Acromioclavicular Joint Reconstruction

Presented by Mr Simon Moyes

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Significant increase in number of AC joint reconstruction articles in recent years

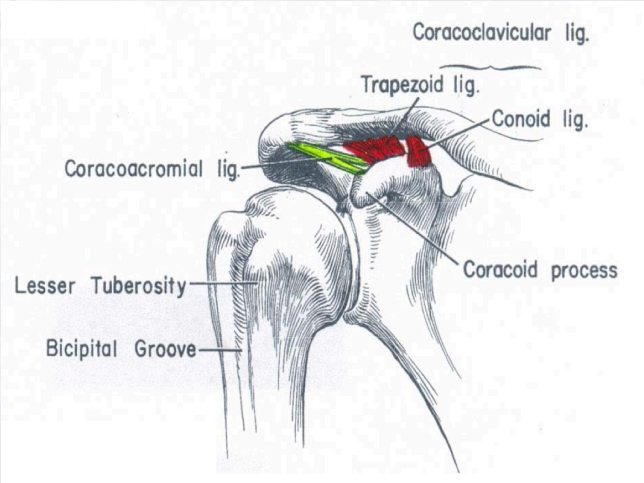
- Nearly 70 described techniques for AC joint reconstruction
- From Weaver Dunn to double bundle “anatomic” reconstructions
- Obviously, we still do not have a “perfect” technique

Today's Plan

- Review the basics
  - Anatomy
  - Classifications
  - Controversies
- Discuss the relevant questions
- Apply some of the literature
- Provide some suggestions
- Tell you what I do

AC Joint Anatomy

- Minimal range of motion at AC joint
- Shoulder girdle suspended by the distal clavicle
- AC ligaments: superior and inferior ligaments:
- Coracoclavicular ligaments:
  - Conoid – posteromedial
  - Trapezoid -anterolateral
- Deltoid and Trapezius fascia



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AC Joint Stability

- Fukuda 1986, AC Joint Biomechanics
  - Horizontal stability by AC ligaments
  - Vertical stability by CC ligaments
  - Fascia of Deltoid & Trapezius dynamic stability
    - Importance increases in presence of AC & CC ligament injury

Mechanism of Injury



Direct blow on point of shoulder

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US Data Shoulder Injuries



- NFL Quarterbacks with 1534 injuries, 1980-2001
- 15% were shoulder injuries
- 40% of shoulder injuries were to AC joint

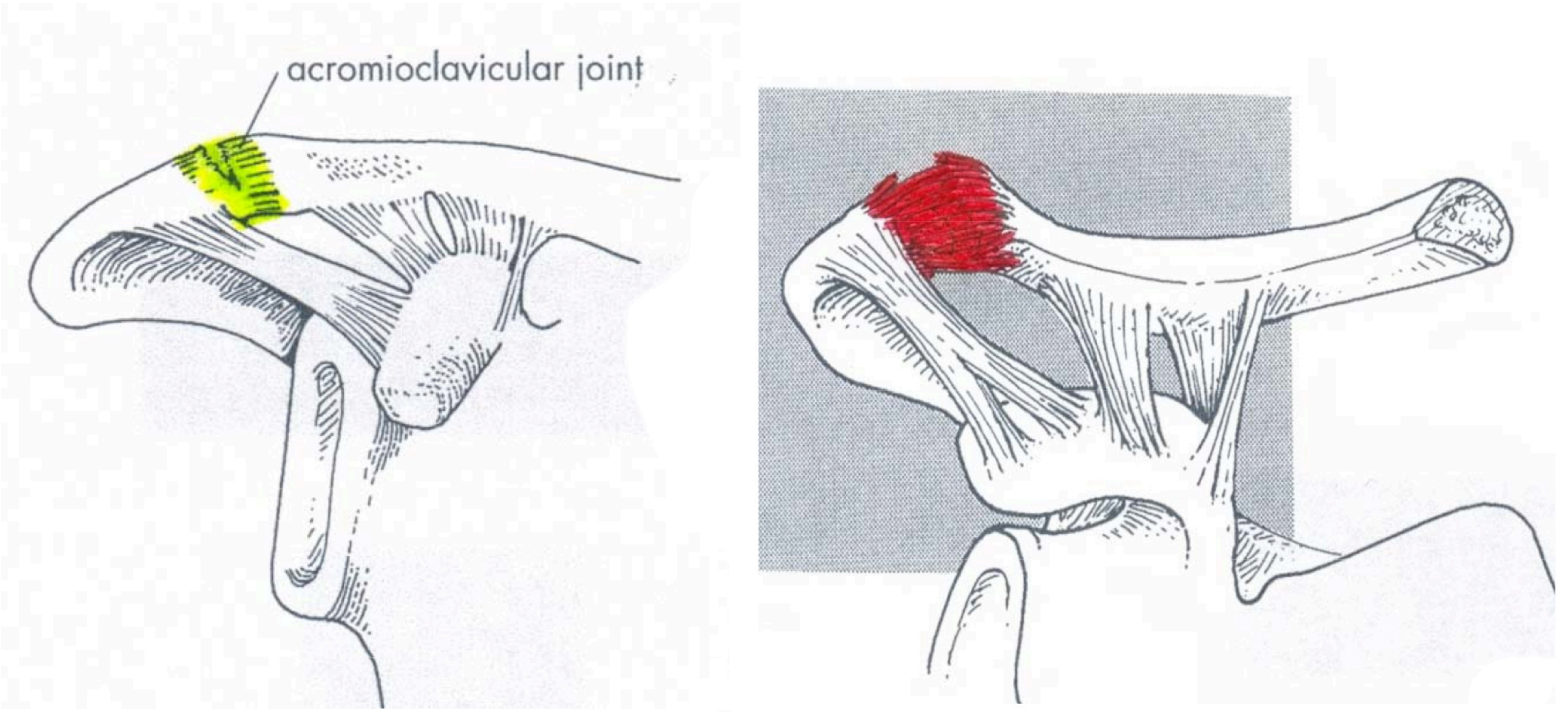
Orthopaedics Dec, 2008

Acute Acromioclavicular Injuries in Adults

Injury Classification

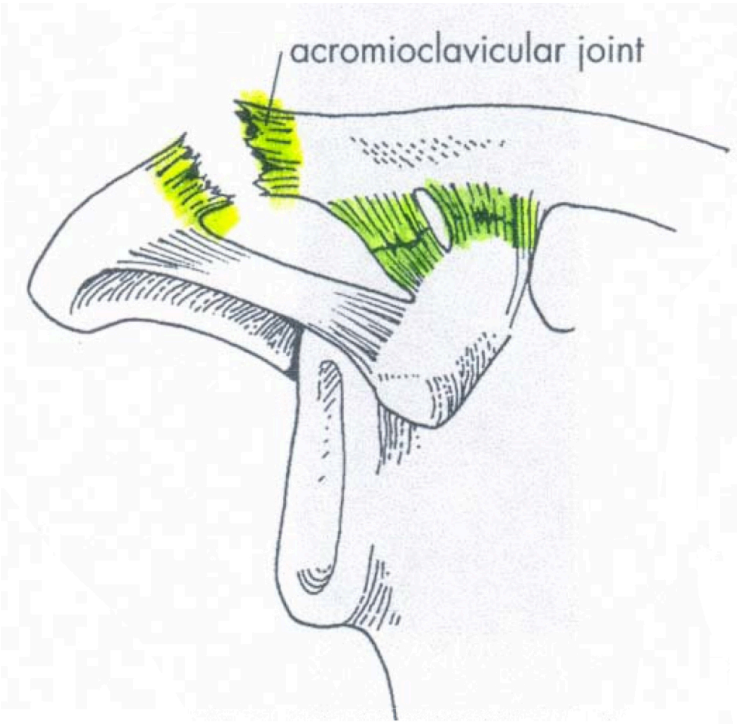
- JD Tossy 1965, Classification with only three types of injuries
- Modified in 1985 by Charles Rockwood to include six types

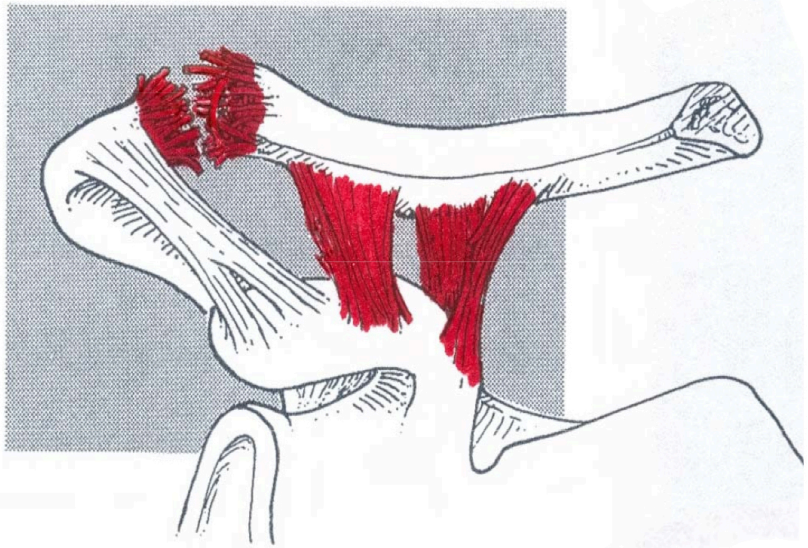
Rockwood Type I



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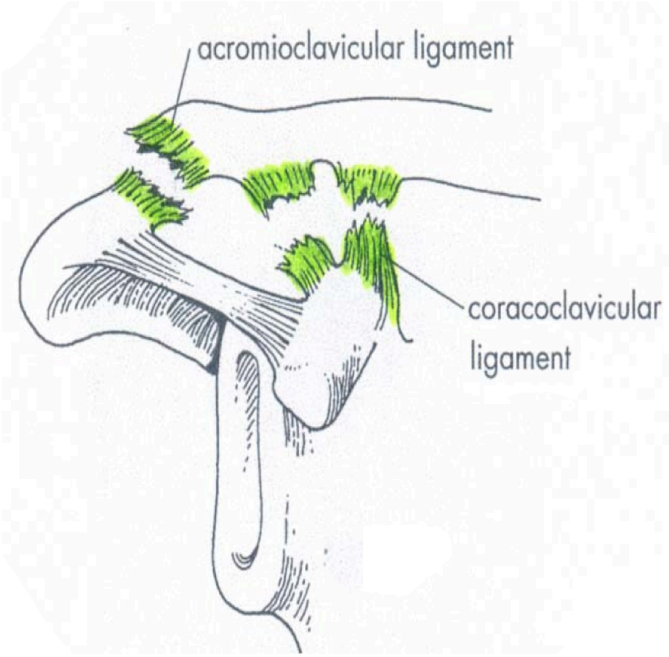
Rockwood Type II

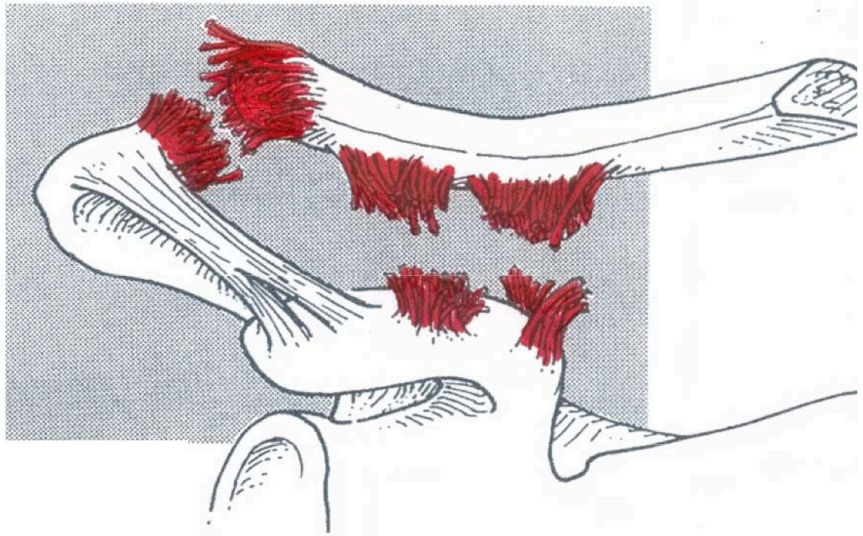




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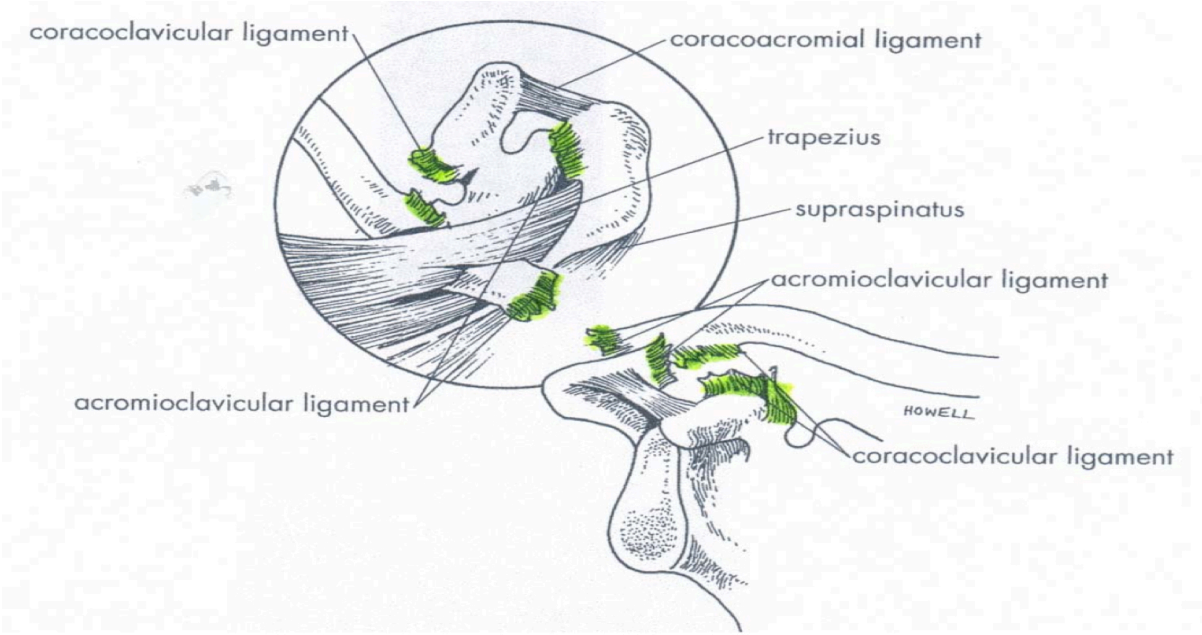
Rockwood Type III





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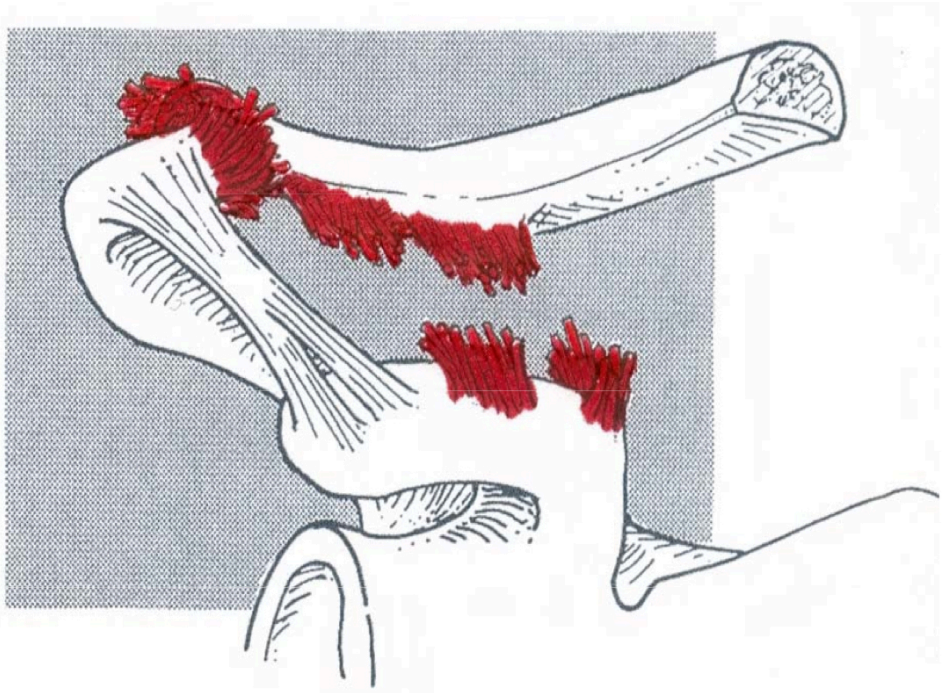
Rockwood Type IV



- In Type IV injuries, the force is directed posteriorly with disruption of all ligamentous restraints as in Type III, but with significant posterior translation and buttonholing through the trapezius fascia.

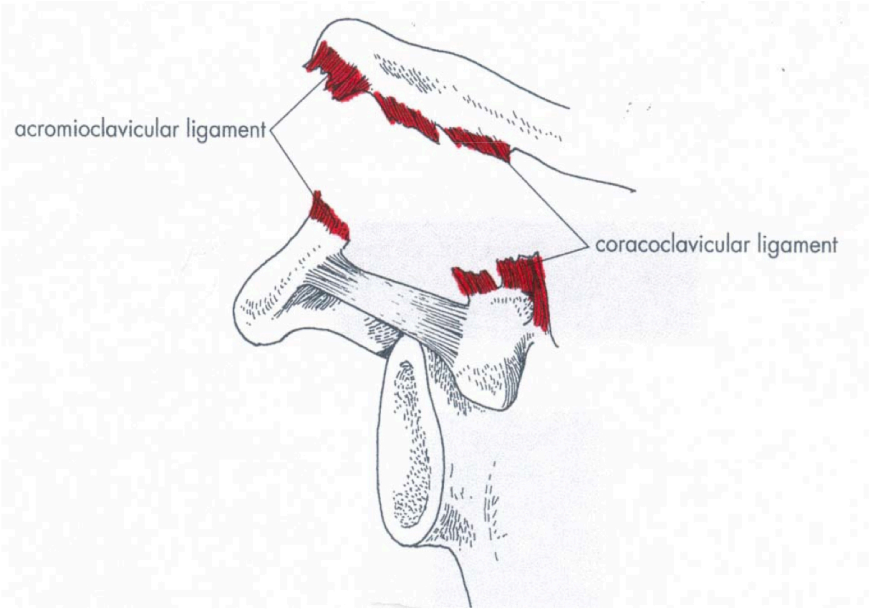
Rockwood Type IV





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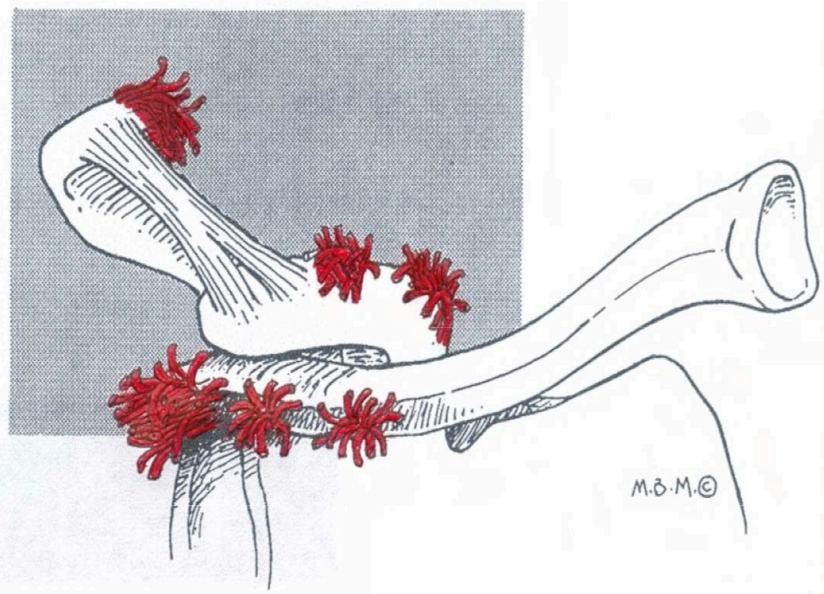
Rockwood Type V

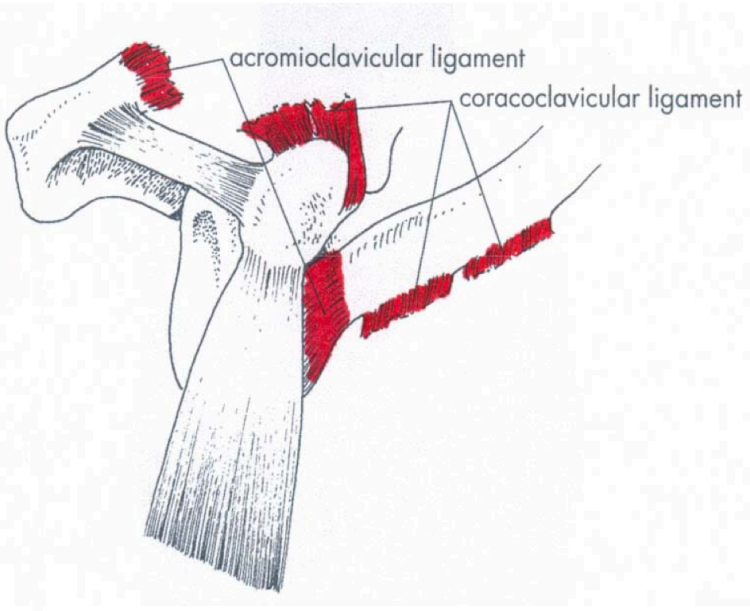


- Type V is described as the “ear tickler” due to the extreme superior displacement, a result of the clavicle buttonholing superiorly through the trapezius fascia. The key is the damage to the delto-trapezial fascia.

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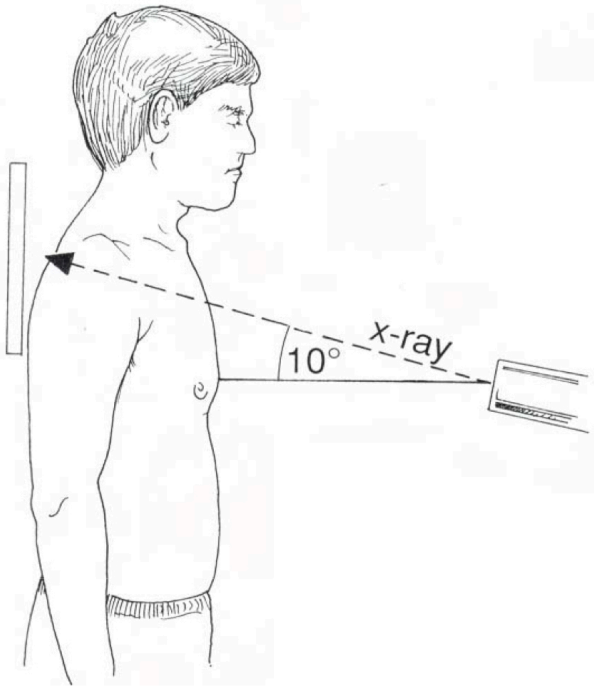
Rockwood Type VI



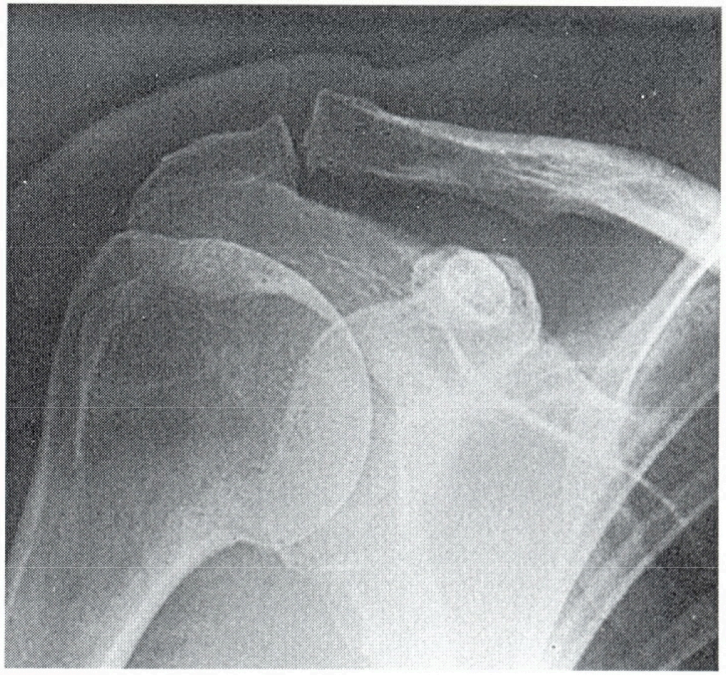


- Type VI injuries are extremely rare, consisting of an inferior dislocation of the clavicle beneath the coracoid.

X ray Evaluation



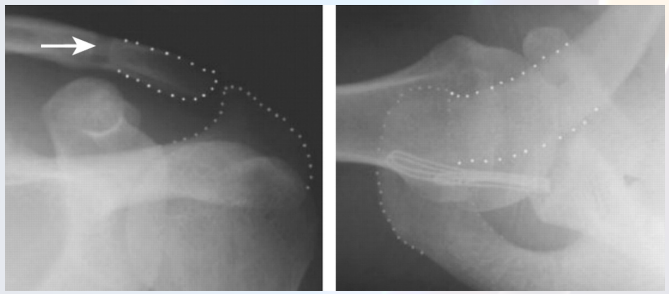
Angle beam up slightly



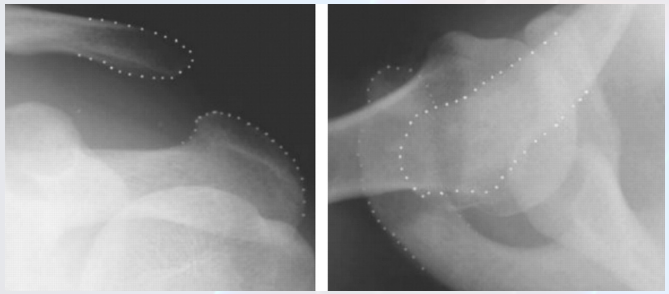
Shoot Up

AC joint dislocations

- Diagnosis:
  - Clinical
  - Radiological (stress views, axillary views, comparison with normal shoulder)









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Surgical Treatment

- Type I - No
- Type II - No
- Type III - Maybe
- Type IV - Yes
- Type V - Yes
- Type VI - Yes

So, one challenge is differentiating grade 3 from 5



- Is the clavicle truly just under the skin?
  - If so, grade 5
- Stress test with bilateral Shoot Up view can help determine grade 5 injury

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Should we operate on Grade 3?

- Certainly the most controversial
- What is a grade 3 and what is a grade 5?
  - Is the difference always obvious?
- Do all grade 3's act the same?
- Can we predict which grade 3's will be a problem?
- What does literature say?

Major studies on Grade 3

Ceccarelli	2008	Review	No difference
Tamaoki	2008	Review	No difference
Phillips	1998	Review	No difference
Larsen	1987	Prospective	No difference
Schlegel	2001	Prospective	20% failure in non-op
Tibone	1992	Retro	No difference

Grade 3

Meta-analysis: 1172 patients

	Surgery	Conservative
Satisfactory Ouctomes	88%	87%
Complications		
Further Surgery	59%	6%
Infection	6%	1%
Deformity	3%	37%
Pain and Function	Equal	Equal

But surgery included the use of Hook plates and Bosworth screws!

Grade 3

- Schlegel:
  - 20% Type III dissatisfied with conservative treatment

So, most do the same either way.

But, if they fail non-operatively.

? Go ahead and fix them once they fail.

Very few studies address that question

- Weinstein AJSM 1995
  - Weaver-Dunn
    - Acute fixation: 96% healed/good & excellent
    - Chronic: 77% healed
- Rolf 2008
  - Compared early vs delayed fixation (varied methods)
    - Early had better constants and fixation
- Cook, Tokish 2014
  - Early fixation showed improved results over delayed

So, maybe some should be fixed early…*but who?*

- Currently that goes to the high demand patient
  - Keen Sportsperson
  - Overhead worker
  - Overhead athlete
  - Weightlifter

More confusion

- Schlegel AOSSM 2005 –15 NFL quarterbacks 12/15 initially treated successfully with non-operative methods
- McFarland AJO 1997 – 16/20 non-operative grade 3 injuries = pain free with nl function.
- Poll – 70% MLB team physicians would initially treat grade 3's non-operative

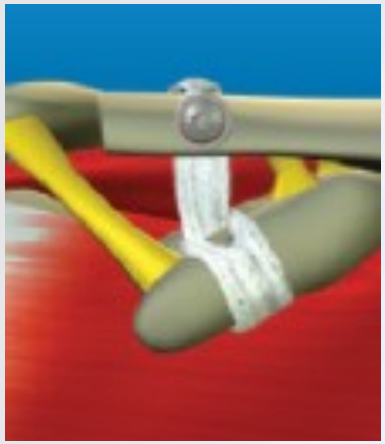
Treatment

- Acute:
  - Age
  - Hand dominance
  - Occupation
  - Hobbies and sport
  - Risks of re-injury
  - CC ligament repair/augmentation
  - Tightrope, surgilig, etc

Playing hurt. How I do it.

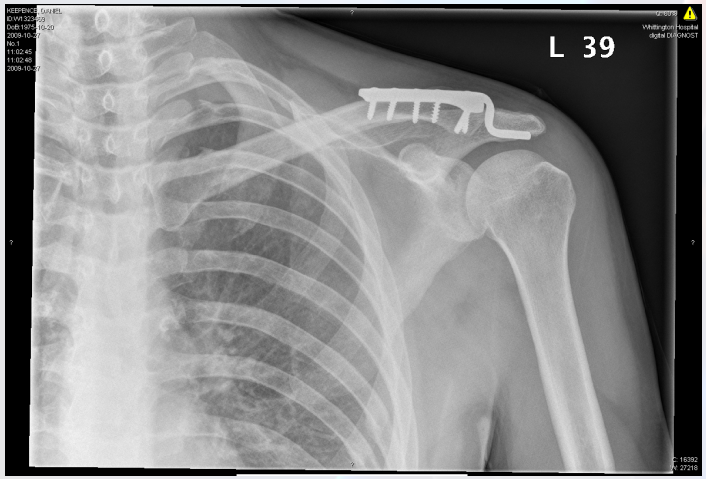
- Donut pad taped on AC joint Anesthetic injection.
- Allow participation if pain is controlled & able to keep well padded. Patient must feel they are able to play
- Start attempting about 7 days post injury and move out as pain persists.

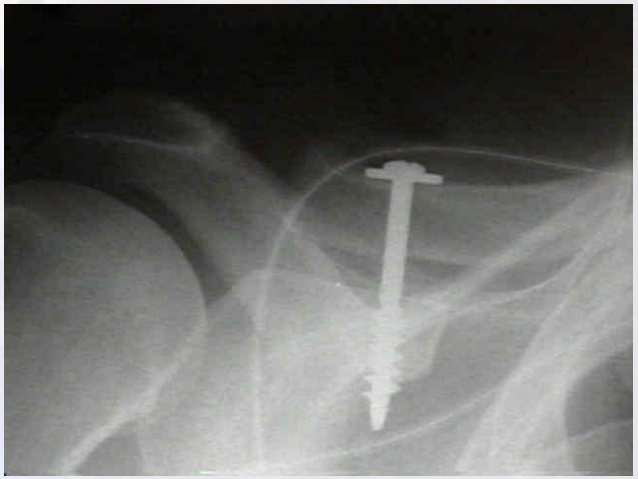
Grade 3 treatment



Acute vs. Chronic







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Fixation Techniques:

Divide into early and delayed:

- Early needs less biologic, just needs reduction and stabilization
- Delayed needs reduction, stabilization, and biologic

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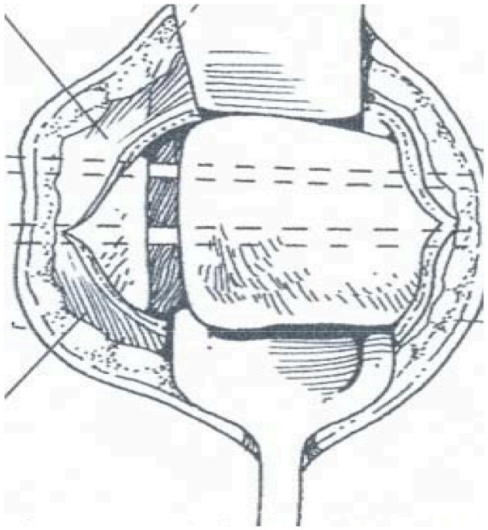
A few historic methods of treatment:

- Percutaneous Pinning
- Bosworth or Rockwood Screw
- Weaver-Dunn
- Modified Weaver-Dunn
- Distal Clavicle Excision

Historic Operative Techniques

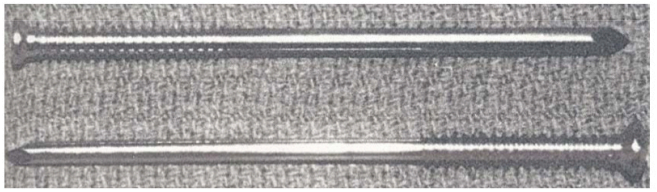
- Percutaneous Pinning
  - Usually with limited arthrotomy
  - K-wires Knowles pins Simmons pins
  - Migration is a problem
  - Breakage is a problem
  - Requires a second procedure for removal
  - Can be combined with ligament repair

Historic Operative Techniques



Open or Percutaneous





Simmons screw

Pin Complications

Migration of a Threaded Steinmann Pin from an Acromioclavicular Joint into the Spinal Canal

A Case Report

BY HORACE NORRELL, JR., M.D.*, AND R. C. LLEWELLYN, M.D.†,
NEW ORLEANS, LOUISIANA

From the Division of Neurosurgery, Tulane University School of Medicine, New Orleans

MIGRATION OF A KIRSCHNER WIRE FROM THE SHOULDER REGION INTO THE LUNG

REPORT OF TWO CASES

BY ROBERT MAZET, JR.

Commander, Medical Corps, United States Naval Reserve

From the Surgical Service of the United States Naval Hospital, National Naval Medical Center, Bethesda, Maryland

Asymptomatic Spinal Canal Migration of Clavicular K-Wire at the Cervicothoracic Junction

SAAD BENNIS, MD; PIETRO SCARONE, MD; JEAN-FRANÇOIS LEPEINTRE, MD; PHILIPPE PUYO, MD; SORIN ALDEA, MD; STEPHAN GAILLARD, MD

abstract

Full article available online at OrthoSuperSite.com/view.asp?rID=32939

Unstable clavicular fractures can be treated surgically with pins and wires or with plates. The migration of metallic devices such as Kirschner wires from the shoulder to a variety of anatomical proximal and distal locations is well documented. A 57-year-old man presented with a neurologically asymptomatic cervicothoracic migration of a K-wire after treatment of a clavicular fracture sustained during a sports accident. Surgical removal of 2 percutaneous K-wires was planned for approximately 4 months later. Radiographs taken preoperatively revealed the migration of one of the K-wires into the spinal canal at the cervicothoracic junction (Figure 1). At that time, the patient was neurologically asymptomatic. Fortuitous detection by radiographic control allowed for prompt surgical treatment without postoperative sequelae. This case is the first asymptomatic spinal migration of a clavicular K-wire described in the literature. It illustrates a rare complication of percutaneous surgical treatment of clavicular fractures with wires. When spinal migration occurs, a precise radiologic study is necessary for surgical removal and to avoid unwanted complications. Using the same path and axis of penetration during removal is necessary to prevent spinal cord damage and subsequent neurological deficits.

Drs Bennis, Scarone, Lepeintre, Aldea, and Gaillard are from the Department of Neurosurgery, and Dr Puyo is from the Department of Thoracic Surgery, Hôpital Foch, Suresnes, France.

Drs Bennis, Scarone, Lepeintre, Puyo, Aldea, and Gaillard have no relevant financial relationships to disclose.

Correspondence should be addressed to: Pietro Scarone, MD, Service de Neurochirurgie, Hôpital Foch, 40 Rue Worth, 92151 Suresnes, France.

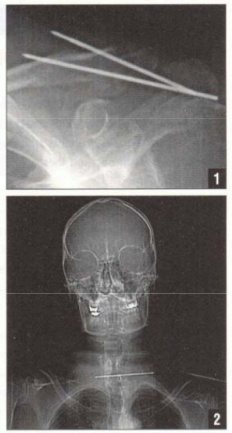


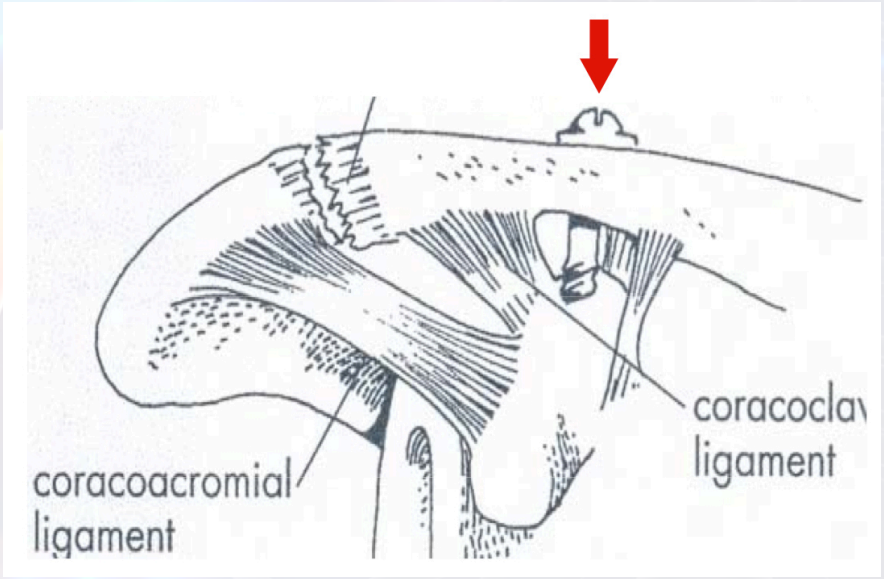
Figure 1: AP radiograph of the shoulder showing the state of the clavicular fracture 3 months postoperatively. **Figure 2:** AP radiograph before surgical removal of K-wire showing migration of the K-wire into the cervical spinal canal at the cervicothoracic junction.

Orthopaedics Dec, 2008

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Historic Operative Techniques

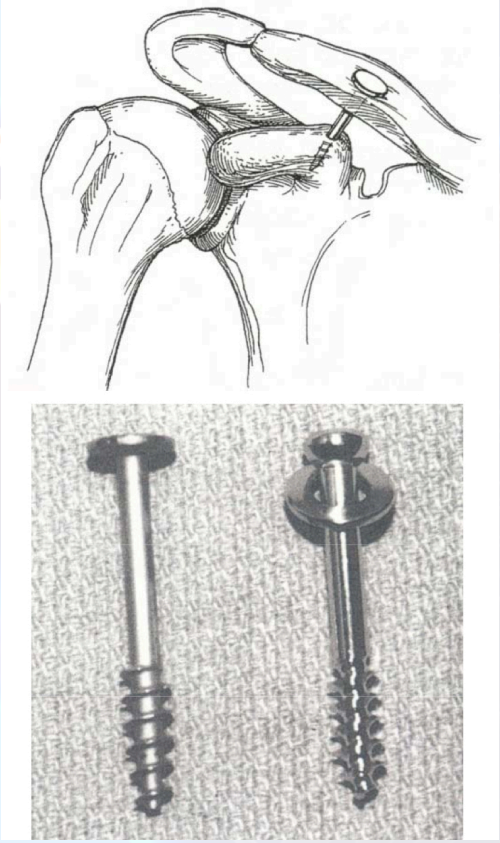
- Bosworth or Rockwood Screw
  - Bosworth or Rockwood Screw
  - Described by Bosworth in 1941 for acute injury
  - No ligament repair, did not open the joint
  - Many modifications since original description



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Bosworth Screw

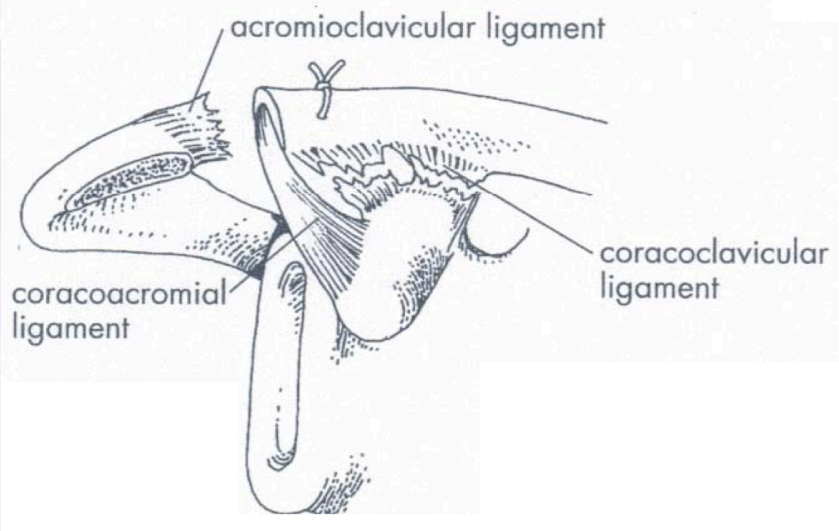
- Screw “too” rigid
- Usually fails by pulling out or breaking
- Most effective for acute injuries with removal at 3 months



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Historic Operative Techniques

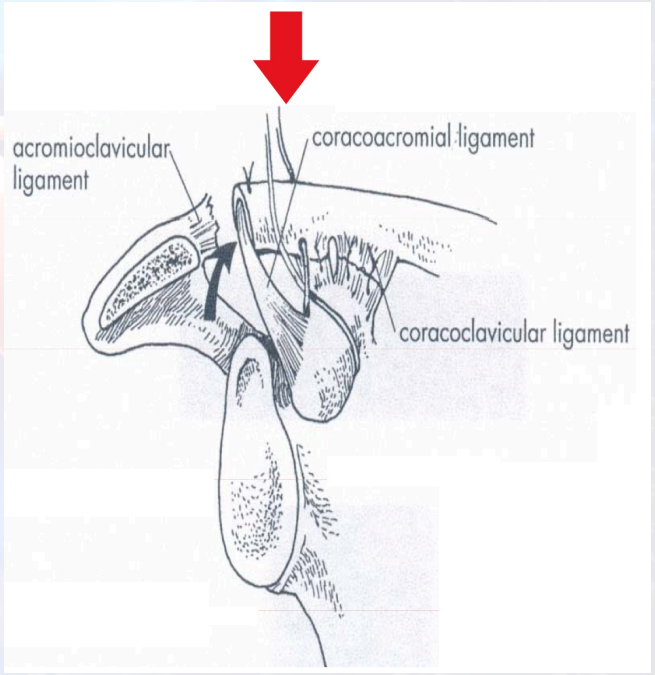
- Weaver-Dunn, 1972
  - Transfer of Coracoacromial ligament
  - Ligament may be thin & weak
  - No other support for shoulder girdle



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Historic Operative Techniques

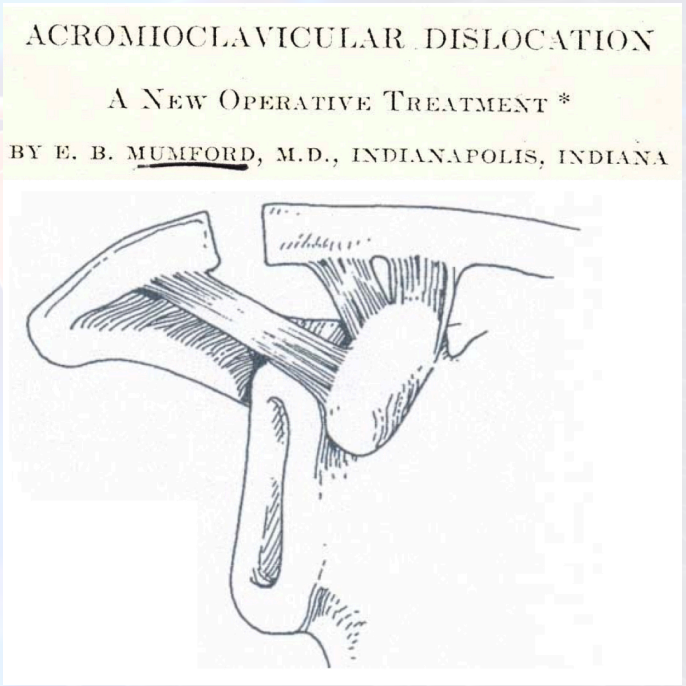
- Modified Weaver-Dunn
  - CA ligament transfer
  - Augmented with cerclage beneath coracoid
    - Braided suture
    - Dacron tape
    - Mercilene tape
  - Repair CC ligaments if acute



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Mumford

- JBJS 1941
- 4 patients
- Type 2, maybe 3
- Sling x 1 week
- Facial sling for patients with “complete” dislocation



ACROMIOCLAVICULAR DISLOCATION

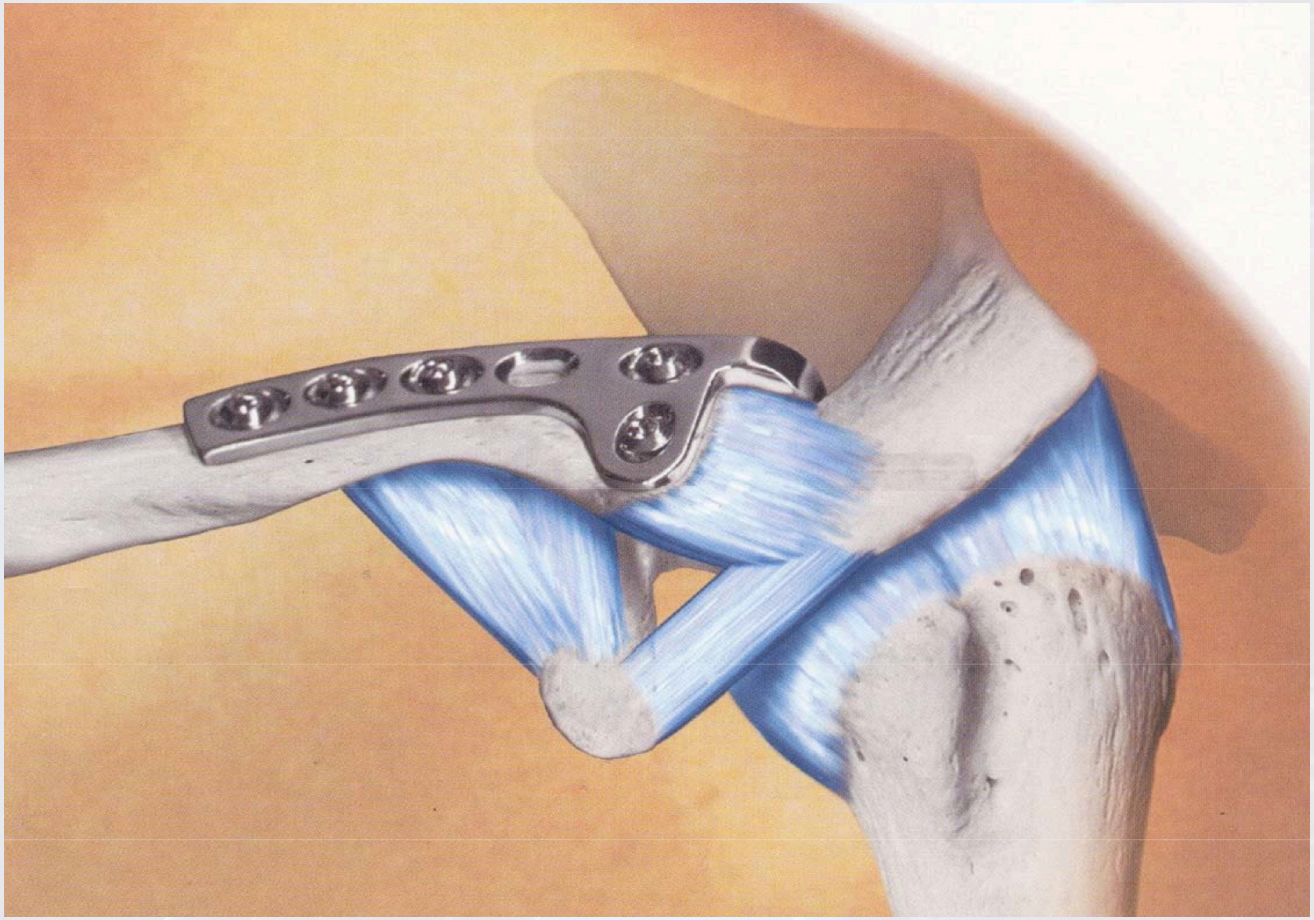
A New Operative Treatment *

BY E. B. MUMFORD, M.D., INDIANAPOLIS, INDIANA

Newer Operative Techniques

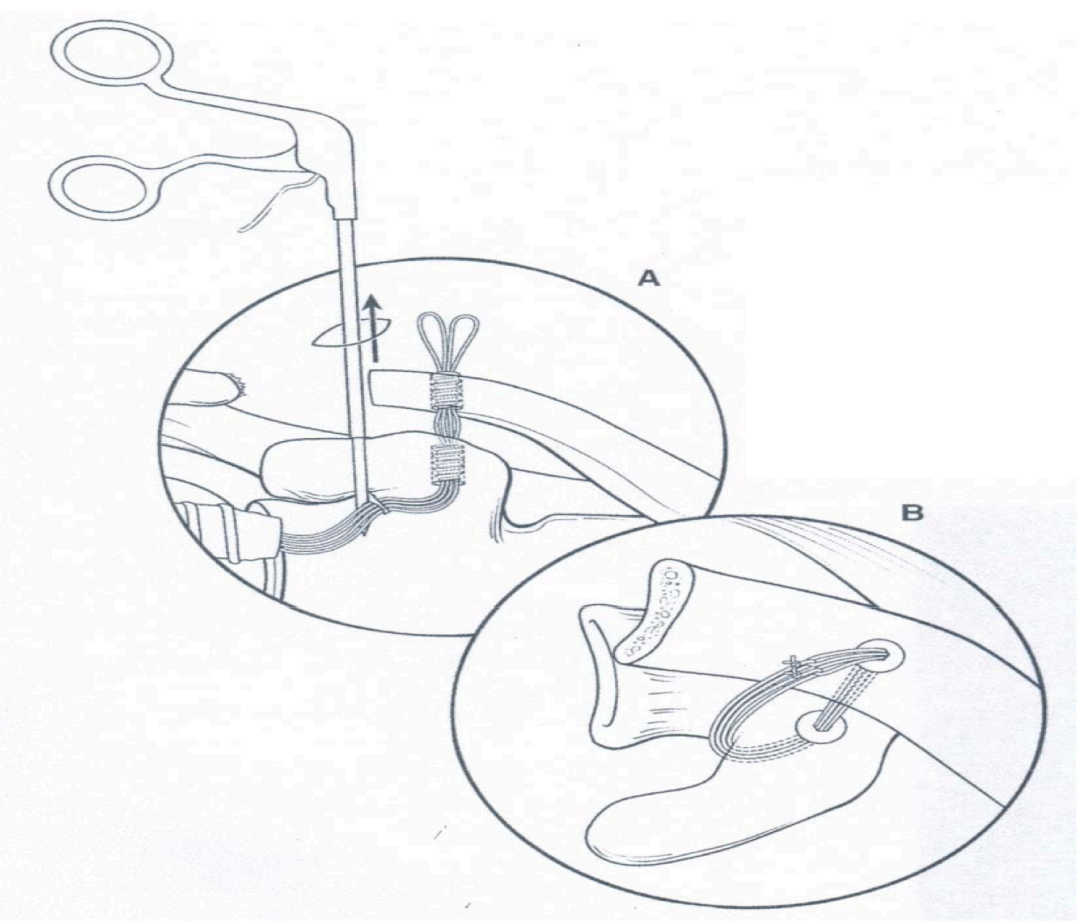
- Plate Techniques
- Initial Arthroscopic Reconstruction Attempts
- Combination Techniques
- Biologic Techniques
- Suture Anchors
- Conjoined Tendon Transfer
- “Tight Rope” (no biologic fixation)
- “Tight Rope” X 2
- Immediate and Long term fixation (anatomic/biologic)
- “Graft Rope” 2008
- Anatomic CoracoClavicular ligament Reconstruction
- (ACCR)

Plate Fixation



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Wolf Arthroscopic Technique 1995



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Fixation Materials

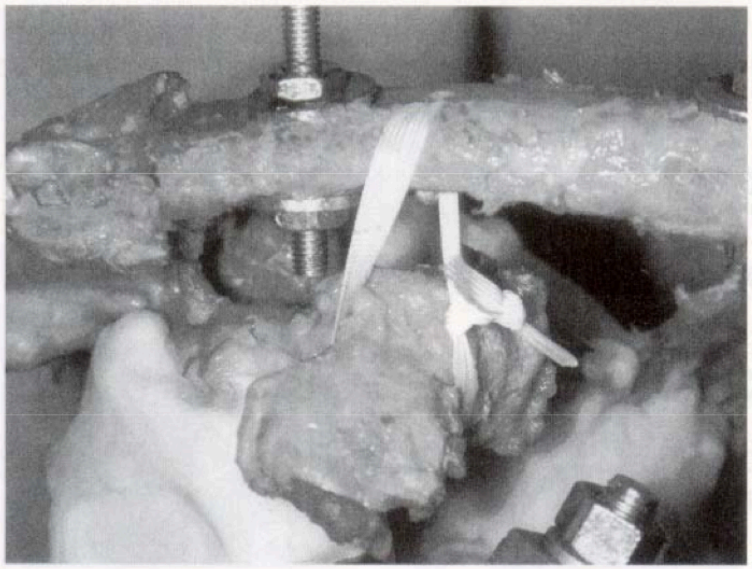


Figure 2. Five-mm Mersilene tape is looped under the coracoid and through a drill hole in the clavicle, then tied on the medial side.

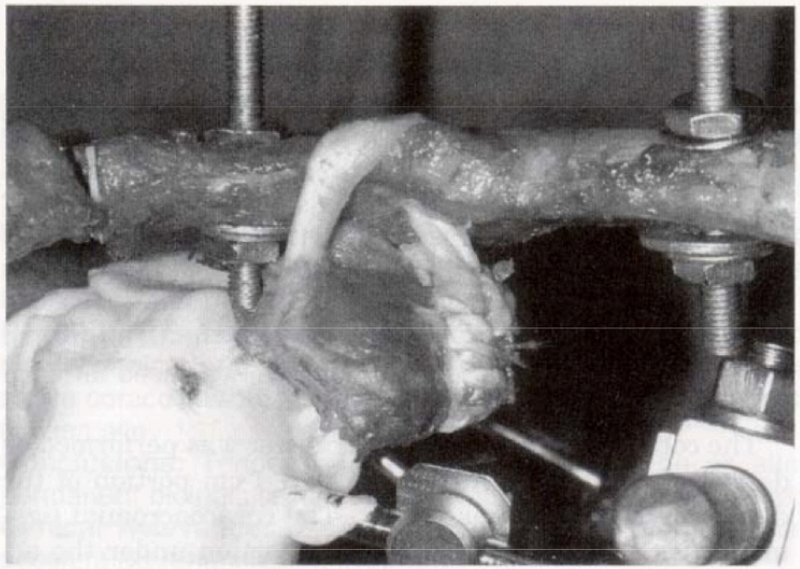


Figure 3. Reconstruction with a gracilis tendon graft. The tendon ends are tied in a knot on the medial side, and supplemental sutures help to secure the knot.

AJSM 2003

Nicholas Sports Med Institute

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Newer Operative Techniques

- Combination Techniques
  - – Using strong initial fixation techniques with newer ultra-strength suture
  - – Combined with biologic auto or allograft tendon placed in an anatomic location to replicate the CC ligaments and provide long-term fixation.

Suture Fixation

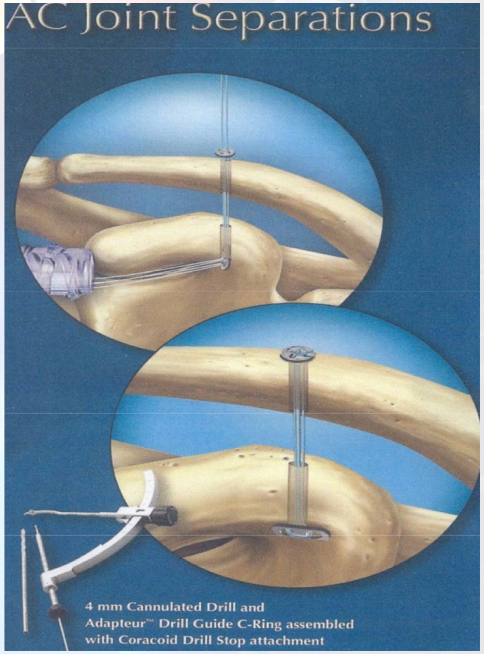
- All non-biologic
- #5 (ultrastrength suture)
- Rectangular button beneath coracoid and round washer above clavicle
- Uses principle of a “come along” hoist to provide power and 2 strands of suture to provide strength

Newer Operative Techniques

(Available from several implant companies)

- Tightrope fixation system

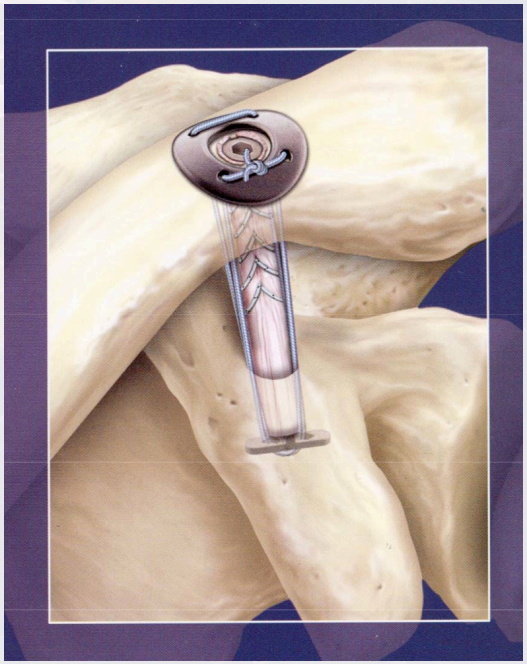




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Suture plus Graft Combination

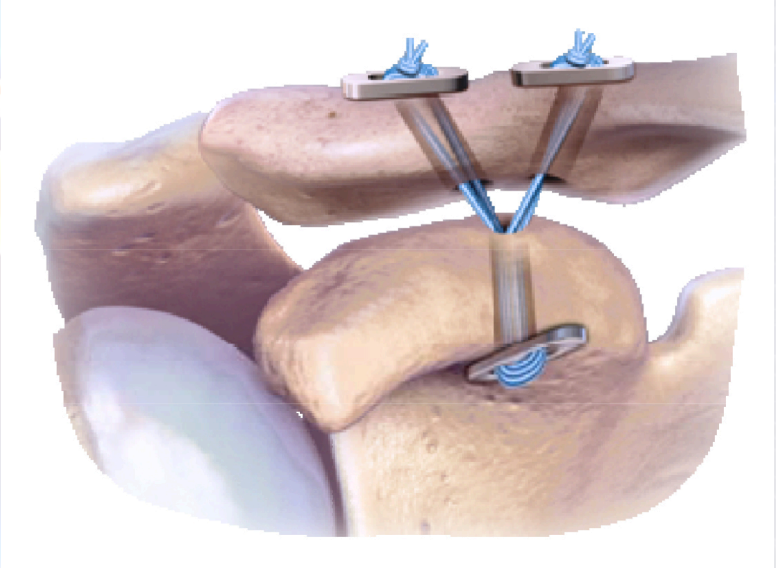
- Combines biologic and non-biologic
- Strong initial fixation using 2 strands #5 fiberwire
- Strong biologic fixation using semitendinosis
- Single clavicular drill hole
- Smaller clavicular incision



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Tight rope twin tail

- Remember that any trans coracoid fixation is anatomic, but is a little scary due to the stress riser in the base of the coracoid and potential fracture



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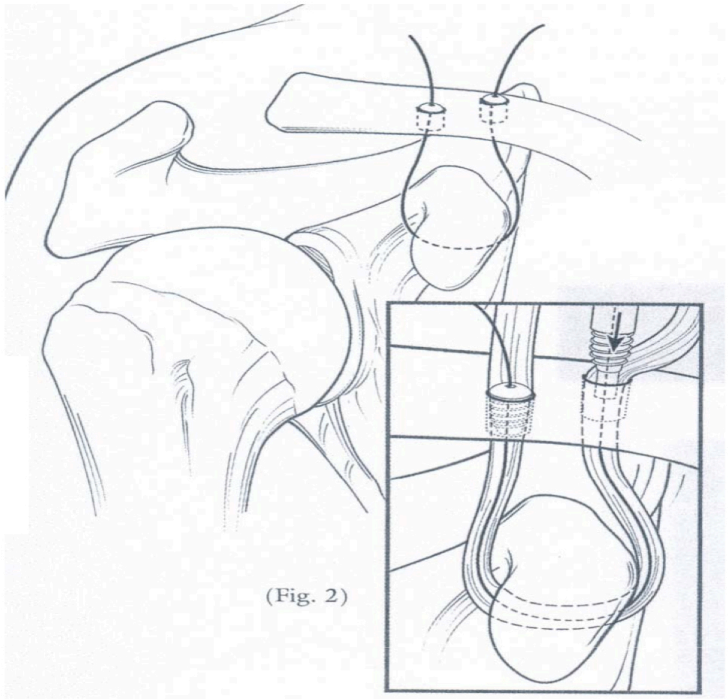
Suture through plus Graft Around Coracoid

- Combines strong non-biologic with biologic
- Reproducible arthroscopic technique
- Moderate learning curve

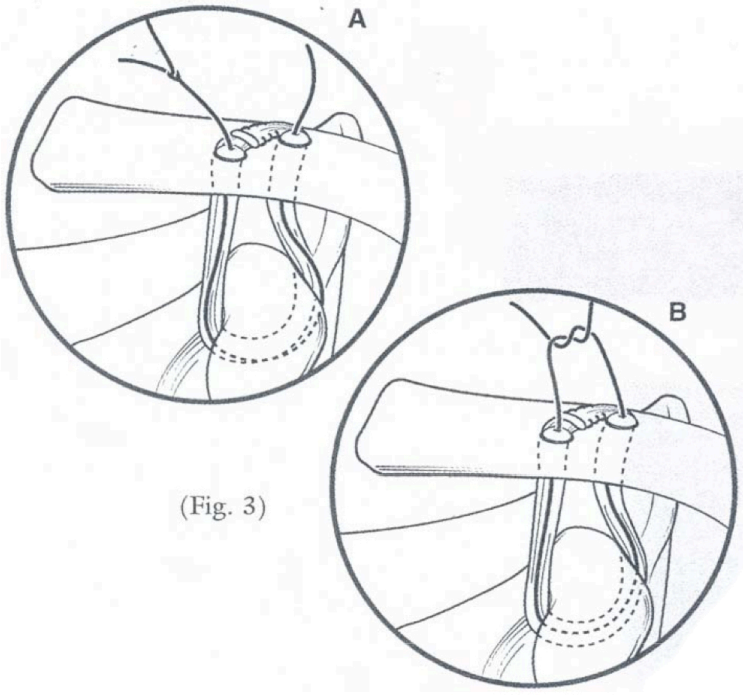
Problems:

- Requires more drill holes in clavicle
  - Stress riser
  - Larger dorsal incision to spread holes

Graft plus Sutures



(Fig. 2)



(Fig. 3)

Current methods for grade 3 over 3 weeks old

- Uses both non biologic and biologic fixation
- Non biologic holds immediately
- Biologic is the long term fixation
- Can use either autograft or allograft
- Can do either fully open or partially arthroscopic



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Post-op

- Sling immobilization for 4 weeks
  - Protecting the biologic fixation
- AROM and AAROM 4-12 weeks
- Strengthening after 12 weeks
- Full contact sports after 4-6 months



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Thank You

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