

# The effect of biceps tenotomy on clinical results in patients with rotator cuff rupture

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## Abstract

**Aim:** This study aims to evaluate the effect of tenotomy on clinical and radiological outcomes in the treatment of biceps long head tendon pathologies associated with rotator cuff tears.

**Material and Methods:** The study was conducted with 66 patients who met the inclusion criteria and were available (Group 1: Tenotomy, n = 40; Group 2: Non-tenotomy, n = 26). Clinical evaluation of the patients was performed with Modified Constant-Murley Scoring, radiological evaluation with ultrasonography, functional evaluation with dynamometer and visual evaluation with the detection of Popeye Sign finding.

**Results:** The mean age of the patients in group 1 was  $58.17 \pm 7.95$ , the follow-up period was 28.87 months, the mean age of the patients in group 2 was  $60.61 \pm 4.66$ , and the follow-up period was 35.28 months; there was no statistically significant difference between two groups ( $p > 0.05$ ). The mean score of the patients in group 1 was  $89.83 \pm 7.87$ , whereas the mean score of the patients in group 2 was  $86.19 \pm 7.07$  ( $p > 0.05$ ). In the ultrasonographic examination, the tendon cut in 24 (60%) of the 40 patients who underwent tenotomy was seen in the bicipital groove, but not in the groove in 16 (40%) patients, but only 3 of these patients had "Popeye Sign" findings.

**Conclusion:** Tenotomy for the treatment of biceps tendon pathologies associated with rotator cuff tear may be an effective treatment method in terms of cost, pain relief and postoperative rehabilitation in the appropriate patient group.

**Keywords:** Rotator cuff, long head of biceps, tenotomy, popeye sign.

## INTRODUCTION

Biceps long head (BLH) tendon pathologies are common causes of shoulder pain (1). These pathologies frequently accompany rotator cuff tears. Elser et al. (2) showed that primary tendinitis of the BLH was rarely seen (5%), and most of these pathologies were associated with rotator cuff tears and impingement syndrome.

Tears of different degrees of BLH often seen during arthroscopy. These pathologies are more common in patients over the age of 50 and account for 96% of all BLH pathologies. Tenotomy or tenodesis treatments are required when the degree of these tears exceeds 25% (3). Which treatment should be done has been the subject of wide debate (4).

Tenotomy is an easy and very short surgical procedure.

Possibility of early postoperative rehabilitation and high satisfaction rates are the main advantages. Disadvantages include cosmetic deformity (Popeye Sign), cramp-like pain and loss of strength (5).

Our aim in this study was to evaluate the effect of tenotomy on clinical and radiological results in the treatment of BLH pathologies associated with rotator cuff tears.

## MATERIAL and METHODS

After obtaining approval from the institutional ethics committee review board (06.09.2018-14/5) and informed patient consent, between March 2013 and July 2017, 130 patients who underwent arthroscopic rotator cuff repair were retrospectively evaluated. Patients who had rotator cuff arthropathy, fatty degeneration, no follow-up or follow-up of less than one year, and out of reach

Received: 05.07.2019 Accepted: 04.09.2019 Available online: 30.09.2019

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were excluded from the study (Figure 1). The study was completed with 66 patients (Group 1: tenotomy, n = 40; Group 2: non-tenotomy, n = 26). All patients were evaluated clinically, radiologically, functionally and cosmetically. Modified Constant-Murley scoring (MCMS) was used for clinical evaluation (6). According to this scoring, 90-100 points were rated as excellent, 80-90 points as good, 70-80 points as moderate, and below 70 as poor. Ultrasonography (USG) was used to determine whether biceps long head tendon was in the biceps groove for radiological evaluation, and numerical measurement of biceps strength with dynamometer was performed on both arms for functional evaluation.

Measurements with isokinetic dynamometer were repeated 3 times with 30-second intervals. The results were evaluated in kg-force (kgf) units. Of these three measurements, the highest value was recorded for the study. For the visual evaluation, the finding of Popeye Sign, which could develop in the postoperative period, was determined. All patients were operated by the same surgeon using standard shoulder arthroscopy portals in the lateral decubitus position under hypotensive general anesthesia.

The operated shoulder was immobilized using sling immobilizer for 3 weeks. Elbow and wrist exercises were initiated from the first postoperative day. After three weeks of immobilization, passive and assisted-active shoulder exercises were initiated. Strengthening exercises were initiated 6 weeks after the operation. Three months after the operation, patients were allowed to engage in light sports activities. Full activity of the patient was allowed 6 months after the operation.

Statistical package for the social sciences (SPSS 22, Chicago, IL, USA) was used for statistical analysis of the data. Categorical variables were described using relative frequency, and continuous variables were described using mean and standard deviation (SD). Distribution of continuous variables was investigated by Kolmogorov-Smirnov and Shapiro-Wilk normality tests. Independent sample t-test was used in detecting the relationship between the dual groups not conforming to normal distribution. Chi-Square test was used in the analysis of categorical variables and  $P < 0.05$  accepted as significant

in all analyses.

## RESULTS

The mean age was  $58.17 \pm 7.95$  and follow up period was 28.87 months in group 1, and the mean age was  $60.61 \pm 4.66$  and the follow up period was 35.28 months in group 2. There was no significant difference between the two groups in terms of age and follow-up duration ( $p > 0.05$ ). In group 1, 15 (37.5%) were male and 25 (62.5%) were female. In group 2, 10 (38.5%) were male and 16 (61.5%) were female. In group 1, 32 patients (80%) had problems on the right side and 8 patients (20%) on the left side. In group 2, 21 (80.8%) patients had a problem on the right side and 5 (19.2%) on the left side. In group 1, twenty-eight patients (70%) were operated on their dominant sides, while 12 patients (30%) were operated on their non-dominant sides. In group 2, 21 patients (80.7%) were operated by their dominant sides, while 5 patients (19.3%) were operated by their non-dominant sides. Demographic characteristics of the patients were similar in both groups ( $p > 0.05$ ).

According to Constant-Murley scores following the operation, the mean score in the tenotomy group (Group 1) was  $89.83 \pm 7.87$ , and the mean score in the non-tenotomy group (Group 2) was  $86.19 \pm 7.07$ . There was no statistically significant difference between the two groups ( $p > 0.05$ ) (Table 1).

In our study, elbow flexion and forearm supination strengths of the two groups were compared and no statistically significant difference between the two groups was found (Table 2).

Biceps strength of the operated and not operated sides of the patients in both groups were compared. There was a statistically significant decrease in the strength of the operated side in both the tenotomy group and the non-tenotomy group ( $p < 0.05$ ) (Table 3 and Table 4).

In our study, localization of the cut tendon and the amount of retraction were evaluated in patients who underwent biceps tenotomy with USG (Figure 2). The tendon cut in 24 (60%) of the 40 patients who underwent tenotomy was seen in the biceps groove, but not in the groove in 16 (40%). Although the tendon was not present in the biceps groove, only 3 of these 16 patients had "Popeye Sign".

**Table 1. Distribution by modified CMS grade**

		CMS				Total	±ss	min-max	p
		Poor	Medium	Good	Excellent				
Group 1	n	1	2	8	29	40	86.19±7.07	65-93	0.061
	%	2.5	5.0	20.0	72.5	100.0			
Group 2	n	1	3	8	14	26	89.83±7.87	68-98	
	%	3.8	11.5	30.8	53.8	100.0			
Total	n	2	5	16	43	66			
	%	3.0	7.6	24.2	65.2	100.0			

	Groups	n	$\bar{x} \pm ss$	Good	Excellent
Flexion	Group 1	40	10.14±5.031	0.471	0.465
	Group 2	26	11.13±5.909		
Supination	Group 1	40	14.48±7.071	1.436	0.156
	Group 2	26	17.08±7.324		

Force	Side	Group 1 $\bar{x} \pm ss$	p
Elbow flexion	Operated	10.14±5.031	0.035
	Non-operated	14.18±4.304	
Supination	Operated	14.48±6.071	0.046
	Non-operated	17.62±4.392	

Force	Side	Group 2 $\bar{x} \pm ss$	p
Elbow flexion	Operated	10.53±5.90	<0.001
	Non-operated	11.53±5.26	
Forearm supination	Operated	17.08±7.32	<0,01
	Non-operated	21.59±5.47	

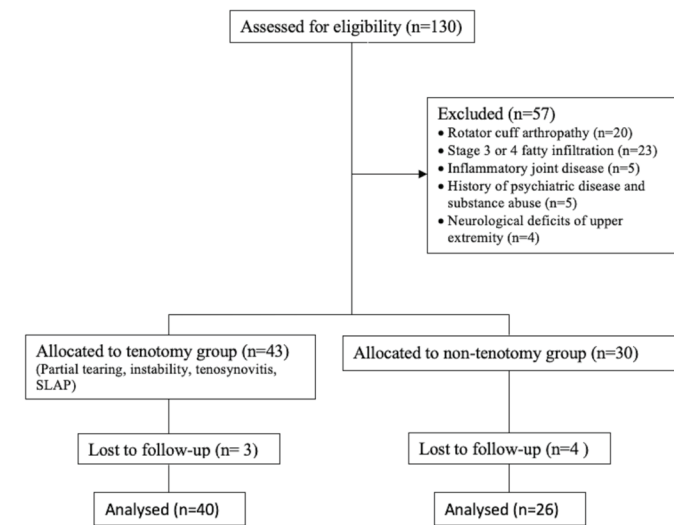


Figure 1. Flow chart detailing patients' selection

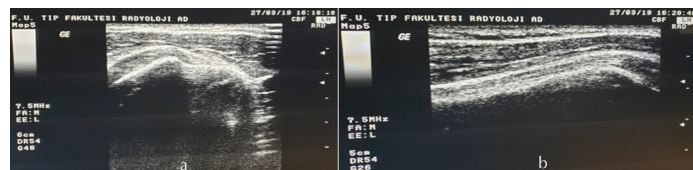


Figure 2. Evaluation of the biceps groove and biceps tendon by USG in transverse (a) and longitudinal (b) directions

## DISCUSSION

Most patients with rotator cuff tears are accompanied by glenohumeral joint pathologies. These pathologies can

be serious problems such as large labrum tear, cartilage lesion and biceps pathologies (7). What is important here is whether these pathologies require surgical treatment and prevent rehabilitation in the postoperative period. Two techniques are mainly used in the surgical treatment of massive biceps tears (> 25%) accompanying the rotator cuff tear and other pathologies of this tendon: tenodesis and tenotomy methods. Compared to tenodesis, tenotomy method is shorter, simpler, cheaper and requires less rehabilitation (8).

In our study, the functional, radiological and clinical results of 66 patients who underwent arthroscopic rotator cuff repair with a mean follow-up duration of 31.29 months were analyzed. In our study, the most important glenohumeral joint pathology with rotator cuff tears was biceps tendon injury. It was observed that the patients with damaged biceps tendon and who underwent tenotomy started rehabilitation earlier and were more easily adapted.

Slenker et al. (9) showed excellent and good results in 77% of 699 patients who underwent tenotomy, and 430 had BLH pathology accompanying the rotator cuff tear. In our study, 92.5% excellent and good results were obtained in the tenotomy group and 84.6% excellent and good results in the non-tenotomy group.

Carpenter JE et al. (10) showed a 20% loss of strength in the forearm supination and 8-20% in the elbow flexion after tenotomy. However, in our study, it was observed that strength loss in patients undergoing biceps tenotomy

did not cause any loss of function in daily activities. As a matter of fact, even if there was a relative comfort difference between the two groups, similar scores were observed in the strength parameters according to the Constant scores evaluated. There was no significant difference between the tenotomy and non-tenotomy groups in terms of forearm supination and elbow flexion forces ( $p > 0.05$ ). In addition, both groups were compared in terms of forearm supination and elbow flexion forces between the operated side and the non-operated side. In this comparison, there was a significant difference between the operated side and the non-operated side in favor of the non-operated side ( $p < 0.05$ ). In other words, the non-operated sides of the patients were significantly stronger in terms of forearm supination and elbow flexion than those operated.

In their study comparing biceps tenotomy and tenodesis, Kyoung Koh et al. (11) concluded that tenotomy led to more "Popeye Sign" findings than tenodesis. There are also studies suggesting that there is no cosmetic deformity after tenotomy, although postoperative "Popeye Sign" and cramp-like pain due to muscle retraction may be seen (12). Lemos et al. (13) described that BLH, which has become hypertrophic as a result of inflammation, can remain in the biceps groove of the tendon after tenotomy. Hypertrophic tendinopathy, adhesions or vincula formation has been shown to cause auto-tenodesis and may prevent muscle contraction (14).

In our study, according to shoulder USG results, the cut biceps long head was not in the bicipital groove in 16 out of 40 patients who underwent tenotomy, but only 3 (7.5%) among these 16 patients developed "Popeye Sign" findings. In patients who developed Popeye Sign symptoms, tenotomy-related weakness, instability, cramp pain or loss of function were not observed. Compared to the other patients, patients with Popeye Sign were found to be weaker and had less subcutaneous fat tissues.

Kukkonen et al. (15) in a study of 148 patients found that patients with biceps damage and who underwent tenotomy had a faster postoperative recovery. In our study, no significant difference was found between the tenotomy group and non-tenotomy group in terms of long-term functional results. However, it was observed that the process of returning to daily living activities was faster and there was an earlier response to rehabilitation in the tenotomy group.

## CONCLUSION

In conclusion, in the appropriate patient group, the tenotomy method in the treatment of biceps tendon pathologies accompanying rotator cuff tear seems to be an effective treatment method in terms of cost, pain relief and postoperative rehabilitation.

*Competing interests: The authors declare that they have no competing interest.*

*Financial Disclosure: There are no financial supports*

*Ethical approval: This study was approved by Firat University Ethics Committee with 14/05 numbered decision. Approval date: 16.09.2018.*

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