ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

Original Research Article

High-grade acromioclavicular joint dislocation patients treated with tight loop endobutton

Dr. Surendra Singh Yadav[1] (M.S. Orthopaedics, Professor), Dr. Sonendra Kumar Sharma[2] (D Ortho, DNB Orthopaedic, Assistant Professor), Dr. Vivek Kumar Gupta[3] (M.S. Orthopaedics, Senior Resident) & Dr. Ankit Agarwal[4] (DNB Orthopaedics, Senior Resident)

Department of Orthopaedics, GRMC, Gwalior Madhya Pradesh, India.[1]
Department of Orthopaedics, SRVS Medical College Shivpuri, Madhya Pradesh, India[2]
Department of Orthopaedics, GRMC, Gwalior, Madhya Pradesh, India[3]
Department of Orthopaedics, SRVS Medical College, Shivpuri, Madhya Pradesh, India[4]

Corresponding Author: Dr. Ankit Agarwal

Abstract

Background: Acromioclavicular joint dislocations accounts for about 12% of shoulder girdle injuries. However, there is no gold standard procedure for surgical treatment of acute high-grade AC joint injury. Recently, the endobutton technique has been elucidated for the treatment of AC-joint dislocation. Hence, we employed this technique and analyzed its outcome.

Material & Method: 24 patients aged between 20-65 years with acute Type III–VI AC joint dislocation were included in the study. Radiograph of both clavicle anteroposterior (AP) stress view was obtained to diagnose. All patients were treated with tight loop endobutton technique. Postoperative rehabilitation regimen was followed for all the patients. Outcome was assessed using VAS, UCLA score, DASH score and AP radiograph of affected side at regular intervals.

Result: A higher prevalence of males was observed (83.3%) with mean age of 37.5 ± 12.5 years. RTA was the most common cause of injury. For clinical outcome, the mean post-operative VAS was 0.35 ± 0.48 and mean postoperative UCLA score was 29.5. 8 patients had excellent results and 16 patients had good results according to UCLA score. DASH score decreased gradually postoperatively, with significant improvement starting from the third month post-surgery. Radiologically loss of reduction was observed in only 5 cases.

Conclusion: Tight loop Endobutton technique is a simple, cost-effective, one-time surgery which restores the coraco-clavicular (CC) interval and maintains it till the native ligaments heal. It proves to be an excellent alternative modality to treat the AC joint dislocation.

Keywords: AC joint dislocation, endobutton technique, AC joint reconstruction.

1. Introduction

Acromioclavicular (AC) joint dislocation is one of the most commonly encountered injury of the shoulder accounting for 2 to 16% of total joint dislocations and almost 12% of all shoulder joint injuries.[1,2] This kind of injury involves any age, and is a common injury in sports especially those who play sports like football, rugby and hockey, military training, traffic accidents, and falls.[3,4] One of the most common mechanism is falling or being tackled onto the lateral aspect of the shoulder with the arm in an adducted position which produces compressive and shear force across the joint. The injury force which drives the acromium medially and downward produces a progressive injury pattern, first disruption of the acromioclavicular ligaments, followed by coracoclavicular ligaments and finally disruption of fascia overlying

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

the clavicle that connects the deltoid and trapezoid muscle attachments.[5]

The **Rockwood classification** (1998) is the most common classification system in use for acromioclavicular joint injuries. The Rockwood classification takes into account not only the acromioclavicular joint itself but also the coracoclavicular ligament, the deltoid, and trapezius muscles, whilst considering the direction of dislocation of the clavicle with respect to the acromion. Essentially types IV, V, and VI are variants of type III.[6] While Rockwood type I and II can be treated non-operatively, surgical treatment is commonly required for more than type IV injury of Rockwood classification for adequate reduction and stabilization of the AC joint. But the management of Rockwood type III AC dislocation is still controversial,[7,8] although surgical treatment is accepted for young patients, athletes, physical labour and for cosmetic purposes. The surgical treatment aims at recovery of the distance between coracoid and clavicle, and maintenance of stability. There are different methods like fixation between coracoid process and clavicle, fixation of AC joint, fixation with AC joint and CC joint both, resection of distal clavicle, tightropes apply a nonrigid and transfer of muscles. There are various types of surgical methods to treat AC joint dislocation, but there is still wait for gold standard technique.[9-11] Superiority of a single technique is debatable.

As of late, the endobutton technique has been elucidated for the treatment of complete AC-joint dislocation.[12] This technique allows to reconstruct the coracoclavicular ligament in its anatomical position and also for chronic AC-joint dislocation to achieve biological reconstruction of CC and CA ligament.[13] The technique has an excellent outcome and validated for biomechanical study with no risk of knot slip and not require any second surgery of implant removal.[14] In advent of same the present study was purposed to show the effectiveness of Tight loop endobutton fixation for acromioclavicular joint dislocation in terms of functional outcome.

2. MATERIAL & METHODS

After approval from the institutional ethical committee, the present prospective observational study was conducted for a period of 2 years from August 2021 to April 2023 on 24 patients who reported to the OPD of Department of Orthopaedics at Shrimant Rajmata Vijayaraje Scindia Government Medical College and Hospital, Shivpuri (MP) with acute AC joint dislocations. Patients who qualified the inclusion and exclusion criteria were enrolled for the study after taking a pre informed written consent.

Inclusion criteria:

Patients who consented for the study and qualified the following criteria were included:

- Adults with acute, closed and acromioclavicular joint injury which was of higher grade than Rockwood type III of AC joint dislocation were included
- Surgical Fixation was done by Tight loop endobutton by open method,
- The patient who had normal shoulder function before injury,
- There were no associated injuries
- Patients who were followed up till atleast 1 year.

Exclusion criteria:

Whereas patients with:

- Open injuries of the shoulder
- Fracture at clavicle or acromium,
- Chronic dislocations,
- Ipsilateral accompanied neurological damage in same upper extremity were excluded.

Methodology:

All the patients enrolled were classified as per the Rockwood classification of acromioclavicular joint injury. Out of 24 patients; 14 patients had type III injury and 10 patients

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

had type IV injury. Preoperatively, X ray of the patients were taken in both anteroposterior and scapular Y view to assess and evaluate the severity of the dislocation and also to rule out any associated fracture. Radiograph of both clavicle AP stress view was obtained to diagnose the AC joint dislocation. All AC joint dislocations were treated with Tight loop Endobutton technique. Patients were followed up at 2^{nd} , 4^{th} , 8^{th}, 12^{th}, 24th and 48^{th} week.

Post-operatively, operated limb was immobilized in universal shoulder immobilizer for initial 2 weeks, followed by gentle pendulum exercise for next 2 weeks. ROM exercises were instituted after 4 weeks and strengthening exercises were allowed after 8 weeks. The sporting activities were not permitted for 3 months. Radiographs of all of our patients were taken postoperatively, after 6 months and 1 year after surgery and were followed up clinically. The radiographs were evaluated for complications like loss of reduction, acromium osteolysis and posttraumatic osteoarthritis which may or not accompanied by clinical symptom.

Clinical outcomes were assessed using the University of California Los Angeles (UCLA) score which analyses pain (1-10), function (1-10), active forward flexion (0-5), strength (0-5) and satisfaction (0-5), DASH Score and VAS Scores. Furthermore, cross body adduction test was also performed to check clinical relevance to AC joint osteoarthritis in all patients. Shoulder functions were evaluated at the first, third, sixth, and twelfth months after surgery.

Surgical technique:

All 24 patients were operated under general anesthesia in beach-chair position with antibiotic prophylaxis. For the surgical procedure, a 6 cm incision was made to the anterior edge of the distal clavicle from the palpable point of the coracoid. After dissection of subcutaneous tissue, deltoid was cut off the clavicle subperiosteally, to expose coracoid process The clavicle was reduced, and the clavicle was drilled about 3 cm from the AC joint. The drill hole should be directly over the base of the coracoid to prevent iatrogenic fracture. It was then drilled all the way throughout the base. When the clavicle was reduced anatomically, the endo-button depth gauge was used to determine the canal length. The endo-button, along with its associated sutures, was pushed into the top of the clavicle through the previously drilled hole and then pushed further into the coracoid drill hole until it reached underside of the coracoid. After the endo-button was placed under the coracoid, the second endo-button was adapted to the upper part of the clavicle, and all threads were tightened. Reduction of joint was also maintained by k-wire across lateral side of acromium to distal clavicle, which was removed 4 weeks post-operatively. The wound was closed in layers with sterile dressing done and universal shoulder immobilizer given.

Statistical analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences) 25.0 version, IBM, Chicago. Descriptive statistics were performed. The chi-square test was used to assess the association between different variables. P value<.05 was considered statistically significant.

3. Results

Out of 24 patients, 14 patients had type III injury and 10 patients had type IV injury as per the Rockwood classification of acromioclavicular joint injury. A higher prevalence of males was observed [20 (83.3%)] as compared to females [4 (16.7%) with mean age of 37.5 ± 12.5 years (20-65 years). The maximum number of cases were seen in the age group of 20-30 years. Most common cause of injury was road traffic accident [16(63.7%)] followed by fall [6(25%)] and fall from height [3(8.3%)]. Left side was affected more [14(58.3%)] as compared to right side [10(41.7%)] in patients, which was the non-dominant side. Average time from injury to surgery was 11.30 ± 3.26 days. The mean duration of surgery was 31.95 ± 3.97 minutes.

With regard to the clinical outcome, at the final follow up the mean post-operative VAS was 0.35 ± 0.48 and mean postoperative UCLA score was 29.5. 8 patients had excellent results and

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

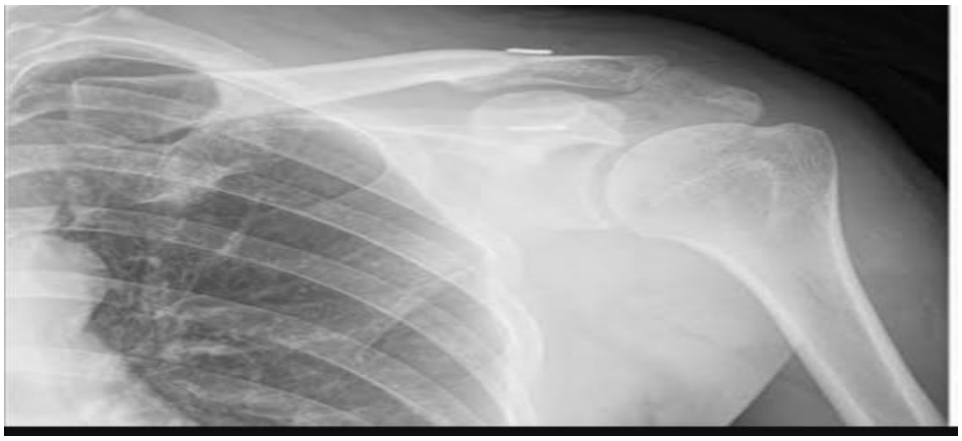
16 patients had good results according to UCLA score. DASH score decreased gradually postoperatively, with significant improvement starting from the third month after the surgery ($p < 0.001$ vs. the first month). Radiologically, reduction was maintained till the final follow-up in 19 patients and loss of reduction was observed in 5 patients. 2 patients had pain at the acromioclavicular joint for 4 months postoperatively although the X-ray showed no evidence of AC joint arthritis in 1 year follow up and the rest had no complications like re-dislocation, infection. Mean Range of movements at final visit in forward flexion and abduction revealed 176.4°/172.5°. No patient had aggravation of pain on cross body adduction test which showed no patient developed acromioclavicular joint arthritis.

VARIABLE	FREQUENCY
No. of patients	24
Age	37.5 ± 12.5 years (20-65 years).
Gender	
Male	20 (83.3%)
Female	4 (16.7%)
Grade of injury	
Rockwood III	14 (58.3%)
Rockwood IV	10 (41.7%)
Side of injury	
Left	14 (58.3%)
Right	10 (41.7%)
Cause of injury	
Road traffic accidents	16 (63.7%)
Fall	6 (25%)
Fall from height	3 (8.3%)
VARIABLE	**MEAN VALUES**
Details of Surgery	
Average time from injury to surgery	11.30 ± 3.26 days.
Duration of surgery	31.95 ± 3.97 minutes.
Clinical Outcome	
VAS Scores	0.35 ± 0.48
UCLA Score	29.5
DASH Score	
1st month	82
2nd month	52
6th month	30
12th month	18
Cross body abduction	
Mean flexion values	176.4 degrees
Mean abduction value	172.5 degrees
Final Outcome	
Excellent results	8
Good results	16

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

a. Preoperative X ray of left shoulder showing AC joint dislocation

b. Postoperative X ray showing AC joint fixed with Tightloop endobutton



Post op X – ray after 1 year of follow up

Figure 1(a,b,c). X ray of patient

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

Figure 2: Postopertaive clinical pictures at 3months followup

Figure 3: Postopertaive clinical pictures at 1year followup

4. Discussion

Dislocation of the AC joint is prevalent, accounting for 12% of the shoulder injuries. AC joint dislocation can be categorised into six grades based on the extent of displacement of the clavicle in respect to the acromium.[15]

Early surgical repair for grade III dislocations and above results in better outcome and faster return to normal activities.[16,17] Surgical treatment helps to restore the AC joint anatomy. Common goals of various treatment options of AC joint injuries are pain relief, restoration of normal anatomy and biomechanics of the AC joint.[18] According to Struhl S et al.[19], the long-term stability of AC joint requires initial strong fixation to maintain reduction throughout the biological healing process. Reconstructions using suture button configurations in anatomically placed drill holes have improved clinical results.

Out of 24 patients, 20(83.3%) were male and 4 (16.7%) were female, with mean age of 37.5 ±

12.5 years. The maximum number of cases were seen in the age group of 20-30 years. The age group and gender preponderance were attributed to the lifestyle and outdoor activities of the study population. The findings of the study were concurrent with previous studies done by Dey S et al.[20], Kraus et al.[21], Saier et al.[22], Guhan R et al.[23], Katsensis et al.[24], Greiner et al.[25]

Out of 24 AC joints, left side was involved in 14 (58.3%) patients and was a non-dominant side as compared to 10 patients with right sided injury. 14 patients had type III injury and 10 patients had type IV injury as per the Rockwood classification of acromioclavicular joint injury. Similar results were observed by Guhan R et al.[23], Yi Zhao et al.[26] and Zanfaly et al.[27]

Most common cause of injury was road traffic accident seen in 63.7% cases followed by fall and fall from height. Although sports and contact injury has been described as the most

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

common cause of AC joint dislocation, we didn't notice such cases in our study and we attribute this again to the lifestyle of the study population. Similar results were seen in study done by Dey S et al.[20] whereas fall was the most common reason of injury in study done by Guhan R et al.[23]

With respect to the clinical outcome the mean postoperative VAS was 0.35 ± 0.48 and mean post-operative UCLA was 29.5. Salzmann GM et al.[28] and Wei HF et al.[7] observed similar results in their study. As per UCLA score, 33.3% cases showed excellent and 66.7% cases showed good results. Radiologically, reduction was maintained till the final follow-up in 19 cases and loss of reduction was observed in 5 cases. These findings are very much comparable with the studies conducted by Guhan R et al.[23], Struhl and Wolfson[19], Shin SJ et al.[29], Zanfaly et al.[27], Zhang et al.[30], Sharma B et al.[31] and Cai L et al.[32], which showed the risk of loss of reduction ranging between 10%-30%. Mean Range of movements at final visit in forward flexion and abduction revealed 176.4°/172.5°. No patient had aggravation of pain on cross body adduction test which showed no patient developed acromioclavicular joint arthritis. This was in concurrence with study done by Guhan R et al.[23]

Many complications are associated with the Double Endobutton technique like surgical site infection, suture failure, knot slippage, implant migration, AC joint arthrosis, heterotopic calcification of ligaments, foreign body reaction, perioperative fractures and loss of reduction. In our study, except for loss reduction, we have not noticed any other complications.

Our study has limitation like cases studied were few. There was no comparison group to compare the efficacy of tightrope endobutton technique of AC joint dislocation with other methods like TightRope fixation and Hookplate which are widely used by some surgeons.

5. Conclusion

Double Endobutton technique is a simple, cost effective, minimally invasive, one-time surgery which gives better cosmetic and functional outcome. This technique restores CC interval to normal and maintains it till the native ligaments heal. It also provides optimum strength, time and environment for the native ligaments heal.

Acknowledgements

None

Conflicts of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Funding

None

6. REFERENCES

1. Collins DN (2009) Disorders of the acromioclavicular joint. In: Rockwood CA (ed) The shoulder, vol 1, 4th edn. Saunders/Elsevier, Philadelphia, pp 453–526
2. Bontempo NA, Mazzocca AD. Biomechanics and treatment of acromioclavicular and sternoclavicular joint injuries. *Br J Sports Med*. 2010; 44(5): 361–369. doi: 10.1136/bjsm.2009.059295.
3. Babhulkar A, Pawaskar A (2014) Acromioclavicular joint dislocations. Curr Rev Musculoskelet Med 7:33–39
4. Verdano MA, Pellegrini A, Zanelli M, Paterlini M, Ceccarelli F (2012) Modified Phemister procedure for the surgical treatment of Rockwood types III, IV, V acute acromioclavicular joint dislocation. Musculoskelet Surg 96:213–222
5. Simovitch R, Sanders B, Ozbaydar M, Lavery K, Warner JJ: Acromioclavicular joint

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

injuries: diagnosis and management. J Am Acad Orthop Surg, 17: 207-219, 2009
6. Gaillard F, Botz B, Knipe H, et al. Rockwood classification of acromioclavicular joint injury.
7. Wei HF, Chen YF, Zeng BF, Zhang CQ, Chai YM, Wang HM, et al. Triple endobuttton technique for the treatment of acute complete acromioclavicular joint dislocations: preliminary results. International orthopaedics. 2011 Apr 1;35(4):555-9.
8. Arirachakaran A, Boonard M, Piyapittayanun P, Phiphobmongkol V, Chaijenkij K, Kongtharvonskul J. Comparison of surgical outcomes between fixation with hook plate and loop suspensory fixation for acute unstable acromioclavicular joint dislocation: a systematic review and meta-analysis. European Journal of Orthopaedic Surgery & Traumatology. 2016 Aug 1;26(6):565-74.
9. Pan Z, Zhang H, Sun C, Qu L, Cui Y. Arthroscopyassisted reconstruction of coracoclavicular ligament by Endobutton fixation for treatment of acromioclavicular joint dislocation. Archives of orthopaedic and trauma surgery. 2015 Jan 1;135(1):9-16.
10. Di Francesco A, Zoccali C, Colafarina O, Pizzoferrato R, Flamini S. The use of hook plate in type III and V acromio-clavicular Rockwood dislocations: clinical and radiological midterm results and MRI evaluation in 42 patients. Injury. 2012 Feb 1;43(2):147-52.
11. Wellmann M, Zantop T, Petersen W. Minimally invasive coracoclavicular ligament augmentation with a flip button/polydioxanone repair for treatment of total acromioclavicular joint dislocation. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2007 Oct 1;23(10):1132-e1.
12. Mazzocca AD, Arciero RA, Bicos J. Evaluation and treatment of acromioclavicular joint injuries. The American journal of sports medicine. 2007 Feb;35(2):316-29.
13. Lu D, Wang T, Chen H, Sun LJ. A comparison of double Endobutton and triple Endobutton techniques for acute acromioclavicular joint dislocation. Orthopaedics & Traumatology: Surgery & Research. 2016 Nov 1;102(7):891-5.
14. Wirth MA, Rockwood CA. Acute and chronic traumatic injuries of the sternoclavicular joint. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 1996 Sep 1;4(5):268-78.
15. Mazzocca AD, Arciero RA, Bicos J: Evaluation and treatment of acromioclavicular joint injuries. Am J Sports Med, 35: 316-329, 2007.
16. Eschler A, Gradl G, Gierer P, Mittlmeier T, Beck M: Hook plate fixation for acromioclavicular joint separations restores coracoclavicular distance more accurately than PDS augmentation, however presents with a high rate of acromial osteolysis. Arch Orthop Trauma Surg, 132: 33-39, 2012.
17. Cote MP, Wojcik KE, Gomlinski G, Mazzocca AD: Rehabilitation of acromioclavicular joint separations: operative and nonoperative considerations. Clin Sports Med, 29: 213- 228, vii, 2010.
18. Nolte PC, Lacheta L, Dekker TJ, Elrick BP, Millett PJ. Optimal Management of Acromioclavicular Dislocation: Current Perspectives. Orthopedic Research and Reviews. 2020;12:27.
19. Struhl S, Wolfson TS. Continuous loop double endobutton reconstruction for acromioclavicular joint dislocation. The American journal of sports medicine. 2015 Oct;43(10):2437-44.
20. Dr. Sudipan Dey, Dr. Shamim Ahmed Barbhuiya, Dr. Sachin M. Management of acromioclavicular joint dislocation by double Endobutton technique. Int J Orthop Sci 2022;8(3):334-337.
21. Kraus N, Haas NP, Scheibel M, Gerhardt C. Arthroscopically assisted stabilization of acute highgrade acromioclavicular joint separations in a coracoclavicular Double-TightRope technique: V-shaped versus parallel drill hole orientation. Archives of orthopaedic and

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 6, 2023

trauma surgery. 2013 Oct 1;133(10):1431-40.
22. Saier T, Plath JE, Beitzel K, Minzlaff P, Feucht JM, Reuter S, et al. Return-to-activity after anatomical reconstruction of acute high-grade acromioclavicular separation. BMC Musculoskeletal Disorders. 2016 Dec 1;17(1):145.
23. Guhan R, Kumar M, Vanchi P, Raghav R. Tightrope Fixation for Acromioclavicular Joint Dislocation. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) Volume 20, Issue 7 Ser.16 (July. 2021), PP 38-44
24. Katsenis DL, Stamoulis D, Begkas D, Tsamados S. Minimally invasive reconstruction of acute type IV and Type V acromioclavicular separations. Orthopedics. 2015 Apr 14;38(4):e324-30.
25. Greiner S, Braunsdorf J, Perka C, Herrmann S, Scheffler S. Mid to long-term results of open acromioclavicularjoint reconstruction using polydioxansulfate cerclage augmentation. Archives of orthopaedic and trauma surgery. 2009 Jun 1;129(6):735-40.
26. Zhao Y, Tan L, Tang W, Yu T. A New Coracoclavicular Guider for Minimally Invasive Anatomic Coracoclavicular Reconstruction with Two Tight Rope Systems in Acute Acromioclavicular Joint Dislocation. Scientific Reports. 2019 Oct 8;9(1):1-1.
27. Zanfaly AI, Anis H. Arthroscopic assisted stabilization of acute acromioclavicular dislocations by cortical fixation buttons for acute acromioclavicular dislocation. International Journal of Orthopaedics. 2018;4(4):693- 701.
28. Salzmann GM, Walz L, Buchmann S, Glabgly P, Venjakob A, Imhoff AB. Arthroscopically assisted 2- bundle anatomical reduction of acute acromioclavicular joint separations. The American journal of sports medicine. 2010 Jun;38(6):1179-87.
29. Shin SJ, Kim NK. Complications after arthroscopic coracoclavicular reconstruction using a single adjustable – loop-length suspensory fixation device in acute acromioclavicular joint dislocation. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2015 May 1;31(5):816-24.
30. Zhang LF, Yin B, Hou S, Han B, Huang DF. Arthroscopic fixation of acute acromioclavicular joint disruption with TightRope™: Outcome and complications after minimum 2 (2–5) years follow-up. Journal of Orthopaedic Surgery. 2017 Jun 19;25(2):2309499016684493.
31. Sharma B, Tiwari AK, Joshi S, Parmar R, Sharma R, Kumawat P. Mini invasive double endobutton in patients with acute AC joint dislocation grade III and V: Functional outcome and complication.
32. Cai L, Wang T, Lu D, Hu W, Hong J, Chen H. Comparison of the tight rope technique and clavicular hook plate for the treatment of Rockwood type III acromioclavicular joint dislocation. Journal of Investigative Surgery. 2018 May 4;31(3):226-33.