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Evidence-Based Management of AC Joint Injuries

Ryan M. Coyle, MD

Sept. 29, 2022

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Disclosures

- I have no disclosures relevant to this presentation

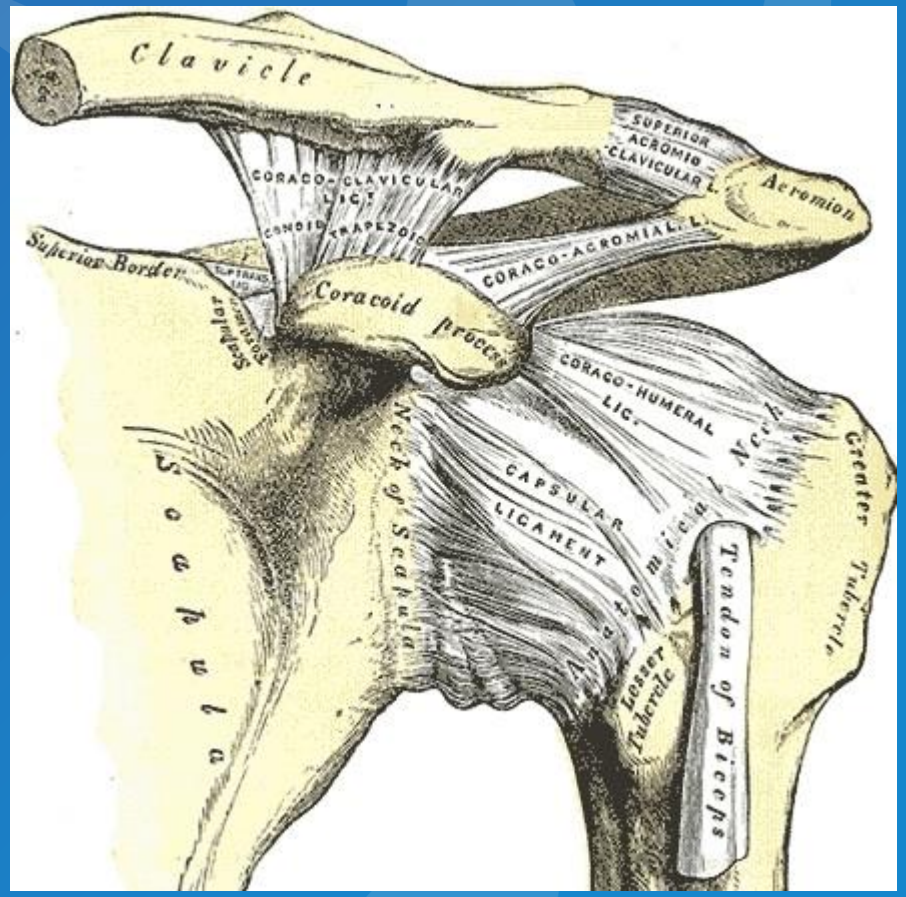
- What is the optimal evidence-based management of both the acute and chronic AC joint injury?

Epidemiology

- Most commonly affect young males
  - Athletes particularly at risk
- Fall directly onto shoulder, less frequently FOOSH
- Low-energy injuries (Type 1-3) far more common than high-energy injuries

Anatomy

- Acromioclavicular joint:
  - Plane/gliding joint stabilized by:
    - Acromioclavicular ligaments
    - Coracoclavicular ligaments
      - Conoid/Trapezoid ligaments



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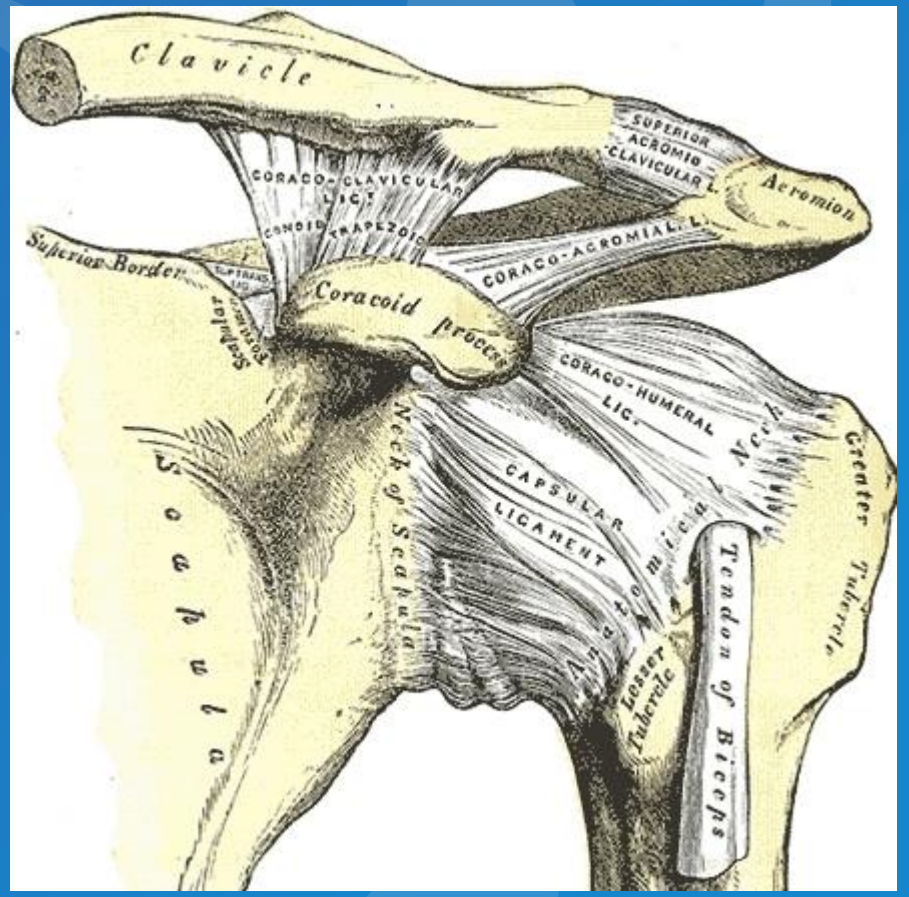

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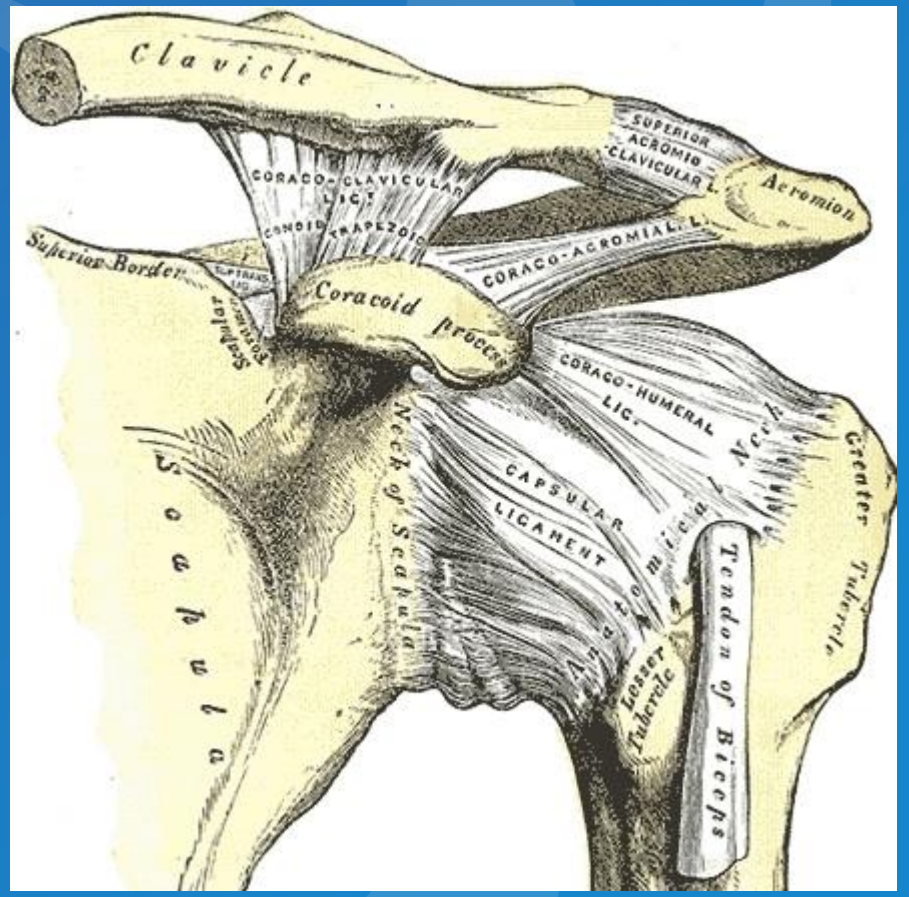
      - Responsible for superoinferior constraint



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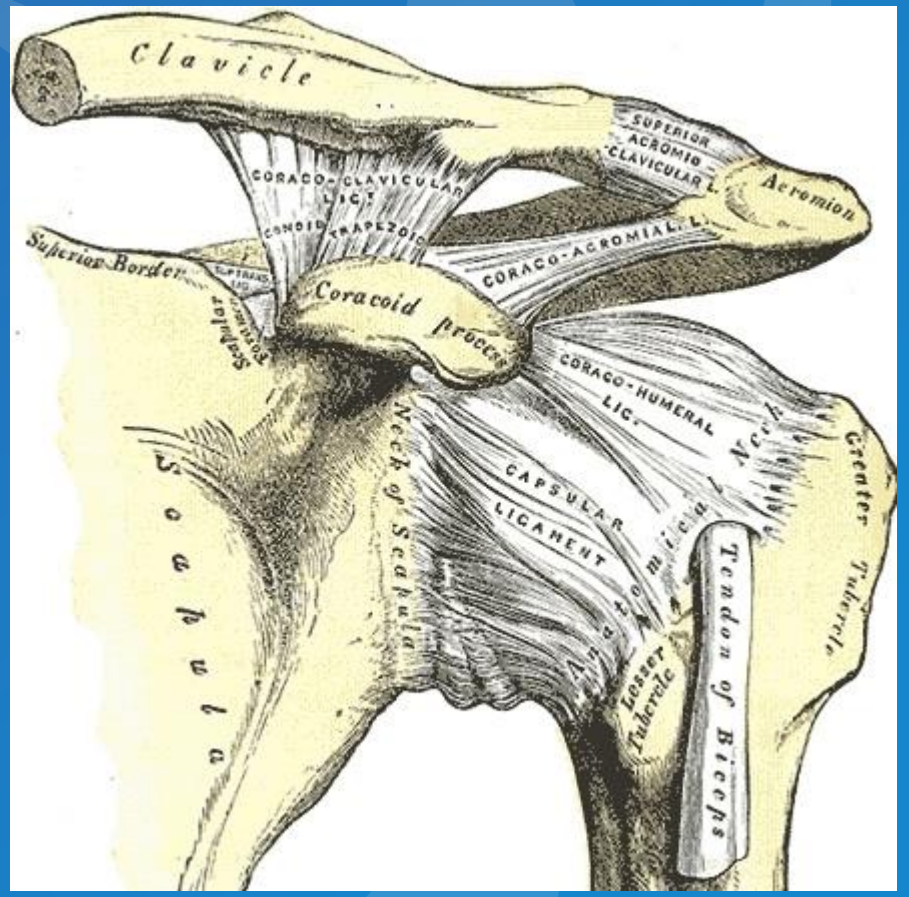
      - Conoid/Trapezoid ligaments
      - Responsible for superoinferior constraint
      - Conoid ~ 4.5 cm medial to distal clavicle, posterior
      - Trapezoid ~ 2.5-3 cm medial to distal clavicle, anterior



Ligamentous and capsular restraints to anterior-posterior and superior-inferior laxity of the acromioclavicular joint: a biomechanical study

Jillian Lee, BHB, MBChB, FRCS(Orth)[a,*], Hadi El-Daou, PhD[b], Mohamed Alkoheji, MB BCh, FRCS(Tr&Ort)[a], Adrian Carlos, MBChB, MSc(SurgSci), FRCS(Tr&Ort)[a], Livio Di Mascio, MB BS, FRCS(Tr&Orth)[a], Andrew Amis, DSc, FREng[b]

JOURNAL OF SHOULDER AND ELBOW SURGERY

J Shoulder Elbow Surg (2021) 30, 1251–1256

- Cadaveric study (20 specimens)
- Sequential sectioning of ligaments
- Conoid ligament most important for superior restraint
- AC capsule most important to resist inferior, posterior translation

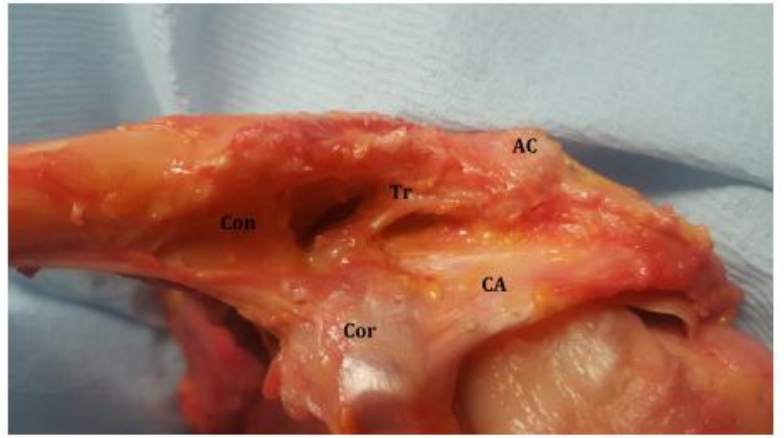


Figure 1 Dissected specimen. *Cor*, coracoid; *CA*, coracoacromial ligament; *AC*, acromioclavicular joint capsule; *Con*, conoid ligament; *Tr*, trapezoid ligament.

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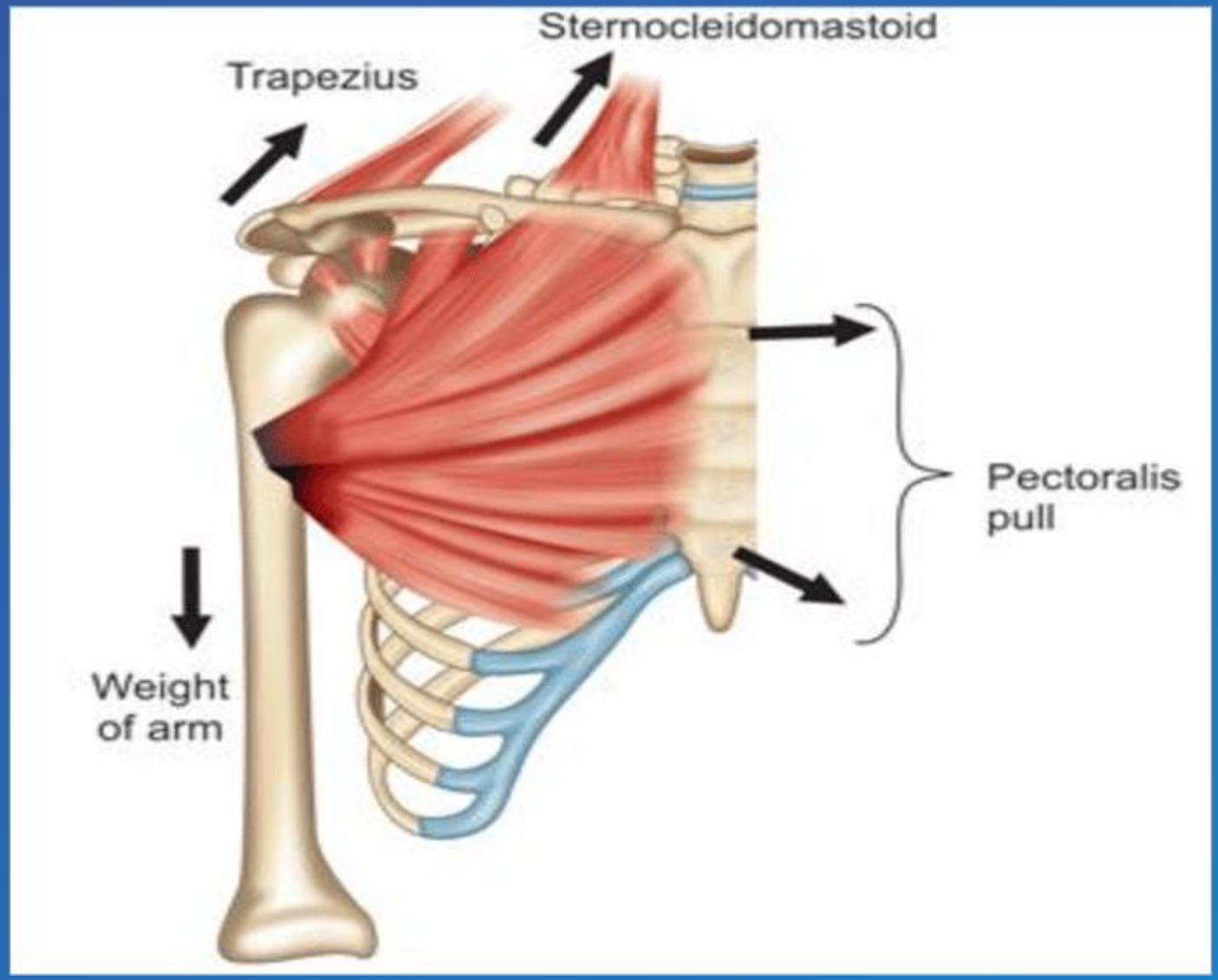


- Deforming forces
  - Trapezius, SCM elevate clavicle, exert posterior-directed traction
  - Scapula follows the upper extremity with weight of arm

Table 2

Summary of the Rockwood Classification System for AC Joint Injuries

Type	AC Ligament Injury	CC Ligament Injury	Deltotrapezial Fascia	Clinical Findings	Radiographic Findings
I	Intact	Intact	Intact	AC tenderness; no obvious visible deformity	Normal
II	Ruptured	Incomplete injury	Mild injury	Pain with motion, clavicle unstable in the horizontal plane possibly displaced A/P	Lateral end of the clavicle slightly elevated. Stress views approximately 25% separation
III	Ruptured	Ruptured	Mild to moderate injury	Clavicle unstable in both horizontal and vertical planes, extremity adducted, and acromion depressed relative to the clavicle Clavicle appears "high-riding"	Plain radiographs and stress radiographs abnormal—25%-100% separation. In reality, the acromion and upper extremity are displaced inferior to the lateral clavicle
IV	Ruptured	Ruptured	Injured as the clavicle is posteriorly displaced	Possible skin tenting and posterior fullness; AC joint irreducible on PE	Clavicle displaced posteriorly on axillary view, possibly penetrating the trapezius muscle
V	Ruptured	Ruptured	Injured and stripped off clavicle	More severe vertical incongruity than III injury, shoulder with severe droop; if shoulder shrug does not reduce, then type V injury	100% to 300% increase in the clavicle-to-acromion distance
VI	Ruptured	Mild injury, usually intact	Possible injury	Rare inferior dislocation of the distal clavicle for high-energy hyperabduction, ER injury; accompanied by other severe injuries; transient paresthesias; always evaluate for neurovascular injury	Clavicle lodged behind the intact conjoined tendon

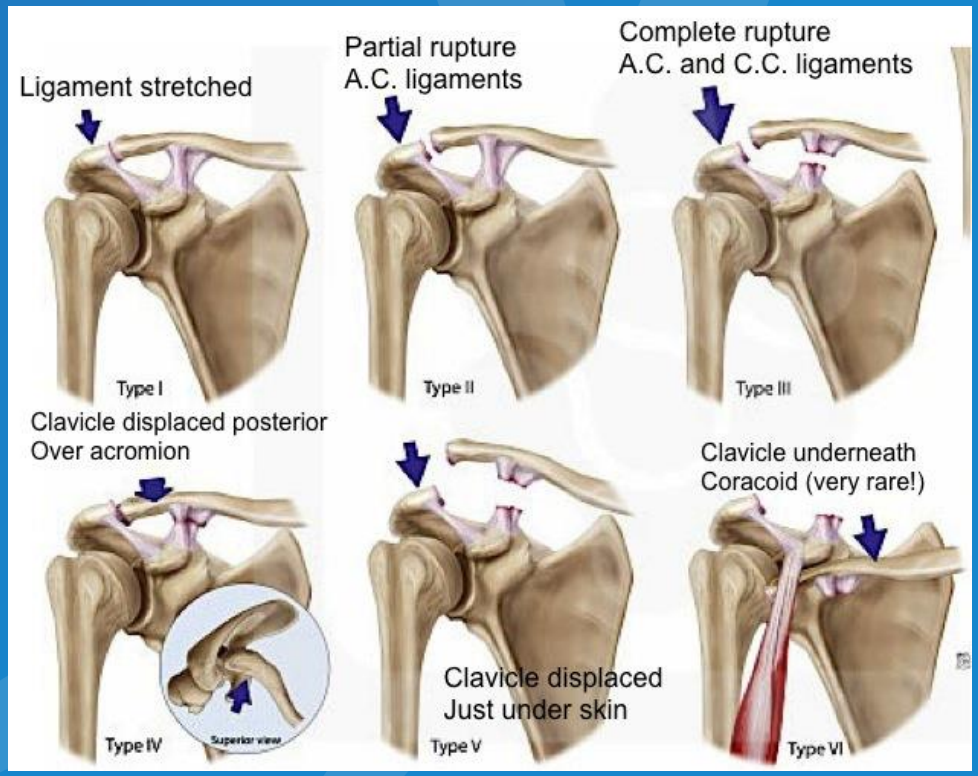
AC = acromioclavicular, A/P = anterior/posterior, CC = coracoclavicular, ER = external rotation, PE = physical examination

Review Article

Acromioclavicular Joint Injuries: Evidence-based Treatment

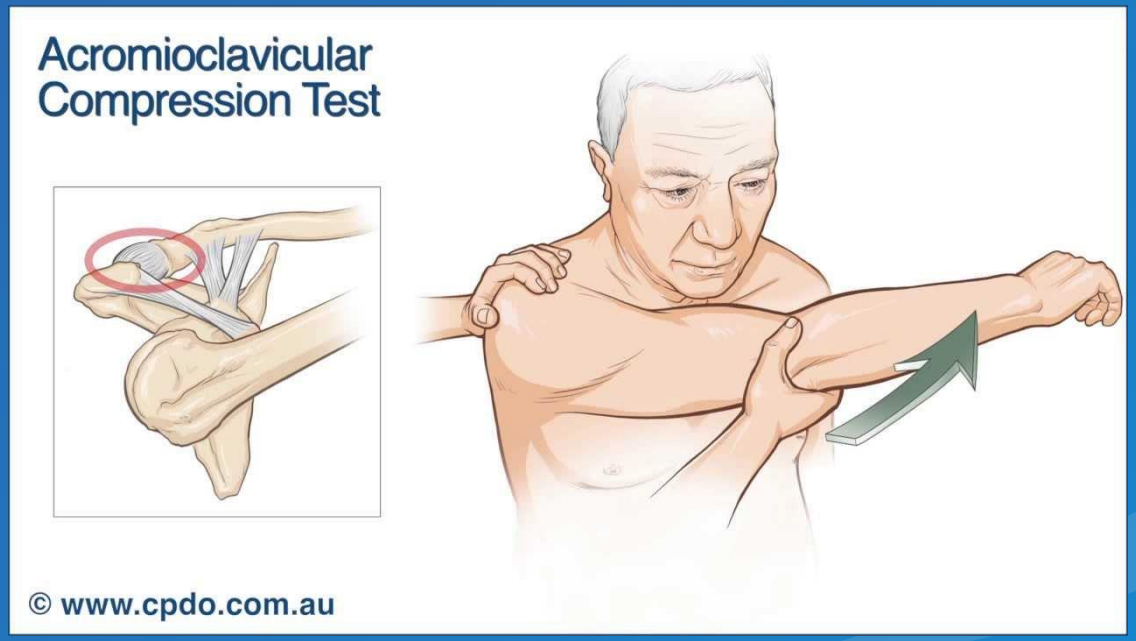
Rachel M. Frank, MD
Eric J. Cotter, MD
Timothy S. Leroux, MD
Anthony A. Romeo, MD

J Am Acad Orthop Surg 2019;27: e775-e788



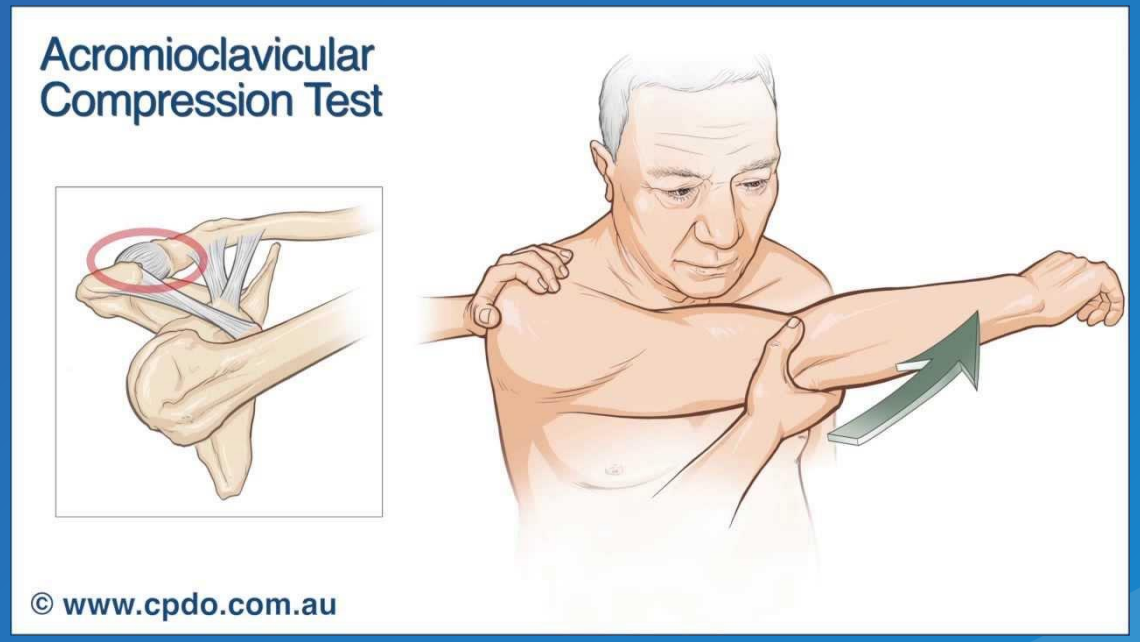
Examination

- Tenderness over ACJ
- Pain with cross-body adduction
- Pain with O'Brien active compression test localized to ACJ



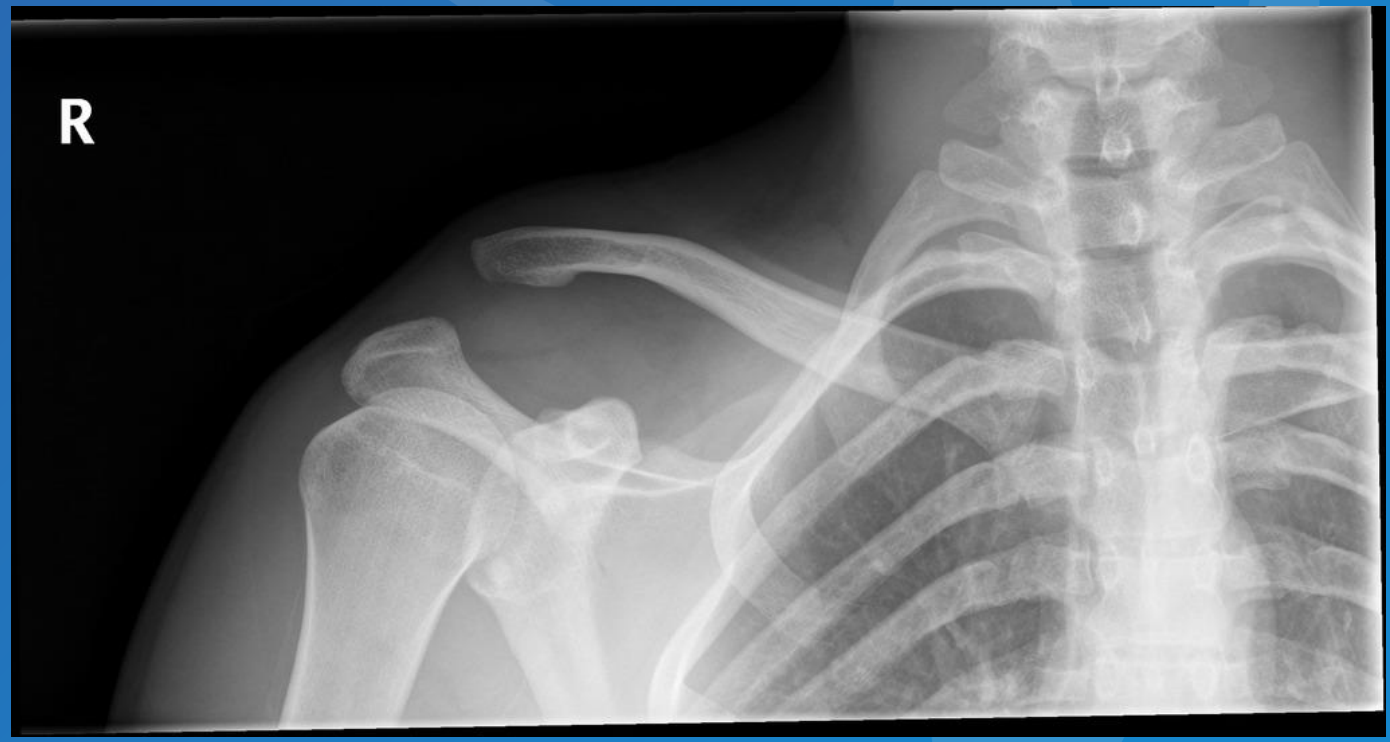
Examination

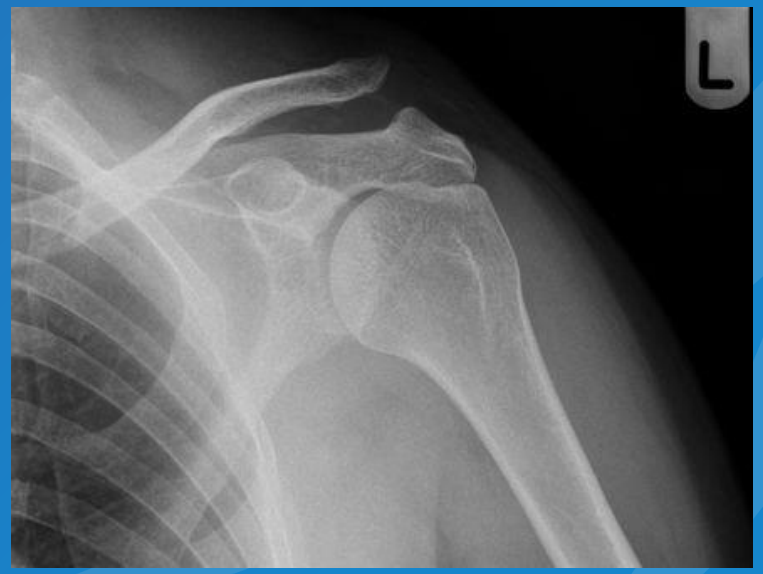
- Does the distal clavicle reduce when the patient shrugs? (fires trapezius)



Examination

- Radiographs typically demonstrate/confirm diagnosis
  - Specialized views:
    - Zanca (10-15 degree cephalad tilt)
    - Axillary view to demonstrate A-P translation





Management

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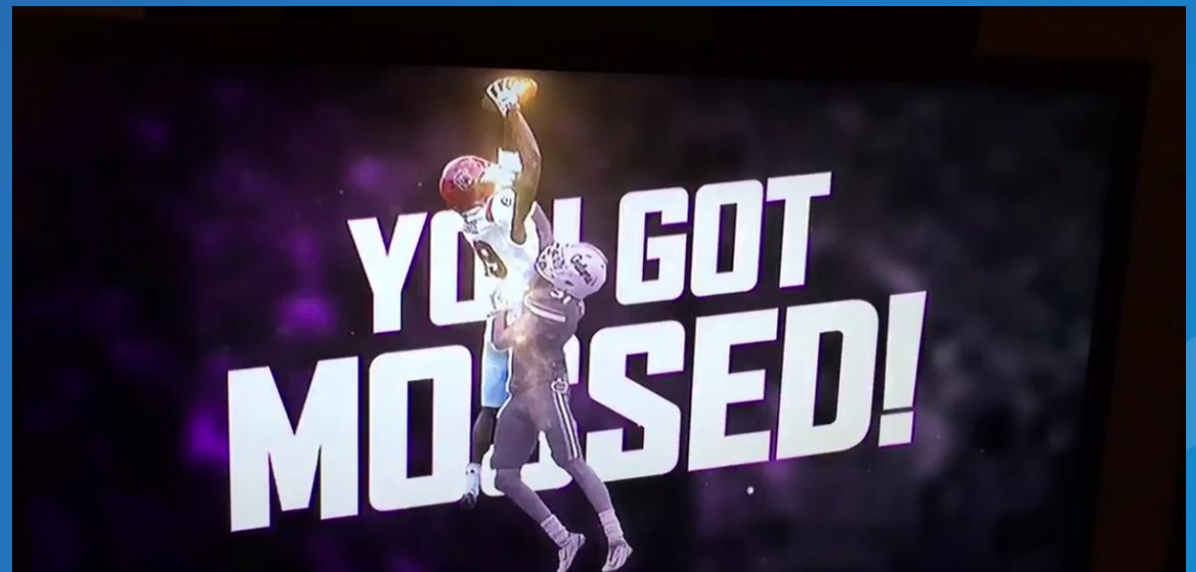

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- What are the patient's demands?
  - Overhead athlete? In season? Dominant arm?
- Acute or chronic injury?

Management

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  - Type 1-2 → conservative treatment
  - Type 4-6 → typically operative
- What are the patient's demands?
  - Overhead athlete? In season? Dominant arm?
- Acute or chronic injury?
  - Has the patient had previous treatment?

The American Journal of Sports Medicine
2021;49(3):757–763
DOI: 10.1177/0363546520981993

Long-term Outcome After Nonoperative Treatment for Rockwood I and II Acromioclavicular Joint Injuries

Daniël E. Verstift,*† MD, Iris D. Kilsdonk,‡ MD, PhD, Marieke F. van Wier,† PhD, Robert Haverlag,§ MD, and Michel P.J. van den Bekerom,† MD, PhD
Investigation performed at OLVG Hospital, Amsterdam, the Netherlands

- 75 patients (80% male), median 7 yr follow-up
- 50% type 1, 50% type 2 injury

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- Clinically non-relevant differences in Constant score and DASH score at final follow-up, slightly worse on injured side

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TABLE 5
Outcomes at Follow-up[a]

	Total	Rockwood I AC Joint Injuries	Rockwood II AC Joint Injuries
Patients	75	38	37
DASH	4.2 (0.0-10.8)	4.2 (0.0-7.5)	5.8 (0.4-15.0)
SST	100 (91.7-100.0)	100 (91.7-100.0)	100 (87.5-100.0)
AC joint pressure pain at injured shoulder	12 (16)	6 (16)	6 (16)
Positive cross-arm adduction test			
Injured shoulder	12 (16)	8 (21)	4 (11)
Contralateral shoulder	2 (3)	1 (3)	1 (3)
Patient satisfaction	83 (70.0-95.0)	80 (70.8-96.0)	85 (69.0-95.5)
Subsequent surgery	2 (3)	2 (5)	0 (0)
Sports			
Preinjury	65 (87)	33 (87)	32 (87)
Postinjury	50 (67)	30 (79)	20 (54)
Symptoms during sports[b]	13/50 (26)	8/30 (27)	5/20 (25)
Shoulder symptoms as reason for not participating in sports[c]	3/25 (12)	0/8 (0)	3/17 (18)

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TABLE 6
Radiologic Outcomes for Rockwood I and II AC Joint Injuries[a]

	Rockwood I (n = 37)				Rockwood II (n = 35)			
	Injured Shoulder	Contralateral Shoulder	*P* Value	MD (95% CI)	Injured Shoulder	Contralateral Shoulder	*P* Value	MD (95% CI)
AC displacement,[b] mm	8.5 ± 3.5	8.2 ± 3.0	.499[c]	0.3 (−0.5 to 1.2)	10.7 ± 4.9	7.8 ± 2.5	.004[c]	2.9 (1.5 to 4.4)
AC joint space,[d] mm	9.8 ± 4.5	7.9 ± 2.3	.036[c]	1.9 (0.5 to 3.5)	10.4 ± 3.4	7.8 ± 2.2	<.001[c]	2.7 (1.4 to 3.9)
Degenerative changes, grade[e]	16 (43)	16 (43)	.511[f]		16 (46)	17 (49)	.864[f]	
I	11 (30)	7 (19)			11 (31)	10 (29)		
II	4 (11)	7 (19)			4 (11)	6 (17)		
III	1 (3)	2 (5)			1 (3)	1 (3)		
IV	0 (0)	0 (0)			0 (0)	0 (0)		
Osteolysis of distal clavicle	9 (24)	0 (0)	<.001[f]		13 (37)	0 (0)	<.001[f]	
Ossification of the ligaments	8 (22)	2 (5)	<.001[f]		13 (37)	3 (9)	<.001[f]	
Deformity of distal clavicle	7 (19)	0 (0)	<.001[f]		7 (20)	0 (0)	<.001[f]	

Comparison of surgical and conservative treatment of Rockwood type-III acromioclavicular dislocation

A meta-analysis

Guolong Tang, MD[a], Yu Zhang, MD[a], Yuan Liu, MD[b], Xiaodong Qin, MD[a], Jun Hu, MD[a,*], Xiang Li, MD[a]

- 10 studies, 649 patients
- 2-20 year followup

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Table 2

Results of the meta-analysis.

Outcome	Studies	Effect size	*P*	Heterogeneity	
				I^2, %	χ^2 (*P*)
Pain	6	0.89 [0.47, 1.67]	.71	0	3.64 (.60)
Weakness	2	1.00 [0.34, 2.91]	1.00	0	0.12 (.72)
Tenderness	2	0.92 [0.18, 4.75]	.92	9	1.10 (.29)
Loss of anatomical reduction	3	0.07 [0.04, 0.13]	<.00001*	0	1.96 (.38)
Post-traumatic arthritis	6	0.80 [0.18, 3.64]	.77	79	23.98 (.0002*)
Coracoclavicular ligaments ossification	6	1.62 [1.01, 2.61]	.05*	5	5.27 (.38)
Osteolysis of the lateral clavicle	5	2.87 [1.27, 6.52]	.01*	44	7.18 (.13)
Restriction of strength	2	1.00 [0.34, 2.89]	1.00	0	0.12 (.73)
Unsatisfactory function (only "poor" or "fair" category)	5	0.74 [0.34, 1.60]	.44	38	6.48 (.17)
Constant score	4	0.00 [−1.47, 1.47]	1.00	41	5.07 (.17)
UCLA score	2	−0.28 [−2.54, 1.99]	.81	57	2.35 (.13)
Imatani score	1	−0.40 [−8.28, 7.48]	.92	NA	NA
SST score	2	−0.27 [−3.61, 3.06]	.87	92	12.67 (.0004*)
DASH score	1	−0.02 [−5.65, 5.61]	.99	NA	NA
Larsen score	1	0.00 [−0.72, 0.72]	1.00	NA	NA
ACJI score	1	15.50 [14.44, 16.56]	<.00001*	NA	NA

- Essentially no clinical outcomes differences

No difference in clinical outcome at 2-year follow-up in patients with type III and V acromioclavicular joint dislocation treated with hook plate or physiotherapy: a randomized controlled trial

Journal of Shoulder and Elbow Surgery

J Shoulder Elbow Surg (2022) 31, 1122–1136

- 121 patients (61 type 3, 60 type 5) randomized to hook plate fixation or PT
  - Nonop tx: 2 weeks in sling, 6 weeks total NWB
  - 61 randomized to nonop, 60 op
- Mean age: 40
- 92% male
- 11/60 patients crossed over from non-operative to operative arm

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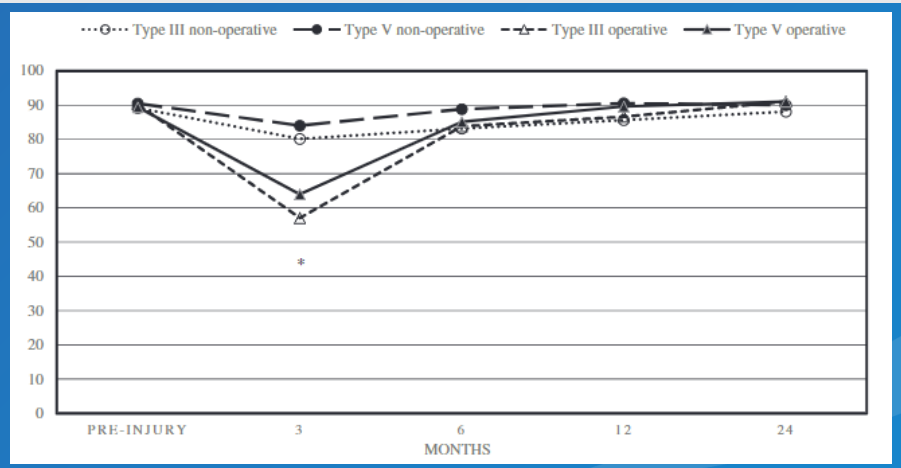
Table III Average Constant scores, measuring clinical function, at different time points

Time point	Rockwood type III		Rockwood type V		*P* value*
	Nonoperative	Operative	Nonoperative	Operative	
Before injury	89.2 (4.7)	90.2 (4.3)	90.5 (4.1)	89.4 (5.8)	.682
3 mo	80.2 (13.3)	57.1 (17.4)	84.1 (11.2)	64.0 (17.9)	<.001†
6 mo	83.2 (12.6)	83.9 (11.8)	88.9 (8.6)	85.1 (7.8)	.158
12 mo	85.7 (10.5)	86.6 (13.3)	90.6 (8.8)	89.6 (6.4)	.188
24 mo	88.1 (11.1)	91.1 (5.9)	90.0 (10.0)	91.0 (5.0)	.477

The Constant score ranges from 0 to 100, in which 100 is the best possible result. Standard deviations are shown in parentheses.

* One-way analysis of variance.

† Significant difference between nonoperative and operative patients (Tukey honestly significant difference test).



Which patients fail conservative tx?

- Emerging consensus in literature does not show an advantage to operative treatment
- Still a question: which patients will not do well with nonoperative treatment?

J Orthop Traumatol (2017) 18:305–318
DOI 10.1007/s10195-017-0452-0

Management of chronic unstable acromioclavicular joint injuries

Luis Natera Cisneros[1,2] · Juan Sarasquete Reiriz[1,3]

- Acute vs. chronic traditionally defined as 3 weeks post-injury
- Trend in literature of better outcomes with acute surgery

J Orthop Traumatol (2017) 18:305–318
DOI 10.1007/s10195-017-0452-0

Management of chronic unstable acromioclavicular joint injuries

Luis Natera Cisneros[1,2] · Juan Sarasquete Reiriz[1,3]

Table 1 Management in the chronic setting versus management in the acute setting

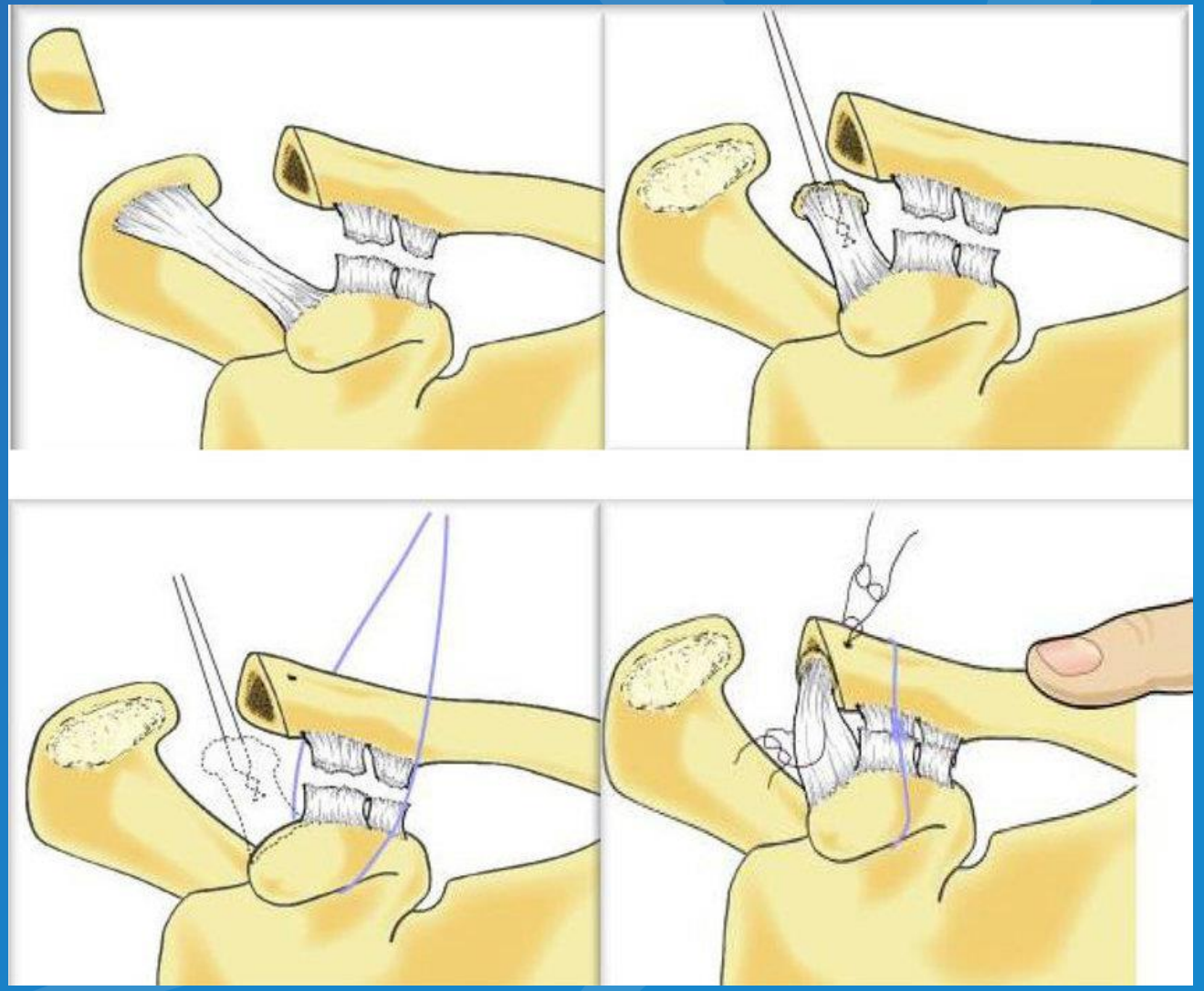
Study	*n*	Type of treatment	Mean follow-up	Results
Weinstein et al. [6]	44	Modified Weaver–Dunn technique in 15/27 acute cases, and in 14/17 chronic cases. The rest of the repairs were performed by means of AC non-absorbable sutures	4 years (range 2–9)	Satisfactory results in 96% of acute cases and 76% of chronic cases. The differences were statistically significant in favor of acute cases
Rolf et al. [11]	49	29 patients using the modified Phemister technique versus a group of patients who underwent surgery after failure of conservative treatment (20 modified Weaver–Dunn)	53 months (range 20–92)	The results were significantly superior in the group of patients managed in the acute phase
von Heideken et al. [12]	37	22 patients treated in the acute phase versus 15 patients treated in the chronic phase. Hook plate in all cases	22 acute patients were re-evaluated at average of 38 months (range 15–96 months) after surgery, and 15 chronic patients were re-evaluated at an average of 36 months (range 18–62) after surgery	The results significantly favored both the clinical and radiological aspects, to the group of patients treated in the acute phase
Mignani et al. [13]	40	25 patients in the acute phase versus 15 patients in the chronic phase. In both groups the management consisted of AC and CC temporary fixations with K-wires	Unknown	Satisfactory results in 100% of patients in the acute group and 93% of patients in the chronic group. No statistically significant differences
Dumontier et al. [14]	56	32 patients in the acute phase versus 24 patients in the chronic phase. All patients were treated by means of CA ligament transposition	Acute group (mean follow-up 46 months) and chronic group (mean follow-up 51 months)	The results were satisfactory in 81% of patients treated in the acute phase and in 79% of patients treated in the chronic phase, with no significant differences

How to treat surgically?

- Many surgical techniques described in the literature

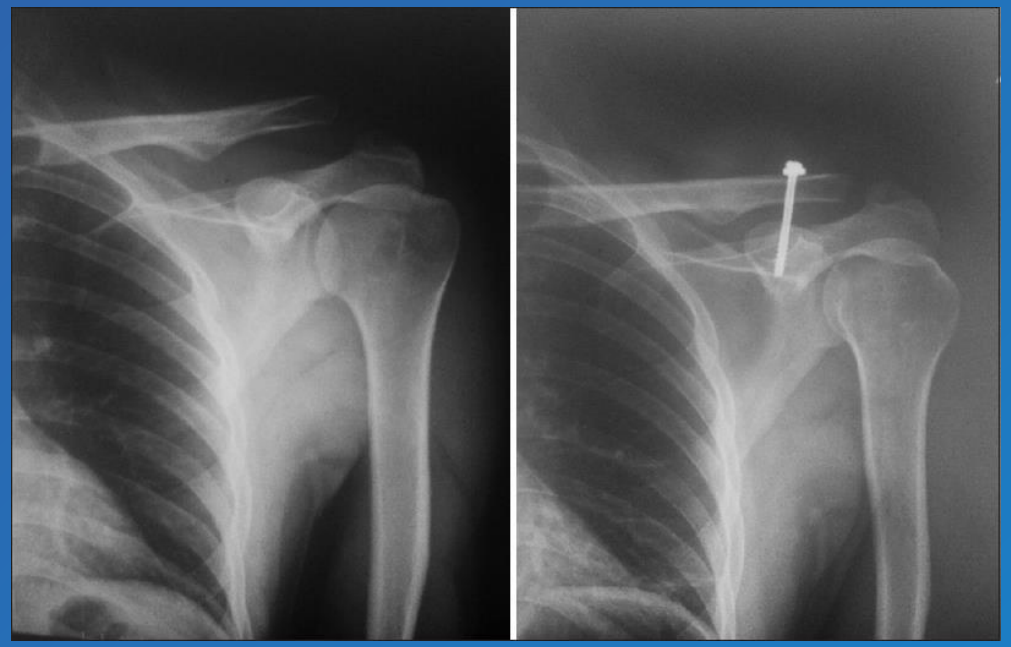
How to treat surgically?

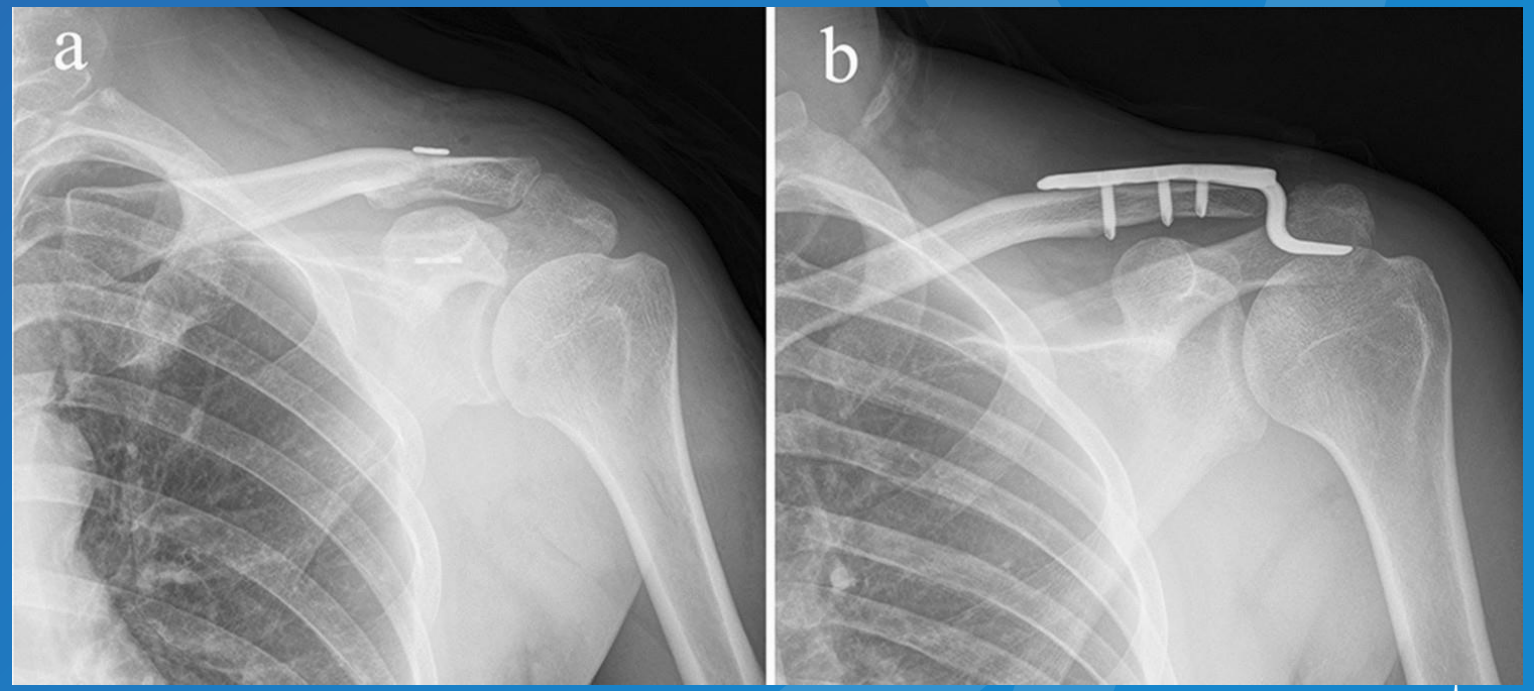
- Weaver-Dunn procedure
  - Transfer of CA ligament to distal clavicle with or without supplementary fixation



How to treat surgically?

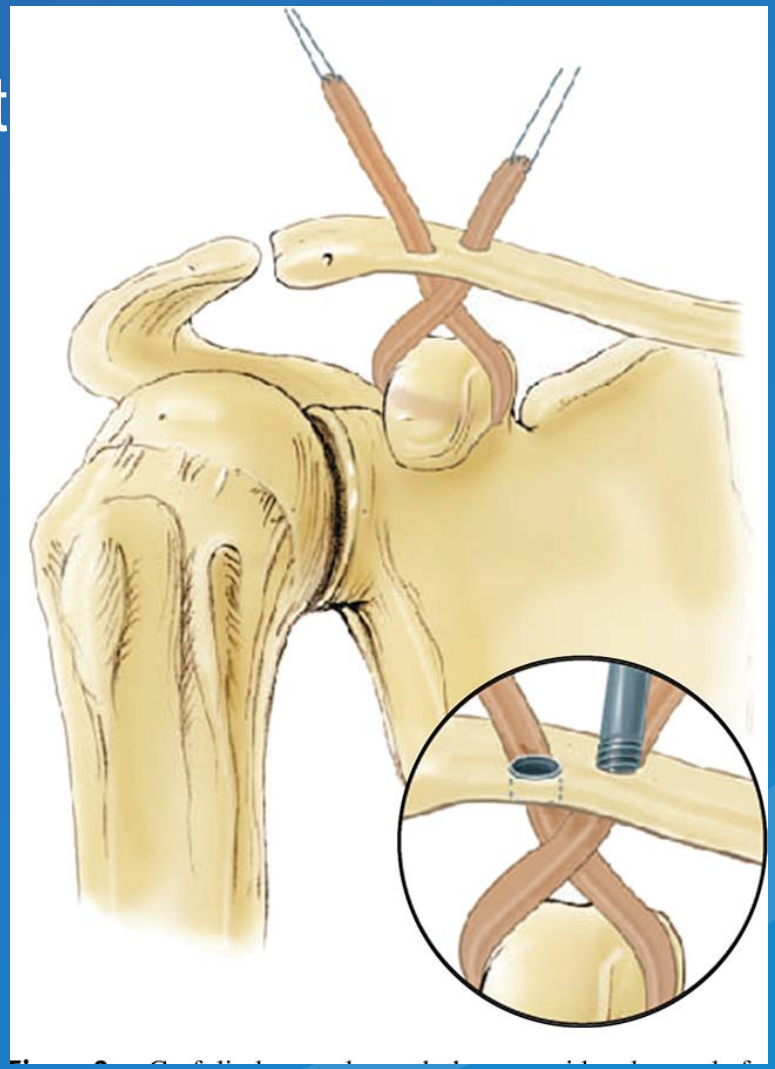
- Internal fixation
  - Hook plate
  - Suture button
  - Screw





How to treat surgically?

- Anatomic CC/AC reconstruct

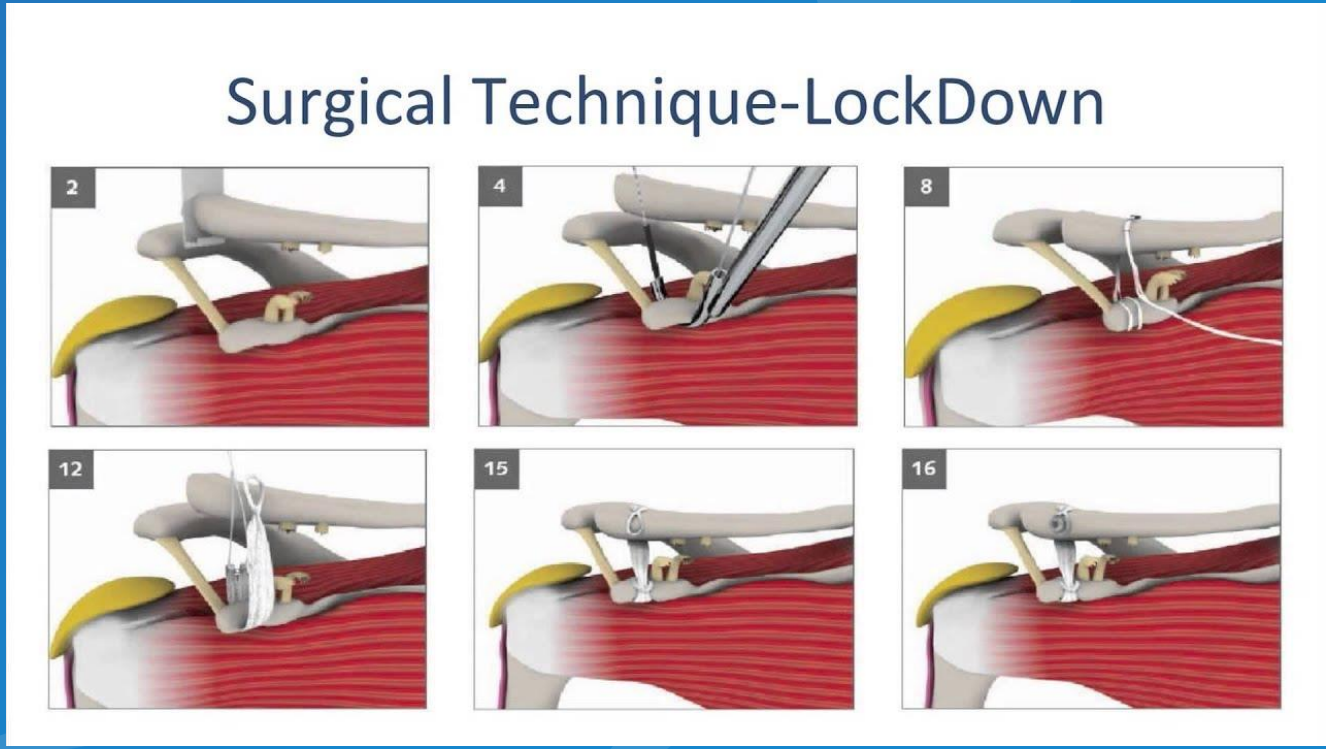


Knee Surgery, Sports Traumatology, Arthroscopy (2021) 29:2237–2248
https://doi.org/10.1007/s00167-020-06059-5

Anatomic reconstruction of the acromioclavicular joint provides the best functional outcomes in the treatment of chronic instability

Giuseppe Sircana[1] · Maristella F. Saccomanno[1] · Fabrizio Mocini[1] · Vincenzo Campana[1] · Piermarco Messinese[1] · Andrea Monteleone[1] · Andrea Salvi[2] · Alessandra Scaini[2] · Almerico Megaro[3] · Giuseppe Milano[2,3]

- Systematic review of 44 studies
- Trend toward:
  - ***Synthetic reconstruction*** (artificial ligaments) vs graft/internal fixation
    - Fewer complications
    - Improved ASES/Constant scores
  - ***Augmentation*** of auto/allograft
  - ***Arthroscopic*** assisted procedure
  - CC+AC recon vs. CC recon
    - No clinically significant differences



Future Directions of Research

- Which patients are at risk of failure of conservative tx?
- How to decide whether to recommend early intervention?
- Is there a dominant surgical intervention?

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Thank You!

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