

# **A Systematic Temporal Analysis of the Morphology of Tendon Healing at the Tendon-Bone Interface Post Rotator Cuff Repair**

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## **INTRODUCTION:**

The most common complication of a rotator cuff repair is retear, where sutures pull through the edge of the repaired tendon. This is particularly evident during the first 6 weeks postsurgery, in elderly patients with larger tears, prior to the tendon reattaching itself to bone. Shear-wave elastography is a relatively new technology that evaluates the quality (stiffness) of tissue, in a non-invasive fashion. The aim of this study was to answer the following questions; 1) does the elastographic stiffness of the supraspinatus change as it heals, 2) does the morphology of the healing tendon change over time, and 3) are these factors associated with age and tear size, post primary arthroscopic repair using shear wave elastography ultrasound?

## **METHODS:**

This was a prospective cohort study conducted in consecutive single-row inverted mattress arthroscopic rotator cuff repairs evaluated in a systematic fashion at 1 week, 6 weeks, 12 weeks, 6 months, and 12 months, using conventional B mode ultrasound and shear wave elastography with ultrasound system with transducer by a single experienced musculoskeletal sonographer (Figure 1).

## **RESULTS:**

Fifty patients were prospectively enrolled in this study. At 1 week, two had return, leaving 48 patients in the study. Of those 48, an additional two patients had a retear of their repair at 6 weeks, two at 12 weeks, and one at 24 weeks. Their data was included in the study.

### **Tendon Thickness**

At the tendon-to-bone interface of the arthroscopically repaired supraspinatus tendon, the tendon thickness decreased by 11% (0.6 mm) from 6mm to 5.4mm in the first 6 weeks postoperatively ( $P = 0.008$ ). From 6 weeks onwards, there were no further changes in tendon thickness (Figure 2).

### **Tendon Stiffness**

The shearwave elastographic stiffness of the repaired tendon improved by 22% from 8 days to 12 months ( $P = .0001$ ) (Figure 3). The lateral tendon, at its footprint, stiffened before the medial tendon.

### **Stiffness and Tendon Thickness**

The less stiff a tendon was following rotator cuff repair, the thinner it became at 6 weeks postoperatively ( $r = .38$ ,  $P = 0.01$ ).

### **Factors Associated with Elastographic Stiffness**

Advanced age was associated with reduced elastographic stiffness of the supraspinatus tendon postrotator cuff repair ( $F^2 = 0.52$ ,  $p = 0.0001$ ).

Larger rotator cuff tear size was also associated with lower supraspinatus tendon stiffness as measured by shearwave elastography postoperatively ( $r = 0.50$ ,  $P = .02$ ).

## **DISCUSSION AND CONCLUSION:**

The major findings of this study were that the stiffness of the lateral supraspinatus tendon improved before the medial portion at the insertion site post rotator cuff repair. The thickness of the repaired rotator cuff tendon, measured at the tendon-to-bone interface, decreased from 1 to 6 weeks by 11% (6mm) postoperatively and thereafter remained unchanged at 12 months. The shearwave elastographic stiffness of the healing supraspinatus postrepair improved in a curvilinear manner by 21% over 12 months. Tendons in older patients and those with larger tears were found to have reduced supraspinatus tendon stiffness as measured by shearwave elastography ultrasound.

In short, younger patients with smaller tears had tendons that were significantly stiffer as assessed by a non-invasive variation of ultrasound (shearwave elastography) and those tendons were less prone to stretch out. These findings support the hypothesis that tendon elastographic stiffness is a dynamic, measurable, material property critical for robust tendon healing postrotator cuff repair.