Treatment of Biceps Tendon Lesions in the Setting of Rotator Cuff Tears : Prospective Cohort Study of Tenotomy Versus Tenodesis

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Prospective Cohort Study of Tenotomy Versus Tenodesis

Kyoung Hwan Koh, MD, Jin Hwan Ahn, MD, Sang Min Kim, MD, and Jae Chul Yoo,* MD
From the Department of Orthopaedic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

Background: During rotator cuff repair, biceps tendon lesions are frequently encountered. However, there is still controversy about optimal treatment for these lesions.

Purpose: To compare the results of tenotomy and suture anchor tenodesis prospectively.

Study Design: Cohort study; Level of evidence, 2.

Methods: From January 2006 to June 2007, 90 patients (age, >55 years) with a rotator cuff tear and biceps tendon lesion (tear more than 30%, subluxation or dislocation, or degenerative superior labrum anterior to posterior lesion type II) were evaluated prospectively. The first 45 patients treated consecutively underwent biceps tenodesis, and the next 45 underwent biceps tenotomy. Postoperatively, patient evaluations were conducted with a focus on (1) ''Popeye'' deformity, (2) arm cramping pain, and (3) elbow flexion powers (measured with a hand dynamometer). Overall shoulder function was assessed with the American Shoulder and Elbow Surgeons (ASES) score and the Constant score.

Results: At final follow-up, 43 in the tenodesis and 41 in the tenotomy groups were available for evaluation. There was no difference between groups in demographic data such as age, sex, dominant arm, and the time from symptom to surgery and in preoperative ASES score, Constant score, and rotator cuff tear size. A Popeye deformity occurred in 4 (9%) in the tenodesis group and in 11 (27%) in the tenotomy group ($P = .0360$). Mild cramping pain was observed in 2 in the tenodesis group and 4 in the tenotomy group ($P = .4274$). Mean elbow flexor power ratio (vs the contralateral side) showed no difference between the 2 groups, with mean values of 0.92 ± 0.15 (tenodesis) and 0.94 ± 0.19 (tenotomy) ($P = .7475$). The ASES and Constant scores were improved from 38.9 ± 14.2 and 52.1 ± 21.3 to 84.7 ± 13.6 and 82.9 ± 13.5 in the tenodesis group ($P < .0001$) and from 35.2 ± 10.5 and 48.1 ± 21.3 to 79.6 ± 15.8 and 78.3 ± 14.1 in the tenotomy group ($P < .0001$), respectively.

Conclusion: Suture anchor tenodesis of the long head of the biceps tendon appears to lead to less Popeye deformity than tenotomy. No other clinical variables showed a difference between the 2 modalities.

Keywords: biceps long head tendon; biceps tenodesis; biceps tenotomy; suture anchor tenodesis; Popeye deformity

Biceps long head tendon (BLHT) lesions can be broadly classified as inflammation, instability, or trauma.[4,23] The diagnosis for these lesions is often quite obscure, and optimal treatment involves a difficult decision. When the partial tear is considered less than 25% or the biceps lesion is reversible, a conservative method like partial debridement may be selected as a treatment.[1,3,31] However, when a tear more than 30%, subluxation, or a degenerative superior labrum anterior to posterior (SLAP) type II lesion is observed, and only debridement or observation is applied, it could result in lasting pain even after the rotator cuff surgery,[4,15,25] so this may not be an effective treatment.[2] Therefore, in a rotator cuff surgery when a biceps tear more than 30%, subluxation or dislocation, or degenerative type II SLAP lesion is observed, a definitive treatment such as tenotomy[16,25,32] or tenodesis[1,19,20,22,26] is considered.

There has been ongoing debate on the appropriate treatment for those biceps lesions, although both tenodesis and tenotomy have been reported to produce favorable clinical results.[5,16,22,25,26] Nevertheless, a consensus appears to have been reached that for a patient over 55 to 60 years, a biceps tenotomy is indicated, and for a patient younger than 50 years or for any age in those involved in heavy labor, a biceps tenodesis is indicated.[1,2,19]

*Address correspondence to Jae Chul Yoo, MD, Department of Orthopaedic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, 50 Ilwon-Dong, Kangnam-Gu, Seoul, Korea 135-710 (e-mail: osdoc.koh@gmail.com).

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Lesions of the BLHT that require surgical treatment (partial tear more than 30%, subluxation or dislocation, and degenerative type II SLAP) are diagnosed as accompanied by rotator cuff tear or impingement syndrome[5-8,12,22,30,32] rather than as an isolated form.[30] When one encounters a biceps lesion during rotator cuff repair or any other shoulder arthroscopic procedures, the most common procedures used on the biceps are tenotomy or tenodesis. Biceps tenotomy is currently a more popular option when the tendon is diseased,[4] especially when accompanied by a rotator cuff tear. Proponents of biceps tenotomy advocate that it is simple, causing few extra minutes of surgical time in the arthroscopic setting, with very low surgical morbidity, simple rehabilitation, avoidance of implant complication, and acceptable pain relief with minimal functional deficits.[24,27] On the other hand, advocates of biceps tenodesis argue that tenodesis can better maintain the length-tension relationship, prevent muscle atrophy, maintain elbow flexion and supination power, avoid cramping pain, and minimize cosmetic deformities.[1] However, tenodesis takes longer than tenotomy, where a simple release is done at the junction of the biceps labrum complex. And when impingement syndrome or partial-thickness rotator cuff tear (PTRCT) is present or the cuff tear size is small, it could be complicated to perform the tenodesis by identifying the biceps tendon in the subacromial space.

However, there are only a few reports on the treatment of biceps lesions combined with rotator cuff lesions and even fewer studies on tenotomy versus tenodesis.[5,28,34]

Our hypothesis was that arthroscopic biceps tenodesis with tendon suturing using suture anchors is relatively easy to be performed and produces a better cosmetic appearance than biceps tenotomy. The purpose of this study was to identify differences between BLHT tenotomy and suture anchor tenodesis in terms of cosmetic problems, cramping pain, and elbow flexion power.

MATERIALS AND METHODS

Patient Enrollment and Evaluation

Institutional review board (IRB) approval was obtained before patients were enrolled in this study. The inclusion criteria were a rotator cuff tear combined with a biceps lesion, such as a tear of more than 30% of normal width of the tendon, subluxation or dislocation, or a degenerative SLAP type II lesion (Figure 1), and age older than 55 years. The combined surgical procedures were arthroscopic rotator cuff repair, subacromial decompression, and distal clavicle resection. All of the patients underwent rotator cuff repair. Subacromial decompression was performed in 6 (14.6%) in the tenotomy group and 2 (4.7%) in the tenodesis group as well as rotator cuff repair. Distal clavicle resection was applied to 3 (7.3%) in the tenotomy group and 5 (11.6%) in the tenodesis group. Exclusion criteria were any prior surgery on the affected shoulder, age older than 55 years with a job involving heavy labor, combined arthritic changes in the glenohumeral joint, any history of open surgery, and those who selected the surgical method. The IRB required that the enrolled patients have the opportunity to select the procedure after being told about the tenotomy and tenodesis, although no patients elected to make such a choice. Those with a partial rotator cuff tear not requiring repair and those with no tear were also excluded.

From January 2006 to June 2007, 119 patients with a combined rotator cuff tear and biceps long head lesion aged over 55 years were treated. Preoperatively, we evaluated the biceps tendon for tear, subluxation or dislocation, and superior labral lesion as well as evaluating the rotator cuff. Only the cases confirmed arthroscopically were included in this study. Because we considered the tenosynovitis reversible, when this was the only abnormal finding, neither tenotomy nor tenodesis was done for these patients, and they were not included in the study.[2,3,23,31]

After the exclusion criteria were applied, 90 patients were enrolled in this study. In addition to rotator cuff repair, arthroscopic biceps tenodesis using suture anchor was performed on the first 45 consecutive patients, and in the next 45 patients, arthroscopic biceps tenotomy was performed.

Surgical Techniques: Biceps Tendon Tenotomy

Standard posterior and anterior portals were prepared for glenohumeral joint exploration. After a routine diagnostic examination, the BLHT was evaluated for any pathological change, such as partial tear, subluxation, tenosynovitis, or a degenerative SLAP lesion. With use of a probe, the BLHT was drawn into the joint to allow examination of the portion within the bicipital groove. The upper portion of the subscapularis tendon was also examined for a tear. If there were other pathological conditions in the glenohumeral joint, they were properly managed first. When biceps lesions had been confirmed and inclusion in this study had been determined, arthroscopic scissors or a radiofrequency device (Bisector, ArthroWand; ArthroCare, Sunnyvale, California) was used to sever the tendon at its junction with the superior labrum (Figure 2).

Surgical Technique: Biceps Tendon Tenodesis Using a Suture Anchor

Except for management of the BLHT, all procedures conducted in the glenohumeral joint were similar. Tenodesis was performed in the subacromial space accompanied by rotator cuff repair. Therefore, the arthroscope was introduced into the subacromial space, and routine anterolateral and anterior portals were made. In most rotator cuff tears that involved the supraspinatus, the biceps tendon was easily seen in the subacromial space. When a biceps tendon was not visible because of a remnant or intact portion of the anterior supraspinatus and rotator interval, a tagging suture was needed intra-articularly with minimal rotator interval opening for visualization. After the biceps tendon was identified, the biceps sheath, including the upper portion of the transverse humeral ligament,

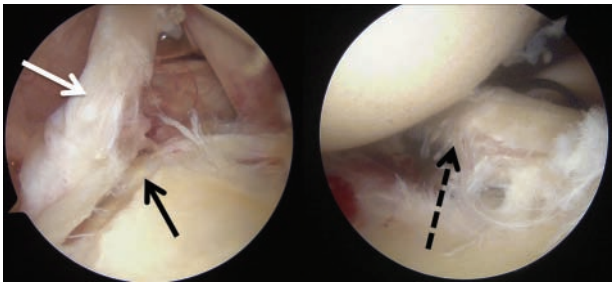

Figure 1. Biceps lesions encountered during arthroscopic surgery. The white arrow indicates a biceps long head tendon (BLHT) with a tear of more than 30%. The black arrow shows a degenerative superior labrum anterior to posterior (SLAP) lesion. The dotted black arrow indicates a dislocated BLHT.

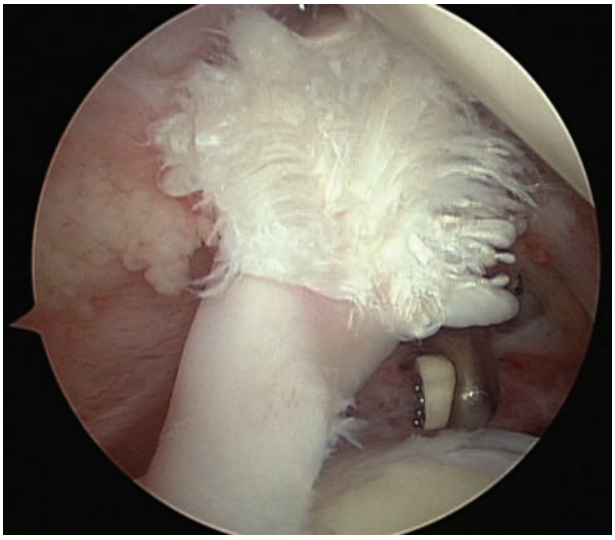

Figure 2. Tenotomy is performed at the junction of the labrum and biceps long head tendon.

was transected using a hook-type radiofrequency device (ArthroCare). The bicipital groove was exposed by pulling the tagging suture. After a bleeding bone bed was prepared using a bur in the groove, a suture anchor (5.5-mm Biocork FT suture anchor; Arthrex, Naples, Florida) with 2 Fiberwire sutures (Arthrex) was inserted into the groove at its most lateral margin. With use of a penetrator (Mitek, Johnson & Johnson, Somerville, New Jersey) or a suture hook (ConMed-Linvatec, Largo, Florida) loaded with nylon suture material, the biceps tendon was penetrated and grasped with monofilament. The 2 Fiberwire sutures (Arthrex) were then passed through the biceps tendon in a cross-over fashion to avoid the possibility of a longitudinal split (Figure 3). Remnant biceps tendon distal to the tenodesis was removed with arthroscissors. A usual rotator cuff repair was then performed with or without acromioplasty and distal clavicle resection. One case in the tenotomy group and 3 in the tenodesis group underwent double-row repair. All the other patients underwent the single-row repair.

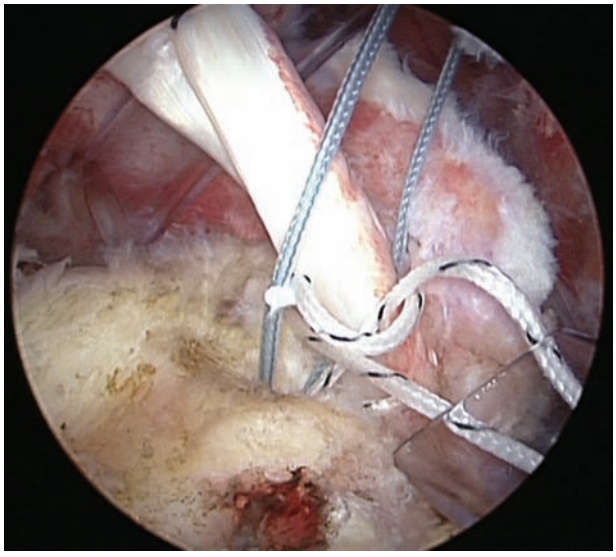

Figure 3. Two Fiberwire sutures (Arthrex) loaded in a suture anchor penetrate and grasp the biceps tendon in a crossed fashion to avoid a longitudinal split.

Postoperative Rehabilitation and Follow-up

Because rotator cuff repairs were made in all 90 patients, routine postoperative rehabilitation for rotator cuff repair was performed, namely, 4 weeks of immobilization with an abduction brace followed by range of motion exercises and then by resistive exercises after the achievement of full range of motion. Patients were followed at 2 and 6 weeks and at 3, 6, 12, 18, and 24 months after surgery.

Outcome Assessments

For radiological assessments, plain radiographs and preoperative magnetic resonance arthrograms or magnetic resonance images were available. For the general preoperative comparison, the American Shoulder and Elbow Surgeon (ASES) scores and Constant scores were evaluated. Surgical times were recorded and compared. In terms of biceps lesions at final follow-up, we recorded the presence of arm cramping pain (yes or no); Popeye deformity (observed or not); elbow flexor power (lb), which was measured using a hand-held Myometer (Mercmesisn Co, Nottingham, United Kingdom); ASES score; and Constant score for the operated shoulder. To compare elbow flexor strengths between the tenodesis and tenotomy groups, we estimated the Elbow Strength Index (ESI), which is similar to the Shoulder Strength Index.[29] As Park et al[29] suggested, because the normal muscle strengths of patients differ, comparisons based on absolute values are of limited value, and thus, the ESI was calculated by dividing elbow flexor power of the affected upper extremity by that of the contralateral upper extremity. Both groups were surveyed on overall satisfaction level as excellent, good, fair, or poor.

TABLE 1
Comparison of Demographic Data and Clinical Results Between Tenodesis and Tenotomy[a]

	Tenodesis (n = 43)	Tenotomy (n = 41)	*P* Value
Mean follow-up, mo	27.05 (24-35)	27.93 (24-33)	.094
Sex	16 male, 27 female	9 male, 32 female	.1263
Age, y	65 (55-77)	66 (55-82)	.2352
Preoperative ASES score	52.1 ± 21.2	48.1 ± 21.3	.2102
Preoperative Constant score	38.9 ± 14.2	35.2 ± 10.5	.7784
Postoperative ASES score	84.70 ± 13.58	79.64 ± 15.76	.1766
Postoperative Constant score	82.91 ± 13.49	78.27 ± 14.08	.1933
Mean surgical time, min	119.74 ± 22.96	108.90 ± 28.94	.0601
Popeye deformity	4	11	.0360
Arm cramping pain	2	4	.4274
Elbow Strength Index	0.92 ± 0.15	0.93 ± 0.19	.7475

[a]ASES, American Shoulder and Elbow Surgeon.

Statistical Analysis

Preoperative comparison between the tenodesis and tenotomy groups for age distribution (*t* test), sex (χ^2 test), BLHT lesion (χ^2 and Fisher exact test), Constant score (*t* test with Bonferroni correction), ASES score (Wilcoxon 2-sample test with Bonferroni correction), and rotator cuff tear size (Fisher exact test) was performed.

The rate of Popeye deformity and arm pain was evaluated using the Pearson χ^2 test and Fisher exact test. Comparison between the Constant and ASES scores was analyzed using the Wilcoxon 2-sample test with Bonferroni correction, whereas the *t* test was used to compare the 2 groups in terms of ESI and surgical times.

The significance level was set to .05, and the power analysis was conducted on nonsignificant items with the given sample size to ensure adequate numbers for comparison of significance using a statistical program (nQuery Advisor 4.0; Statistical Solutions, Cork, Ireland).

For the purpose of comparing tenotomy with tenodesis, the null hypothesis was that no differences in clinical results were present between tenotomy and tenodesis groups. Considering the .05 two-sided significance level, 80% statistical power, and the findings of prior studies performing tenotomy that nearly 70% of subjects developed Popeye deformity,[19] and assuming that, in the present study, the group undergoing tenodesis shows over a 50% decrease, the sample size was 31 in each group. The tenotomy (n = 41) and tenodesis (n = 43) groups had enough patients to meet the power analysis. Statistical analysis was performed using SAS version 9.13 (SAS Institute Inc, Cary, North Carolina).

RESULTS

Patient Demographics and Preoperative Clinical Scores

In the tenodesis group, 1 of the 45 patients was lost to follow-up, and 1 patient was disqualified because of fracture surgery conducted at another hospital on the affected shoulder after a traffic accident. Whether the fracture took place at the tenodesis suture anchor site was not clear. In total, 43 patients were evaluated at a mean of 27.93 months (range, 24-35 months) after surgery. For these 43 patients, the mean age was 61 years (range, 55-77 years). Sixteen were men, and 27 were women. Three had PTRCTs, 5 had small tears, 19 had medium tears, and 16 had large to massive tears; 5 of the 16 with large to massive tears underwent incomplete repair. In terms of biceps lesion, there were 34 tears more than 30%, 4 subluxations or dislocations, 3 cases of severe tenosynovitis, and 19 degenerative unstable SLAP lesions (some cases overlapped).

In the tenotomy group, 41 patients were followed to final evaluations at a mean of 27.05 months (range, 24-33 months) after surgery. Mean patient age was 66 years (range, 55-82 years). Of the 45 patients initially enrolled, 2 were lost to follow-up, and 2 underwent arthroplasty at 17 and 13 months after surgery. Of the 41, 9 were men, and 32 were women. There were 3 PTRCTs, 6 small tears, 16 medium tears, and 16 large to massive tears; 6 of the 16 large to massive tears were incompletely repaired. Regarding biceps lesions, there were 29 biceps tears of more than 30%, 0 subluxations or dislocations, 3 cases of severe tenosynovitis, and 21 degenerative unstable SLAP lesions. There were no differences between the 2 groups in terms of the cuff tear size ($P = .805$) or biceps lesions. There were no differences between groups in terms of age, sex, symptom duration, rotator cuff tear size distribution, and preoperative clinical scores (Table 1).

Arm Pain, Popeye Deformity, and ESI

Two patients in the tenodesis group and 4 in the tenotomy group complained of arm pain at resisted flexion ($P = .4274$; power = 13%), although the cramping pain was very mild with minor complaints from patients. In the tenodesis group, 4 (9.3%) patients had Popeye deformity, whereas 11 (26.8%) had Popeye deformity in the tenotomy group, and this difference was significant ($P = .0360$). None of the 15 patients with Popeye deformity complained on their own or were bothered by it. All of the deformities

were detected by the independent assessor (physiotherapist), who was blinded to the surgery and the purpose of this study. When the assessor asked whether there was any difference in the shape of both arms, 4 of 11 with Popeye deformity in the tenotomy group had self-awareness; so did 2 of 4 in the tenodesis group. Mean ESIs were 0.92 ± 0.15 for the tenodesis group and 0.93 ± 0.19 for the tenotomy group, which was not a significant difference (P = .7475; power = 99%) (Table 1).

Clinical Outcomes

The ASES and Constant scores were improved from 52.1 ± 21.3 and 38.9 ± 14.2 to 84.7 ± 13.6 and 82.9 ± 13.5 in the tenodesis group ($P < .0001$) and from 48.1 ± 21.3 and 35.2 ± 10.5 to 79.6 ± 15.8 and 78.3 ± 14.1 in the tenotomy group ($P < .0001$), respectively (Table 1). Clinical evaluations showed no differences between the 2 groups: P = .1766 for ASES scores (power = 71%) and P = .1933 for Constant scores (power = 73%). The mean surgical time was 119.7 (±23.0) minutes in the tenodesis group and 108.9 (±28.9) minutes in the tenotomy group, which again was not significantly different (P = .0601; power = 73%).

In the tenodesis group, 36 patients responded with excellent or good, 5 with fair, and 2 with poor results, while in the tenotomy group, 35 responded with excellent or good, 4 with fair, and 2 with poor results. There was no difference between the 2 groups (P = .7703). A Popeye deformity was not detected in 4 patients who were not satisfied with surgery, nor did the patients complain of it. Two in the tenodesis group and 1 in the tenotomy group who showed poor results had irreparable massive tears. Another one in the tenotomy group who reported a poor result had poor tissue quality at the rotator cuff surgery and was observed to have a retear on magnetic resonance imaging at 6 months.

DISCUSSION

As expected, our results show that suture anchor tenodesis of the biceps long head leads to fewer Popeye deformities than tenotomy for lesions of the BLHT accompanied by rotator cuff tear. Additional mean surgical time was approximately 10 minutes to perform the tenodesis. However, clinical scores, total surgical times, and functional results related to the biceps, such as arm pain and elbow flexor strength, revealed no statistical differences between tenotomy and tenodesis.

One of our inclusion criteria was a partial-thickness tear greater than 30% of normal width of the tendon, although the degree of the partial tear was somewhat subjective. When the biceps is found to have a partial tear or tenosynovitis, the surgeon might decide that nothing but partial debridement or observation should be done. When the tear is considered less than 25% or reversible, a more conservative treatment such as partial debridement may be a choice.[1,3,31] As a rule, when there is a tear more than 30%, subluxation, or degenerative SLAP type II lesion and just debridement or observation is done, it could result in pain after rotator cuff surgery.[4,15,25] This may not be an effective treatment.[2] Consequently, for a rotator cuff surgery when more than 30% of the biceps tear, subluxation or dislocation, or degenerative type II SLAP lesion is observed, tenotomy[16,25,32] or tenodesis[1,19,20,22,26] is considered as a definitive treatment. Another inclusion criterion was SLAP type II lesions. A SLAP type II lesion can be a source of pain, and according to evidence, it should be repaired to restore the stable biceps–superior labrum as a principle. But in patients older than 40 years accompanied by degeneration, it may not be indicated especially when it is found together with RCT.[13,21] Further, this degenerative SLAP lesion may be considered one of the long head of biceps injuries that require operative intervention, and without being diagnosed or treated, this biceps lesion is thought to be the cause of lasting pain in the shoulder, which is possibly cured with tenotomy or tenodesis.[9,28] Moreover, recently, Franceschi et al[13] found that a type II SLAP lesion associated with rotator cuff repair in patients over 50 years of age did not get any advantage from the SLAP repair.

Although tenotomy and tenodesis have both been reported to produce good clinical results,[5,15,16,19,22,32] there is a constant dilemma over the preferred treatment of biceps lesions during combined rotator cuff surgery. Treatment algorithms are suggested according to age, gender, and activity,[23] but some authors prefer tenotomy[16,25,32] and others tenodesis.[1,19,20,22,26] Few studies have actually compared the results between the 2 treatment modalities.[5,11,12,28] Furthermore, subjects enrolled in some previous studies had irreparable rotator cuff tears, which are not commonly encountered, and the biceps tenotomy and tenodesis were adopted as salvage options for irreparable massive rotator cuff tears. The results of treatment on the biceps lesion accompanied by rotator cuff tear are not frequently reported.[5,12,13] Accordingly, little comparative information is available on these 2 options.

The main reason for preferred tenotomy is simplicity.[4,15,23] Some authors advocate tenotomy because it requires less immobilization and rehabilitation, produces better functional results, and allows an earlier return to normal activities.[6,13] Some studies that compared tenotomy and tenodesis have reported that cosmetic problems related to Popeye deformity are rare[5] or found that patients treated with both modalities were satisfied with the cosmetic results.[28] Furthermore, in terms of elbow function, some have concluded that tenotomy and tenodesis are similar with respect to forearm supination and elbow flexion strength.[15,17] Similar results were found in our study.

On the other hand, one study on tenotomy reported that as many as 70% and 37% of patients showed Popeye deformity or persistent biceps fatigue discomfort, respectively.[19] Wolf et al,[34] in a cadaveric study, reported that 40% in the tenotomy group showed distal migration of the BLHT under physiological loading versus 0% in the tenodesis group and recommended that tenodesis be conducted in any patient sensitive to cosmetic deformity and associated dysfunction produced by distal BLHT migration after

tenotomy. Boileau et al[5] recently compared tenotomy and tenodesis in the context of irreparable rotator cuff tears and found that although clinical results, that is, Constant scores, arm pain, and bicipital groove pain, were not statistically different, the incidence of Popeye deformity was 62% in the tenotomy group but only 3% in the tenodesis group. The results of the present study also revealed that Popeye deformity was more frequent in the tenotomy group (9.3% in tenodesis vs 26.8% in tenotomy). However, the prevalence of Popeye deformity in the tenotomy group was relatively low compared with other studies in which some authors reported 3% to 70% Popeye deformity after tenotomy.[5,10,13,16,19,22,32] This might suggest that in patients with rotator cuff tear, as in our inclusion criteria, inflammation in the rotator interval or bicipital groove possibly encouraged an autotenodesis effect for the biceps tendon.[23,28] The period of immobilization after rotator cuff surgery might also influence the autotenodesis, leading to fewer Popeye deformities. In the present study, 4 cases of Popeye deformity developed in the tenodesis group. Three of the 4 tenodesis patients who showed a Popeye deformity experienced some "popping" sound at the anterior shoulder while lifting up things at about 3 months after surgery and temporary pain that lasted for 1 to 2 weeks and then reduced gradually. This might be attributable to failure of fixation, suggesting that the suture anchor tenodesis is weaker than the general subpectoral tenodesis or interference screw. On the other hand, it may have resulted from a retear in the fixation area because the BLHT may have been diseased, with poor tissue quality in the setting of rotator cuff tear. Two recent studies reported good clinical results and a low level of Popeye deformity for soft tissue tenodesis, which is possibly weaker than suture anchor tenodesis (S. C. Weber et al, unpublished data).[14] We believe that suture anchor tenodesis provides sufficient initial fixation strength compared with those soft tissue tenodesis under physiological loading to avoid Popeye deformity.

When biceps lesions are accompanied by a rotator cuff tear,[15,18,33] which is more commonly encountered than an isolated lesion, there is always a time factor for both or more procedures. Hence, surgeons might prefer biceps tenotomy and to expedite the rotator cuff repair. However, if the biceps tenodesis can be simplified compared with previous techniques, such as subpectoral tenodesis and interference screw techniques, one would be more prone to perform biceps tenodesis in combined arthroscopic rotator cuff surgery.

We agree that, whatever technique one uses, tenodesis is technically more complicated than tenotomy, and the tenodesis using suture anchors hardly differs in clinical results from tenotomy. Nonetheless, tenodesis is less likely to produce Popeye deformity so tenodesis is a better approach except for the aged, senile, and less active. Furthermore, suture anchor tenodesis can add approximately 10 minutes to the surgery time in most cases, and it does not involve a separate incision or additional device for the interference screw technique. It can be addressed easily during rotator cuff surgery because it is usually at the site of the involved cuff tendon.

In the present study, both tenotomy and tenodesis were performed in patients with a concomitant rotator cuff repair. Therefore, both treatments used involved the same rotator cuff repair rehabilitation protocol. Immobilization was applied to all patients in both the tenotomy and tenodesis groups just as the rehabilitation protocol for rotator cuff repair. Namely, this can somewhat offset the weakness that tenodesis needs a longer rehabilitation period than tenotomy.

The present prospective cohort study provides level 2 evidence, and its findings could be used as a guideline for managing biceps lesions combined with rotator cuff tear. Arm pain, elbow flexor power, and Popeye deformity findings were found to be appropriate for evaluating biceps treatments combined with rotator cuff repair, whereas clinical scores, such as the Constant or ASES scores, which have been used in previous studies as outcome measures, were not found to be useful during this comparative evaluation of treatments for biceps lesions.

In this study, a hand-held dynamometer was used to measure the elbow flexion power, while the supination strength could not be measured with such an approach. It is one of the weaknesses of our study. Hawkins et al[17] reported through isokinetic strength tests that there was no difference in supination or elbow flexion strength. However, others reported a 20% decrease in supination strength and an 8% to 20% decrease in flexion strength. Also, supination strength was reported to have decreased by 40% after tenotomy.[24,25] Although in this study, the 2 groups had no difference in clinical scores, flexion power, and patient satisfaction level after surgery, tenodesis might be a more optimal treatment than tenotomy for those whose job requires repetitive supination as Boileau stated.[5] Future research on measurement of supination strength and differences in power between tenotomy and tenodesis will be able to help to find the answer. This study is not a randomized study, which might have sample bias, and the results only pertain to this specific suture anchor tenodesis technique. The size of our study group was relatively small and underpowered in terms of arm cramping pain, ASES score, Constant score, and mean surgical time. Therefore, the results should be interpreted with care. Lack of evaluation of supination strength or pain with resisted supination is another weakness of our study, as we described above.

Our findings suggest that suture anchor suture tenodesis of the BLHT is associated with less than 10% incidence of Popeye deformity. Surgical times and clinical results between tenotomy and tenodesis showed no statistical difference. Suture anchor biceps tenodesis can be a reasonable option for the treatment of biceps lesions accompanied by a rotator cuff tear.

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