Superior Suspensory Ligament Complex Reconstruction for Acute and Chronic ACJ Dislocations: The QUASR LARS Technique

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Disclosures

QUASR- Funding from Australian Research Council, QUT, Stryker, Zimmer Biomet, Australian Biotechnologies, Materialise, Akunah

Australian Shoulder Research Fellowship (ASRI) - Funding from Stryker, Zimmer Biomet, Device Technology, Arthrex

AG: Consultant for Zimmer BIOMET, Device Tech, Sironix; Founder and CEO Akunah; hold shares with Tetrous

KI: employee of Akunah

ELSEVIER
JSES International
Volume 9, Issue 1, January 2025, Pages 31-39

Shoulder Trauma/Sports

Superior suspensory complex of the shoulder reconstruction for acute and chronic acromioclavicular joint dislocations: the Queensland Unit for Advanced Shoulder Research 3-tunnel technique

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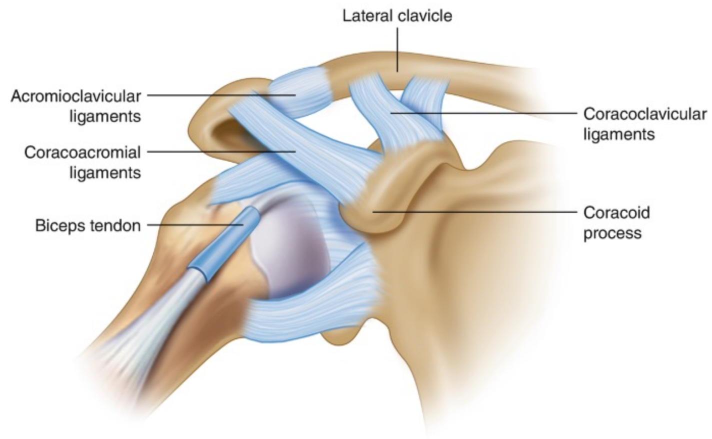
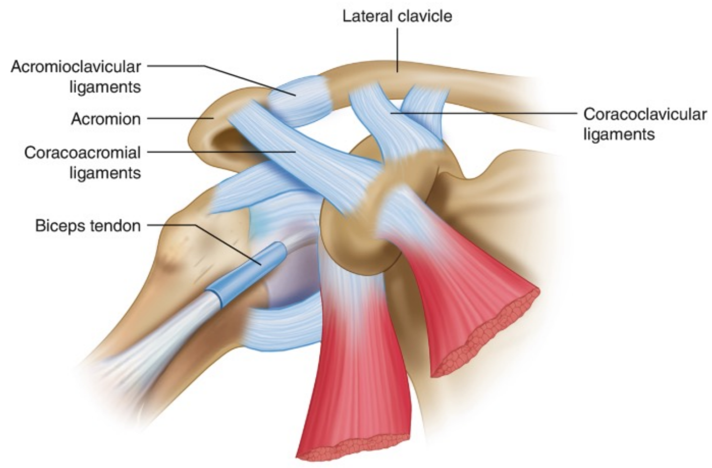
Introduction

- **The ACJ contributes to the superior shoulder suspensory complex (SSSC), a complex ring structure divided into three parts:**
  - (i) the clavicular–coracoclavicular (CC) ligamentous–coracoid link
  - (ii) the clavicular–AC joint–acromial strut
  - (iii) the scapular body junction
- **High grade ACJ injuries** occur within parts (i) and (ii) causing vertical and horizontal instability, respectively.





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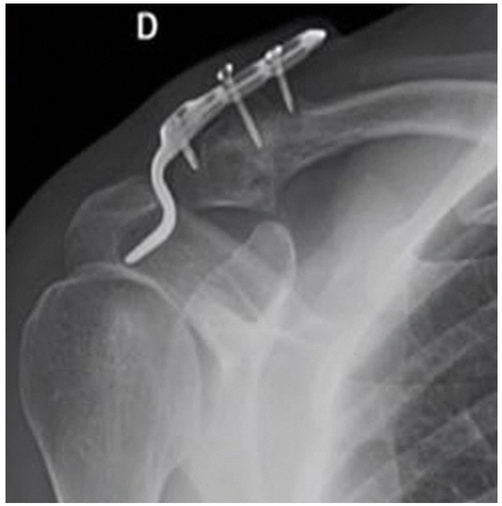
Current Technique Drawbacks

- Failure to maintain adequate joint reduction
- Clavicle fracture through the graft tunnel
- Coracoid base fractures
- Residual horizontal instability in the ACJ



Aim of the Study

To describe the **QUASR 3-Tunnel Technique with LARS artificial ligament**

- reconstructs part (i) and (ii) of the SSSC
- without the use of transtunnel interference screws
- addresses both horizontal and vertical instability

To present the **clinical and radiological outcomes** of this technique

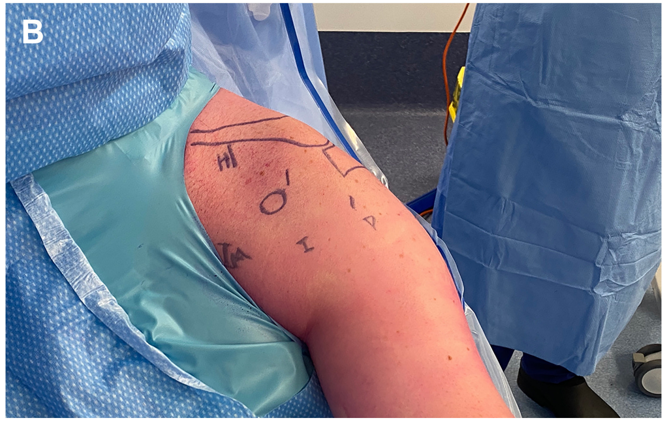
Surgical Technique

Standard shoulder arthroscopy

- Address concomitant intraarticular lesions

Arthroscopic coracoid dissection

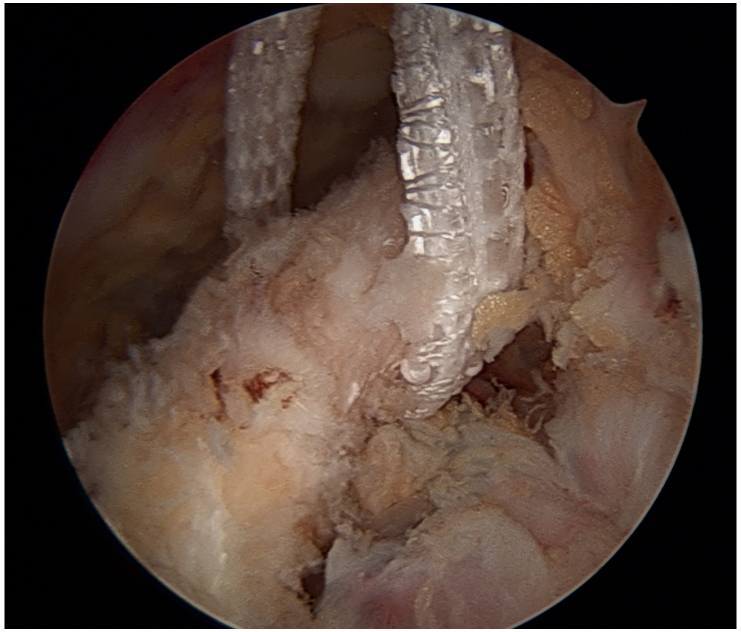
- Coracoid dissected laterally and superiorly (viewing: A portal, working: D portal)
- Clear the medial coracoid soft tissue (viewing: D portal, working: I portal)
- Partial release of the pec minor (viewing: D portal, working: M portal)
    - To safely pass the graft and ensure the brachial plexus is protected
- H portal is created superiorly and adjacent to the anterior border of the clavicle
    - Opened with blunt artery forceps to avoid injury to the superficial tributaries of the cephalic vein



Surgical Technique

Pass LARS ligament under coracoid

- One end introduced through H portal on the undersurface of the lateral coracoid (between subscapularis and conjoint tendon)
- From M portal: ligament is guided under the coracoid and placed proximal to pec minor tendon
- From H portal: ligament is retrieved and pulled out to form a loop around the coracoid



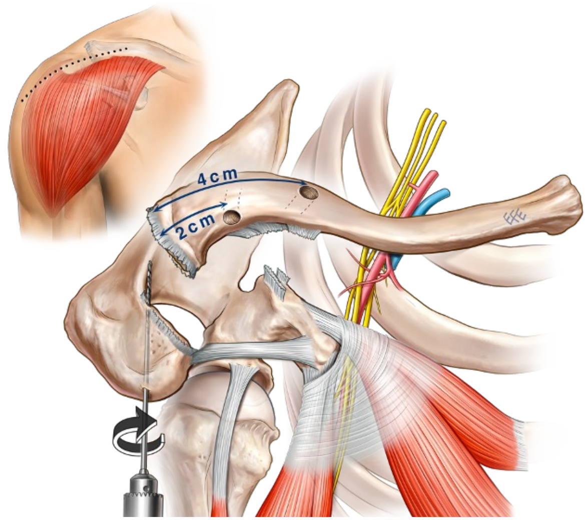
Preparation of ACJ and excision

- Transverse incision 5 cm medial to the AC joint extending to the anterolateral edge of the acromion (following central axis of clavicle)
- Deep dissection: single layer full thickness flaps of the deltoid and trapezius muscles
- Articular disc and 5mm of lateral clavicle are excised to complete the exposure

Surgical Technique

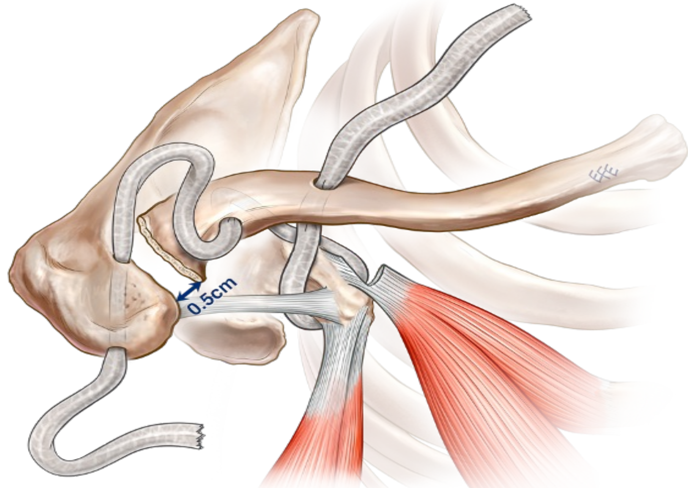
Drilling the tunnels

- **Divergent clavicular tunnels**
  - **Medial (CMed)**: posterior on the clavicle, 4cm from distal clavicle, directed anterior and lateral
  - **Lateral (CLat)**: anterior on the clavicle, 2cm from distal clavicle, directed posterior and medial
- **Acromioclavicular tunnel (Acr)**
  - One 3.5mm tunnel drilled from anterolateral tip of the acromion directed to the posteromedial border of the AC joint



Pass the graft

- Medial limb of graft is brought laterally through Clat and lateral limb brought medially through Cmed
- Anterolateral limb from Clat is shuttled from posterior to anterior through Acr



Surgical Technique

Reduction of the AC Joint

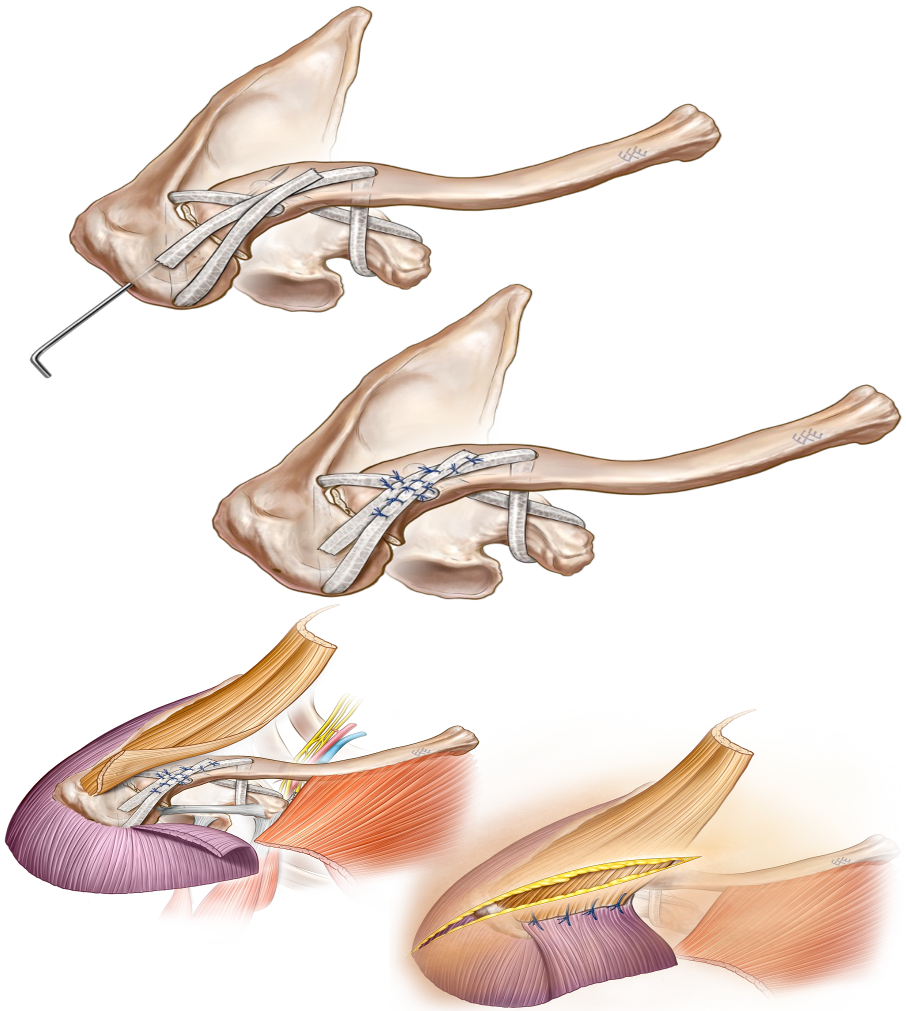
- Reduction is temporarily held by K-wire inserted from lateral to medial transfixing the AC joint

Secure the graft

- Ligament ends are crisscrossed over the top of the clavicle under tension and repaired with a 2-0 FiberWire

Closure

- K-wire is removed, maintenance of ACJ reduction is visually checked
- **Do not over-reduce:** LARS construct has no elasticity, over-reduction may result in reduced forward elevation post operatively
- **Delto-trapezial fascia:** tightened, double-breasted to compensate for capsule redundancy
- ***Critical step***



Methods

- Patients with injuries to SSSC who underwent the QUASR 3-Tunnel Technique with LARS artificial ligament (July 2016 to October 2022)
- Single subspecialist shoulder surgeon
- **Outcomes**
  - **Patient-reported outcome measures (PROMs):** VAS, ASES, Constant score, UCLA, SST, SACS
  - **Bilateral strength testing** (lateral elevation)
  - **Routine AP radiograph of the clavicle postoperatively** (to evaluate CC distance)
- **Time points:** preop, 3,6, 12, 24, 36, 48, 60 months

Table I. Demographic characteristics of the study cohort

Age at time of surgery, median; range (years)	**45; 15–69**
Gender	
Male, N (%)	23 (88%)
Female, N (%)	3 (12%)
Dominant side affected	
Yes, N (%)	15 (58%)
No, N (%)	11 (42%)
Injury type	
Rockwood Type III, N (%)	7 (27%)
Rockwood Type IV, N (%)	3 (12%)
Rockwood Type V, N (%)	10 (38%)
Clavicle fracture with CC disruption	6 (23%)
Duration from injury to surgery in days median; (range); mean ± SD	102; (2-4553); 656 ± 1247
Acute within 4 weeks, N (%)	7 (27%)
Chronic after 4 weeks, N (%)	19 (73%)
Mode of Injury	
Cycling, N (%)	8 (31%)
Contact sport, N (%)	7 (27%)
Motor vehicle accident, N (%)	5 (19%)
Fall, N (%)	4 (15%)
Surfing/Snowboarding, N (%)	2 (8%)

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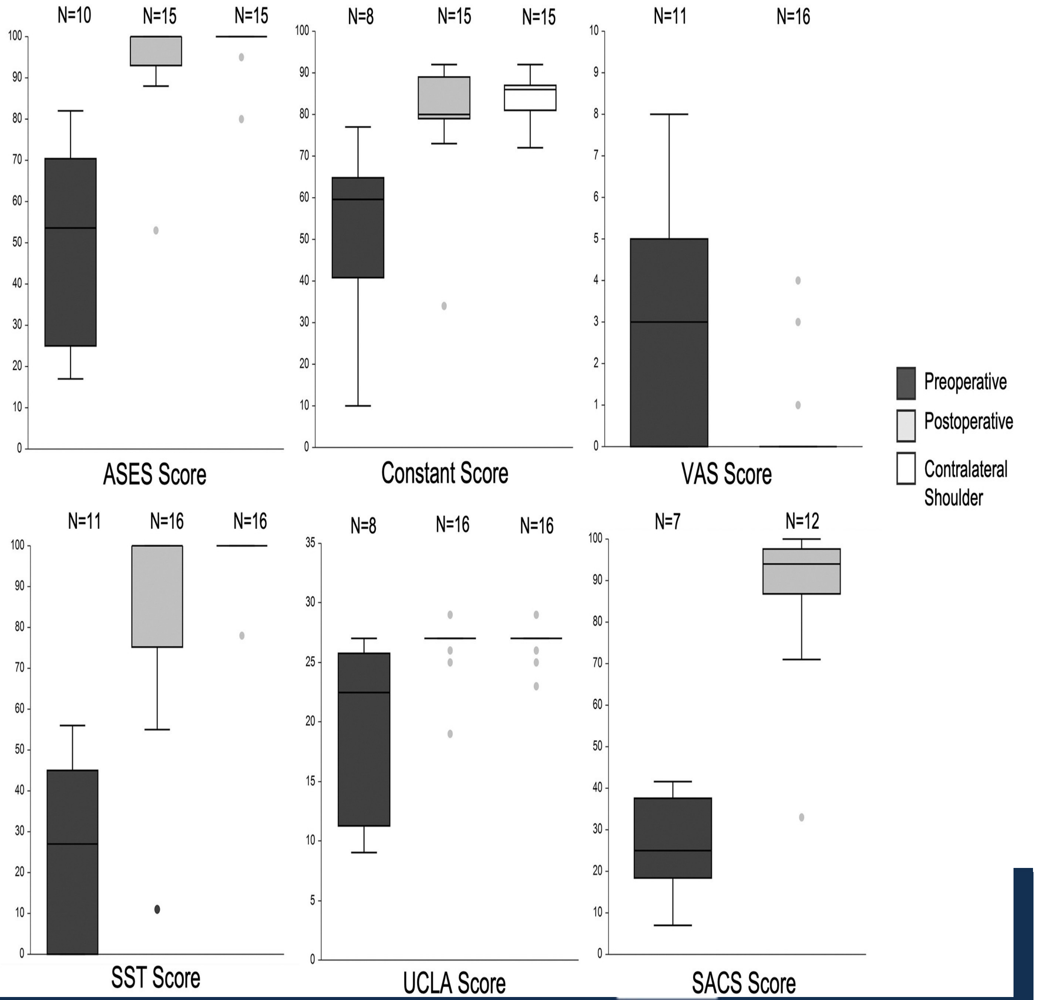
Results

- **26 patients**
- **Mean follow-up:** 23 months (6-65)
- **All functional outcome scores** improved postoperatively and similar to uninjured shoulder

Table IV. Comparison between preoperative and postoperative outcome scores.

	Preoperative			Postoperative		
	n	Mean (SD)	95%CI	n	Mean (SD)	95%CI
VAS	11	2.73 (0.76)	1.03, 4.43	16	0.50 (0.30)	-0.15, 1.15
Constant	8	53.00 (7.36)	35.59, 70.41	15	79.47 (3.34)	71.87, 87.07
SST	11	25.09 (6.25)	11.17, 39.01	16	85.44 (6.15)	72.34, 98.54
ASES	10	50.30 (6.99)	34.48, 66.12	15	94.60 (3.15)	87.85, 101.35
UCLA	6	19.38 (2.63)	13.17, 25.58	16	26.44 (0.53)	25.30, 27.57
SACS	7	27.07 (4.63)	15.75, 38.39	12	87.38 (5.45)	75.38, 99.37

Preoperative, postoperative and contralateral clinical outcome scores

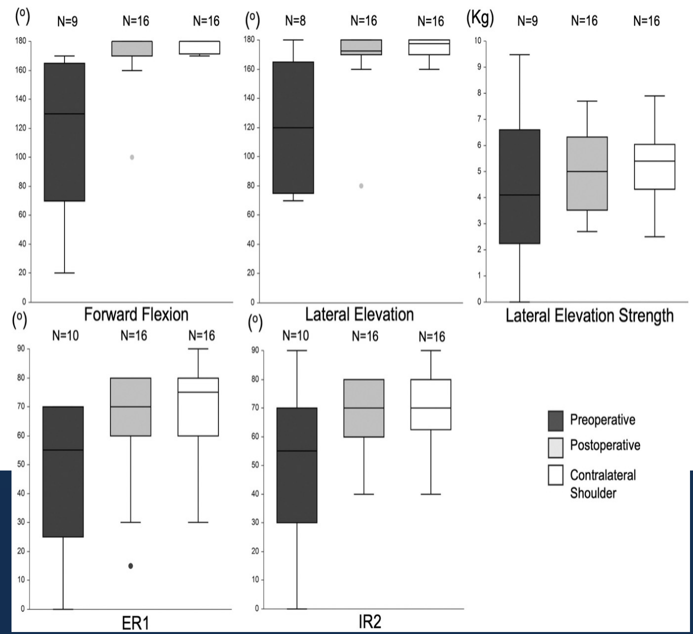


Results

- **All range of motion and strength** improved postoperatively and similar to uninjured shoulder
- **Physical examination:** vertically and horizontally stable during full ROM
- **Radiographic outcomes:**
  - Average postop CC distance: 10.9mm (4.8-15.8)
  - No tunnel widening, osteolysis or additional fracture
- **Complications**
  - Infection (2), loss of reduction (2), stiffness (1), asymptomatic clavicle fracture nonunion (1)

Table IV. Comparison between preoperative and postoperative outcome scores.

	Preoperative			Postoperative		
	n	**Mean (SD)**	**95%CI**	**n**	**Mean (SD)**	**95%CI**
Range of motion						
FF	9	114.44 (17.96)	73.03, 155.86	16	171.56 (4.99)	160.92, 182.21
LE	8	121.25 (15.29)	85.10, 157.40	16	168.44 (6.08)	155.47, 181.41
ER1	10	47.00 (8.03)	28.82, 65.18	16	65.63 (4.76)	55.47, 75.78
IR2	10	52.00 (8.27)	33.28, 70.72	16	69.06 (2.89)	62.89, 75.23
LE Strength	9	4.43 (0.96)	2.21, 6.65	16	5.07 (0.40)	4.22, 5.92



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Advantages

- Avoids interference screws and coracoid drilling
- Smaller tunnels reduce the risk of fracture
- Securing the LARS ligament to itself and in a side-to-side fashion shares the load within the construct.
- The LARS ligament is stiff, therefore loss of reduction by creep relaxation is unlikely.
- Arthroscopic passage and positioning of the LARS ligament around the coracoid ensures that the surrounding neurovascular structures are visualized and protected.
- Allows intraarticular pathologies to be addressed
- Can be used in both acute and chronic cases, in lateral clavicle fractures, and in revision cases

Limitations

- Small sample size
- Statistical comparisons could not be performed due to small sample size
- Follow-up was attempted in all patients up to five years, however due to the transitory nature of the young and working population, with few ongoing issues requiring a review after the early postoperative period, and the COVID pandemic, face to face clinical follow-up was challenging.
- Non-standardized pre and postoperative X-rays and contralateral imaging

Conclusion

- The QUASR 3-Tunnel Technique with LARS artificial ligament is a safe and efficient technique for both acute and chronic AC joint reconstructions, lateral clavicle fractures with CC disruption and complex revision cases, with favourable outcomes at mid-term follow-up.

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