"Together, We Can Go Further"
KSES 2026
The 33rd Annual International Congress of the Korean Shoulder and Elbow Society
March 27(Fri) ~ 28(Sat), 2026
BEXCO, Busan, Korea

- Abstract No. : F-0140
- Category : Shoulder
- Detail Category : Rotator cuff

Biomechanical Evaluation of Lower Trapezius Transfer in Anterosuperior Rotator Cuff Tears

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Introduction and Background

This study aimed to evaluate the biomechanical effects of lower trapezius transfer (LTT) in massive anterosuperior (AS) rotator cuff (RC) tears with AS instability, a condition traditionally considered an indication for latissimus dorsi transfer (LDT).

Material and Method

Eight cadaveric shoulders (79.1±10.1 years) were tested using a custom-designed dynamic shoulder testing system (Fig 1). The RC, LD, and pectoralis major were statically loaded, whereas the three deltoid fibers were dynamically pulled by real-time actuators to reproduce physiologic arm elevation. Seven conditions were tested: (1) intact; (2) complete supraspinatus tear with upper-half subscapularis tear (Yoo and Rhee type III); (3) complete supraspinatus and subscapularis tear (type IV); (4) LTT with 7N; (5) LTT with 14N; (6) LDT with 7N; and (7) LDT with 14N (Fig 2). Maximal abduction angle (MAA), humeral head instability, cumulative deltoid force (CDF), and subacromial contact pressure (SCP) were recorded for each condition.

Results

The MAA progressively decreased with increasing severity of AS tear (intact: 90.5±1.6°, type III: 64.7±21.7°, type IV: 53.9±31.3°; $P<0.05$). LTT restored the MAA similar to the intact state (LTT 7N: 83.2±12.4°; LTT 14N: 84.5 ± 10.4°; $P>0.5$), whereas LDT did not (LDT 7N: 56.4±25.3°; LDT 14N: 59.3±17.7°; $P<0.02$). Instability was present in all specimens with large AS tears. Stability was restored in 5 of 8 specimen after LTT with 7N but in only 1 of 8 after LDT with 7N, even though insignificant ($P=0.119$). With 14N, stability was restored in 7 of 8 after LTT and in 4 of 8 after LDT ($P=0.282$). When normal biomechanics were not restored, instability persisted and CDF and SCP did not show meaningful trends.

Conclusions

In this cadaveric biomechanical study, LTT showed superior restoration of arm elevation and improved stability compared with LDT in massive anterosuperior RC tears, indicating a more favorable recovery of overall shoulder function.

Figure & Table 1.

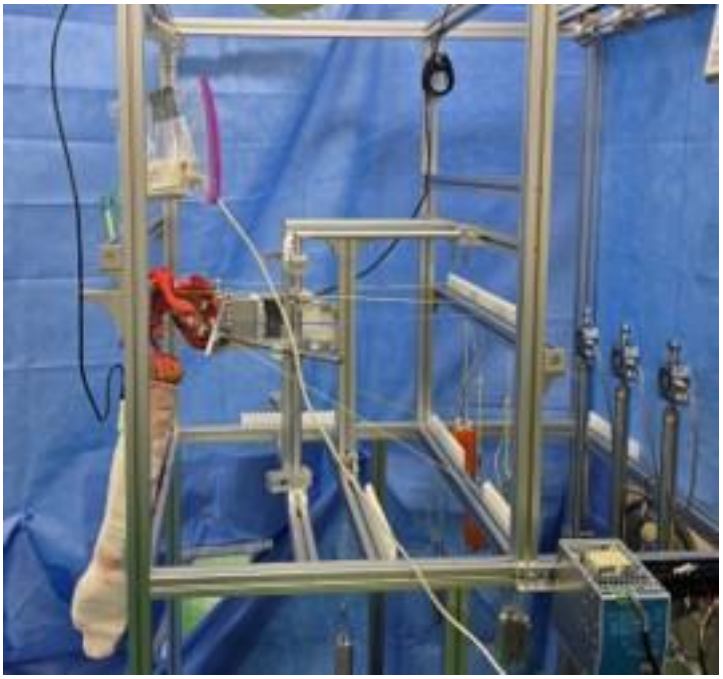

Figure & Table 2.