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Arthroscopic assisted stabilization of acute acromioclavicular dislocations by cortical fixation buttons for acute acromioclavicular dislocation

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Abstract
Purpose: To evaluate the results of 15 patients following arthroscopically assisted AC joint fixation using cortical fixation buttons (AC tightrope or dog bone fiber tape construct) for acute AC joint separations.
Patients and Methods: Patients with acute AC joint injuries (Rockwood grades III–V) of less than 3 weeks duration were included in the study. We had 15 cases of AC joint injuries, which fulfilled the inclusion criteria. All patients were diagnosed based on history, examination and plain radiographs. Patients with grades III–V were selected for arthroscopic assisted fixation using cortical fixation buttons (AC tightrope or dog bone fiber tape construct or double endobutton, Zip Tight). Functional outcome of patients was assessed using constant shoulder score, Quick DASH score preoperatively and postoperatively.
Results: VAS for pain in 80% of patients there was a minimal pain VAS score of (0-2). Mean post-operative constant score at one year was 92.33. The Quick DASH subjective functional disability score was ≤ 10 in 75% of patients. The difference in Coracoclavicular distance between the injured and uninjured sides showed a significant improvement in mean values between the preoperative and 1-year evaluations (9.3 mm and 2 mm, respectively; p < 10–6). All patients had satisfactory outcome. We reported only one case of coracoid fracture, which was the 2nd case operated due to improper exposure of coracoid base & was fixed with hook plate.
Conclusion: Arthroscopic fixation using the cortical fixation buttons (AC Tightrope or dog bone fiber tape construct) for acute AC joint dislocation achieves satisfactory outcome.

Keywords: acute arthroscopic- Coracoclavicular acromioclavicular dislocation –ACJD- cortical fixation buttons- flip buttons-loop-tightrope-dog bone- single-Adjustable loop-length suspensory-fixation device

Introduction
Acromioclavicular-1(AC) joint-1injuries account-1for about 12% of all injuries of the shoulder girdle in the overall population, but this rate is significantly higher for those participating in contact sports, especially for males [1].
While Rockwood grades I and II injuries are typically treated non-operatively with good results, grades IV, V, and VI injuries often require surgical intervention to prevent long-term sequelae such as persistent pain and diminished shoulder function. Controversy still exists regarding the optimal management of grade III injuries; however, many surgeons prefer to operate on grade III injuries in selected patients, who are more likely to fail with non-operative treatment (such as those who participate in overhead sports or manual labor) [2].
Historically, surgical reduction and fixation of the AC joint often involved the implantation of rigid constructs that utilized pins, K-wires, screws or plates. However, in addition to the common need for subsequent hardware removal, these methods are all recognized as non-anatomic procedures & were associated with numerous complications including loss of reduction, fractures, hardware migration and restricted range of motion [2].
During the last decade endoscopic techniques have been widely developed, aiming for an anatomical minimally invasive & non rigid reconstruction of the cc ligaments. The advantages of arthroscopically assisted procedures are the detection and treatment of additional glenohumeral lesions as well as minimal soft-tissue dissection, smaller incisions, and more

precise tunnel placement at the coracoid process because it is performed under a direct visualization. With treatment performed in an early stage after the initial injury, healing of the AC and CC ligaments can occur without need for soft tissue grafts [3].

This study will focus on arthroscopic assisted stabilization of acute cases of AC joint dislocation with Coracoclavicular cortical fixation buttons CFBs utilizing single tunnel technique.

Patients and Methods

Study design

After obtaining Institutional Review Board approval (IRB), A prospective study of 15 patients were treated for acute acromioclavicular joint dislocation from August 2015 to August 2016 in our university hospitals, Zagazig, Ash Sharqia, Egypt. The implant used was any type of cortical fixation buttons CFBs or suspensory loop devices as AC tightrope of Arthrex 2nd generation buttons or dog bone DB fiber tape construct or any similar buttons.

Inclusion criteria

- Acute AC joint dislocation (maximum 3 weeks from injury to operative interference)
- Patients with (Rockwood grade IV,V)
- Patients with Acute AC joint dislocation type III B (unstable type in overhead athletes, manual laborers and other highly active individuals
- Age between 18 and 60 years.
- A minimum of one-year follow-up.

Exclusion criteria

- AC joint injuries Rockwood types I and II.
- Type III (A) AC joint dislocation.
- Chronic (more than 3 weeks) cases were excluded from study.
- Arthritic changes of the AC joint or Glenohumeral arthritis.
- Patients with a neurologic upper extremity deficit will be excluded.
- Associated clavicular fractures, Fracture coracoid, greater tuberosity fracture).
- Previous AC joint surgery (e.g., resection of lateral clavicle.).
- Patients with incomplete evaluation at final follow-up (minimum one year) will be excluded .
- Elderly patients (more than 60) or patient age less than 18 years.
- Low functional demand patients.

Preoperative evaluation

a. Clinically

A careful detailed history was taken and_includes the age, gender, affected side, dominant side, occupation, mechanism of injury, time lapse since injury, associated injuries, body mass index (BMI), and the degree of physical activity in work (heavy manual work, moderate activity or light work). Severity of symptoms including the pain (VAS for pain). Complete shoulder examination for concomitant lesions (rotator cuff, instability), the reducibility of the AC joint. Quick Disabilities of the Arm, Shoulder and Hand (Quick DASH) [5] score, Constant-Merely -score (CS) [6] and visual analog pain scale (VAS) were completed preoperative & at final follow-up. Occupation was categorized as sedentary, clerical, light manual or heavy manual. Time to and rate of return to work and to sport was assessed, as well as an overall 4-part satisfaction scale (very satisfied = 1, satisfied = 2, partially satisfied = 3, not satisfied =4). These scores were compared preoperatively and post-operatively.

All patients signed an informed consent preoperatively and were evaluated postoperatively and at regular interval every 3 months till completing the final follow-up evaluation at 12 months.

b. Radiological evaluation

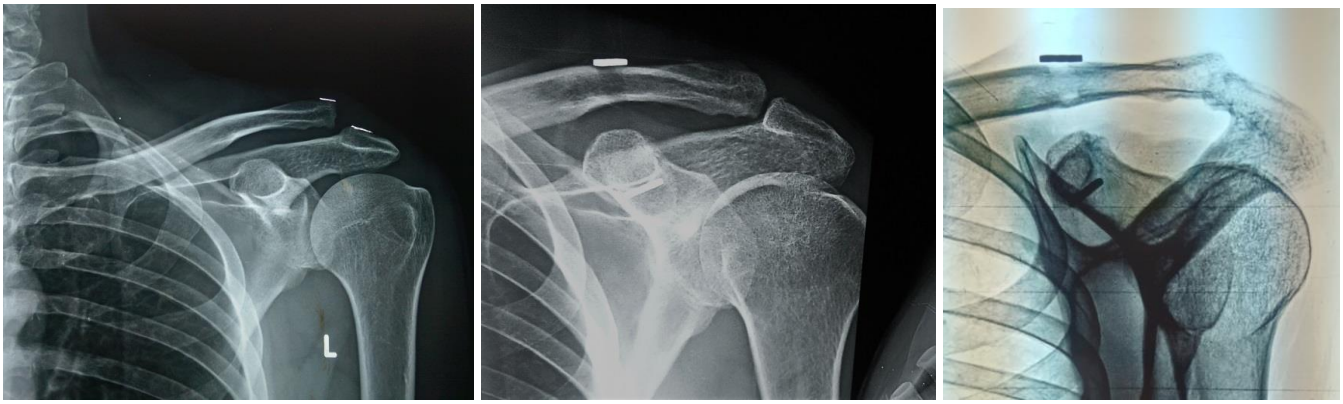
Radiological examination consisted of bilateral AP and axillary radiographs & Zanca view. Dislocations were graded according to the Rockwood`s classification. Unilateral AP stress and axillary views was done in the last follow-up visit. The radiological assessment comprised a comparative analysis of vertical and horizontal displacements measured on pre and postoperative x-rays (fig: 1, 2, 3). Coracoclavicular (CC) distance is measured, as the distance between highest point on the superior surface of the coracoid and the opposing clavicular inferior surface on the AP stress view. Acromioclavicular (AC) displacement was measured as the distance between the anterior border of the lateral clavicular end and the acromion on the axillary view.

Operative technique

All operations were carried out with the patient in beach chair position. After diagnostic arthroscopy from a standard posterior portal, anterior portal was established. We used 70 degree Lense to better view coracoid base or we created additional anterosuperior portal through supraspinatous for better viewing of entire coracoid base. The coracoid base was identified by following the subscapularis tendon medially. If necessary, the middle glenohumeral ligament was divided and debrided for better visualization. The coracoid base was skeletonized (fig: 4-a) from soft tissues using a radiofrequency electrode.

The AC joint was reduced perfectly in vertical and horizontal plane and temporarily fixed with a (K-wire) under fluoroscopic guidance. Small incision 1 to 2 cm about 3.5 cm from the AC joint was done. The AC C-guide was positioned under the coracoid, and a guide wire was drilled though the clavicle and base of the coracoid under arthroscopic vision.

A 4.5-mm hole was drilled over the guide wire (fig: 4-b) through the clavicle and coracoid. Then we passed a nitinol wire for shuttling (fig: 4-c) the tightrope from up down to settle under the coracoid base. The K-wire was removed, the deltotrapezial fascia was closed and the wound was closed. For the DB (fig: 5a, b) first steps were similar to the TR technique except for the 3 or 2.4 mm drill instead of 4 mm. Once the concavity of the Inferior button was seated against the coracoid the superior button was positioned onto the tapes exiting the clavicle after checking the reduction endoscopically through subacromial space or fluoroscopically, the tapes were tied above the clavicle.



a. b. c.

Fig (1): a-Plain radiograph of Acute AC joint dislocation before reduction. **b-** AP radiograph of left shoulder after arthroscopic fixation with AC tightrope. **C-** scapular y view showing adequate reduction of AC joint.

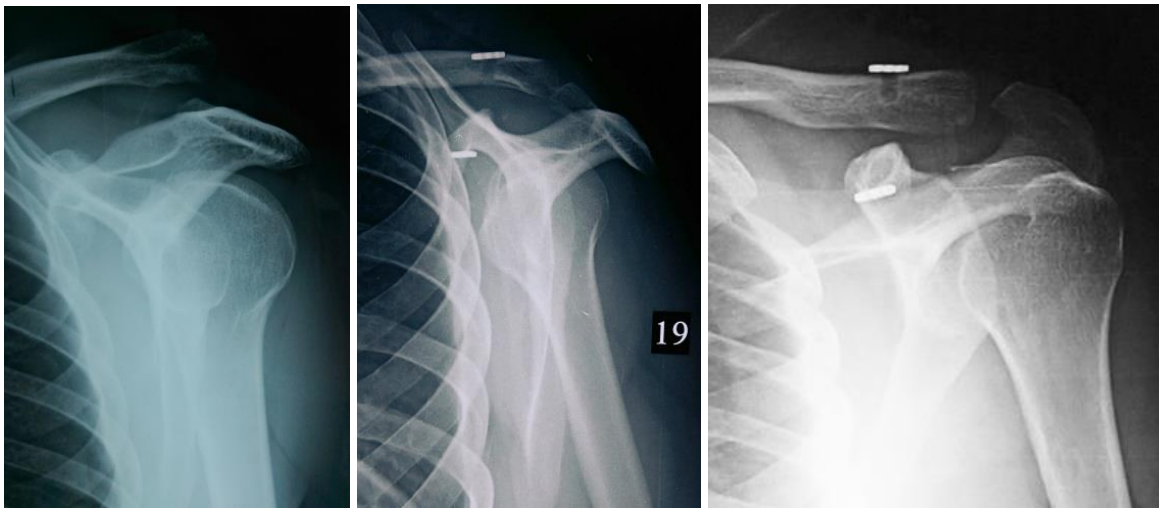


Fig 3: CT scan & AP view & axillary view of AC joint dislocation stabilized by Dog Bone construct.

Fig 2: acute AC joint dislocation before fixation y view, after fixation with ac tight rope in supraspinatous outlet view & AP view.

a. b.

c. d.

Fig 4: Steps of surgical technique utilizing TR. **a.** Exposure of coracoid base with RF device. **b.** Drilling of the Coracoclavicular tunnel under arthroscopic guidance. **c.** passage of the TR device using the nitinol wire. final placement of the TR clavicular button beneath the coracoid base.

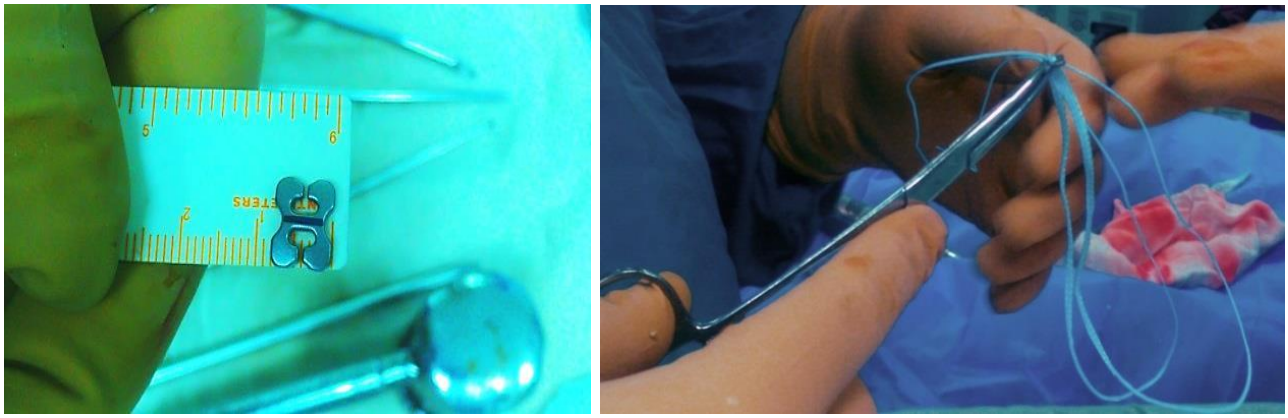


Fig 5: DB button, DB -2 FT construct.

Rehabilitation

The upper arm was immobilized with a sling for 4-6 weeks, at which time physiotherapist-guided gentle range-of-motion (ROM) exercises were started. Patients visited an outpatient clinic at 6 weeks postoperatively and, if ROM was restored, the patients were allowed to start strengthening exercises. Manual labor was gradually allowed at 3 months after the surgery, return to contact sports was permitted after 6 months.

Statistical analysis

Statistical comparison of functional scores and radiographic measurements was performed using the paired t-test. All tests were calculated with use of the SPSS, version 16.0 (SPSS Inc., Chicago, IL) statistic package for personal computers.

Results (Fig: 6, 7)

1. Patients characteristics (table:1)

In our study 14 males & 1 female with acute AC joint dislocation were fixed arthroscopically with CFBs. The mean patient age was 38.53, mean time from injury to operative interference was 9.46 (median was 8). In 6 patients (40%) the RT side was affected while in the remaining 60 % LT side was affected. The dominant arm was injured in 12 patients. Regarding classification of injury according to Rockwood there were 4 cases with Type 3 injury & 3cases with type 4 injuries & 8 patients type 5. Concerning the patients Occupation there was 1 sedentary life style, 2with clerical work, 3 patients with light manual work & 9 practicing heavy manual work. No professional athletes were encountered during this study despite it is more common injury in contact sports. Sporting activities were in form of recreational sports as football. Injury occurred during traffic accident in10 patients, Sports activities in 3 & domestic accident in only 2 patients.

2. Functional outcomes

VAS for pain in 80% of patients there was a minimal pain VAS score of (0-2). Mean post-operative constant score at one year was 92.33. Only 53.33% of patients reported being very satisfied or satisfied, although 93.33 % would have the procedure again. The Quick DASH subjective functional disability score was ≤ 10 in 75% of patients.

3. Radiological outcomes

The difference in Coracoclavicular distance between the injured and uninjured sides showed a significant improvement in mean values between the preoperative and 1-year evaluations (9.3 mm and 2 mm, respectively; $p < 10–6$). The analysis in the horizontal plane on the axillary view and the difference in the distance from the anterior edge of the acromion to the anterior edge of the clavicle revealed a significant improvement in mean values from the preoperative to the 1-year time points (4.2 mm and 2mm, respectively; $p < 10–5$). Thus, significant improvements were documented postoperatively in all planes.

4. Complications

There was an occurrence of superficial wound infections & irritation by ethibond suture which were successfully treated via debridement & closure. This patient also suffered from limitation in ROM due to long period of immobilization (improper FU) & was treated with physiotherapy. In another patient, a coracoid fracture was observed due to technical failure, in which the coracoid drill hole was not placed

centrally (due to improper exposure of the coracoid base), we fixed it with hook plate in the same setting (this was excluded from the study as he was not fixed with CFBs). In 3 cases (20%) there were partial loss of reduction CCD increased by 2 mm from post-operative measurement to the measurement at final follow up, but it did not affect the functional results. In the 3rd case operated there was a clavicular fracture due to anterior positioning of the tunnel in lateral end of clavicle & also there was a fissure in the lateral clavicle but was not seen preoperative, but we managed this complication by cutting the clavicular button and made new tunnel, in which the fiber wire FW was shuttled & also through the button upon which FW was tied. No other complications were recorded.

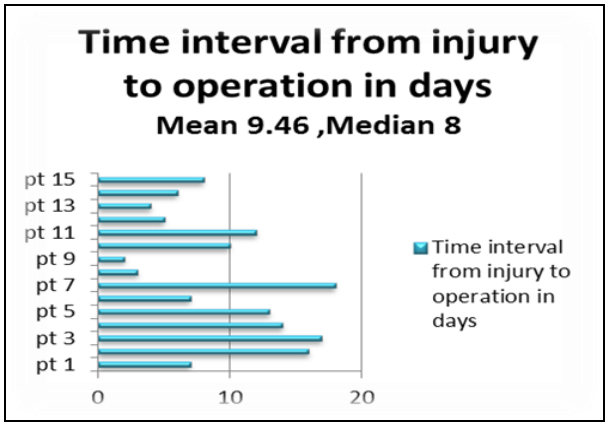
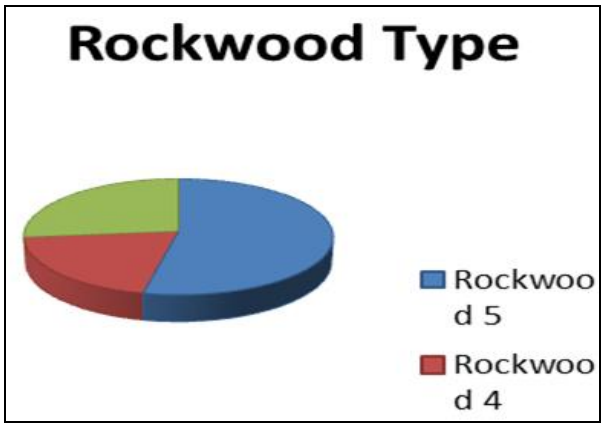
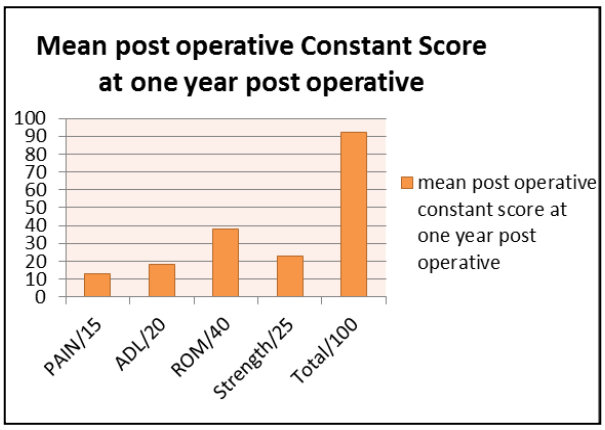


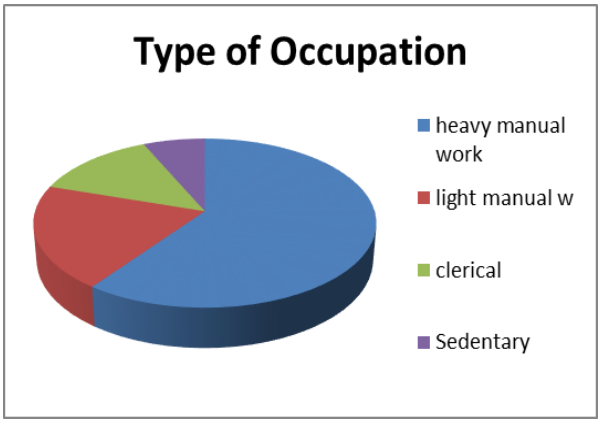
Fig 6: time interval from injury to operative interference in days.

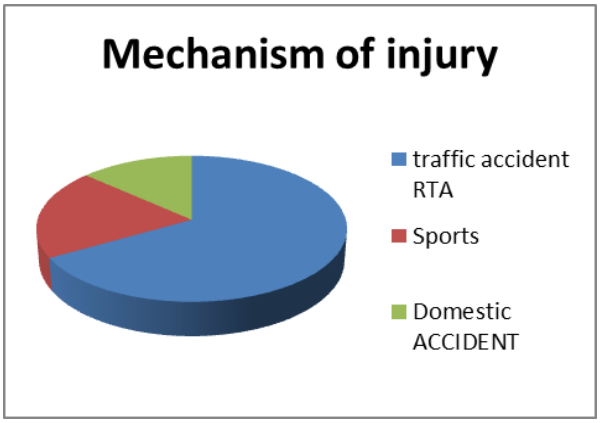
Table 1: Patient Demographics and Constant Scores,VAS.

Sex	Age	Time i/ s	Side	Job	Rockwood	Injury mechanism	CS pre injury	CS post	VAS Score pain Pre op & 1 y post op
F	23	7	L	Medical student	Iii	Domestic accident	58	84	6 0
M	40	16	L	Seller in market	Iii	Domestic accident	65	88	8 2
M	43	17	L	Hair dresser	Iii	RTA	50	98	7 0
M	50	14	L	Clerk	V	RTA	32	90	8 4
M	36	13	R	Truck driver	V	Sports	45	94	6 1
M	52	7	R	Sedentary life style	V	Sports	50	93	7 2
M	36	18	R	Electrician	V	RTA	30	98	8 3
M	32	3	L	Sales Representative	Iii	Sports	25	92	7 2
M	34	2	L	Driver	V	RTA	28	94	6 2
M	45	10	R	Heavy Manual worker	4	RTA	73	90	8 2
M	38	12	L	Heavy Manual Worker	4	RTA	64	96	7 2
M	25	5	L	Manual Worker	V	RTA	56	86	7 2
M	58	4	R	Manual work	V	RTA	70	94	6 2
M	32	6	L	Manual Worker	V	RTA	58	98	8 2
M	34	8	R	Heavy Manual Worker	4	RTA	79	90	7 4









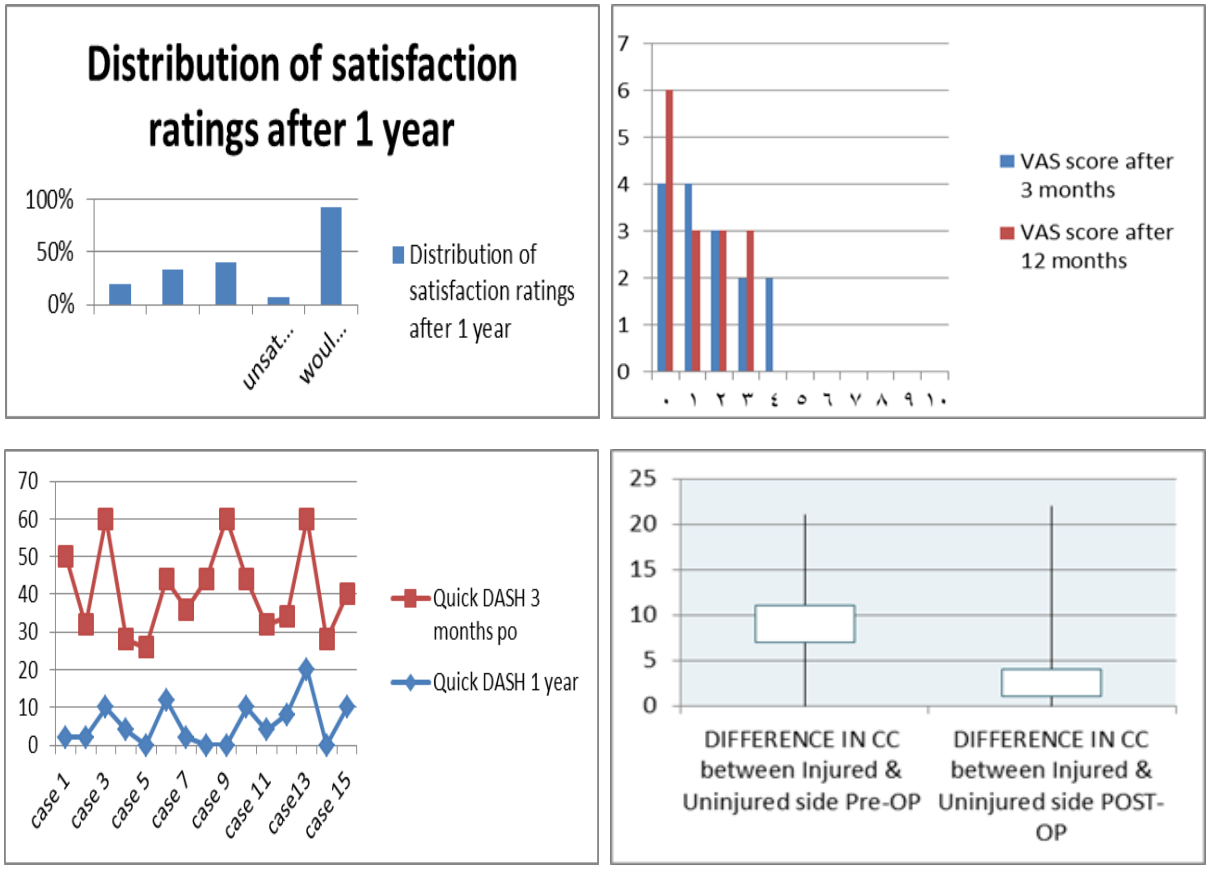


Fig 7: charts & diagrams illustrating results & outcomes of our different study parameters**.**

Discussion

Many surgical techniques have been described for treatment of AC joint dislocations. But still there is no gold standard method .Temporary fixation with pins or wires is no longer recommended because of the increase incidence of degenerative AC joint changes, bony erosion, and pin breakage and intra- thoracic migration. A second procedure for implant removal is also needed. Coracoclavicular screw owing to be the stiffest construct, disrupts the normal scapulohumeral motion, also requires hardware removal. Sub coracoid loops have the potential for suture cut-through, distal clavicle osteolysis, anterior implant dislocation & neurovascular damage [5]. Hook plates must be removed 8–12 weeks after surgery before allowing overhead shoulder activities. Also numerous complications were reported as subacromial impingement and even rotator cuff tears, Cutting upward through the acromion, acromial osteolysis, fracture, AC osteoarthritis, plate bending. Despite timely removal of the plate, there could be also an increased risk of fracture of the distal clavicle after low energy trauma [5].

In 2001, Wolf and Pennington [6] described for the first time the arthroscopic CC stabilization using polyethylene wire cerclages. Elser *et al.* [7] used suture anchors for arthroscopic CC stabilization without image intensifier. Chernchujit, *et al* [8] used suture anchors & titanium plate for Arthroscopic reconstruction of the acromioclavicular joint.

Originally, the Tight Rope™-system has been developed for stabilization of the tibio-fibular syndesmosis. 9 In the meantime, the use of this implant in a slightly modified version has become popular for ACJ repair, as well. Two titanium buttons, one round clavicular and one oblong coracoidal button, are used to allow homogenous distribution of loads on bone surfaces and thus avoid the sawing effect of the sutures associated with failure in other anchor and suture techniques. A continues loop of No. 5 Fiber Wire suture organized as a pulley (#5 FW, 4-suture bundle) is used to connect the two buttons placed on the top of the clavicle and under the coracoid. Imhoff and Chernchujit 8 showed that No. 5 Fiber Wire failed at 485 N whereas the native CC ligament complex failed at 589 N. Thus, the tensile strength of two strands of No. 5 Fiber Wire is higher than the tensile strength of intact CC ligament complex.

The arthroscopically assisted Tight Rope stabilization technique represents a minimally invasive method to augment the torn conoid and trapezoid ligaments in acute AC joint separations with no need for implant removal with better visualization of the coracoid base for safe application of TR. Another important advantage of arthroscopic techniques is diagnosis and treatment of concomitant intra articular pathology which is frequent. Millette, Brady, Imhoff.

Different flaws have been described in the tight rope technique, with primarily the post-operative partial loss of reduction due to cortical osteolysis under the clavicular button, with implant migration. Another shortcoming may be the large tunnel through the coracoid base, with early failures subsequent to monocortical coracoid fracture. Finally, the initial stability provided by a single TR would not be sufficient, as advocated by scheibel and colleagues. We attribute the failure of TR was due to the difference between the first & second generations of TR (size of clavicular button) [10].

Salzman *et al.* [11] described arthroscopically assisted 2-bundle anatomical reduction of acute acromioclavicular joint separations to mechanically fix the AC joint till healing of torn ligaments. Clinical results of modern anatomical arthroscopically assisted techniques for AC joint reconstruction with 2 drill tunnels have been favorable in midterm and long-term follow-ups. Nonetheless, these surgical techniques are highly demanding and dependent on the skills of the surgeon. In some cases, the anatomy of the

patient may even exclude correct and safe positioning of the bone tunnels.

Patzer *et al*. [12] showed that only one bone tunnel for CC reconstruction can provide comparable clinical results. Beitzel *et al* [13]. Showed that there was no significant difference between single and double clavicular tunnel techniques with regards to stability imparted to AC joint. Spiegl *et al* [14]. investigated the biomechanical consequences of CC reconstruction techniques on clavicle strength. They showed that tendon graft reconstruction with two 6- mm drill holes and tenodesis screws caused significantly more reduction of clavicle strength than a CFB technique with two 2.4-mm drill holes.

In a biomechanical study to determine the effect of coracoid drilling for acromioclavicular joint reconstruction techniques on coracoid fracture risk, Martetschläger *et al*. [15] concluded that one 2.4-mm drill hole led to less destabilization of the coracoid than one or two 4-mm drill holes. The mode of failure in TR via button pull through or fracture while in DB the failure occurs due to suture (fiber tape FT) breakage. So Techniques with small "2.4-mm" drill holes might decrease the risk of severe iatrogenic fracture complications.

So according to the previous mentioned studies we used a single bundle technique for fixation of AC joint dislocation using different varieties of the CFBs as the 2nd generation TR system, double endobutton system and the dog bone fiber tape construct). The dog bone is made of two bone-shaped buttons, linked by two loops of 2-mm fiber tape (2 FT, 4-sutures) bundle. the contact area of the dog bone button with the bone about 80 mm2 while that of the 1st generation TR clavicular button about 33.2 mm 2 allowing for better tensile forces distribution & decreasing incidence of clavicular osteolysis [10]

The 1st generation TR has a clavicular button of 6.5 mm diameter flat button while the 2nd generation has a 10 mm curved clavicular button that provided a contact area of 78.5 mm2 thus no significant bone lysis & decrease risk of caudal migration. In addition the fiber tape (braided composite polyethylene & polyester sutures) has larger cross sectional area than fiber wire & greater ultimate load to failure. Finally since only tapes pass through the tunnels, in DB the tunnel may be smaller (between 2.4 & 3 mm) while 4 mm in TR the smaller the tunnels the lesser the risk of fracture [10]

Table 2: Results of different studies evaluating arthroscopic assisted fixation of AC joint with CFBs

Study	Pt. No	Mean FU months	Mean post op score	Failure rate	complications
Defoort and Verborgt, 2010	16	17	-DASH score: 2.29; -visual analogue score for pain: 0.82; -subjective shoulder value*:* 90.5%	6.25	Stable residual subluxation (n=5)
Salzman 2010 D.TR	23	30.6	- rate of secondary displacements : 35 % (8/23)	……	
Scheibel *et al* 2011 D.TR	28	26.5	- secondary displacements -57.1% (16/28) revealed a stable situation on the Alexander view - 42.9 % (12/28) were unstable	…….	
Thiel *et al*., 2011 (single and double Tightrope)	12	24	-Simple Shoulder Test: 11 of 12 positively answered questions	16.6	Loss of reduction (n=1)
El Sallakh, 2012	10	24	-Constant score: 96.3	10	Coracoid # in one case
A, Beris *et al* (mini-open) 2013	12	18.25	-Constant score was 94.8 -mean DASH score decreased from 19.6 preoperatively to 0.25 Final FU mean VAS score from 5.75 to 0.2	…..	……..
Glanzmann 2013 Double TR			-CS was 90.2 points (SD 6.5) -SST was11.5 points -Immediate Postoperative CCD of the injured side / median 10 mm (range 4.6–19 mm) -changed to a median of 13 mm (range 4.6–24 mm) at final follow-up. - At that time and compared to the non-injured side the operated shoulder demonstrated a CC distance with a median plus of 2 mm (range −4 to 12 mm). - Loss of reduction of more than 2 mm in the coronal plane stress views was present in 6 patients (32 %) with no associated loss of functional outcome. -2 patients (21 %) a complication occurred: two patients showed migration of the endobutton with loss of reduction within the frst 6 months after the procedure -2patients postoperative stiffness		
Flinkkila and Ihanainen, 2014	56	31	-DASH score: 9; -Constant score: 88 -Of 31 patients with a CCDD of >5 mm, 7 underwent reoperation	16	7 cases underwent reoperation
Chaudhary 2015	17	22.1	-Constant score: 86.4 -The CCD decreased from 21.5±5.2 mm preoperatively to 10±3.2 mm at one year. -Two patients had partial loss of reduction (≥2 mm displacement from initial reduction) -1 Pt complete failure (weight lifting)	5.88	*Loss of reduction (n=2) *1 complete failure
Gangary 2015 TR	11	12	-The mean constant score was 82. -UCLA score was 30.3 points -loss of partial reduction 5 patients (45%) -loss of full reduction noted in 5 (45%) rehab - One patient was lost in follow-up. -CCD pre-op was 18.9 (1.4) mm -CCD post-op was 11(0.5) mm - 10 returned to their previous occupation.	……..	……..
Natera *et al*. 2015	20	36	- secondary displacements in 40 % (8/20)	…..	……
Shin *et al*. 2015	18	25.6	The mean Constant score was 95.6 at 6 months after the operation and 97.5 at		Complications

			the final follow-up -Preoperative CC distance of the injured shoulder was 16.1+/- 2.7 mm -Increased by 99%+/-36% on average compared with the contralateral shoulder -Average CC distance was 10.5 +/- 2.5 mm -Increased by 30%+/-30% at the final follow-up - CC distance was maintained in 12 patients, increased (50% : 100%) in 4 patients, and increased (more than 100%) in 2 patients at final follow-up. -CC fixation failure of greater than 50 %of the unaffected side in radiological examinations occurred in 33% of the patients - 8 patients 44% had complications associated with the adjustable loop-length suspensory fixation device and surgical technical problems.		(8 patients), 1case AC arthritis, 1 case of delayed distal clavicular fracture at the clavicular hole, 3 cases of clavicular or coracoid button failures, 3 cases of clavicular bony erosion.
Clavert P. *et al*. 2015	116	12	- With defined clinical failures as a final Constant score of less than 85% points. -32 patients Constant score 71.5 points compared to 93 points for the rest of the series -11complications due to hardware failure resulting in a loss of reduction, 1 coracoid fracture, 7 cases of adhesive capsulitis, 2 local infections,5 cases of hardware pain -8 cases of loss of reduction - 2 immediate postoperative infections - 7 cases of type I complex regional pain syndrome. - 1 case of erosion of the distal quarter of the clavicle. -1 ossifications of the coracoclavicular ligaments in one patient -48 patients(41.3%) had persistent dislocation 150% on an AP X-ray which affected the pain and activity CS		-overall complication rate of 22.4% -Good to excellent outcomes were reported in patients without complications
Zhang LF 2017	24	39.45	-CS Pre71.58 +5.67 --PO 82.75 + 4.89 -UCLA scores 17.62 +3.67--PO30.54+ 3.02 -CC distance Pre21+2.49 PO11.43+2.54 -CS was significantly lower in Pts. with complications.	8.33	*Six patients had partial loss of reduction within 3–6 months *two patients had a failure of construct.
B. Schliemann 2015 MINAR open 1.0-mm suture (Ethibond, Ethicon)	63 of 71 FFU	39	-Overall Constant score was 95.2 points (range 61–100 points) compared to 97 points -SSV 90 % -CCD 11.1 mm affected side -CCD 9.7 mm - Loss of reduction 18 patients (28 %) - Nine patients (14.3 %) needed surgical revision. -Inappropriate positioning of the coracoid bone tunnel with subsequent button dislocation was the most frequently observed mode of failure (6 cases, 9.5 %) -The patient's age at the time of trauma had a significant impact on the clinical outcome	…..	-Heterotopic ossifications 7 cases (11 %) -Revision Nine of 63 patients (14.3 %) complete coracoid fracture 1 case -migration of the clavicular button (seen in 11 cases, 17.5 %)
Vulliet p 2017	40 22TR 18D B	27.7+/- 8.3	-CS & QD 94.3+-4.4and 2.0+-2.6in TR group, 95+-6.1 and 3.43.3in the DB group -Post op Loss of reduction in 4 cases DB, 1 case with TR, final post op, more than half DB group showed loss of reduction, less than quarter of TR group -Complete loss of reduction in 6 pts. (3 TR, 3 DB)(3 due to recurrent trauma)	…….	-2 cases DB revision (bulky clavicular knot) -1 case mono-cortical coracoid fracture 6 pts. not resumed their usual activity

Earlier studies of TightRope fixation of AC dislocations have involved only small numbers of patients and the results have been controversial. Thiel *et al*. [16] and Defoort and Verborgt [17] studied 12 and 15 patients, respectively, and each reported fixation failure in one-third of the patients with grade III and V AC dislocations.

El-Sallakh [18] studied 10 patients and reported only one failure of fixation, which was the result of a technical error [12] Scheibel *et al*. [19] and Salzmann *et al*. [11] studied 27 and 23 patients, respectively, who received double Tight Rope fixation that was intended to fix and replace both conoid and trapezoid parts of coracoacromial ligament; early failures were rare but they reported slight losses of reduction at up to 6 months postoperatively, which did not affect clinical results.

In clinical practice, healing ligaments are usually allowed to carry some load after 6 weeks to 12 weeks. However, animal studies have shown that, under load, healing knee medial collateral ligaments creep and elongate permanently. It is also possible that they do not achieve the mechanical strength of intact ligaments even at 1 year postoperatively. Some studies have proposed that torn CC ligaments should be replaced with tendon grafts even in acute injuries because tendon grafts stretch less than healing ligaments. [20]

Zhang LF, *et al* [21] retrospectively assessed the results of 24 patients of acute AC joint dislocation who were operated using Tight Rope system. The mean follow-up was 39.45 months. Constant and UCLA scores were significantly increased postoperatively. Six patients (25%) had partial loss of reduction within 3–6 months and two patients had a failure of construct.

Vulliet P *et al*. [10] compared the clinical and radiologic outcomes between two consecutive series, the 1st fixed with TR & the 2nd fixed with dog bone DB button technology, they concluded that both techniques provided good to excellent functional outcomes. However they reported inferior radiologic results using the dog bone device, so preferred the TR technique.

Analysis of our results

Study limitations

This study has several limitations. First, unfortunately there were some patients that did not want to present themselves for follow-up due to their symptom-free shoulder Limitations to this study included the small sample size and short follow-up.

Conclusion

Arthroscopic fixation using the Tight Rope device for acute AC joint dislocation achieves satisfactory outcome. Furthermore, placement of the coracoid button centrally under the coracoid base is crucial to prevent failure.

Declaration of conflicting interests

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