National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474

www.orthoresearchjournal.com
2019; 3(4): 41-47
Received: 25-08-2019
Accepted: 27-09-2019

Dr. Bharat Sharma
M.S. Orthopaedics, GMC, Kota, 202, Marudhar Nagar; Pali, Rajasthan, India

Dr. AK Tiwari
Senior Professor and Ex Hod, GMC, Kota, 1-T-1 Vigyan Nagar, Kota, Rajasthan, India

Dr. Sachin Joshi
Associate Professor and Unit Head, GMC, Kota, Kr-128 Civil Lines, Kota, Rajasthan, India

Dr. Rahul Parmar
M.S. Orthopaedics, GMC, Kota M K Thakrar Hospital, Porbander, Gujarat, India

Dr. Rajesh Sharma
M.S. Orthopaedics, GMC, Kota, S.R. Dept. of Orthopaedics Sms, Hospital Jaipur, Rajasthan, India

Dr. Pradeep Kumawat
M.S. Orthopaedics, Gmc, Kota, S.R. Dept. of Orthopaedics Jln Medical College and Hospital Ajmer, Rajasthan, India

Corresponding Author:
Dr. Bharat Sharma
M.S. Orthopaedics, Gmc, Kota, 202, Marudhar Nagar; Pali, Rajasthan, India

Mini invasive double endobutton in patients with acute AC joint dislocation grade III and V: Functional outcome and complication

Dr. Bharat Sharma, Dr. AK Tiwari, Dr. Sachin Joshi, Dr. Rahul Parmar, Dr. Rajesh Sharma and Dr. Pradeep Kumawat

DOI: https://doi.org/10.33545/orthor.2019.v3.i4a.179

Abstract
AC joint dislocation is a common shoulder injury confronted by an orthopaedic surgeon as a diagnostic as well as therapeutic challenge. Still there is no gold standard treatment and no sufficient evidence from randomized control trial to guide for the treatment. Many fixation methods were studied, used and rejected as per experimental and clinical evidences.
Aim of our study in this path is to assess functional outcome and complications of mini invasive double endobutton for the treatment of acute ACJ dislocation grade III and V in means of Constant score.
Material and Methods: Anatomical reconstruction was done in 23 patients by using double endobutton and polyester no. 5 suture assembly with minimum follow up of 12 months. Constant score was used for functional outcome.
Results: Twenty three patients were operated for acute ACJ dislocation. Loss of reduction was noted major complication in 5 patients and superficial infection occurred in 1 patient. Constant score at final follow up was 91.17.
Conclusion: Double endobutton is an impressive modality to treat acute ACJ dislocation with high functional scores and low complications.

Keywords: Double endobutton, acute AC joint dislocation, CC ligament

1. Introduction
AC joint injuries present a diagnostic and therapeutic challenge to an orthopaedic surgeon during his practice. AC joint injuries account for 12% of all shoulder injuries and 4% of all body dislocations with an incidence of 3-4 per 100,000 in general population [1]. Males and sports persons are affected more with 25-52% injuries occurred during sports activities [2, 3]. Most common mode of injury is direct fall on affected shoulder with arm held in adduction [1]. These injuries may present as simple soft tissue injury which resolves with symptomatic treatment without any residual impairment to severe chronic form which may result in altered shoulder biomechanics, undesired deformity and permanent disability [4].
Controversy over AC joint treatment exists as old as medicine practice. Hippocrates in 400 B.C. was first who recognized this injury and treated it conservatively by compressive bandages. After around six hundred years later Galen (129 AD) sustained AC joint dislocation during wrestling and was unable to tolerate tight bandaging [4, 5].
Cadenat (1918) was first who described sequential failure of AC joint ligament complex [1]. According to failure of soft tissue and displacement Tossy in 1963 given a simple, reproducible classification system but they only considered vertical displacement [6]. Further in 1984, Rockwood introduced a classification which also encompassed horizontal displacement and inferior displacement of clavicle from case report. This classification system somehow also guides about the treatment [1].
Main aim of surgery in acute setting is achieving ligament healing comparable to pre injury state while maintaining the coracoclavicular reduction whereas in chronic injury it is to augmented reconstruction of the torn ligament and incorporation of the graft [7, 8].

In broad way treatment options can be subdivided into two groups: 1) modalities which harvest primary healing response of torn ligament and 2) which reconstruct the coracoclavicular ligament [9]. More than 60 treatment options were presented in the past like Bosworth screw, k wire, TBW, Steinman pin, hook plate, suture/tape sling, suture button device, musculo fascial and tendon graft substitutes [8, 10]. From last century to till date many treatment modalities were tested, used and rejected as per clinical and experimental studies. But none of them could provide an ideal treatment modality [7]. Debate is still ongoing upon the ideal mode of treatment, best timing for surgery, perfect implant choice and most suitable technique.

The purpose of our study is to assess function outcome and complications of mini invasive double endobutton device in patients with acute AC joint dislocation grade III and V.

2. Materials and Methods

This prospective study was conducted in the Department of Orthopaedic Surgery, Government Medical College, Kota and associated hospitals from September 2015 to December 2017. Approval from our Institutional Ethics Committee obtained and informed consent from the patients were taken. The study was comprised of 23 patients treated for acute Type III and V AC joint dislocations.

Patients with chronic dislocation of any grade, age below 18 year, other injuries in ipsilateral limb, previously operated in the same limb, any disease/degeneration in the same shoulder, neurological involvement, compound injuries and injuries which affect the final scoring system were excluded from the study. Age, gender, affected side, dominant hand, mechanism of injury, time from injury to surgery were obtained from patient records. Specified post-operative protocol was followed for all patients. In addition, rehabilitation program of the patients was conducted in the same Institution.

Patients were diagnosed with antero-posterior radiographs and clinical examinations.

Constant score was used to measure the final functional outcome [28].

Acute dislocations were defined as those occurred within 4 weeks of surgery. Right side and dominant arm affected predominantly. Most common mechanism of injury was a road traffic accident in 17 patients (73.91%). Demographics of patients are summarized in table 1.

Table 1: Patient Demographic Information, Historical Findings, and Surgical Details

All acute AC joint Injuries (N = 23)
Age
Mean age- 31.4±8.54 years (range; 18-54 years)
Sex
Male 19 patients (82.6%)
Female 4 patients (17.4%)
Injured side
Right 16 (69.56%)
Left 7 (30.44%)
Arm dominance
Dominant side 15 (65.22%)
Non dominant side 8 (34.78%)
Interval to surgery
Mean value-4.8±2.59 (Range; 1 to 12 days)
Rockwood grade
III- 15 (65.22%)
V- 8 (34.78%)

All cases reported in our two hospitals were included in this study. All dislocations were classified according to Rockwood classification system. Surgeries were done by skilled, expertise surgeons of our institute. Minimum follow up period was 12 months.

2.1 Surgical Technique

The patients were taken up for surgery under general anesthesia or inter scalene block anesthesia. The procedure was performed in the beach-chair position. A small towel bump was placed along the medial border of the scapula to prevent protraction of the scapula. A 2-2.5cm horizontal incision was made over lateral end of clavicle, 2-2.5cm medial to AC joint. Delto-trapezial fascia was split and periosteum stripped off. Second vertical incision (approx 2cm in size) was made over palpable base of the coracoid tip. Delto-pectoral groove was identified through blunt dissection. Tip of coracoid process felt, soft tissue released over tip of coracoid process and inferior surface with taking care not to disrupt coracoacromion soft tissue further. PCL zig was positioned over base of coracoid and clavicle, approx 2.5cm medial to AC joint and in between the anterior and posterior border. Beath pin was drilled through bullet and resistance felt over clavicle and then over coracoid process. Just to prevent over drilling a curette was placed over the tip of the zig (to prevent accidental propagation of drill bit). After checking and conformation with the help of C arm, 4.5mm sized drilling was done over Beath pin. Then a Beath pin with Polyester No.5 in its eye was driven through clavicle to coracoid in reverse direction. Then double button and polyester no. 5 suture assembly was pulled through the pulling Polyester No.5. Flipping occurred under coracoid process after first endobuton came out of clavicle. AC joint was reduced manually by applying pressure over clavicle under fluoroscopic guidance and endobutton tightened. Ending threads of Polyester No.5 were fastened. Closure was done in usual fashion.

2.2 Follow Up

The limb was supported in sling for 3 weeks. At 3 weeks sling was discarded. From 3 to 6 weeks Codmans pendulum exercise was advised in clockwise and anti clockwise directions. At 6-8 weeks assisted active/passive forward flexion up to 90 degrees, total elevation up to 90 degrees, shoulder shrugging exercises and full internal and external rotation was advised. At 8-10 weeks forward flexion of 120 degrees and total elevation of 120 degrees was advised with continued shoulder shrugging exercises. At 4-5 months full range of movements and light weight training was advised. At 6 month full activity was resumed.

3. Results

The study was comprised of 23 patients operated on for a Rockwood Type III and V AC joint dislocations with minimum follow up of 12 months. Nineteen patients (82.6%) were male while 4 (17.4%) were female. Mean age at the time of surgery was 31.4 years (range: 18–54 years). Right shoulder was operated on in 16 patients and the left in 7 patients. Fifteen patients injured their dominant side while 8 patients injured non-dominant side. Most common mechanism of injury was road traffic accident in 17 cases (73.91%) followed by fall on ground in 4 cases (17.39%) and sports injury in 2 cases (8.7%). Rockwood type III dislocation was diagnosed in 15 patients while type V in 8 patients. Mean time from injury to surgery was 4.8 days (range; 1-12 days). All patients were operated on by the skillful experienced surgeons. No deep surgical site infection,

suture failure, knot slippage, calcification or perioperative fractures were observed. Partial loss of reduction was the most common complication found in 5 patients (21.74%). Superficial infection was noted in 1 patient that was controlled with oral antibiotics successfully. One patient complained of shoulder pain at final follow up but pain was not so severe to hamper his daily activity and he gained useful range of motion with physiotherapy.

The final follow-up mean Constant score was 91.17.

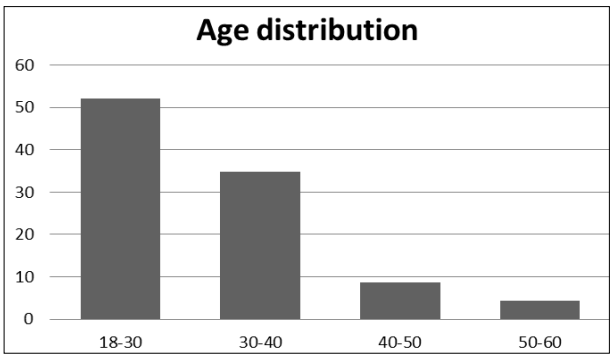

Fig 1: Age distribution of study patients in years

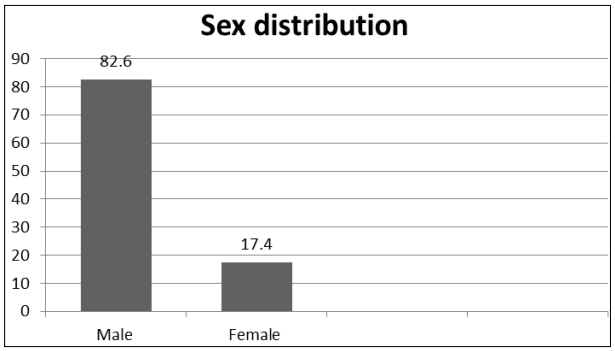

Fig 2: Gender distribution of study patient

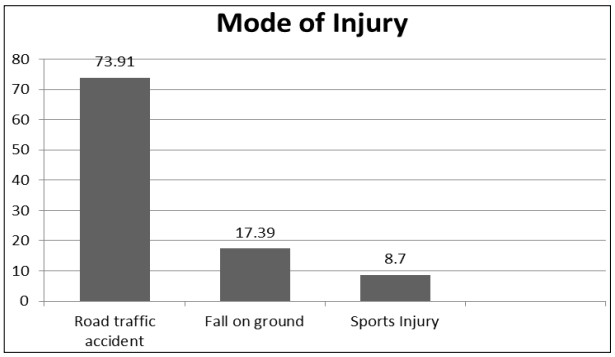

Fig 3: Mode of injury in study patients

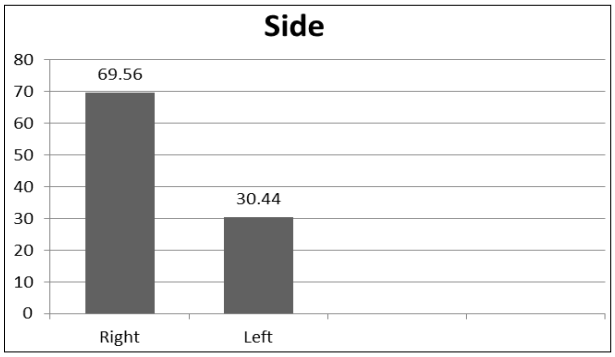

Fig 4: Affected side in injured patients

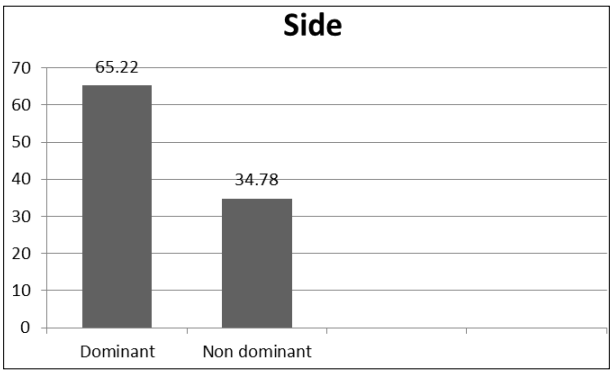

Fig 5: Side of dominance in study patients

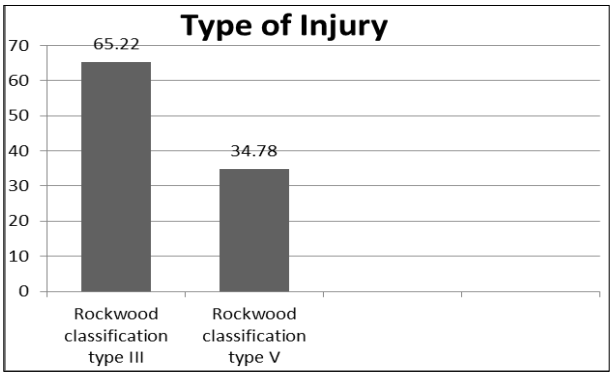

Fig 6: Distribution of type of injury in study patients

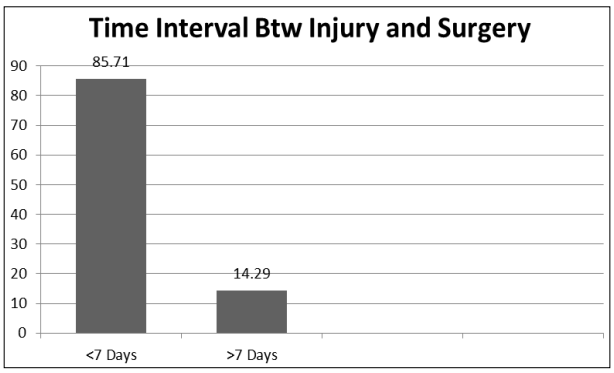

Fig 7: Time interval between injury and surgery in days.

4. Discussion

AC joint ligament complex plays a critical role in weight transmission from appendicular skeleton to core skeleton.[11] AC joint capsule, coraco acromion ligament, conoid and trapezoid ligaments are the main constituents which stabilize the joint while allowing weight transfer [24].

Fukuda *et al*. in his studies described functions of AC joint ligament complex. He found that role of each structure not only depends upon the magnitude of the force but also on the direction of the applied force. CA ligament mainly responsible for resisting posterior displacement, conoid ligament resist anterior and superior displacement and trapezoid ligament resist compression forces against clavicle [12].

Harris in his study found that resection of either conoid or trapezoid ligament does not affect the final strength and stiffness of coraco clavicular ligament. Conoid ligament is primary physiologic load bearing structure while trapezoid ligament is important secondary load bearing structure [13].

Various experimental studies have been done in past but no one exactly explains the role and failure of the ligaments under physiologic and pathologic loads.

Treatment guidelines for grade I and II is conservative management whereas in grade IV, V, VI is surgical. Controversy exists upon grade III, there is no unanimous guidelines for treatment of grade III dislocation [11]. Some studies lean towards operative treatment in young active, sports person, manual laborer and person engaged in over head activities [1, 14, 15]. Whereas some surveys found it to be a surgeons choice like in one survey in American orthopaedic surgeons preferred conservative management in oppose to Germany where surgical treatment was the choice [16, 17]. Smith *et al*. in their study documented that surgical treatment leads to delay recovery and return to work but improved cosmetic results [18]. While Gsettner reported higher mean Constant score in patients treated operatively (90.4) comparative to conservatively treated patients (80.7) [19]. No prospective randomized control trial exist currently to guide this most unsettled subject [1, 27].

Although these treatments options are combined many times, treatment for AC joint dislocation can be categorized into 5 groups 1.) AC joint fixation using k wire, hook plate, TBW. 2.) CC joint fixation using screws, suture sling, suture anchors, tape, button device etc. 3.) CC ligament reconstruction. 4.) Dynamic muscule transfer. and 5.) Excision of lateral end clavicle [11].

Gravity continuously posses strain on AC joint so choice of implant should provide adequate stabilization, minimum joint reaction force and preservation of the joint to increase chances of recovery and decrease complications [10].

Bosworth in 1941 introduced screw fixation between coracoids and clavicle. But implant failure, loosening, mal positioning, osteolysis, second surgery for removal and fracture of coracoids and clavicle were significantly noted complication [1, 24].

In 1972 Weaver-Dunn has given a technique to transfer CA ligament and resection of distal end clavicle which was later popularized with augmentation [20]. High failure rates and complications were registered with this technique [22]. CA ligament transfer is a weaker substitution and shown one fourth strength of intact CC ligament complex [9, 13]. Indeed excision of distal end clavicle and transfer of coracoacromion ligament should not be done in acute cases where potential for spontaneous healing is present [1, 21]. Graft is initially a stiffer material but it elongates during physiologic cyclic loadings and revascularization. Though, revascularization is an assumption so on other side without incorporation of graft eventually it would have been failed [9, 23].

Anatomical coracoclavicular reconstruction shown less A-P displacement and more resemblance to intact complex despite no attempts has been made to repair AC capsular ligaments [8]. In acute injury state, ligament has high healing property if provided sufficient rest to the healing tissue [23]. Various materials have been used to maintain AC joint reduction in the past while allowing spontaneous healing to take place. Successful result from the past techniques (pinning, screws, hook plate) strongly indicate this healing capacity [7]. In MR imaging study of 10 patients Struhl documented strong evidence of thick healing tissue between coracoids and clavicle [23].

Timing of surgery also affects the final outcome. Early surgery provides better outcome, low infection and escapes from more invasive approach, graft related morbidity and removal of distal end clavicle [21, 22, 23]. These findings also supports strong primary healing response of the injured ligaments. Even only adequate coracoclavicular fixation yields ligament healing without repair of torn ligament [1, 15]. In one study author reported continuous healing process of injured ligament for years after surgery [25].

In endobutton assembly physiologic loads bear by two surfaces of endobutton and not the suture itself so there are less chances of suture failure [7]. In a recent long follow up study, anatomical reconstruction using closed loop endobutton device obtained excellent results in 31 patients with mean constant score of 98 (struhl) [23].

Functional scores were outstanding in our study. We found no coraco clavicular fracture, no calcification, no joint degeneration, and no suture failure or knot slippage with our technique. Loss of reduction was the main complication in our study which was also present in other studies as well. But interestingly it causes no compromise in final functional outcome, same findings were supported by literature as well [15, 24, 25, 26]. Improvement in early loss of reduction is also anticipated on long follow up period [25]. Infection is also not an exception in surgical management and superficial infection also documented in 1 patient which was successfully controlled with antibiotics.

Limitations of our study are no control group to compare, short sample size and follow up, lack of blinding, no base line preoperative scores, no cost effectiveness interpretations and no data regarding lost working days.

Arthroscopic repair by using different materials now a days gaining popularity as it is cosmetically better tolerated and it can also diagnose concomitant glenohumeral injuries and shoulder pathologies but it has certain limitations like difficulty in correct placement of coracoids drill hole, inability to repair delto trapezoidal fascia, technically demanding, long learning curve and also there is no evidence to prove it superior to open technique [21]. In future our technique can be used via arthroscopic means to get faster recovery and cosmetically better outcomes.

Clinical photographs

Case 1

Fig 1: Incision

Fig 2: ROM

Fig 3: ROM

Fig 4: ROM

Fig 5: X-ray at final F/U

Case 2

Fig 6: Incision

Fig 7: ROM

Fig 8: ROM

Fig 9: ROM

Fig 10: X ray at final F/U

5. Conclusion

Double endobutton and its modification devices have good tracking record in the past. It can be adapted for open surgery and also for arthroscopic procedures without the need of second procedure for removal. It is a simple but effective, reproducible in results and successful mode of treatment to stabilize AC joint so physiological healing can be achieved in acute injuries. In future we wish to include further biomechanical and MR imaging studies for better understanding of the subject.

6. References

1. Tauber M. Management of acute acromioclavicular joint dislocation: current concepts. Arch Orthop Trauma Surg. 2013; 133:985-95.
2. Allman Jr FL. Fractures and ligamentous injuries of the clavicle and its articulation. J Bone Joint Surg Am. 1967; 49:774-84.
3. Dias JJ, Gregg PJ. Acromioclavicular joint injuries in sport: recommendations for treatment. Sports Med. 1991; 11:125-32.
4. Edgar C, DeGiacomo A, Lemos MJ, Mazzocca AD. Rockwood and Green's fractures in adults. Edn 8, Wolters Kluwer Health, Philadelphia. 2015; 1:1573-1603.
5. Lim YW, Sood A, Riet RPV. Acromioclavicular Joint Reduction, Repair and Reconstruction Using Metallic Buttons-Early Results and Complications. Tech Shoulder Elbow Surg. 2007; 8:213-21.
6. Tossy JD, Mead NC, Sigmond HM. Acromioclavicular separations: useful and practical classification for treatment. Clin Orthop Relat Res. 1963; 28:111-9.
7. Struhl S. Double endobutton technique for repair of complete acromioclavicular joint dislocations. Tech Shoulder Elbow Surg. 2007; 8(4):175-9.
8. Mazzocca AD, Santangelo SA, Johnson ST, Rios CG, Dumonski ML, Arciero RA. A biomechanical evaluation of an anatomical coracoclavicular ligament reconstruction. Am J Sports Med. 2006; 34(2):236-46.
9. Lee SJ, Nicholas SJ, Akizuki KH, McHugh MP, Kremenic IJ, Ben-Avi S. Reconstruction of the coracoclavicular ligament with tendon grafts: a comparative biomechanical study. Am J Sports Med. 2003; 31(5):648-54.
10. Jari R, Costic RS, Rodosky MW, Debski RE. Biomechanical function of surgical procedures for acromioclavicular joint dislocation. Arthroscopy. 2004; 20(3):237-45.
11. Lemos MJ. The evaluation and treatment of the injured acromioclavicular joint in athletes. Am J Sports Med. 1998; 26(1):137-44.
12. Fukuda K, Craig EV, An KN, Cofield RH, Chao EYS. Biomechanical study of the ligamentous system of the acromioclavicular joint. J Bone Joint Surg Am. 1986; 68(3):434-40.
13. Harris RI, Wallace AL, Harper GD, Goldberg JA, Sonnabend DH, Walsh WR. Structural properties of the intact and the reconstructed coracoclavicular ligament complex. Am J Sports Med. 2000; 28:103-8.
14. Guy DK, Wirth MA, Griffin JL *et al*. Reconstruction of chronic and complete dislocations of the acromioclavicular joint. Clin Orthop. 1998; 347: 138-49.
15. Murena L, Vulcano E, Ratti C, Cecconello L, Rolla PR, Surace MF. Arthroscopic treatment of acute acromioclavicular joint dislocation with double flip button. Knee Surg Sports Traumatol Arthrosc. 2009; 17:1511-5.
16. McFarland EG, Blivin SJ, Doehring CB, Curl LA, Silberstein C. Treatment of grade III acromioclavicular separations in professional throwing athletes: results of a survey. Am J Orthop (Belle Mead NJ). 1997; 26:771-4.
17. Bathis H, Tingart M, Bouillon B, Tiling T. The status of therapy of acromioclavicular joint injury. Results of a survey of trauma surgery clinics in Germany. Der Unfallchirurg. 2001; 104:955-60.
18. Smith TO, Chester R, Pearse EO, Hing CB. Operative versus non-operative management following Rockwood grade III acromioclavicular separation: a meta-analysis of the current evidence base. J Orthop Traumatol. 2011; 12:19-27.
19. Gstettner C, Tauber M, Hitzl W, Resch H. Rockwood type III acromioclavicular dislocation: surgical versus conservative treatment. J Shoulder Elbow Surg. 2008; 17(2):220-5.
20. Weaver JK, Dunn HK. Treatment of acromioclavicular injuries, especially complete acromioclavicular separation. J Bone Joint Surg Am. 1972; 54:1187-94.
21. Phadke A, Bakti N, Bawale R, Singh B. Current concepts in management of ACJ injuries. J Clin Orthop Trauma 2019; 10(3):480-85.
22. Weinstein DM, McCann PD, McIlveen SJ, Flatow EL, Bigliani LU. Surgical treatment of complete acromioclavicular dislocations. Am J Sports Med. 1995; 23:324-31.
23. Struhl S, Wolfson TS. Continuous Loop Double Endobutton Reconstruction for Acromioclavicular Joint Dislocation. Am J Sports Med. 2015; 43(10):2437-44.

24. Babhulkar A, Pawaskar A. Acromioclavicular joint dislocations. Curr Rev Musculoskelet Med. 2014; 7(1):33-39.
25. Virtanen KJ *et al.* Surgical treatment of Rockwood grade-V acromioclavicular joint dislocations: 50 patients followed for 15-22 years. Acta Orthop. 2013; 84:191-5.
26. Glanzmann MC, Buchmann S, Audigé L, Kolling C, Flury M. Clinical and radiographical results after double flip button stabilization of acute grade III and IV acromioclavicular joint separations. Arch Orthop Trauma Surg. 2013; 133:1699-07.
27. Tamaoki MJ, Belloti JC, Lenza M, Matsumoto MH, Gomes Dos Santos JB *et al*. Surgical versus conservative interventions for treating acromioclavicular dislocation of the shoulder in adults. Cochrane Database Syst Rev. 2010; (8):CD007429.
28. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res. 1987; 214:160-4.