

THE EFFECT OF RETURN TO OVERUSE ACTIVITY AFTER ROTATOR CUFF TEARS ON JOINT FUNCTION AND BICEPS MECHANICAL PROPERTIES IN A RAT MODEL

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Background: Rotator cuff tendon tears are common shoulder injuries and are prevalent in populations performing repetitive overhead activities. In addition, long head of the biceps (LHB) tendon degeneration often occurs secondary to cuff tears; however, the mechanical and functional consequence at the shoulder is poorly understood.

Purpose: Therefore, the purpose of this study was to evaluate the effect of returning to overuse activity following a supraspinatus or a supraspinatus/infraspinatus tendon tear on shoulder function and LHB mechanical properties.

Design and Setting: Cross-sectional and laboratory based study.

Patients or Other Participants: Seventy-four Sprague-Dawley rats.

Methods: Following a two week training period, all animals underwent 4 weeks of overuse activity (defined as downhill (10°) treadmill running @ 17 m/min for 1 hr 5 days/wk) to induce a degenerative condition prior to undergoing unilateral detachment of the rotator cuff tendons. Following detachment surgery, animals were randomly divided into cage activity or continued overuse experimental groups. Cage activity animals were returned to their cages, and overuse animals were gradually returned to the overuse protocol over 3 weeks. Prior to, and for 8 weeks following detachment surgery, the ambulation of all animals was recorded to assess joint function using our custom quantitative ambulatory assessment method. Eight weeks following detachment surgery, animals were sacrificed and the LHB was prepared for mechanical and collagen fiber alignment testing. LHB tendon samples were tested with an Instron testing device augmented with a custom cross polarized light set-up to assess collagen fiber alignment. The test consisted of 10 cycles of pre-conditioning, a stress relaxation test, and a ramp to failure test during which images were collected to calculate local mechanical properties and collagen fiber alignment.

Results: Overuse activity following supraspinatus and supraspinatus/infraspinatus tendon detachment did not have any significant effects on the ambulatory measurements compared to the cage activity group throughout the study. LHB tendon cross-sectional area, linear modulus, and collagen fiber alignment were not significantly different at both the insertion and midsubstance locations in the overuse compared to the cage activity groups for supraspinatus tears. For supraspinatus/infraspinatus tears there were no significant differences for cross-sectional area or collagen fiber alignment at both the insertion site and the midsubstance when comparing overuse to cage activity. In animals with a supraspinatus/infraspinatus tear, overuse activity was also not significantly different for linear modulus at the midsubstance but there was a

significant increase in linear modulus at the insertion site compared to the cage activity group.

Conclusions: Although shoulder function may appear normal, overuse activity following a massive rotator cuff tear causes changes to the mechanical properties of the biceps tendon.

Clinical Relevance: These findings may provide clinicians with important information that can be used to treat and advise rotator cuff tear patients, which will minimize the risk of further joint injury.