with a reconstruction plate with two holes put across the superior border of the clavicle.

Group B

Acromioclavicular joint reduction and CC ligament reconstruction with endobutton flip technique.^[4] The patient is placed in the supine position under a supraclavicular block. Access through the Roberts incision is made topographically along the anterior edge of the clavicle, 5mm medial to the acromioclavicular joint, to the top edge of the coracoid process. To visualise the acromioclavicular joint and the coracoid process, the deltotracheal fascia is opened, and the deltoid is retracted. The medial and lateral borders of the coracoid base were plainly visible. A 4.5mm drill bit positioned anteriorly above the base of the coracoid. To have it protrude from the bottom of the coracoid,

a free 4-hole endobutton filled with 5.0 Ethibond was inserted into the drill hole. To secure the endobutton to the coracoid's underside, the Ethibond was pulled in its upper part. The trapezoid drill hole was produced over the distal end of the clavicle, and the two pairs of Ethibond tails are pulled out in the two-hole recon plate fitted over the anatomical conoid. To keep the decrease going, the Clavicle is subjected to strong downward pressure. From the acromion to the clavicle's lateral end, two K wires are attached. Over the recon plate, the Ethibond was tied.

Group C: Autologous hamstring graft for acromioclavicular joint reduction and repair.^[5] Curvilinear incision from the distal end of the clavicle to the coracoid tip in longitudinal lines. Raise the clavicle's full-thickness flaps anteriorly and posteriorly. Dissect the coracoid posterior to the deltoid after releasing the delto-trapezial muscles. To make graft passage simple, use a right-angled clamp to construct a tunnel under the exposed coracoid. Using the proper steel reamer, drill the first tunnel 45 mm from the distal clavicle (35 mm if distal clavicular resection has previously been done). To restore the natural conoid position, it should be placed somewhat posteriorly. To replicate the trapezoid location, drill the second tunnel 15 mm laterally to the first tunnel, somewhat anteriorly. To create a figure-of-eight, suture the graft's lateral limb through the first (posterior) tunnel and then cross it posteriorly. Next, feed the graft's medial limb via the anterior tube. Instead of crossing the suture, pass it straight through to create a circle. After manually reducing the acromioclavicular joint, bind the graft that was removed using the drill holes in the distal clavicle. The periosteum of the clavicle was used to sew the non-absorbing sutures that were placed on both limbs of the transplant.

In an acromioclavicular ligament replacement, route the tendon graft's remaining lateral limb and sew it to the acromion. Securely close the deltotrapezial interval and use

absorbable monofilament suture to seal the skin.

Protocol after an operation

K-wires are typically removed after 4 weeks, and sutures are removed on the 12th postoperative day. The brace is worn for 6 weeks and is only removed for pendulum and active-assisted activities. Twelve weeks mark the start of strengthening, and six months mark the return to sports. Scaling enhancement used Constant Score.^[6]



Figure 3: Autologous hamstring graft used for acromioclavicular joint reduction and repair.

RESULTS

24 individuals hospitalized in the orthopaedics department participated in this study. The findings and observations from the investigation are listed below.

Table 1: Demographic distribution (n=24)

Age group	No of cases			Percentage%	
	A	B	C		
20-30 yrs	4	1	1	2	16
30-40yrs	7	1	4	2	29
40-50yrs	12	5	3	4	50
50-60yrs	1	0	1	0	5
Gender					
Male	23	7	8	8	96
Female	1	1	0	0	4
Mode of injury					
Self fall	10	2	4	4	42
RTA	14	6	4	4	48
Side effected					
Right	13	5	5	3	54
Left	11	3	3	5	49
2-5days	16	4	6	6	67
5-7days	6	4	2	0	25
>7days	2	0	0	2	8

A consistent score has been used for each of the 24 patients treated with three different surgical techniques. Every instance was monitored for 6 weeks, 3 months, 6 months, and

12 months. For pain, range of motion, and radiography, the mean value has been determined.

Functional and Radiological Outcomes

Table 2: 3-Month Follow-up Comparison

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	Group C (Mean ± SD)
X-ray Score	4.0 ± 0.0	4.0 ± 0.0	4.0 ± 0.0
Pain Score	2.9 ± 0.4	3.0 ± 0.0	3.0 ± 0.0
Abduction	3.0 ± 0.0	3.0 ± 0.0	3.0 ± 0.0
Constant Score	85.0 ± 1.9	83.3 ± 3.2	83.8 ± 1.3

After three months, it was discovered that the average scores for abduction across the three techniques and the radiological location of the AC joint were comparable. However, patients

in group A had less postoperative discomfort than those in groups B and C.

Table 3: 6-Month Follow-up Comparison

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	Group C (Mean ± SD)
X-ray Score	3.9 ± 0.4	4.0 ± 0.0	4.0 ± 0.0
Pain Score	3.6 ± 0.5	3.4 ± 0.5	3.0 ± 0.0
Abduction	4.0 ± 0.0	4.0 ± 0.0	4.0 ± 0.0
Constant Score	88.0 ± 0.9	87.0 ± 2.8	87.3 ± 1.5

Compared with patients treated with the endobutton flip method and autograft transfer technique, those treated with suture anchors had a slightly higher constant score at 6

months. However, in our investigation, all three approaches produced excellent functional results. The three approaches did not vary statistically significantly.

Table 4: 12-Month Follow-up Comparison

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	Group C (Mean ± SD)
X-ray Score	3.9 ± 0.4	4.0 ± 0.0	4.0 ± 0.0
Pain Score	3.8 ± 0.5	4.0 ± 0.0	3.9 ± 0.4
Abduction	4.0 ± 0.0	4.0 ± 0.0	4.0 ± 0.0
Constant Score	93.8 ± 2.2	91.8 ± 2.5	92.0 ± 1.9

All the patients' reductions were deemed adequate radiologically and statistically insignificant at the one-year follow-up. However, compared with the other two procedures, patients treated with suture anchors had a slightly higher constant score. Every patient had positive radiological and functional results. When it comes to repairing the

coracoclavicular ligament, no technique is better than any other. All three approaches produced excellent functional results in our research when used to treat type III to type VI acromioclavicular joint disturbances. None of the three approaches differs statistically significantly from the others, and they are all similar.

Table 5: Complications in present study

Complications:	Group A	Group B	Group C
Calcification	0	0	1
Superficial infection	0	0	1
Subluxation	0	1	0

One patient had an infection treated with antibiotics, another had AC joint disturbances treated with the hamstring graft procedure, and another had calcification at the graft application site. However, during the six-month follow-up after surgery, the patient's range of motion was excellent. One patient had subluxation because of noncompliance with the endobutton flip approach for treating AC joint disturbances. The patient obtained abduction 1000.

DISCUSSION

The primary goal in the surgical management of acromioclavicular (AC) joint dislocations is to achieve stable anatomical reduction of the AC joint with restoration of both coracoclavicular (CC) and acromioclavicular ligaments, along with preservation of deltatrapezial fascia integrity. Numerous surgical techniques have been described in the literature; however, high-level comparative data between suture anchor fixation, endobutton flip technique, and hamstring graft reconstruction remain limited.

In the present study, 24 patients with Rockwood Type III–VI AC joint dislocations were randomly allocated into three equal groups. Group A: 5 mm double-loaded suture anchor technique. Group B: Endobutton flip technique. Group C: Hamstring graft reconstruction. All three techniques demonstrated good functional and radiological outcomes at 1-year follow-up, with no statistically significant difference among groups.

In our study, all 8 patients treated with double-loaded suture anchors achieved a good range of motion with a mean Constant score of 93.8 at 12 months. This technique offers the advantage of shorter surgical time, minimal hardware under the coracoid, and reduced risk of neurovascular injury. Augmentation over the clavicular cortex enhances fixation strength and decreases the risk of distal clavicle osteolysis.

A 2021 systematic review by Gowd et al,^[7] reported that suture-based CC reconstructions provide reliable functional outcomes with reduced implant-related complications compared to rigid fixation methods. Similarly, a 2022 study by Martetschläger et al,^[8] demonstrated excellent mid-term outcomes with suture-

anchor-based CC reconstruction, reporting mean Constant scores above 90 and low complication rates. Biomechanically, double-strand suture constructs have been shown to approximate the native tensile strength of the CC ligaments (Abrams GD et al),^[9] supporting the stability observed in our cohort. Compared to previously published studies (Basyoni et al., Zhang et al., Darren et al.),^[10-12] our results are comparable in terms of functional outcome, though our follow-up duration was 1 year.

The endobutton flip technique allows anatomical replication of the CC ligament and stable reduction of the AC 2 joint. In our study, the mean Constant score was 91.8 at 12 months. One patient developed subluxation due to non-compliance, but no neurovascular injuries were reported. Recent evidence suggests that suspensory fixation techniques such as endobutton systems provide excellent early stability and favourable clinical outcomes. A 2019 meta-analysis by Hurley et al,^[12] found that cortical button techniques demonstrated superior radiographic maintenance of reduction compared to hook plates, with fewer implant removal surgeries. Similarly, a study by Millett PJ et al,^[13] reported high patient satisfaction and Constant scores above 90 following double-button CC reconstruction. However,

technical errors such as improper flipping of the button can lead to loss of reduction, consistent with the subluxation observed in our study. Although the endobutton technique is cost-effective compared to suture anchors, it carries a higher theoretical risk of neurovascular injury due to instrumentation under the coracoid. Anatomical hamstring graft reconstruction restores both the CC and AC ligaments and provides biological augmentation. In our study, the mean Constant score was 92, with all patients achieving a good range of motion. One patient developed superficial infection and another developed graft-site calcification; both were managed successfully. Recent literature supports the use of autograft reconstruction for chronic or high-grade AC joint dislocations. A 2021 review by Saccomanno et al,^[15] concluded that biological graft reconstruction provides durable stability with favourable long-term outcomes. Additionally, a prospective study by Tauber et al,^[16] demonstrated that tendon graft reconstructions achieve good biomechanical stability and satisfactory clinical scores (Constant score >90), though with longer operative time and donor-site morbidity. Complication rates such as infection and graft calcification have been reported in other graft-based studies (Virtanen et al.), consistent with our findings.

Table 6: Comparison of our study findings with other studies

Suture anchor and cortical button techniques	Total pts	Pt nos with good rom	Mean constant score	Complications
Basyoni Y et al, ^[10]	15	14	92.8	subluxation
Zhang et al, ^[11]	28	26	96.3	Fixation loosening
Darren et al, ^[12]	22	18	92.3	Anchors pull out
Our study	08	08	93.8	
Endobutton flip technique				
Lei zhang et al, ^[11]	21	18	91	Infection, stitch granuloma
Raif ozden et al, ^[17]	10	10	89	
Suresh kumar et al, ^[18]	20	17	90	Infection, wound gaping
Our study	8	7	91.8	Subluxation
Hamstring graft technique.				
Khaleed et al, ^[19]	20	16	93.7	Infections
J Virtanen et al, ^[20]	39	25	83	# clavicle-5pts, # coracoid 4pts
Our study	8	8	92	Calcification and infection

Comparative Analysis

At 3, 6, and 12 months follow-up, all three groups showed progressive improvement in pain, range of motion, and Constant scores. Although Group A demonstrated slightly higher mean Constant scores at 6 and 12 months, the differences were not statistically significant.

Recent comparative studies (2020–2024) suggest that:

Suture anchor and cortical button techniques show similar functional outcomes.

Biological graft reconstruction may offer better long-term ligamentization but at the cost of increased surgical time and donor-site morbidity.

No single technique has demonstrated clear superiority in randomised clinical trials.

A systematic review by Gowd et al,^[7] and a meta-analysis by Lee et al,^[21] concluded that modern suspensory and suture-based techniques provide comparable functional outcomes, with Constant scores typically ranging from 88 to 95, consistent with our findings.

Clinical Implications

Based on our study: Suture anchor technique offers shorter operative time and lower hardware-related risk.

The Endobutton technique provides anatomical reduction and cost-effectiveness but requires technical precision.

Hamstring graft technique provides biological reconstruction with good stability but involves longer surgery and donor-site morbidity.

All three techniques yielded satisfactory functional and radiological outcomes in the management of Rockwood Type III–VI AC joint dislocations. None of the methods demonstrated statistical superiority over the others.

Our findings align with recent 5-year literature indicating that modern CC reconstruction techniques—whether suture-based, cortical button-based, or biological graft-based—provide good to excellent functional outcomes with mean Constant scores above 90. The choice of technique should therefore depend on the surgeon's expertise, patient factors, cost considerations, and the availability of implants, rather than on the expectation of a superior functional outcome.

CONCLUSION

In this research, the endobutton flip method, suture anchor, and hamstring graft technique were used to treat ac joint disruptions of types III to VI. 91.8, 93.8, and 92 were the mean constant scores, respectively. The three groups did not vary statistically significantly. Morbidity was significant in the hamstring graft procedure, with one patient experiencing infection and another developing calcification over the graft application site. There is a significant risk of injury to neurovascular structures when passing the graft and dissecting across the coracoid. After 6 months, all patients returned to their regular activities and had a good range of motion without discomfort. Due to early weightlifting activities, one patient had subluxation at three months using the endobutton flip procedure. Within six months, every other patient had a decent range of motion and was able to return to their regular activities without any problems. The endobutton's malposition under the coracoid increases the risk of subluxation. Every patient had an excellent range of motion with the suture-anchor approach. This group has not experienced any of the issues mentioned above. Compared with other techniques, the likelihood of neurovascular damage is quite low. Within three months, all the patients returned to their regular activities. In our investigation, the mean constant score for all three approaches is more than 90. There was no statistically significant difference between the groups. CC distance was maintained in the follow-up x-rays, and the patients' range of motion was excellent and pain-free. More research is needed to determine which approach is superior. Patients treated with suture anchors had fewer problems in a one-year follow-up than those treated with alternative techniques.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Lemos MJ. The evaluation and treatment of the injured acromioclavicular joint in athletes. *Am J Sports Med.* 1998; 26:137–144.
- Court-Brown CM, Heckman JD, McQueen MM, Ricci WM, Tornetta P, McKee MD, editors. *Rockwood and Green's fractures in adults.* 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2010.
- Friedman DJ, Barron OA, Catalano L, Donahue JP, Zambetti G. Coracoclavicular stabilization using a suture anchor technique. *Am J Orthop (Belle Mead NJ).* 2008 Jun;37(6):294-300.
- Zhang L, Zhou X, Qi J, Zeng Y, Zhang S, Liu G, Ping R, Li Y, Fu S. Modified closed-loop double-endobutton technique for repair of rockwood type III acromioclavicular dislocation. *Exp Ther Med.* 2018 Jan;15(1):940-948.
- Frank RM, Bernardoni ED, Cotter EJ, Verma NN. Anatomic Acromioclavicular Joint Reconstruction with Semitendinosus Allograft: Surgical Technique. *Arthrosc Tech.* 2017 Oct 2;6(5): e1721-e1726.
- Vrotsou K, Avila M, Machón M, et al. Constant–Murley Score: systematic review and standardized evaluation in different shoulder pathologies. *Qual Life Res.* 2018;27(9):2217–2226.
- Gowd AK, Liu JN, Cabarcas BC, Cvetanovich GL, Garcia GH, Manderle BJ, Verma NN. Current Concepts in the Operative Management of Acromioclavicular Dislocations: A Systematic Review and Meta-analysis of Operative Techniques. *Am J Sports Med.* 2019 Sep;47(11):2745-2758.
- Samitier G, Vinagre G, González-Martín D. Acromioclavicular Fracture-Dislocation Fixation Technique with Cerclages and Osteosutures: The "Invisible" Repair. *Arthrosc Tech.* 2022 Mar 16;11(4): e523-e529.
- Abrams GD, McGarry MH, Jain NS, Freehill MT, Shin SJ, Cheung EV, Lee TQ, Safran MR. Biomechanical evaluation of a coracoclavicular and acromioclavicular ligament reconstruction technique utilizing a single continuous intramedullary free tendon graft. *J Shoulder Elbow Surg.* 2013 Jul;22(7):979-85. doi: 10.1016/j.jse.2012.09.013. Epub 2013 Jan 11. PMID: 23313367.
- Basyoni Y, El-Ganainy AE, Aboul-Saad M. Acromioclavicular joint reconstruction using anchor sutures: surgical technique and preliminary results. *Acta Orthop Belg.* 2010 Jun;76(3):307-11. PMID: 20698448.
- Zhang LF, Yin B, Hou S, et al. Arthroscopic fixation of acute acromioclavicular joint disruption with TightRope™: Outcome and complications after minimum 2 (2–5) years follow-up. *J Orthop Surg (Hong Kong)* 2017;25(2):2309499016684493.
- Gao, YS., Zhang, YL., Ai, ZS. et al. Transarticular fixation by hook plate versus coracoclavicular stabilization by single multistrand titanium cable for acute Rockwood grade-V acromioclavicular joint dislocation: a case–control study. *BMC Musculoskelet Disord* 2015;16, 360.
- Hurley ET, Lim Fat D, Farrington SK, Mullett H. Open Versus Arthroscopic Latarjet Procedure for Anterior Shoulder Instability: A Systematic Review and Meta-analysis. *Am J Sports Med.* 2019 Apr;47(5):1248-1253.
- Millett PJ, Warth RJ, Greenspoon JA, Horan MP. Arthroscopically Assisted Anatomic Coracoclavicular Ligament Reconstruction Technique Using Coracoclavicular Fixation and Soft-Tissue Grafts. *Arthrosc Tech.* 2015 Oct 21;4(5):e583-7.
- Saccomanno MF, Sircana G, Cardona V, Vismara V, Scaini A, Salvi AG, Galli S, Marchi G, Milano G. Biologic, and synthetic ligament reconstructions achieve better functional scores compared to osteosynthesis in the treatment of acute acromioclavicular joint dislocation. *Knee Surg Sports Traumatol Arthrosc.* 2021 Jul;29(7):2175-2193. doi: 10.1007/s00167-020-06217-9. Epub 2020 Aug 14. PMID: 32797247.
- Tauber M, Eppel M, Resch H. Acromioclavicular reconstruction using autogenous semitendinosus tendon graft: results of revision surgery in chronic cases. *J Shoulder Elbow Surg.* 2007;16:429–433. 28.
- Özden, Raif, Endobutton Technique For The Treatment Of Acute Acromioclavicular Joint Dislocations. *Dicle Medical Journal/Dicle Tip Dergisi.* 2014; 41. 268-271.
- Sureshkumar A, Manikandan P, Devendran R, Anandan H. Functional Outcome of Complete Acromioclavicular Joint Dislocation Repair Using Double Endobutton Technique: A Prospective Analysis. *Int J Sci Stud* 2016; 4(7):168-172.
- Khaled Nabil Youssef, Amr Nabil, Ahmed Naeem Atiyya, and Mohammed Mostafa El-Mahy: Functional outcomes of three-corner fusion without triquetrum excision versus conventional four-corner fusion in scaphoid non-union advanced collapse G II and III in active patients: a prospective randomized control trial, *SICOT-J*, 10 (2024) 55.
- Virtanen, K. J., Savolainen, V., Tulikoura, I., Remes, V., Haapamäki, V., Pajarinen, J., Björkenheim, J. M., Paavola, M., 2014, Surgical Treatment Of Chronic Acromioclavicular Joint

Dislocation With Autogenous Tendon Grafts. Springerplus.
Aug 10, 3, 420.

21. Lee J, El-Daou H, Alkoheji M, et al. Ligamentous and

capsular restraints to anterior-posterior and superior-inferior laxity
of the acromioclavicular joint: a biomechanical study. J Shoulder
Elbow Surg. 2021;30:1251–1256..