Does surgical approach to biceps tendon repair affect fascicle length?

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Summary

Orthopaedic repairs of the long head of the biceps tendon (LHBT) commonly impose significant geometric change to the biceps muscle-tendon complex. Here, we quantify chronic interlimb fascicle length differences among patients who have undergone unilateral SLAP repair, tenotomy, and tenodesis surgeries to address biceps tendon injury. Differences were observed in all surgical participants but not controls, suggesting chronic fascicle length adaptation post-surgery.

Introduction

Orthopaedic repairs of the LHBT are often required in SLAP (superior labrum anterior-posterior) lesion and rotator cuff injuries. Three primary orthopaedic LHBT repair strategies [1] include SLAP repair (LHBT is reattached to its glenoid origin), tenotomy (LHBT is released and allowed to adhere in the bicipital groove via scar tissue), and tenodesis (LHBT is resected and reattached to the humerus) (Fig. 1). Tenotomy and tenodesis repairs shorten the origin-to-insertion distance of the muscle-tendon complex. Therefore, we hypothesize these two repair strategies result in greater fascicle-level adaptation than the SLAP repair, which seeks to restore native muscle-tendon geometry.

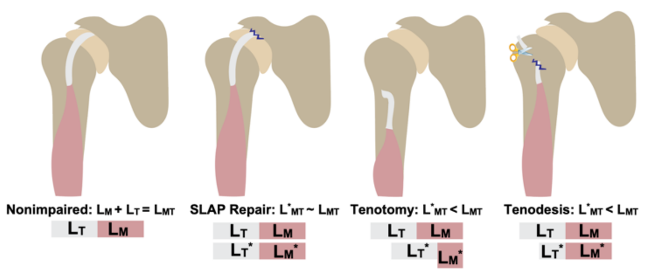

Figure 1: Illustration of the 3 surgical repair strategies for SLAP lesions and their corresponding effects on muscle-tendon unit length.

Methods

To date, 4 participants with unilateral labrum/LHBT surgical repair (μ = 4.3 ± 2.5 years post-op) have been enrolled. EFOV-US images (Siemens Acuson S2000) of the biceps were obtained in both arms using established methods [2]. 3 fascicles were measured in each of 4 qualitatively good EFOV-US images using ImageJ. We compared interlimb differences in biceps fascicle length in participants with unilateral repair and 4 healthy controls, where data from 2 of the controls were first acquired in [3] and sampled to match age demographics between the surgical participants (41 ± 14 years) and controls (42 ± 18 years) for this initial analysis.

Results and Discussion

Our initial results suggest surgical intervention leads to fascicle adaptation (Fig. 2). For example, fascicles were longer in the surgical limb with SLAP repair (15.4 ± 0.7 cm) than the contralateral limb (13.6 ± 0.8 cm). In contrast, fascicles were much shorter in the 2 surgical limbs with tenotomy than the respective contralateral limbs (8.3 ± 0.7 cm vs. 10.3 ± 0.8 cm and 11.4 ± 0.5 cm vs. 13.5 ± 0.5 cm). The difference observed following tenodesis repair was more moderate (13.6 ± 0.8 cm vs. 14.4 ± 0.9 cm) but remained larger than interlimb differences observed in control participants (2.5%) and previously established reliability of our EFOV-US methods (4% [2]).

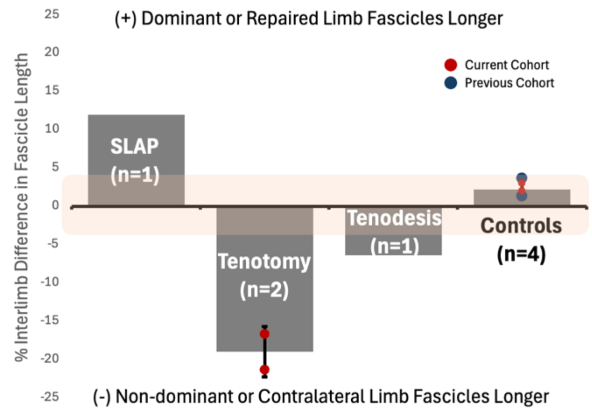

Figure 2: Interlimb differences in fascicle lengths for the biceps in 4 control and 4 surgical participants. Orange shading represents previously reported error of our EFOV-US technique [2].

The interlimb differences in fascicle lengths observed in our initial participants suggest fascicle adaptation may depend on surgical technique. SLAP repair restores native geometry; increased fascicle length may be explained by debridement of damaged tendon and stretching of residual tendon during reattachment. Distal reattachment in tenotomy without tendon resection likely results in substantial under-tensioning. Ongoing work continues to quantify interlimb fascicle differences among a full cohort of surgical participants (n=6 per surgery) and control subjects (prospectively enrolled for this study) and will add coordinated metrics of isometric and isokinetic elbow flexion and supination strength.

Conclusions

We present initial evidence of fascicle length adaptation in the biceps brachii following surgical repair. Because muscle architecture is a primary determinant of muscle function, these chronic structural adaptations are essential to understanding the functional implications of orthopaedic repairs.

Acknowledgments

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