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REVIEW ARTICLES

Biceps tenodesis versus tenotomy: a systematic review and meta-analysis of level I randomized controlled trials

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Background: Biceps tenodesis and tenotomy are 2 surgical treatment options for relief of long head of the biceps tendon (LHBT) pathology and superior labrum anterior-to-posterior (SLAP) tears. The purpose of this systematic review was to compare the clinical outcomes and complications of biceps tenodesis and tenotomy for the treatment of LHBT or SLAP pathology during shoulder arthroscopy.
Methods: We performed a systematic review by searching PubMed, the Cochrane Library, and Embase to identify level I randomized controlled trials that compared the clinical outcomes of biceps tenodesis vs. tenotomy. The search phrase used was as follows: biceps tenodesis tenotomy randomized. Patients were assessed based on the American Shoulder and Elbow Surgeons score, visual analog scale score for pain, and Constant-Murley score, as well as postoperative range of motion, strength, and cosmetic deformity.
Results: Five studies (all level I) met the inclusion criteria, including 236 patients undergoing biceps tenodesis (mean age, 60.3 years) and 232 patients undergoing biceps tenotomy (mean age, 59.7 years). The mean follow-up period was 23.0 months. Overall, 6.8% of tenodesis patients experienced cosmetic deformity at latest follow-up compared with 23.3% of tenotomy patients ($P < .001$). No differences in Constant-Murley, visual analog scale, or American Shoulder and Elbow Surgeons scores were found between groups in any study, and of all the studies evaluating strength and range of motion at latest follow-up, only 1 found a significant difference between groups, in which tenodesis patients demonstrated significantly increased forearm supination strength ($P = .02$). One study found tenodesis patients to experience significantly more biceps cramping at 6-month follow-up compared with tenotomy patients ($P = .043$), although no differences in complication rates at latest follow-up were found in any study.
Conclusion: Patients undergoing treatment for LHBT or SLAP pathology with either biceps tenodesis or tenotomy can be expected to experience similar improvements in patient-reported and functional outcomes. There is an increased rate of cosmetic deformity in patients undergoing biceps tenotomy compared with tenodesis.
Level of evidence: Level I; Systematic Review and Meta-analysis

Keywords: Biceps tendon; biceps tenodesis; biceps tenotomy; Popeye deformity; shoulder; arthroscopy

Direct disruption or tendinopathy of the proximal long head of the biceps tendon (LHBT), along with indirect disruption through superior labrum anterior-to-posterior (SLAP) lesions or biceps pulley lesions, is a known source of anterior shoulder pain.[4] LHBT pathology is often caused by tendon degeneration

Institutional review board approval was not required for this systematic review.

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resulting from persistent inflammation or micro-tearing, tendon anchor disorders (SLAP lesions), and LHBT instability.[32] Although commonly seen in association with other shoulder pathology, especially rotator cuff tears[5] and glenohumeral joint osteoarthritis,[24] injury to the biceps tendon is recognized as a significant independent source of pain if left untreated.[29] Following failure of conservative management, biceps tenodesis and biceps tenotomy are the 2 most common procedures to treat LHBT pathology.[16] Although both techniques have been demonstrated to produce favorable clinical outcomes,[1,18,31] tenotomy requires fewer restrictions in the early postoperative period and may allow for a quicker return to activity when compared with tenodesis.[3] Despite these advantages, tenotomy has consistently demonstrated a higher incidence of cosmetic deformity and may result in decreased supination strength of the forearm.[1,3,31] In general, however, biceps tenodesis and tenotomy have shown comparable results regarding pain reduction and functional improvement.[4] Multiple level I studies have directly compared these techniques,[4,17,19,20,33] although the superiority of one treatment over the other remains unclear.

The purpose of this systematic review was to compare the clinical outcomes and complications of biceps tenodesis and tenotomy for the treatment of LHBT or SLAP pathology during shoulder arthroscopy. We hypothesized that there would be no significant differences in outcomes between groups other than an increased incidence of cosmetic deformity in patients undergoing biceps tenotomy.

Materials and methods

This systematic review was conducted according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines using a PRISMA checklist. Two independent reviewers (J.W.B. and M.J.K.) searched the PubMed, Embase, and Cochrane Library databases up to April 13, 2020. The electronic search strategy used was as follows: biceps tenodesis tenotomy randomized. A total of 82 studies were reviewed by title and/or abstract to determine study eligibility based on the inclusion criteria, and the references from viewed articles were cross-checked to ensure no relevant studies were missed. In cases of disagreement, a third reviewer (E.C.M.) made the final decision. The inclusion criteria were non-overlapping level I randomized controlled trials that directly compared the clinical and functional outcomes of patients undergoing biceps tenodesis vs. biceps tenotomy, studies published in English, and full-text articles published in peer-reviewed journals. The exclusion criteria included nonhuman studies, studies that focused on procedures other than biceps tenodesis and tenotomy, or studies with levels of evidence of II-V. Data extraction from each study was performed independently and then reviewed by a second author (M.J.K.). There was no need for funding or a third party to obtain any of the collected data. Risk of bias was assessed according to The Cochrane Collaboration's risk-of-bias tool,[14] which incorporates an assessment of randomization, blinding, completeness of outcome data, selection of outcomes reported, and other sources of bias. The Cohen κ score was calculated to determine the level of intraobserver agreement between reviewers. A score ≤ 0.20 indicates poor agreement; 0.21-0.40, fair agreement; 0.41-0.60, moderate agreement; 0.61-0.80, good agreement; and 0.81-1.00, very good agreement.[22]

Reporting of outcomes

Outcomes assessed included patient-reported outcomes and postoperative functional evaluations. Patient-reported outcomes included the American Shoulder and Elbow Surgeons (ASES) score,[27] visual analog scale (VAS) score for pain, and Constant-Murley score.[7] Postoperative functional evaluations included range of motion (ROM), bicipital groove pain, cosmetic deformity, and strength.

Study methodologic assessment

The Modified Coleman Methodology Score (MCMS)[6] was used to evaluate study methodologic quality. The MCMS has a scaled potential score ranging from 0 to 100. Scores of 85-100 are excellent; 70-84, good; 55-69, fair; and <55, poor.

Statistical analysis

Weighted averages were calculated for numerical demographic characteristics (age, follow-up, and sex). Weighted averages were also calculated for ASES, VAS, and Constant-Murley scores. Outcome data were summarized in a forest plot when data from ≥ 3 studies were available. Mean differences (MDs) with 95% confidence intervals (CI) were calculated for continuous outcome data (Constant-Murley and VAS scores), whereas relative risks with 95% CIs were calculated for dichotomous outcome data (presence of Popeye deformity). Summary measures were computed using random-effects models[10] (owing to anticipated heterogeneity) and were included in the forest plots. Random-effects models were used as these models incorporate between-study heterogeneity into the overall summary measures. A random-effects model equals a fixed-effects model if there is no between-study heterogeneity.[15] To quantify the degree of heterogeneity due to between-study differences in characteristics, I^2 statistics were calculated and presented in forest plots. Meta-analytic statistics and generation of forest plots were performed using RevMan (version 5.3; The Cochrane Collaboration, London, UK).

Results

Five studies met the inclusion and exclusion criteria[4,17,19,20,33] (Fig. 1). Four randomized controlled trials were excluded from this review because they were of level II evidence owing to a follow-up rate <80%.[2,9,21,26] This review included a total of 468 patients (236 who underwent tenodesis and 232 who underwent tenotomy) with a mean patient age at the time of surgery of 60.3 and 59.7 years in the tenodesis and tenotomy groups, respectively, and an overall mean follow-up time of 23.0 months. The overall percentage of male patients was 48.3% and 47.4% in the tenodesis and tenotomy groups, respectively (Table I).

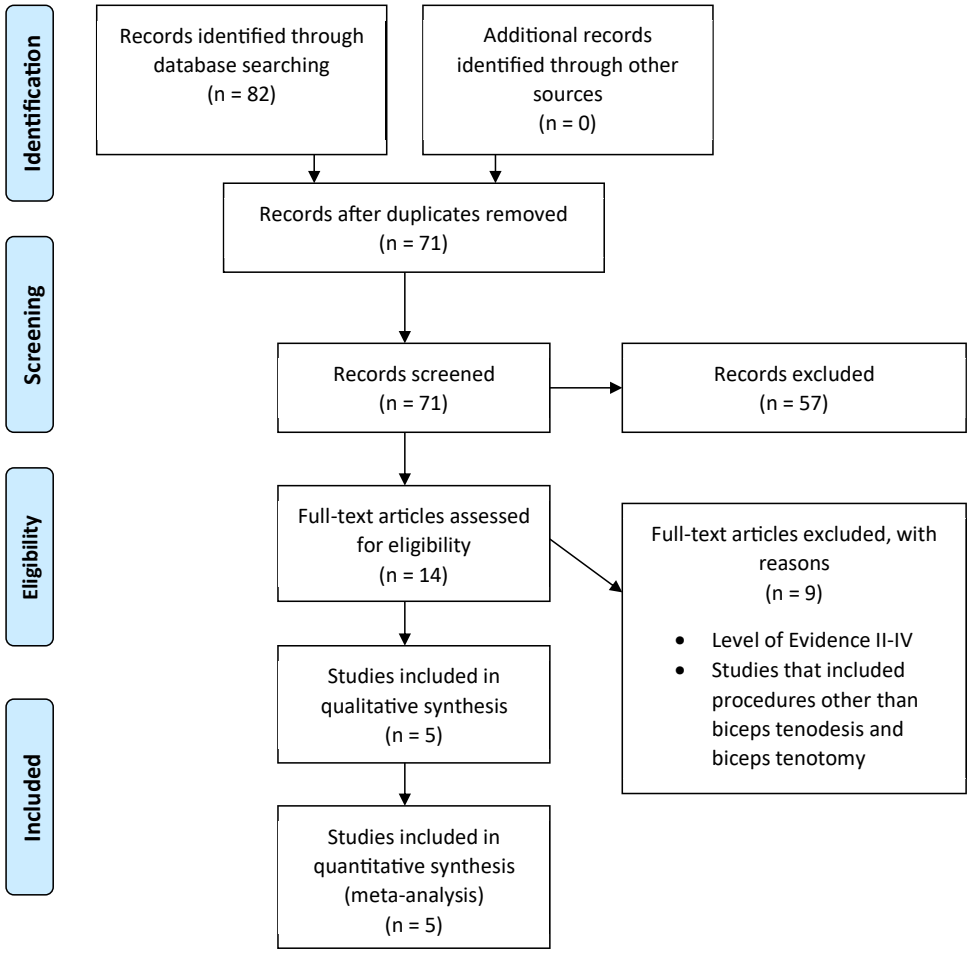

Figure 1 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) flow diagram.

Surgical technique

Biceps tenodesis

All studies described performing biceps tenodesis using similar arthroscopic suprapectoral approaches.[4,17,19,20,33] Patients were placed in either the beach-chair[17] or lateral decubitus position.[4,19] One study described using the beach-chair or lateral decubitus position based on surgeon preference,[20] and 1 study did not describe patient positioning.[33] After a diagnostic arthroscopy, the biceps tendon was tagged using either a No. 2 braided suture[33] or Krackow whipstitches,[17,19] and excision of the proximal biceps tendon was performed at the biceps-labral junction. Anterolateral and posterolateral portals were then

Table I Studies included

	Tenodesis/ tenotomy, n	Patient age, yr		Follow-up, mo	% Male sex: tenodesis/tenotomy
		Tenodesis	Tenotomy		
Study					
Castricini et al,[4] 2018	24/31	57.1 ± 8.0 (40-70)	59.9 ± 8.0 (40-71)	24.0	29.2/45.2
Hufeland et al,[17] 2019	9/11	51.5 ± 9.5 (37-63)	52.8 ± 8.0 (36-62)	12.0	77.8/36.4
Lee et al,[19] 2016	72/56	62.9 (50-75)	62.8 (55-77)	22.1	25.0/19.6
MacDonald et al,[20] 2020	57/57	58.7 ± 10.9 (34-86)	56.3 ± 8.1 (34-86)	24.0	82.5/78.9
Zhang et al,[33] 2015	74/77	61.0 (55-71)	61.0 (55-67)	24.0 (20-29)	47.3/46.8
Total	236/232	60.3 (34-86)	59.7 (34-86)	23.0	48.3/47.4

Patient age and follow-up are reported as mean ± standard deviation (range [when reported]), with the "Total" row reported as weighted average.

established, and the transverse ligaments overlying the biceps tendon within the bicipital groove were visualized. All studies described using a subdeltoid bursectomy to help with identification of the tendon space.[4,17,19,20,33] Via electrocautery, the biceps tendon and bicipital groove were then exposed, and the biceps tendon was pulled out through the anterolateral portal. Next, 15-20 mm of the most proximal aspect of the tendon was excised, followed by careful placement of a locking No. 2 braided suture, which was passed through the tenotomized tendon for tagging. A unicortical bone tunnel was then drilled in the bicipital groove using a guidewire to help with precise placement. Finally, the tendon was fixed into the proximal humerus with 6.5- to 8.0-mm-diameter SwiveLock anchors (Arthrex, Munich, Germany).[17,19,20] Two studies did not mention fixation hardware.[4,33] To provide additional fixation strength, the suture tails were tied to one another using an arthroscopic knot pusher.

One study described using an open subpectoral approach in half of the tenodesis patients.[20] After a diagnostic arthroscopy, a 2- to 4-cm incision was made in the axilla centered over the inferior border of the pectoralis major tendon. The biceps tendon was externalized, and the diseased portion of the tendon was amputated. Fixation of the tendon was performed similarly to the arthroscopic suprapectoral approach.

Biceps tenotomy

All studies described performing biceps tenotomy in a similar fashion.[4,17,19,20,33] Each study positioned patients for surgery the same way as for the biceps tenodesis procedures. After a standard diagnostic arthroscopy, the LHBT was evaluated for any pathologic changes, and the tendon was débrided and released from its insertion on the superior glenoid labrum using an arthroscopic biter or electrothermal device depending on surgeon preference or, in patients undergoing open subpectoral biceps tenotomy, using a scalpel.

Concomitant procedures

All studies included patients undergoing concomitant procedures, including rotator cuff repair,[4,19,20,33] subacromial decompression,[4,17,19,20,33] distal clavicle excision,[17,33] or labral débridement.[17] Four studies excluded patients with evidence of glenohumeral osteoarthritis on radiographic examination.[17,19,20,33] No study reported a significant difference in the types of procedures performed between the tenodesis and tenotomy groups.

Modified Coleman Methodology Score

Table II shows the MCMS values from the 5 included studies. Two studies received excellent scores,[19,33] and 3 received good scores.[4,17,20]

Table II Modified Coleman Methodology Score

	Modified Coleman Methodology Score
Study	
Castricini et al,[4] 2018	83
Hufeland et al,[17] 2019	77
Lee et al,[19] 2016	87
MacDonald et al,[20] 2020	84
Zhang et al,[33] 2015	86
Total	83.4 ± 3.9

Demographic characteristics

No significant differences were found in demographic characteristics between the groups in any of the 5 included studies. Multiple studies reported no differences in sex,[4,17,19,20,33] age,[4,17,19,20,33] body mass index,[20] arm dominance,[4,17,20] and/or lesion type.[4,19,33]

Reporting of outcomes

Three studies used the ASES score,[17,19,20] 4 used the VAS score,[4,19,20,33] and 4 used the Constant-Murley score.[4,17,19,33] Three studies assessed postoperative ROM,[4,19,20] and all studies reported on postoperative strength.[4,17,19,20,33] All studies reported on cosmetic deformity postoperatively.[4,17,19,20,33]

Methodologic quality assessment

The results of the methodologic quality assessment of the 5 randomized studies using The Cochrane Collaboration's risk-of-bias tool[14] are presented in Figure 2. Sequence generation and allocation were adequately reported by all included studies. All studies were deemed at low risk of detection bias because of blinding of the outcome assessor. Patients were blinded to their intervention group (low risk of bias) in all studies, except 1 study in which it was unclear whether patients were aware of their treatment group (unclear risk of bias).[33] Two studies reported minor loss to follow-up with rates between 10% and 20% without a proper explanation (unclear risk of bias),[4,20] whereas no other studies reported significant loss to follow-up (low risk of bias). No other studies were deemed at risk of bias owing to selective reporting or incomplete outcome data (low risk of bias). A Cohen κ score of 0.86 reflected very good agreement between reviewers.

Cosmetic deformity

All 5 studies reported on the development of Popeye deformity at latest follow-up,[4,17,19,20,33] which was indicated based on physician judgment in 4 studies[4,19,20,33] and

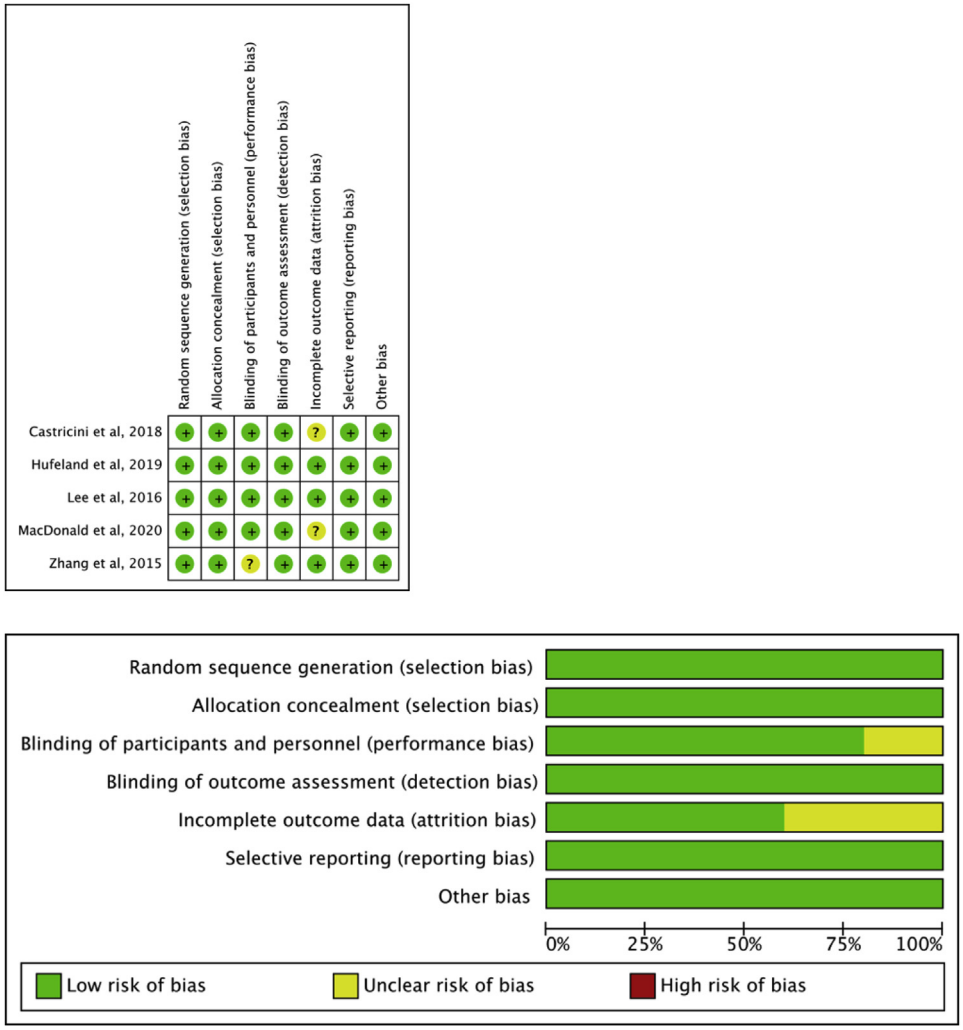

Figure 2 Risk-of-bias graph. Risk of bias is presented as a percentage across all included studies (, low risk; , unclear risk; and , high risk).

preoperative and postoperative measurement of the muscle belly in 1 study.[17] Three studies found patients undergoing biceps tenodesis to experience a significantly decreased incidence of Popeye deformity at latest follow-up compared with tenotomy patients.[4,19,20] Overall, 15.0% of patients experienced cosmetic deformity, including 6.8% in the tenodesis group and 23.3% in the tenotomy group (Table III). The pooled analysis from all 5 studies reporting on the development of Popeye deformity at latest follow-up showed a statistically significant difference in favor of the biceps tenodesis group (relative risk, 0.31 [95% CI, 0.19-0.52]; $P < .00001$) (Fig. 3).[4,17,19,20,33] No significant heterogeneity was found between the 2 groups ($I^2 = 0\%$, $P = .99$).

Table III Popeye deformity

	Tenodesis	Tenotomy	Total	*P* value
Study				
Castricini et al,[4] 2018	5 of 24 (20.8)	18 of 31 (58.1)	23 of 55 (41.8)	.01
Hufeland et al,[17] 2019	1 of 9 (11.1)	3 of 11 (27.3)	4 of 20 (20.0)	.37
Lee et al,[19] 2016	4 of 72 (5.6)	11 of 56 (19.6)	15 of 128 (11.7)	.01
MacDonald et al,[20] 2020	4 of 57 (7.0)	15 of 57 (26.3)	20 of 114 (17.5)	.01
Zhang et al,[33] 2015	2 of 74 (2.7)	7 of 77 (9.1)	9 of 151 (6.0)	.10
Total	16 of 236 (6.8)	54 of 232 (23.3)	70 of 468 (15.0)	<.0001

Data are reported as the number of patients with deformity out of the total number of patients (percentage) at latest follow-up.

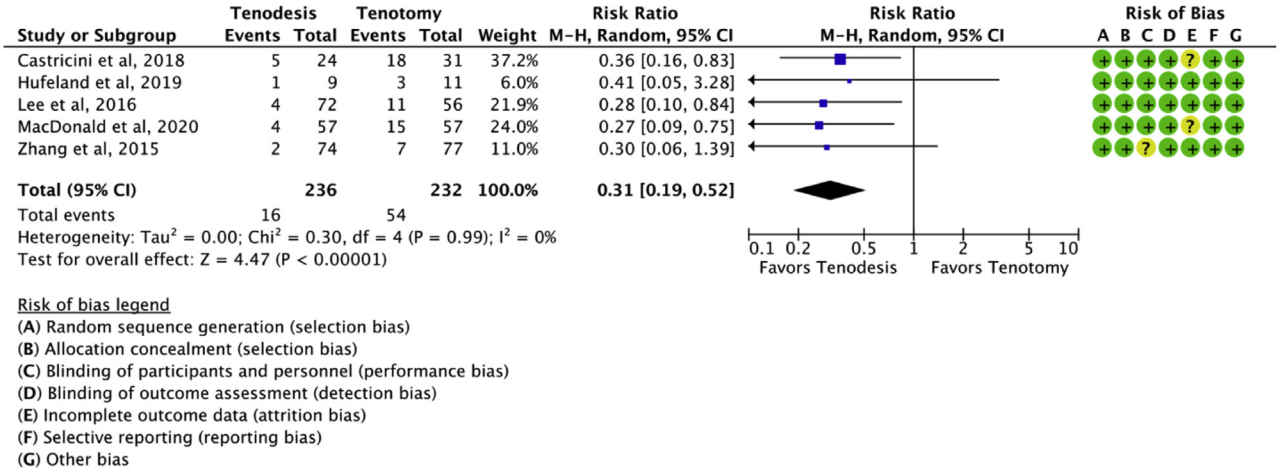

Figure 3 Forest plot with Popeye deformity as outcome at latest follow-up comparing biceps tenodesis vs. biceps tenotomy. *CI*, confidence interval; *M-H*, Mantel Haenszel.

Patient-reported outcomes

Four studies reported using the Constant-Murley score, none of which found significant differences in scores at latest follow-up between the groups (Table IV).[4,17,19,33] Similarly, no significant differences in preoperative Constant-Murley scores were found between the groups ($P > .05$).

Of the 4 studies reporting postoperative Constant-Murley scores, 3 could be used for the pooled analysis[4,17,33] because Lee et al[19] did not report the standard deviations (SDs) of the Constant-Murley scores at latest follow-up. The pooled analysis showed that there was no significant difference in postoperative Constant-Murley scores between the groups (MD, 1.68 [95% CI, –1.99 to 5.35]; $P = .37$) (Fig. 4), with moderate heterogeneity ($I^2 = 66\%$, $P = .05$).

Four studies reported using the VAS score, none of which found significant differences in scores at latest follow-up between the groups (Table V).[4,19,20,33] Similarly, all studies reported no significant differences in preoperative VAS scores between the groups ($P > .05$).

Of the 4 studies reporting postoperative VAS scores, 3 could be used for the pooled analysis[4,20,33] because Lee et al[19] did not report the SDs of the VAS scores at latest follow-up. The pooled analysis showed that there was no significant difference in postoperative VAS scores between the groups (MD, 0.05 [95% CI, –0.33 to 0.43]; $P = .80$) (Fig. 5). No significant heterogeneity was found between the 2 groups ($I^2 = 0\%$, $P = .87$).

Three studies reported using the ASES score,[17,19,20] none of which found significant differences in scores at latest follow-up between the groups (Table VI). Similarly, there were no significant differences in preoperative ASES scores between the groups ($P > .05$). Pooled analysis on the 3 studies reporting postoperative ASES scores[17,19,20] was not possible because Lee et al[19] did not report the SDs of the ASES scores at latest follow-up.

Functional outcomes

Range of motion

Three studies assessed ROM of both the operative and contralateral extremities using a goniometer.[4,19,20] None

Table IV Constant-Murley scores

	Tenodesis		Tenotomy		*P* value
	Preoperative	Postoperative	Preoperative	Postoperative	
Study					
Castricini et al,[4] 2018	47.0 ± 6.3	84.4 ± 6.5	48.1 ± 4.7	85.2 ± 8.1	>.05
Hufeland et al,[17] 2019	60.1 ± 8.5	88.1 ± 7.5	50.9 ± 8.5	77.4 ± 11.8	>.05
Lee et al,[19] 2016	69.9 ± 7.2	86.5	69.9 ± 7.5	88.3	>.05
Zhang et al,[33] 2015	NR	96.5 ± 2.6	NR	95.6 ± 3.0	>.05
Total	63.8	90.4	60.9	90.3	.37

NR, not reported.
Scores are reported as mean ± standard deviation (when reported) at latest follow-up, with the "Total" row reported as weighted mean. The *P* values represent comparisons of postoperative scores between groups.

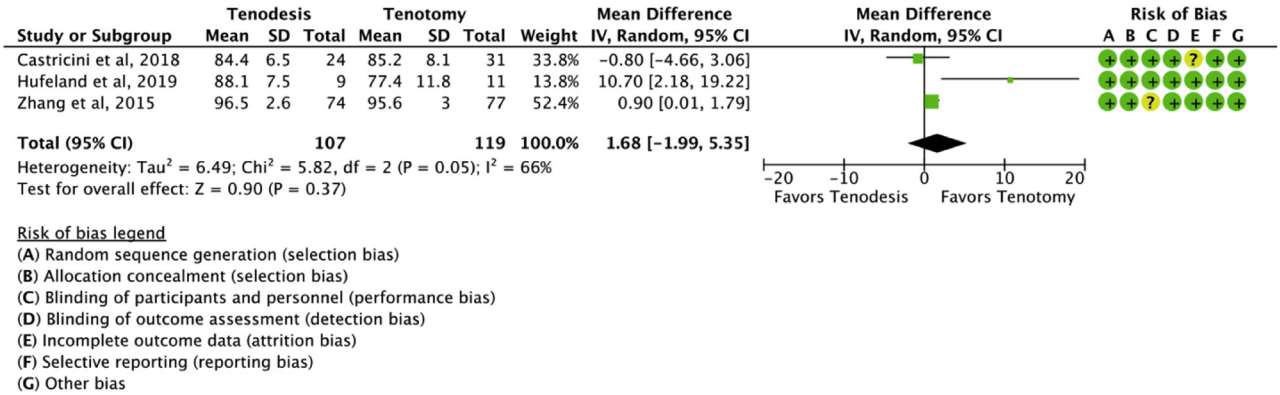

Figure 4 Forest plot with Constant-Murley score as outcome at latest follow-up comparing biceps tenodesis vs. biceps tenotomy. *SD*, standard deviation; *IV*, weighted mean difference; *CI*, confidence interval.

Table V Visual analog scale scores

	Tenodesis		Tenotomy		*P* value
	Preoperative	Postoperative	Preoperative	Postoperative	
Study					
Castricini et al,[4] 2018	NR	1.0 ± 2.0	NR	1.0 ± 1.9	>.05
Lee et al,[19] 2016	6.8 ± 1.3	1.8	7.1 ± 1.4	2.0	>.05
MacDonald et al,[20] 2020	NR	2.1 ± 2.9	NR	2.3 ± 2.9	.73
Zhang et al,[33] 2015	NR	2.1 ± 1.6	NR	2.0 ± 1.1	>.05
Total	6.8	1.9	7.1	1.9	.80

NR, not reported.
Scores are reported as mean ± standard deviation (when reported) at latest follow-up, with the "Total" row reported as weighted mean. The *P* values represent comparisons of postoperative scores between groups.

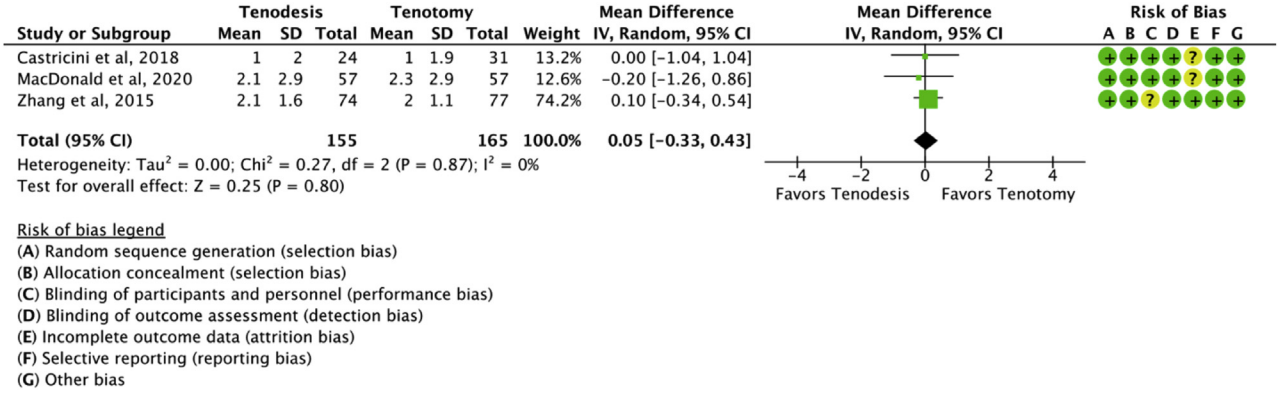

Figure 5 Forest plot with visual analog scale score as outcome at latest follow-up comparing biceps tenodesis vs. biceps tenotomy. *SD*, standard deviation; *IV*, weighted mean difference; *CI*, confidence interval.

found any significant differences between groups regarding shoulder forward flexion,[4,19,20] abduction,[4,19,20] internal rotation,[4,19] or external rotation[4,19] at latest follow-up.

Strength testing

All 5 studies used a dynamometer or transducer to evaluate the strength of both the operative and contralateral extremities postoperatively.[4,17,19,20,33] Multiple studies found no significant differences between the groups regarding strength with elbow flexion,[4,17,19,20,33] forearm supination,[17,20,33] shoulder external rotation,[4] or abduction[4] at latest follow-up. One study demonstrated significantly increased forearm supination strength in patients who underwent biceps tenodesis ($P = .02$).[19]

Table VI American Shoulder and Elbow Surgeons scores

	Tenodesis		Tenotomy		*P* value
	Preoperative	Postoperative	Preoperative	Postoperative	
Study					
Hufeland et al,[17] 2019	48.7 ± 14.8	95.2 ± 10.8	45.9 ± 20.7	76.9 ± 20.3	>.05
Lee et al,[19] 2016	51.5 ± 6.0	77.6	44.2 ± 4.7	82.8	>.05
MacDonald et al,[20] 2020	48.2 ± 17.6	79.4 ± 21.8	47.3 ± 15.9	82.3 ± 17.8	.47
Total	50.0	79.5	45.8	82.0	—

Scores are reported as mean ± standard deviation (when reported) at latest follow-up, with the "Total" row reported as weighted mean. The *P* values represent comparisons of postoperative scores between groups.

Complications

Four studies reported on postoperative complications (aside from cosmetic deformity), including biceps cramping, wound infection, adhesive capsulitis, postoperative stiffness, neural or vascular injury, and need for reoperation.[4,17,20,33] During the entire follow-up duration among all 4 studies, only 1 significant difference was observed: Castricini et al[4] found tenodesis patients to experience significantly more biceps cramping at 6-month follow-up when compared with tenotomy patients ($P = .043$), although no cramping was noted in either group at the 2-year follow-up. No studies found significant differences in complication rates between groups at any other time point.

Discussion

Biceps tenodesis and tenotomy are 2 surgical procedures commonly performed during shoulder arthroscopy for the treatment of various pathologies of the LHBT, including tendinosis, tenosynovitis, complete or partial rupture, subluxation or dislocation, or SLAP tear.[8] Common complications of these procedures include biceps muscle belly cramping and/or cosmetic deformity (Popeye sign) owing to visible bulging of the biceps muscle at the distal humerus. For some patients, this deformity may be unacceptable and may even warrant a revision procedure. Previous level II-IV systematic reviews of biceps tenodesis vs. tenotomy during shoulder arthroscopy have identified a higher risk of Popeye deformity in patients undergoing biceps tenotomy compared with tenodesis.[12,13,25,30]

The current systematic review with meta-analysis is, to our knowledge, the first level I evidence review to compare clinical outcomes and complication rates between biceps tenodesis and tenotomy. Patients in both groups demonstrated improvement from preoperatively to postoperatively in terms of the Constant-Murley score, VAS score for pain, and ASES score. Furthermore, no significant differences were identified between groups in a meta-analysis of Constant-Murley or VAS scores. However, in accordance with previous systematic reviews on the same topic, we identified a significantly higher rate of cosmetic deformity in patients undergoing biceps tenotomy (23.3% vs. 6.8% among tenodesis patients).

It is important for surgeons performing shoulder arthroscopy to counsel their patients on the risks of cosmetic deformity following biceps tenodesis or tenotomy. In a case series of 104 patients undergoing biceps tenotomy, Meeks et al[23] reported that 13% of all patients (14 of 104) noticed the Popeye deformity postoperatively, although only 2 of the 14 patients stated that this deformity bothered them cosmetically. Moreover, in a case series of 117 patients undergoing biceps tenotomy, Duff and Campbell[11] found that 34 patients (27%) noticed a deformity postoperatively, although only 4 of the 34 patients (11%) were concerned about this appearance. Thus, although the development of the Popeye deformity is rarely bothersome to patients, surgeons should seek to identify those patients for whom a cosmetic deformity would result in patient dissatisfaction and should advocate biceps tenodesis rather than tenotomy in these patients.

Although we found a significantly higher risk of cosmetic deformity with biceps tenotomy compared with tenodesis, deformity did occur in 6.8% of tenodesis patients. This may be because of the method of suture passage through the proximal biceps tendon during the procedure. Schrock et al[28] performed a retrospective cohort study comparing the risk of biceps tenodesis failure (including cosmetic deformity) based on suture passage with a BirdBeak suture passer (Arthrex, Naples, FL, USA) vs. a free needle. They found a significantly higher rate of cosmetic deformity with the BirdBeak device (10% vs. 2%, $P < .0001$). They surmised that the higher failure rate was likely because of the larger hole created in the biceps tendon by the BirdBeak device in comparison to the free needle. In the studies included in our systematic review, information regarding suture passage technique was not described in detail.

The strengths of this study include a comprehensive systematic review performed by 2 independent reviewers. In addition, this is the first systematic review of which we are aware that only includes level I studies comparing

outcomes of biceps tenodesis vs. tenotomy. The limitations of this study should also be noted. Five studies were included in this systematic review owing to our strict inclusion criteria of level I evidence studies. A meta-analysis could not be performed on postoperative ASES scores because fewer than 3 studies reported complete information on these scores. Additionally, the results of the evaluated outcomes may have been confounded owing to the concomitant procedures (rotator cuff repair, subacromial decompression, débridement, and so on) included in each study, although isolated biceps tenodesis or tenotomy, without additional procedures, is rarely performed. Finally, this study did not stratify outcomes based on indication (biceps tendinosis, partial or complete proximal biceps tendon rupture, SLAP tear, and so on).

Conclusion

Patients undergoing treatment for LHBT or SLAP pathology with either biceps tenodesis or tenotomy can be expected to experience similar improvements in patient-reported and functional outcomes. There is an increased rate of cosmetic deformity in patients undergoing biceps tenotomy compared with tenodesis.

Disclaimer

Anthony J. Scillia receives research support from ISO-biologics; is a paid consultant for Mitek; and is a board member of the New Jersey Orthopaedic Society. However, none of these are related to the work at hand.

Eric C. McCarty is a board or committee member of the American Orthopaedic Society for Sports Medicine and International Society of Arthroscopy, Knee Surgery & Orthopaedic Sports Medicine; serves on the editorial or governing board of *Orthopedics Today*, *Orthopedics*, and *American Journal of Sports Medicine*; receives research support from Arthrex, Biomet, Breg, Mitek, Ossur, Smith & Nephew, and Stryker; is a paid consultant for Biomet; and receives royalties from Elsevier and Zimmer. However, none of these are related to the work at hand.

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