

## **DETERMINING AN OBJECTIVE MEASURE OF STIFFNESS AND FUNCTION IN FAILED ARTHROSCOPIC ROTATOR CUFF REPAIRS DUE TO REFRACTORY STIFFNESS**

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**Background:** Of the various reasons for failure in arthroscopic rotator cuff repair, refractory post-operative stiffness is the one factor which rehabilitation specialists can most directly influence. Prior studies have helped to qualify which patients may be at the highest risk for post-operative stiffness and that early PROM interventions in this 'at-risk' population can significantly improve their outcomes following arthroscopic rotator cuff repair reducing their need for a secondary lysis of adhesions (LOA). The literature to this point has failed to determine whether a critical, objective ROM or functional measure exists in determining patient success or failure regarding their post-operative stiffness and the necessity of an additional surgery to correct the issue.

**Design and Setting:** Retrospective chart review of patients from a single surgeon. All patient data included received physical therapy at one hospital-based outpatient facility.

**Patients:** Patient charts were reviewed to determine patients receiving arthroscopic rotator cuff repair between the dates of January 1, 2009 and December 31, 2010 (n=522). Patients who developed refractory stiffness 'Stiff group' requiring a secondary surgery (n=16) were examined and determined to all exhibit the following characteristics: primary repair, single tendon (supraspinatus) repair without concomitant labral repair. The patients who did not require a secondary LOA (n=506) were then subdivided based on the same surgical criteria as the 'Stiff group'. Data was then collected on 'Stiff group' (n=10; Age: 52.0 ± 12.3 yrs) and those who did not require a secondary LOA 'Succeed Group' (n=210; Age: 58.9 ± 11.8 yrs).

**Data Extraction:** Surgical data was reviewed from operative reports attained from the hospital. Objective PROM measures [passive forward elevation (PFE), passive external rotation (PER)], and AROM measures [active forward elevation (AFE)] were obtained at established therapeutic time points (3, 6, 9, 12, 16 weeks, discharge) and (9, 12, 16 weeks, discharge). Functional scores (ASES, PENN) were measured at post-op week 6, 12, and 24 from physical therapy electronic medical records.

**Data Analysis:** Group x time ANOVAs with repeated measures under multivariate assumptions were used to determine group differences in ROM. Descriptive analyses were performed on functional scores. One-way ANOVAs were used to determine group differences in ASES and PENN scores at 12 weeks. Receiver operating characteristic curves using known group (stiffness vs no stiffness) as the state variable to determine the probability being able to discriminate between groups, and sensitivity and specificity were calculated to determine if cutoff values could be identified using PFE, ASES, and PENN at post-op 12 weeks.

**Results:** Subjects who developed refractory stiffness reported significantly lower PFE ( $P=0.04$ ) at each time point and lower ASES and PENN scores at 12 weeks ( $40.8\pm 18.4$  vs  $63.5\pm 17.3$  and  $39.0\pm 10.9$  vs  $62.7\pm 18.6$ , respectively,  $P < 0.05$ ) compared to the group who did not. There were no significant interaction effects for PER ( $P=0.79$ ) or AFE ( $P=.076$ ). Area under the curve (AUC) for at 12 weeks for PFE was .90, ASES was .94, and PENN was .87.

**Conclusions:** Patients who develop refractory stiffness display different ROM and functional profiles, and the largest differentiation, both statistically and clinically appear to be post-op 12 weeks. At 12 weeks,  $137.5^\circ$  of PFE produced a sensitivity and specificity of 96% and 63%, respectively. An ASES and PENN scores of ~39 produced a sensitivity of 91.5 % and 87.2%, respectively, and a specificity of 62.5% and 71%, respectively.

**Clinical Relevance:** Determining whether specific post-operative objective measures exist which could better predict refractory stiffness requiring a second surgery following rotator cuff repair will allow rehabilitation specialists to better adjust their treatment program variables to best meet these critical benchmarks to successful recovery.