Margin Convergence to Bone for Reconstruction of the Anterior Attachment of the Rotator Cable in Massive Rotator Cuff Tears

INTRODUCTION:
The rotator cable is a thickened band of the coracohumeral ligament that runs from its anterior attachment just posterior to the bicipital groove to its posterior attachment at the inferior border of the infraspinatus. Being a stronger, thicker tissue it acts as a stress shield for the thinner, weaker rotator crescent tissue. The importance of the anterior attachment of the rotator cable has previously been shown to be associated with rotator cuff tears involving the anterior attachment and the ensuing fatty degeneration. Margin convergence to bone is a surgical technique that uses a suture anchor to perform both footprint restoration and side-to-side repair. The objective of this study was to compare the biomechanical characteristics of a massive rotator cuff tear repaired with either two soft tissue margin convergence sutures or margin convergence to bone reconstructing the anterior cable attachment.

METHODS:
Eight matched-pair cadaveric shoulders were dissected leaving the rotator cuff muscle insertions and the rotator interval tissue intact. The supraspinatus and infraspinatus were secured in a custom curved cryo-clamp specifically designed to accommodate both the supraspinatus and infraspinatus tendons with the proximal humerus in 30° of glenohumeral abduction. (Figure 1) The subscapularis was secured in a separate clamp and a constant 10N load was applied. The supraspinatus and infraspinatus were clamped before creating the massive tear (Figure 2) in order to simulate a retracted, immobile tear. The posterior aspect of the tear was repaired using a transosseous-equivalent suture bridge technique. Two different repair methods were used for the anterior rotator cuff. (Figure 3) In the soft tissue margin convergence group, two margin convergence sutures were placed between the supraspinatus and infraspinatus tendons with the proximal humerus in 30º of glenohumeral abduction. Using margin convergence to bone to reconstruct the anterior attachment of the rotator cable. Margin convergence to bone was then performed between the supraspinatus and the rotator interval. In the margin convergence to bone group, a double-loaded suture anchor was inserted at the anterior attachment of the rotator cable. Margin convergence to bone was then performed between the supraspinatus and the rotator interval. By clamping the supraspinatus and infraspinatus before creating and repairing the tear, non-uniform distribution of tension across the repair was achieved. Each specimen was tested using an Instron material testing machine for biomechanical characteristics and a video digitizing system for gap formation and footprint strain. Each specimen underwent a preload of 10N for 10 seconds followed by cyclic loading from 10N to 180N at a rate of 1mm/s for 30 cycles followed by load to failure. A paired-t test was used for statistical analysis.

RESULTS:
Margin convergence to bone significantly decreased gap formation at cycle 1, cycle 30 and yield load across the entire footprint ($p < 0.05$). (Figure 4) In both constructs, the anterior gap was significantly greater than the posterior gap at cycle 1, cycle 30, yield load, and ultimate load ($p < 0.05$). There was no difference in footprint strain between the two groups. Margin convergence to bone significantly decreased hysteresis during the first cycle and increased yield load as well as stiffness ($p < 0.05$). (Table 1)

DISCUSSION:
Using margin convergence to bone to reconstruct the anterior attachment of the rotator cable improved the structural integrity of the repair by decreasing hysteresis, increasing yield load, increasing stiffness, and decreasing gap formation not just anteriorly, but throughout the entire footprint. The anterior attachment of the rotator cable serves as an anchor to further reduce the tension from the rest of the rotator cuff repair. These results reinforce the concept that the rotator cable acts as a stress shield across the entire footprint.

REFERENCES:

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