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Point Counter Point: Lesser Tuberosity Osteotomy

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Current Solutions in Shoulder and Elbow Surgery
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I have something to disclose.

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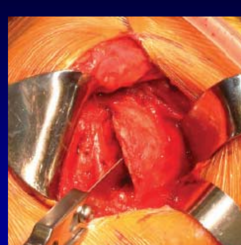
Subscapularis Repair after TSA

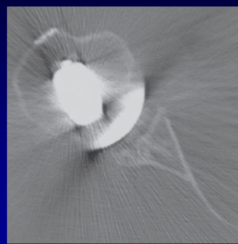
- Subscapularis dysfunction often observed after TSA using standard tendon repair techniques:
  - Abnormal belly-press test as high as 67%
- Gerber et al, JBJS 2005: Use of LTO in TSA
  - 39 pts, mean 39 mo follow-up
  - LTO healed anatomically in all (CT/radiographs)
  - Abnormal belly-press test in 11%



Miller et al, JSES 2003; Armstrong et al, JSES 2006; Gerber et al, JBJS 2005

Subscapularis Repair after TSA

- Potential benefits of lesser tuberosity osteotomy:
  - Anatomic repair technique
  - Bone-to-bone healing
  - More durable repair & function over time
  - Increased surgical exposure
- Evidence for biomechanical difference?
- Evidence for clinical difference?



Gerber et al, JBJS 2005; Gerber et al, JBJS 2006

LTO: Biomechanical Evidence

- Schrock et al, Clin Biomech 2016: Meta-analysis of cadaveric studies
  - All studies comparing biomechanical strength of subscapularis repair techniques evaluated.
  - 5 studies identified comparing subscapularis tenotomy (n=29) vs. LTO (n=46):
    - Load to failure significantly higher in LTO group (443 ± 231 N vs. 350 ± 113 N, p = 0.047).
    - Average cyclic displacement not significantly different (2.1 ± 1.6 mm vs. 1.7 ± 1.3 mm, p = 0.34)

LTO: Biomechanical Evidence

- Ponce et al, JBJS 2005: Biomechanical comparison of subscapularis peel vs. tenotomy vs. LTO
  - 9 cadaveric specimens per group, same number of sutures per repair technique.

TABLE I Results of Biomechanical Testing

Repair	Cyclic Displacement* *(mm)*	Difference Compared with Lesser Tuberosity Osteotomy Repair†	Maximum Load to Failure* *(N)*	Difference Compared with Lesser Tuberosity Osteotomy Repair†
Lesser tuberosity osteotomy	0.88 ± 0.54		738 ± 261	
Transosseous	2.11 ± 1.41	p = 0.02	506 ± 175	p = 0.04
Soft-tissue	2.72 ± 1.24	p = 0.0009	334 ± 88	p = 0.0004

*The values are given as the mean and standard deviation. †Both p values are significant.

LTO: Clinical Evidence

- Miller et al, JSES 2003: Subscap function after tenotomy
  - 41 cases, mean f/u 1.9 yrs.
  - Abnormal belly-press test: 24/36 (66.6%).
  - 68.3% (28/41) reported difficulty tucking in shirt in back of pants.
- Qureshi et al, JSES 2008: Subscap function after LTO
  - 30 cases, mean f/u 1.1 yrs.
  - All osteotomies healed.
  - Abnormal belly-press test: 12/30 (40%).
  - 16.7% (5/30) reported difficulty tucking in shirt in back of pants.

LTO: Clinical Evidence

- Scalise et al, JBJS 2010: Comparison of subscapularis peel to LTO for TSA
  - 35 shoulders evaluated during change over in repair technique: peel (n=15) to LTO (n=20)
    - Mean follow-up 33 months.
  - LTO group significantly higher Penn Score (92 ± 11 vs. 81 ± 20, p = 0.04).
  - LTO group significantly less abnormal US (2/20 vs. 7/15, p = 0.01), and all had bony union.
    - Abnormal US associated with worse functional result.

LTO: Clinical Evidence

- Buckley et al, JSES 2014: Comparison of subscapularis peel to LTO for TSA
  - Retrospective comparison of peel (n=32) to LTO (n=28) done by 2 surgeons.
    - Minimum 1 year follow-up.
  - No significant difference in belly-press and bear-hug.
  - LTO group significantly higher WOOS (91.5 ± 10.2 vs. 82.1 ± 18.9, p = 0.05).
  - LTO group less abnormal US (4/32 vs. 0/28, p = 0.12), but not significant.
    - Abnormal US associated with worse functional result.

LTO: Clinical Evidence

- Lapner et al, JBJS 2012: Level I, RCT of subscapularis peel vs. LTO for TSA
  - Randomized to peel (n=44) vs. LTO (n=43).
    - 83% returned for 2 year follow-up.
  - No significant differences between groups in all measured outcomes:
    - Subscapularis strength (1^{o} outcome)
    - WOOS, ASES
    - Healing rates, subscap fatty infiltration by CT (Lapner et al, JSES 2013)

Conclusions from Literature

- Overall, studies suggest potential biomechanical and clinical benefit of LTO:
  - Only Level I study show no significant differences
  - Data still limited with varying repair techniques, rehabilitation protocols, outcomes measures
- Studies unable to assess quality of healing: Failure-with-continuity shown in tendon-bone RTC healing
  - Clinical series suggest imperfect healing may occur:
    - Imaging and functional assessments do not consistently correlate
    - Increased fatty infiltration occurs postoperatively
  - Future work needed to better understand these differences

Baring et al, JSES 2011; McCarron et al, AJSM 2013

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