# Risk Factors for Tear Progression in Isolated Symptomatic Supraspinatus Tendon Tear – A Prospective Study

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INTRODUCTION: Rotator cuff tendon tears are a common injury in adults, especially the older population with a prevalence of 30% in those over 60 years of age.[1] Although exercise therapy is an effective treatment for patients with symptomatic rotator cuff tendon tears, tear size can increase in conservative treatment.[2] The rate of tear propagation of symptomatic rotator cuff tears has been reported to range from 24% to 49% with 2 to 5 years of follow-up.[3,4] Previous studies reported that smoking was a risk factor for the development of rotator cuff tears,[5] and a full-thickness tear was a risk factor for tear progression.[6] However, a paucity of literature exists regarding isolated supraspinatus tendon tears despite the fact that it is the most commonly injured tendon. Therefore, this study aims to identify risk factors for tear progression at 2 years follow-up in isolated symptomatic supraspinatus tendon tears. We hypothesized that a history of smoking and full-thickness tears would be risk factors for tear progression.

METHODS: Patients who had a symptomatic isolated tear more than 50% partial- or full-thickness of the supraspinatus tendon confirmed by ultrasound were prospectively enrolled. A total of 109 patients, 7 patients were excluded from this study since they underwent rotator cuff repair during follow-up duration. In addition, 22 patients did not undergo ultrasound examination at 2 years follow-up. As a result, the remaining 80 patients (mean age, 60.8 ± 9.2 years; mean BMI, 28.7 ± 5.1; 36 female) were studied. All patients participated in a standard 12-week exercise therapy program for non-operative management of rotator cuff tears. Tear length and width were measured with ultrasound at baseline and 2 years follow-up. Since a repeatability study based on our own internal data demonstrated that the minimal detectable change was 4.6 mm, tear progression was defined by more than a 5 mm enlargement of tear size in length or width or change from partial thickness to full thickness tear at 2 years follow-up. The patients were divided into two groups according to the existence of tear progression; progression group and non-progression group. The risk factors which were considered included age, height, weight, BMI, hand dominance, shoulder pain onset, history of smoking, and job type at the time of enrollment. Job type was divided into 2 groups; sedentary or light laborer and moderate or hard laborer. To identify risk factors for tear progression, baseline data were compared between groups using the chi-square tests for categorical variables and the independent-samples $t$ test or Mann-Whitney $U$ tests for continuous variables. Additionally, multivariate logistic analysis with a forward stepwise technique was performed using variables with $P < 0.10$ during the univariate analysis. Statistical significance was set at $P < 0.05$.

RESULTS: Fifty-eight patients (72.5%) of patients did not have tear progression at 2 years follow-up. BMI and weight were significantly larger in progression group than in non-progression group (31.0 ± 5.0 kg/m$^2$ vs. 27.9 ± 4.9 kg/m$^2$, P=.011; 91.7 ± 17.0 kg vs. 82.0 ± 18.2 kg, P=.033, ) (Table 1). In progression group, the rate of full-thickness tears and history of smoking (current or previous smoker) were significantly higher than non-progression group (77.3% vs. 44.8%, P=.009; 63.6% vs 25.9%, P=.002, respectively). Body weight, BMI, a history of smoking, and tear type were included in the multivariate analysis, which showed that history of smoking was significantly associated with an increased odds of tear progression (OR, 4.48 [95% CI, 1.44-13.9]; $P$ = .009), while no other parameters were found to be significant.

DISCUSSION: The risk factors for progression of an isolated symptomatic supraspinatus tendon tear were 1) a history of smoking, 2) high body weight, 3) high BMI, and 4) a full thickness tear. These findings were consistent with a previous study investigating rotator cuff tears including multi-tendon tears, which showed the risks for progression of the tear were smoking, medium-sized tear, and full thickness tear.[7] Smoking has been reported as a risk factor for developing rotator cuff tendon tear and failure for rotator cuff repair. This study revealed that individuals who were current or previous smokers had a 4.5 times higher risk of tear progression than non-smokers. Based on the data of this prospective clinical study, counseling should be done for the progression of rotator cuff tears when smoking in patients.

SIGNIFICANCE/CLINICAL RELEVANCE: In individuals with symptomatic isolated supraspinatus tendon tears who undergo exercise therapy there is an increased risk of tear progression in those who currently or previously smoke.

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Table 1. Comparison of demographic data between groups

| Variable | Progression group (n=22) | Non-progression group (n=58) | P Value |
|---|---|---|---|
| Age, years | 62.5 ± 9.6 | 60.1 ± 9.1 | .319 |
| Sex (male/female) | 15/7 | 29/29 | .144 |
| Height, cm | 171.9 ± 8.0 | 171.0 ± 11.7 | .709 |
| Body weight, kg | 91.7 ± 17.0 | 82.0 ± 18.2 | **.033** |
| Body mass index | 31.0 ± 5.0 | 27.9 ± 4.9 | **.011** |
| Hand dominance (dominant side/ non-dominant side) | 14/8 | 33/25 | .585 |
| Tear type (partial thickness/ full thickness) | 5/17 | 32/26 | **.009** |
| History of smoking (current or previous smoker/ never smoker) | 14/8 | 15/43 | **.002** |
| Job type (sedentary or light laborer/ moderate or hard laborer) | 11/11 | 27/31 | .783 |
| Shoulder pain onset (injury/ non-injury) | 10/12 | 22/36 | .540 |

Data are reported as mean ± SD, the statistical significance is shown in bold