INTRODUCTION

The rotator cuff represents one of the key dynamic stabilizers of the glenohumeral joint, functioning to maintain appropriate glenohumeral contact via a force couple mechanism. Injury to the rotator cuff which compromises this protective function, often resulting in an ‘unbalanced shoulder’ that experiences increases in glenohumeral force loads, potentially predisposing to degeneration and arthritis. Studies have demonstrated high-tension repairs to result, and repair of larger lesions to result in less favorable clinical outcomes. Recent biomechanical data has demonstrated the presence of a rotator cuff tear to correlate with increased incidence of glenohumeral degeneration. The ability of rotator cuff repair to restore glenohumeral force loads to a baseline ‘unjured’ level remains largely unknown.

HYPOTHESIS

Reapproximation of larger rotator cuff lesions will result in increased force-loading about the glenohumeral joint, even following anatomic reapproximation of a lesion.

MATERIALS AND METHODS

Transduction mapping was performed on the glenohumeral joint of ten fresh-frozen cadaveric shoulder specimens via insertion of a calibrated pressure-mapping sensor. Sensors were inserted through the rotator interval via a standard deltoid splitting approach to ensure soft-tissue stabilizers were not violated. Following a baseline force measurements, analysis of force intensity and total glenohumeral contact area was performed in each specimen for 6 simulated injury and treatment conditions:

1. A 1 cm supraspinatus lesion
2. 2-suture repair of the 1 cm lesion
3. Removal of the 2-suture repair
4. A 2 cm supraspinatus lesion
5. 4-suture repair of the 2 cm lesion and

Repairs were performed via bone with data including glenohumeral force, contact-area, and force per unit area (pressure) recorded over 60s intervals. Values for each lesion, repair, and post-repair condition were expressed as a proportion of baseline measurements. Means and standard deviations were derived and compared via Student’s t-tests.

RESULTS

1 cm Lesion Condition: no statistically significant change from baseline following both creation of a rotator cuff injury and subsequent repair.

2 cm Lesion

- Creation of tear resulted in decrease in overall contact area compared to baseline.
- 4 suture repair resulted in significant changes from uninjured baseline:
  - Increased Glenohumeral force-loads (116%) and
  - Increased Peak Contact Pressure (73.3%)

Largest change in contact area for the 2cm lesion noted with removal of the 4 sutures repair → a ‘spring-back effect’ with decreases in:

- Contact area: 37% (p = 0.002)
- Contact Force: 155% (p = 0.004)
- Glenohumeral Pressure: 86.3% (p = 0.01)

DISCUSSION

- Rotator cuff injury leads to alterations in glenohumeral forces, with significant increases in glenohumeral contact-pressures following repair of larger supraspinatus lesions.
- These findings offer a possible explanation for the high rate of degenerative changes demonstrated following rotator cuff repair.
- Further study is warranted to determine how current treatment methods might be improved to result in glenohumeral contact pressures resembling those experienced prior to injury.

REFERENCES:


CONCLUSION:

While a rotator cuff tear creates glenohumeral disassociation and an "unbalanced shoulder, re-approximation of a larger sized rotator cuff lesion can similarly result in potentially detrimental imbalances secondary to ‘overtensioning’ of the glenohumeral joint’s soft-tissue stabilizers.