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NorthShore University HealthSystem

# A Biodynamic Comparative Study Of Superior Capsular Reconstruction And Lower Trapezius Tendon Transfer With Massive Rotator Cuff Tears

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# Faculty Disclosure Information

- Nothing to disclose

# Introduction

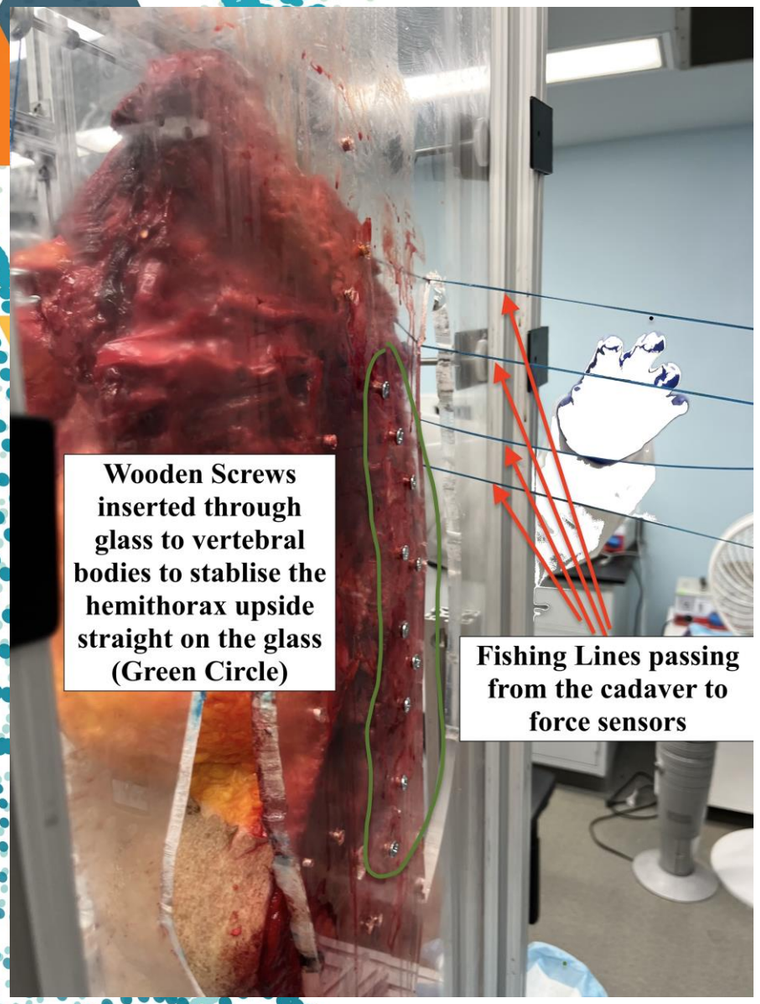
- Massive Rotator Cuff Tears (MRCTs) pose significant clinical challenges, especially in younger, active patients

Joint-preserving surgeries like Superior Capsular Reconstruction (SCR) and Lower Trapezius Tendon Transfer (LTT) are gaining traction

Despite their growing use, the biomechanical impact of SCR and LTT—both separately and together—is not fully understood

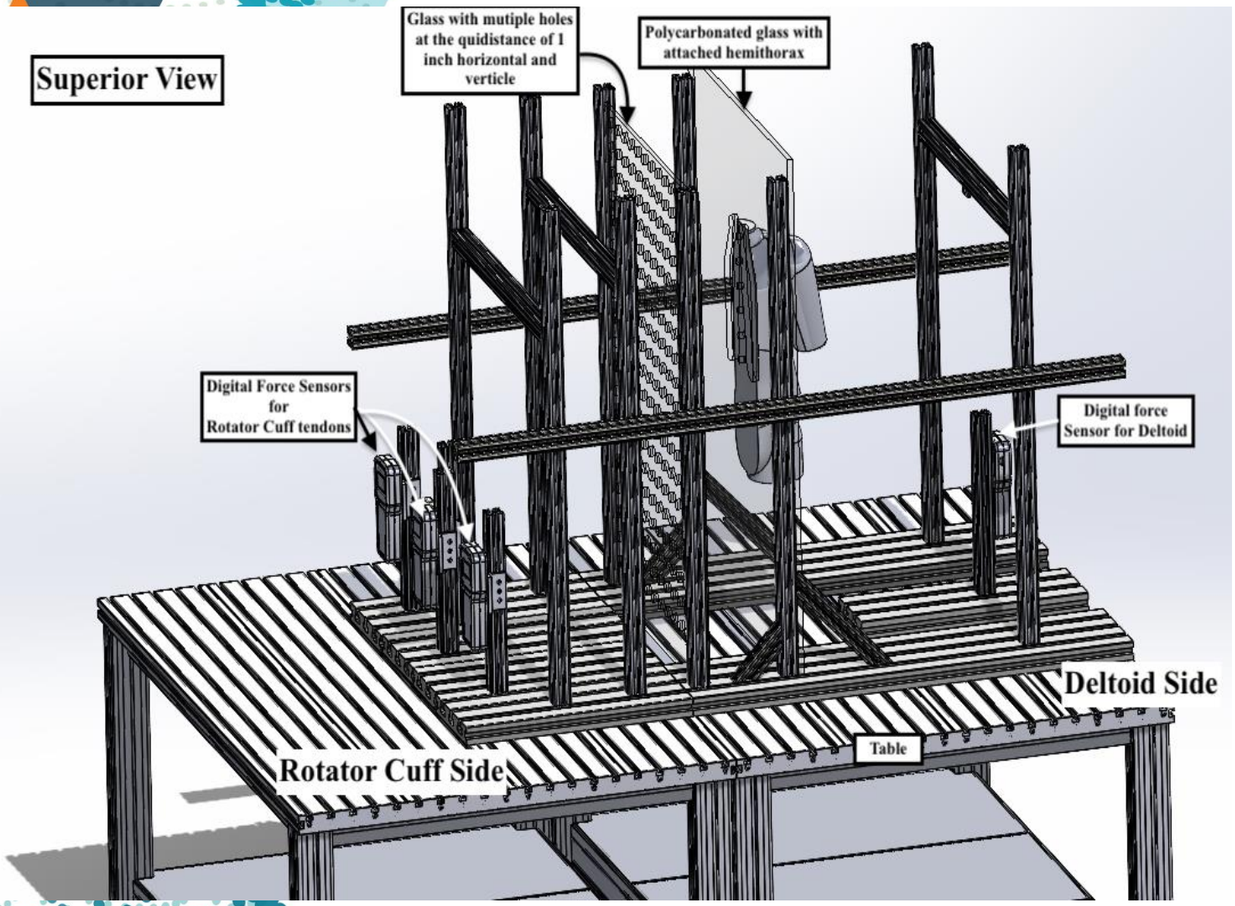
Study Objective: Compare the biomechanical effectiveness of SCR vs. LTT vs. combined (SCR + LTT) in restoring shoulder function in cadaveric models

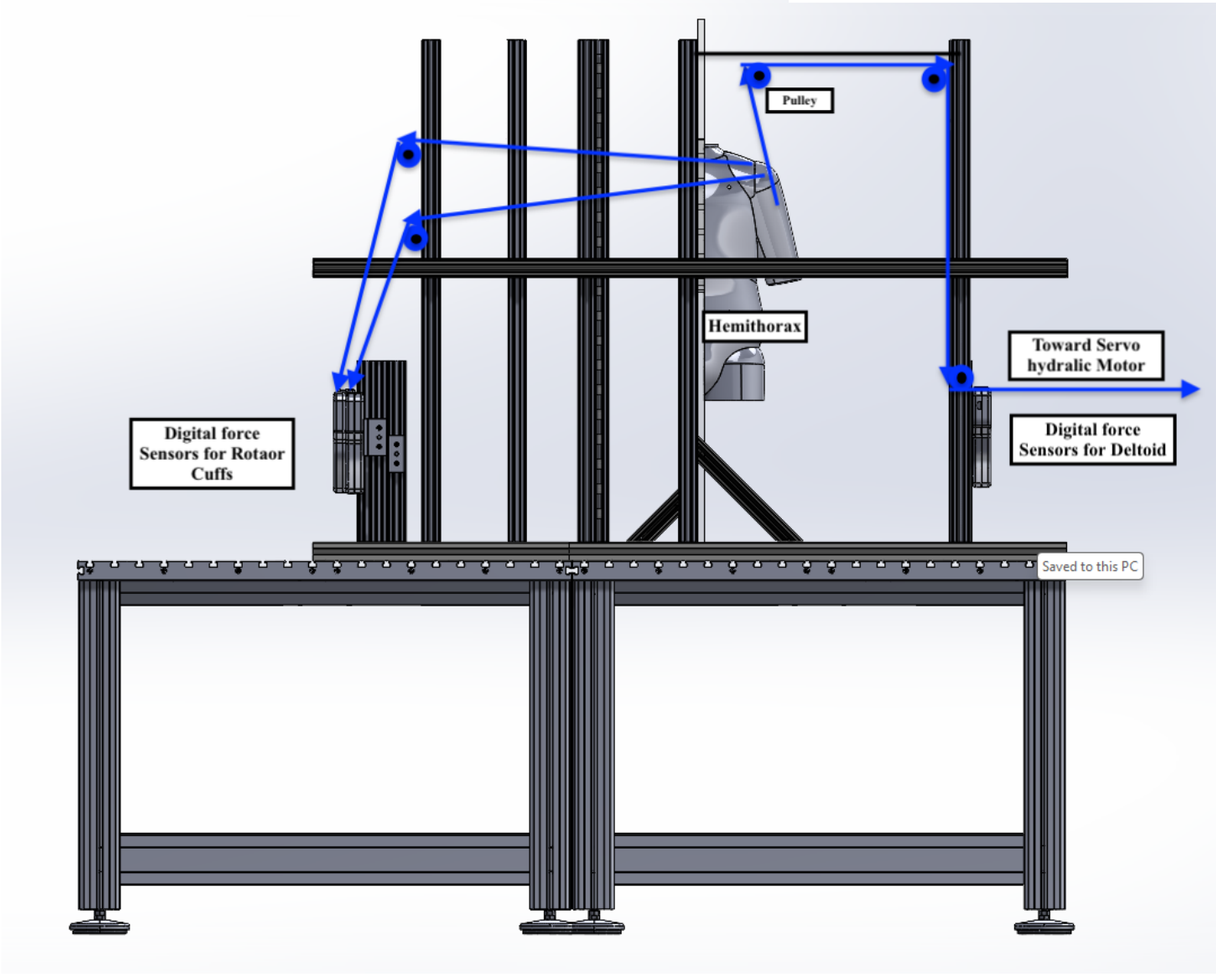
# Methods



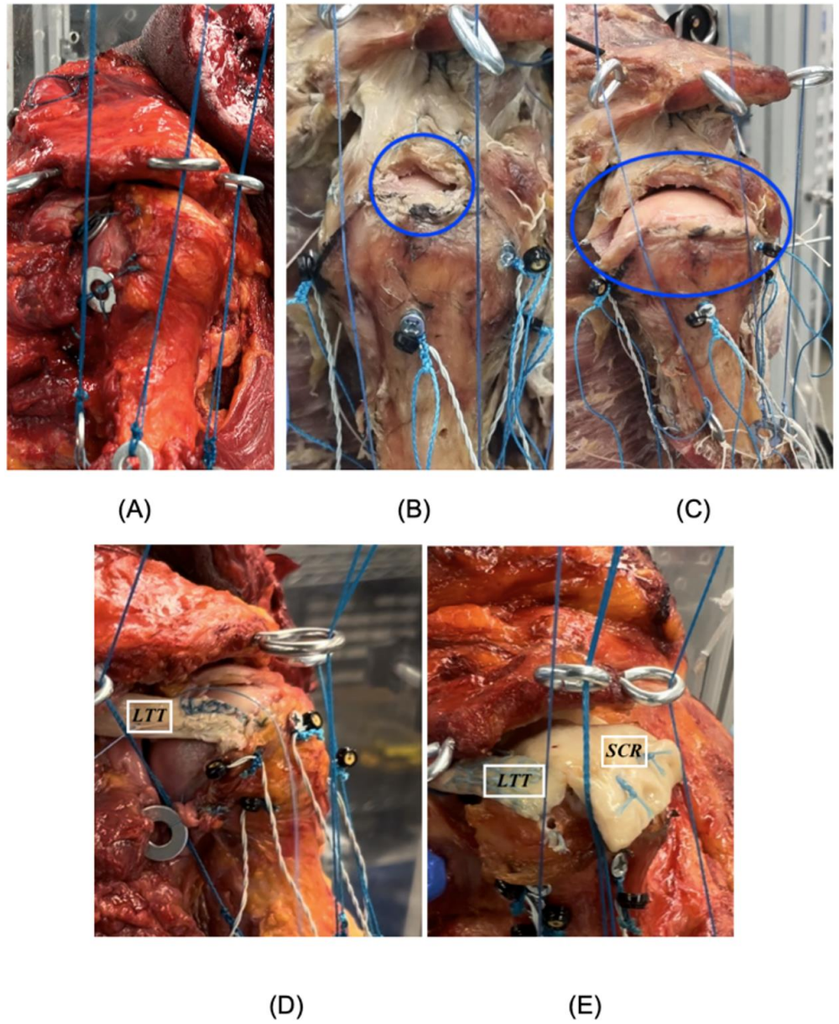

1. **Specimens**: 8 fresh-frozen human shoulders (ages 55–75)
2. **Mounting**: Each hemithorax mounted on polycarbonate glass for biomechanical testing
3. **Force Sensor Setup**: Rotator cuff and deltoid tendons attached to force sensors via pulleys
4. **Testing System**: Allowed unrestricted humeral abduction from 0° to 90° with preloading of Rotator cuff muscles

# A Novel Shoulder Testing System



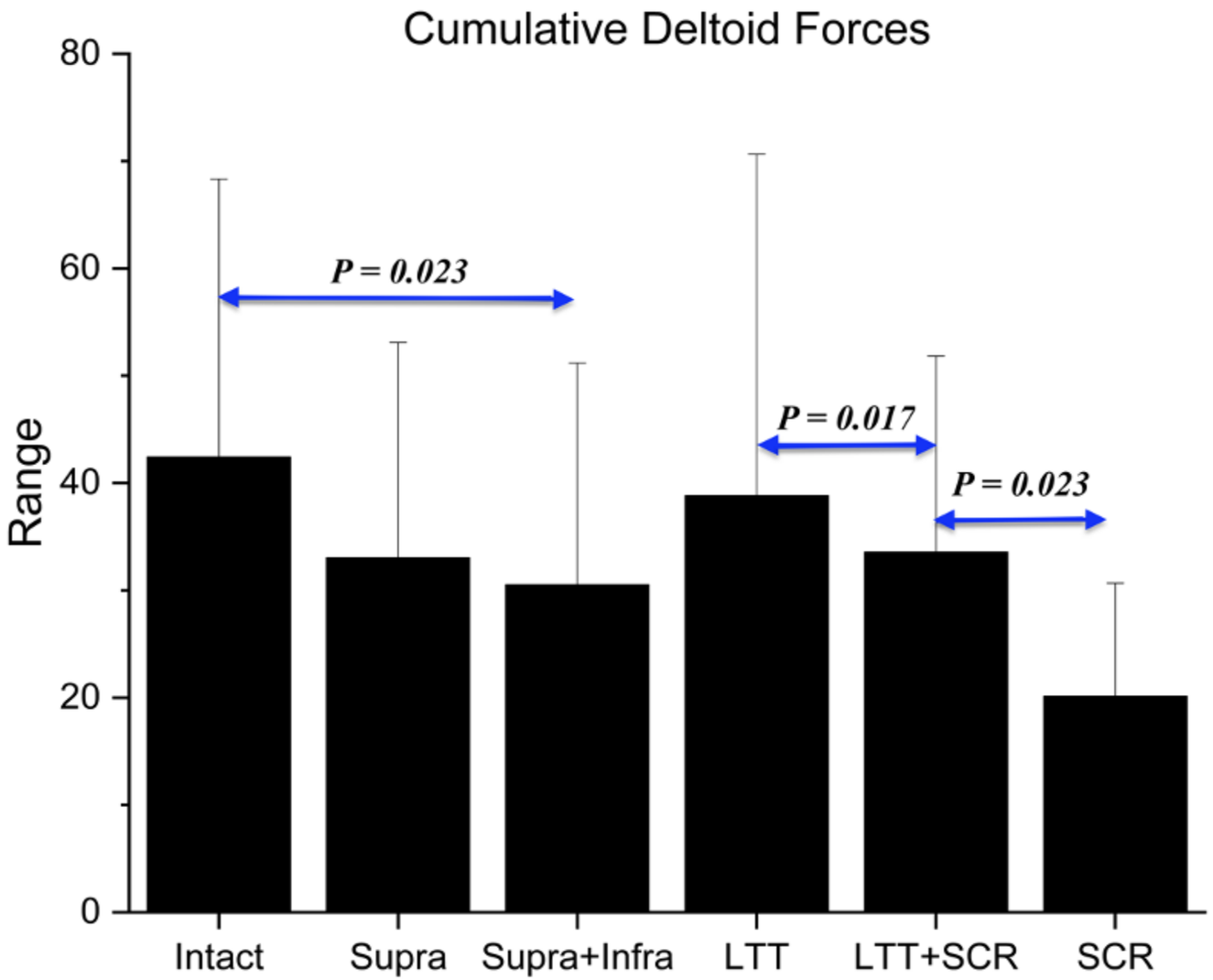
# Experimental Conditions (6 total):




A. Intact rotator cuff (control)
B. Incised supraspinatus & superior capsule
C. Incised infraspinatus & underlying capsule
D. Add LTT (Lower Trapezius Tendon Transfer) with Achilles allograft (LTT Alone)
E. Add SCR (Superior Capsular Reconstruction) with human dermal allograft (Combined SCR + LTT)
F. Lower Trapezius tendon was incised from the humeral head (SCR Alone)

# Results

## Cumulative Deltoid Forces Changes



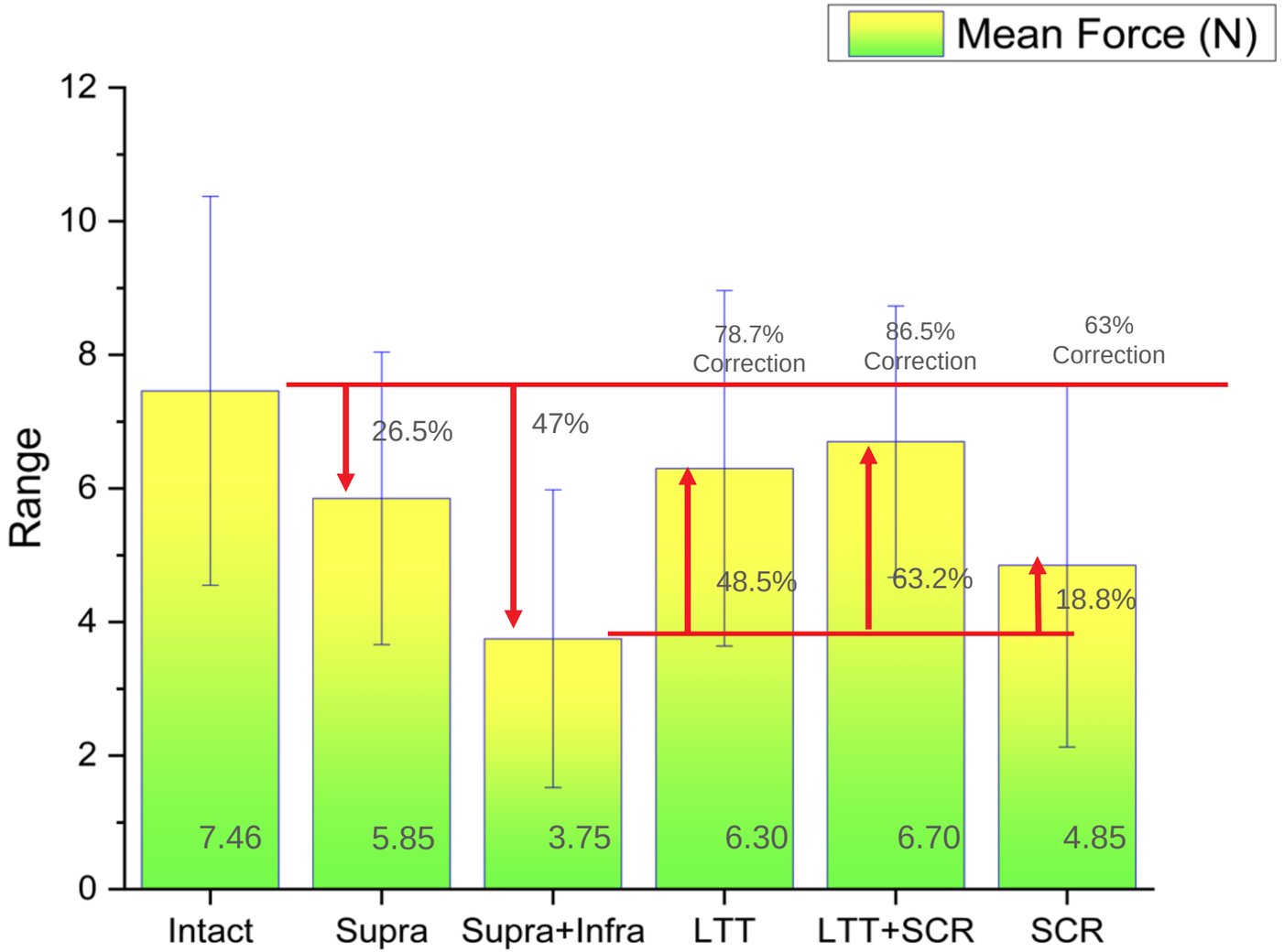

**Intact → MRCT**: Deltoid force decreased by **28%**

**LTT Alone**: Increased deltoid force by **27.25%** compared to MRCT (partial restoration)

**SCR Alone**: Decreased deltoid force by **34%** compared to MRCT (no improvement)

**SCR + LTT**: Increased deltoid force by **32.57%** compared to SCR alone, but **13.6% lower** than LTT alone

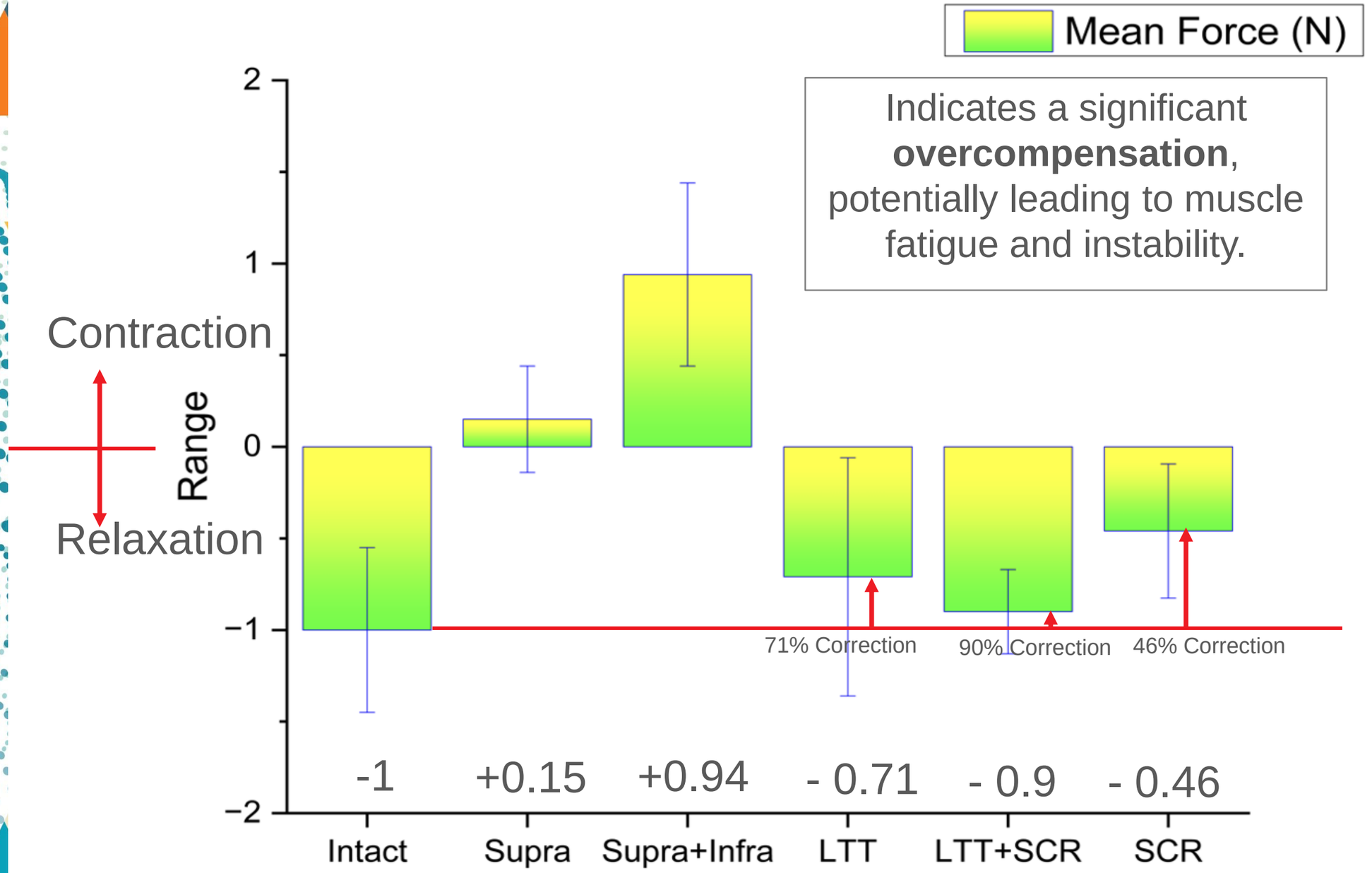
# Teres Minor (TM) Forces Changes




- Rotator cuff tears significantly **reduce TM force**.

- **Combined LTT + SCR** provides the greatest restoration (**86.5%** of intact).

# Sub scapularis (SubS) Forces Changes




- Rotator cuff tears cause **SubS force to become positive** (destabilizing effect).

**- Combined LTT + SCR** restores SubS force closest to intact (**90%** of intact).

# Discussion

- Neither SCR nor LTT alone fully restored shoulder mechanics in MRCT
- Combined approach showed **improved biomechanical outcomes** (e.g., higher deltoid & TM forces, reduced subacromial peak pressure)
- May reduce mechanical stress on the shoulder, potentially leading to **better functional results**
- Highlights need for **further exploration** of combined interventions in clinical practice

# Conclusion

- **Combined SCR and LTT** offers superior restoration of key biomechanical parameters compared to single techniques
- Potential for **improved long-term patient outcomes** in irreparable MRCT cases
- Findings underscore the **importance of multifaceted surgical strategies**
- Calls for **future studies** to validate these benefits across larger, more diverse patient populations

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