

Tenodesis Of The Long Biceps' Tendon Does Not Affect Postoperative Outcome After Rotator Cuff Reconstruction

M. Sgroi PD Dr. med.*, T. Caffard Dr. med.*., M. Ludwig Dr. med.*, D. Kralewski Dr. med.*,
D. Dornacher PD Dr. Dr. med.*, T. Kappe Prof. Dr. med.*, H. Reichel Prof. Dr. med.*

*Department for Orthopaedic Surgery, RKU, University of Ulm, Ulm, Germany



Disclosure of conflicts of interest

No conflicts of interest

Introduction

- The role of the long biceps tendon (LHB) as a pain-causing concomitant pathology of a rotator cuff lesions is well known
- Instability, partial rupture, and SLAP lesions are the most common pathologies of the LHB
- Tenodesis of the LHB is often performed in combination with rotator cuff reconstruction
- The effect of tenodesis of the LBS on clinical and radiographic outcomes after rotator cuff reconstruction remains unclear



Introduction

Methods

Results

Discussion

Research questions



(1) Is performing additional tenodesis of the LHB associated with worse clinical outcome after rotator cuff repair?

(2) Do differences in re-rupture rates and tendon quality occur between patients with isolated rotator cuff repair and those with concomitant LHB tenodesis?

Introduction

Methods

Results

Discussion

Inclusion/Exclusion criteria

Inclusion criteria:

- Reconstruction of a full-thickness SSP tear
- At least 2 years follow-up

Exclusion criteria:

- Ruptured LHB
- LHB tenotomy as treatment
- Quality of preoperative imaging insufficient

n = 51 included

n = 26 with LHB tenodesis

vs.

n = 25 without LHB tenodesis

Follow-up

Clinical and radiological follow-up after 2.3 ± 0.3 years postoperatively:

- Acquisition of clinical results by:
 - American Shoulder and Elbow Surgeons Shoulder Score (ASES)
 - Constant Shoulder Score (CS)
 - Western Ontario Rotator Cuff Index (WORC)
 - Oxford Shoulder Score (OSS)

- MRI of the operated shoulder

Radiological analysis

Two independent observers examined the MRI:

- Integrity of the SSP tendon according to Sugaya
- Quality of the SSP tendon according to Castricini
- Muscle atrophy of the SSP
- Fatty infiltration of the SSP

Introduction

Methods

Results

Discussion

Clinical results

Scores	Tenodesis	No Tenodesis	Difference (95% CI)	P-value
Worc, points \pm SD	98 \pm 2	97 \pm 2	1 (-0.4– 2)	0.19
Constant, points \pm SD	70 \pm 18	72 \pm 14	2 (-7 – 11)	0.73
Oxford, points \pm SD	25.3 \pm 12	24.8 \pm 13	0.5 (-6.80–7.97)	0.87
ASES, points \pm SD	78 \pm 21	85 \pm 16	7 (-4 – 17)	0.22
LHB, points \pm SD	84 \pm 14	none	none	-

ROM	Tenodesis	No tenodesis	Difference (95% CI)	p-value
Abduction ($^{\circ}$ \pm SD)	165 \pm 27	162.00 \pm 37	3 (-15 - 21)	0.71
Adduction ($^{\circ}$ \pm SD)	38.4 \pm 15.6	38.0 \pm 19.5	0.4 (-9.5 - 10.4)	0.92
Flexion ($^{\circ}$ \pm SD)	165 \pm 28	161 \pm 41	4 (-15 - 24)	0.65
Extension ($^{\circ}$ \pm SD)	41 \pm 16	46 \pm 15	5 (-13 - 4)	0.28
External rotation low ($^{\circ}$ \pm SD)	62 \pm 22	58 \pm 21	4 (-5 - 13)	0.39
Internal rotation high ($^{\circ}$ \pm SD)	61 \pm 22	58 \pm 21	7 (-5 - 19)	0.25
Jobe Test Full Can % (n) positive	11 (3)	15 (4)	4 (1)	0.43
Jobe Test Empty Can % (n) positive	19 (5)	11 (3)	8 (2)	0.37

Introduction

Methods

Results

Discussion

Radiological results

Variable	Tenodesis (n = 26)			No Tenodesis (n = 25)				P-value	
Re-Rupture rate, % (n)	27 (7)			20 (5)				0.39	
Tendon thickness, % (n)	1°	2°	3°	1°	2°	3°	0.11		
	23 (6)	35 (9)	42 (11)	36 (9)	44 (11)	24 (6)			
Footprint coverage, % (n)	11 (3)	8 (2)	81 (21)	24 (6)	20 (5)	60 (15)	0.07		
Tendon quality, % (n)	19 (5)	15 (4)	65 (17)	32 (8)	32 (8)	40 (10)	0.06		
Muscle atrophy, % (n)	92 (24)	2 (7.7)	0 (0)	64 (16)	40 (10)	0 (0)	0.18		
Upward migration, ratio ± SD	1.33 ± 0.09			1.27 ± 0.10				0.69	
Fatty infiltration, % (n)	0°	1°	2°	3°	0°	1°	2°	3°	p < 0.01
	81 (21)	15 (4)	4 (1)	0 (0)	68 (17)	28 (7)	4 (1)	4 (1)	

Limitations

Introduction

Methods

Results

Discussion

- Limited number of patients
- Limited follow-up time
- Monocentric
- No randomization

Conclusions

- Tenodesis of the LHB is not associated with worse clinical outcomes after rotator cuff repair
- No differences in terms of re-rupture rates and tendon qualities between both analysed groups
- Fatty infiltration is lower in patients with concomitant tenodesis of the LHB
- Concomitant tenodesis of the LHB with rotator cuff reconstruction is a safe and effective procedure
- Future studies with longer follow-up needed

Introduction

Methods

Results

Discussion

References

1. Abraham VT, Tan BHM, Kumar VP. Systematic Review of Biceps Tenodesis: Arthroscopic Versus Open. *Arthroscopy*. 2016;32:365-371.
2. Aflootoni JO, Meeks BD, Froehle AW, Bonner KF. Biceps tenotomy versus tenodesis: patient-reported outcomes and satisfaction. *J Orthop Surg Res*. 2020;15:56.
3. Anon. Arthroscopic soft tissue tenodesis versus bony fixation anchor tenodesis of the long head of the biceps tendon - PubMed. Available at: <https://pubmed.ncbi.nlm.nih.gov/21257843/> [Accessed October 21, 2022].
4. Belk JW, Kraeutler MJ, Houck DA, Chrisman AN, Scillia AJ, McCarty EC. Biceps tenodesis versus tenotomy: a systematic review and meta-analysis of level I randomized controlled trials. *J Shoulder Elbow Surg*. 2021;30:951-960.
5. Belk JW, Thon SG, Hart J, McCarty EC, McCarty EC. Subpectoral versus suprapectoral biceps tenodesis yields similar clinical outcomes: a systematic review. *J ISAKOS*. 2021;6:356-362.
6. Castricini R, Familiari F, De Gori M, Riccelli DA, De Benedetto M, Orlando N, Galasso O, Gasparini G. Tenodesis is not superior to tenotomy in the treatment of the long head of biceps tendon lesions. *Knee Surg Sports Traumatol Arthrosc*. 2018;26:169-175.
7. Castricini R, Longo UG, De Benedetto M, Panfoli N, Pirani P, Zini R, Maffulli N, Denaro V. Platelet-rich plasma augmentation for arthroscopic rotator cuff repair: a randomized controlled trial. *Am J Sports Med*. 2011;39:258-265.
8. Chen RE, Voloshin I. Long Head of Biceps Injury: Treatment Options and Decision Making. *Sports Med Arthrosc Rev*. 2018;26:139-144.
9. Collin P, Yoshida M, Delarue A, Lucas C, Jossaume T, Lädermann A, French Society for Shoulder and Elbow (SOFEC). Evaluating postoperative rotator cuff healing: Prospective comparison of MRI and ultrasound. *Orthop Traumatol Surg Res*. 2015;101:S265-268.
10. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. *Clin Orthop Relat Res*. 1987;160-164.
11. Creech MJ, Yeung M, Denkers M, Simunovic N, Athwal GS, Ayeni OR. Surgical indications for long head biceps tenodesis: a systematic review. *Knee Surg Sports Traumatol Arthrosc*. 2016;24:2156-2166.
12. Daggett M, Stepanovich B, Meyers A, Geraghty B. Arthroscopic On-Lay Biceps Tenodesis: The Loop-Lock Technique. *Arthrosc Tech*. 2019;8:e935-e939.
13. De Carli A, Vadalà A, Zanzotto E, Zampar G, Vetrano M, Iorio R, Ferretti A. Repairable rotator cuff tears with concomitant long-head biceps lesions: tenotomy or tenotomy/tenodesis? *Knee Surg Sports Traumatol Arthrosc*. 2012;20:2553-2558.
14. van Deurzen DFP, Auw Yang KG, Onstenk R, Raven EEJ, van den Borne MPJ, Hoelen MA, Wessel RN, Willigenburg NW, Klaassen AD, van den Bekerom MPJ, Zijl JAC, Wolterbeek N, Koenraadt KLM, van Beers LWAH, Jaap Willems W, Mathijssen NM, Hesselings B, Lemmens E, Janssens R, Garssen FL, Gurnani N, van Rhijn RI, Spek R, Teuwen M, Verweij LPE, Volkers M, Scholtes VAB. Long Head of Biceps Tenotomy Is Not Inferior to Suprapectoral Tenodesis in Arthroscopic Repair of Nontraumatic Rotator Cuff Tears: A Multicenter, Non-inferiority, Randomized, Controlled Clinical Trial. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. 2021;37:1767-1776.e1.
15. F E, S B, Cb D, Je G, Pj M. Anatomy, function, injuries, and treatment of the long head of the biceps brachii tendon. *Arthroscopy: the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association*. 2011;27. Available at: <https://pubmed.ncbi.nlm.nih.gov/21444012/> [Accessed August 18, 2022].
16. Faruqi S, Kotob MA, Hanna CC, Foad A. The modified Norwegian method of biceps tenodesis: how well does it work? *Knee Surg Sports Traumatol Arthrosc*. 2017;25:3264-3269.
17. Goutallier D, Postel JM, Bernageau J, Lavau L, Voisin MC. Fatty muscle degeneration in cuff ruptures. Pre- and postoperative evaluation by CT scan. *Clin Orthop Relat Res*. 1994;78-83.
18. Gurnani N, van Deurzen DFP, Janmaat VT, van den Bekerom MPJ. Tenotomy or tenodesis for pathology of the long head of the biceps brachii: a systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc*. 2016;24:3765-3771.
19. Habermeyer P, Magosch P, Pritsch M, Scheibel MT, Lichtenberg S. Anterosuperior impingement of the shoulder as a result of pulley lesions: a prospective arthroscopic study. *J Shoulder Elbow Surg*. 2004;13:5-12.
20. Hsu AR, Ghodadra NS, Provencher MT, Lewis PB, Bach BR. Biceps tenotomy versus tenodesis: a review of clinical outcomes and biomechanical results. *J Shoulder Elbow Surg*. 2011;20:326-332.

References

21. Hufeland M, Wicke S, Verde PE, Krauspe R, Patzer T. Biceps tenodesis versus tenotomy in isolated LHB lesions: a prospective randomized clinical trial. *Arch Orthop Trauma Surg.* 2019;139:961-970.
22. I S, P B, G W. The proximal biceps as a pain generator and results of tenotomy. *Sports medicine and arthroscopy review.* 2008;16. Available at: <https://pubmed.ncbi.nlm.nih.gov/18703979/> [Accessed August 18, 2022].
23. Kirkley A, Alvarez C, Griffin S. The development and evaluation of a disease-specific quality-of-life questionnaire for disorders of the rotator cuff: The Western Ontario Rotator Cuff Index. *Clin J Sport Med.* 2003;13:84-92.
24. Kirshner B, Guyatt G. A methodological framework for assessing health indices. *J Chronic Dis.* 1985;38:27-36.
25. Lee H-J, Jeong J-Y, Kim C-K, Kim Y-S. Surgical treatment of lesions of the long head of the biceps brachii tendon with rotator cuff tear: a prospective randomized clinical trial comparing the clinical results of tenotomy and tenodesis. *J Shoulder Elbow Surg.* 2016;25:1107-1114.
26. Lee SE, Jung J-Y, Lee S-Y, Park H. Progression of long head of the biceps brachii tendon abnormality on magnetic resonance imaging after rotator cuff repair. *Br J Radiol.* 2021;94:20210366.
27. Levy DM, Meyer ZI, Campbell KA, Bach BR. Subpectoral Biceps Tenodesis. *Am J Orthop (Belle Mead NJ).* 2016;45:68-74.
28. Martetschläger F, Tauber M, Habermeyer P. Injuries to the Biceps Pulley. *Clin Sports Med.* 2016;35:19-27.
29. Meraner D, Sternberg C, Vega J, Hahne J, Kleine M, Leuzinger J. Arthroscopic tenodesis versus tenotomy of the long head of biceps tendon in simultaneous rotator cuff repair. *Arch Orthop Trauma Surg.* 2016;136:101-106.
30. Olley L, Carr A. The Use of a Patient-Based Questionnaire (The Oxford Shoulder Score) to Assess Outcome After Rotator Cuff Repair. *Ann R Coll Surg Engl.* 2008;90:326-331.
31. Pozzetti Daou J, Nagaya DY, Matsunaga FT, Sugawara Tamaoki MJ. Does Biceps Tenotomy or Tenodesis Have Better Results After Surgery? A Systematic Review and Meta-analysis. *Clin Orthop Relat Res.* 2021;479:1561-1573.
32. Sugaya H, Maeda K, Matsuki K, Moriishi J. Functional and structural outcome after arthroscopic full-thickness rotator cuff repair: single-row versus dual-row fixation. *Arthroscopy.* 2005;21:1307-1316.
33. Thomazeau H, Rolland Y, Lucas C, Duval JM, Langlais F. Atrophy of the supraspinatus belly. Assessment by MRI in 55 patients with rotator cuff pathology. *Acta Orthop Scand.* 1996;67:264-268.
34. Virk MS, Cole BJ. Proximal Biceps Tendon and Rotator Cuff Tears. *Clin Sports Med.* 2016;35:153-161.
35. Watson ST, Robbins CB, Bedi A, Carpenter JE, Gagnier JJ, Miller BS. Comparison of Outcomes 1 Year After Rotator Cuff Repair With and Without Concomitant Biceps Surgery. *Arthroscopy.* 2017;33:1928-1936.
36. Werner A, Mueller T, Boehm D, Gohlke F. The Stabilizing Sling for the Long Head of the Biceps Tendon in the Rotator Cuff Interval: A Histoanatomic Study. *Am J Sports Med.* 2000;28:28-31.
37. Yoshida M, Collin P, Josseaume T, Lädemann A, Goto H, Sugimoto K, Otsuka T. Postoperative rotator cuff integrity, based on Sugaya's classification, can reflect abduction muscle strength of the shoulder. *Knee Surg Sports Traumatol*