

## Increased Post-Operative Stiffness after Arthroscopic Suprapectoral Biceps Tenodesis

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**Objectives:** Biceps tenodesis can be performed open or arthroscopically and can be positioned in a suprapectoral or subpectoral position. Suprapectoral tenodesis can be carried out arthroscopically, whereas the subpectoral tenodesis is performed as an open procedure. The goal of this study is to compare the incidence of postoperative stiffness between arthroscopic suprapectoral and open subpectoral biceps tenodesis and evaluate risk factors for its occurrence.

**Methods:** *Study Design:* The charts of all patients who underwent arthroscopic or open biceps tenodesis who were a minimum of two years post-procedure were reviewed. Patients with preoperative frozen shoulder, prior shoulder surgery, or massive rotator cuff tears which required longer post-operative immobilization were excluded. Post-operative stiffness was defined as persistent range of motion deficit ( $<100^{\circ}$  of forward flexion and abduction;  $<40^{\circ}$  of internal or external rotation) and pain resulting in a diagnosis of post-operative frozen shoulder and requiring either an injection, lysis of adhesions/manipulation, or both.

*Analysis:* Means were calculated for continuous variables and compared using Students t test. Frequencies for categorical variables were compared using chi square tests.

**Results:** We identified 249 consecutive biceps tenodeses from 2008-11 (106 arthroscopic, 143 open) that met inclusion and exclusion criteria. A significantly increased incidence of post-operative stiffness was found in the arthroscopic tenodesis cohort as compared to the open cohort (17.9% vs. 5.6%,  $p=0.002$ ). The groups were otherwise well matched. (*Table I*). Further analysis was performed comparing patients with and without post-operative stiffness within the arthroscopic cohort. (*Table II*) Female gender (63.2% vs 33.3%,  $p = 0.016$ ) and smoking (36.8% vs 16.1%,  $p = 0.040$ ) were independent risk factors for post-operative stiffness after arthroscopic tenodesis. Location of the tenodesis from the top of the humeral head as measured on x-ray was 32.4 mm (stiff cohort) versus 50.3 mm (non-stiff cohort) ( $p < 0.0001$ ). BMI, workmans compensation status and concomitant procedures did not significantly increase the risk of post-operative stiffness. Auto-immune diagnoses such as diabetes mellitus and thyroid disease were also not significant predictors for post-operative stiffness. Of the 19 arthroscopic tenodesis patients who developed post-operative stiffness, 18 had normal range of motion and were pain free by final follow up. In 16 patients, symptoms resolved with one or more injections; two patients did require reoperation, undergoing arthroscopic lysis of adhesions and manipulation.

**Conclusion:** Our results demonstrate a notable incidence of post-operative stiffness after arthroscopic suprapectoral tenodesis. This occurs more commonly in females and smokers. A more proximal location of the tenodesis is noted in patients who develop post-operative stiffness. The relationship between this issue and the arthroscopic suprapectoral tenodesis technique may be multifactorial, with potential etiologies including increased soft-tissue manipulation, fluid extravasation, bursal resection in the sub-deltoid space, increased risk of bleeding in the region of the bicipital sheath, or possibly an effect related to over-tensioning of the biceps with a presentation mimicking post-operative capsulitis, that improves over time and with symptom-based management.

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	Arthroscopic Tenodesis	Open Subpectoral Tenodesis	p
n	106	143	
Age (SD)	51.5 (9.5)	53.5 (11.2)	0.191
BMI (SD)	29.1 (6.2)	30.3 (6.8)	0.142
Gender female # (%)	41 (38.7%)	40 (28.0%)	0.075
Workman's Comp # (%)	5 (4.7%)	11 (7.7%)	0.344
Diabetes # (%)	9 (8.5%)	18 (12.6%)	0.304
Thyroid Disease # (%)	10 (9.4%)	12 (8.4%)	0.774
Depression # (%)	14 (13.2%)	11 (7.7%)	0.152
<b><u>Concomitant Procedures</u></b>			
Rotator cuff repair # (%)	61 (57.5%)	74 (51.7%)	0.364
Acromioplasty # (%)	95 (89.6%)	120 (83.9%)	0.195
Distal clavicle excision # (%)	23 (21.7%)	29 (20.3%)	0.785
<b>Post-op Stiffness</b>	<b>19 (17.9%)</b>	<b>8 (5.6%)</b>	<b>0.002</b>

	No post op stiffness	Post op stiffness	p
n	87	19	
Age (SD)	52.2 (9.8)	50.6 (13.7)	0.446
BMI (SD)	29.5 (5.6)	26.9 (3.8)	0.060
<b>Gender female # (%)</b>	<b>29 (33.3%)</b>	<b>12 (63.2%)</b>	<b>0.016</b>
Workman's Comp # (%)	4 (4.6%)	1 (5.3%)	0.901
Diabetes # (%)	8 (9.2%)	1 (5.3%)	0.577
Thyroid Disease # (%)	7 (8.0%)	2 (10.5%)	0.725
Depression # (%)	12 (13.8%)	2 (10.5%)	0.703
<b>Smoker # (%)</b>	<b>14 (16.1%)</b>	<b>7 (36.8%)</b>	<b>0.040</b>
<b><u>Concomitant Procedures</u></b>			
Rotator cuff repair # (%)	50 (57.5%)	11 (57.9%)	0.973
Acromioplasty # (%)	78 (89.7%)	17 (89.5%)	0.981
Distal clavicle excision # (%)	20 (23.0%)	3 (15.8%)	0.490