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Functional outcomes of arthroscopic rotator cuff repair: transosseous technique versus single-row with anchors

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ABSTRACT

Background: Transosseous repair (TO) has declined in popularity since the introduction of suture anchors and arthroscopic methods in 1985. Nevertheless, failure rates remain significant, at 12% to 40% and the cost of these devices is considerable. Consequently, interest has revived in arthroscopic transosseous technique, the aim of this study was to evaluate whether anchorless transosseous arthroscopic fixation achieves similar or better functional outcomes than single-row fixation with anchors in patients with rotator cuff tears.
Methods: 60 shoulders with complete rotator cuff tears were evaluated, divided into two groups based on fixation technique: Group 1 (transosseous) and Group 2 (single row with anchors). All patients had a minimum 12-month follow-up, including clinical assessments (VAS, range of motion) and functional questionnaires (ASES, Constant scores).
Results: No significant differences were found in VAS scores at 6 months (t=0.244, p=0.404) and 12 months (t=0.220, p=0.413). Additionally, there was no superiority of either group in motion ranges at 12 months (forward flexion t=0.732, p=0.234; external rotation t=1.608, p=0.057; abduction t=0.583, p=0.281). Both groups reported high postoperative satisfaction, with no differences in ASES (t=0.153, p=0.439) and constant scores (t=0.572, p=0.285) at 12 months.
Conclusions: The transosseous repair technique is as effective as single-row anchor repair for rotator cuff repair, achieving similar clinical and functional outcomes.

Keywords: Arthroscopy, Functional outcomes, Rotator cuff, Single-row fixation, Transosseous fixation

INTRODUCTION

Rotator cuff injuries are a common cause of shoulder pain and disability, with a multifactorial etiology influenced by aging, history of microtrauma, smoking, hypercholesterolemia and genetic factors.[1] The treatment of this injury has undergone evolutionary changes. Codman, in 1911, first defined open repair with transosseous fixation as the gold standard for full-thickness rotator cuff tears.[2,3] However, transosseous (TO) repair through an open approach has been gradually abandoned with the advent of suture anchors and arthroscopic repairs. Since their introduction in 1985, multiple devices and techniques (single-row, double-row, transosseous equivalent) have been designed and commercialized.[4,5] However, the cost of the anchors is high and these advancements have not reduced failure rates in the short to medium term (12-40%).[6-9] Complications have been reported, such as knot impingement, suture cutting on the tendon, early device loosening, cyst formation around the anchors and issues related to revision surgeries.[10-13] This has led to a trend among surgeons to use TO repair now with specialized

arthroscopic placement devices (Arthrotunneler®, TransOs®, Taylorstich®, DrillBone®).[14,15]

The aim of this study was to determine whether anchorless transosseous arthroscopic fixation provides similar or superior functional results to single-row fixation with anchors in patients with rotator cuff injuries requiring arthroscopic fixators and to establish a more favorable standardization of the surgical technique with a lower failure rate in the short and medium term.

METHODS

Retrospective study involving a series of 60 cases (60 shoulders) operated on between January 2020 and May 2023, obtained from the database of the Hospital de Ortopedia, Cruz Roja Mexicana, Mérida, Mexico.

Inclusion criteria

Patients with a complete rotator cuff tear identified via MRI, who had undergone physical therapy for at least 2 months, being over 18 years old, having a tear of the supraspinatus or infraspinatus tendon, with a tear measuring 1.5 to 4 centimeters in crescent, L-type, inverted L-type or trapezoidal configuration, having undergone shoulder arthroscopy including subacromial decompression of the acromioclavicular osteophyte, tenotomy or subpectoral tenodesis of the long head of the biceps and rotator cuff repair with transosseous arthroscopic fixation without anchors (Group 1) or with single-row arthroscopic fixation with anchors (Group 2), who had completed 12 months of follow-up and had a complete clinical record (Figure 1).

Exclusion criteria

Patients who did not present arthroscopic findings of rotator cuff injury, partial or massive tears, tears of the subscapularis tendon, prior shoulder surgery or re-tear of the rotator cuff, those with advanced osteoarthritis or grade III-IV fatty infiltration, as well as those who did not complete a 12-months follow-up.

The convenience sampling method was used and all patients who met the inclusion criteria and were operated on during the declared period were included.

Patient assignment to the study groups was carried out through simple randomisation based on the surgical technique used.

Surgical technique

All interventions were performed under general or regional anesthesia, in a beach chair position with hand support (Maquet Trimano®, Smith and Nephew Spyder 2®). A single surgeon performed all surgeries. A four-portal technique (anterior, posterior, anterolateral and posterolateral) was routinely used in all cases.

Routine diagnostic arthroscopy was followed by supraglenoid tenotomy of the long head of the biceps in all cases due to instability or partial tear. Subsequently, via the lateral portal, a bursectomy and decompression of the acromioclavicular osteophyte were performed, preserving the coracoacromial ligament.

Both the anterosuperior and posterosuperior rotator cuff complex were routinely assessed. Those with isolated or mixed supraspinatus and infraspinatus lesions measuring 1.5 to 4 cm were selected. Tissue quality and retraction degree were verified for repair, then tendon footprint was identified and debrided for biological contribution, after which the lesion was repaired.

In cases selected for arthroscopic fixation using a transosseous technique, the TransOS tunneler system (Tensor Surgical®) was employed, creating one or two bone tunnels at the tendon footprint, through which 2 or 3 sutures pre-placed in the tendon were introduced and tied using a sliding knot technique in a simple configuration or Mason-Allen technique according to the type and magnitude of the lesion (Figure 2).

Coronal view of transosseous repair, in this representation, two high-strength sutures previously placed in the tendon can be observed being introduced into a tunnel formed in the footprint B) Sagittal view showing a simple knotting technique with one anterior and one posterior suture, providing complete coverage of the footprint C) Coronal view of single-row repair using two 5.5 mm anchors placed in the most lateral region of the footprint D) Sagittal view of a single-row repair using a simple knotting technique, where it can be seen that one of the anchors was placed in the most anterior portion of the tear and the other in the most posterior portion.

For arthroscopic fixation with suture anchors, PK implants were used in all cases, utilizing one or two Healicoil anchors (Smith and Nephew®) 5.5 mm loaded with two sutures, passing through the tendon with different devices, Accupass (Smith and Nephew®), First pass (Smith and Nephew®) with a fixation to the footprint of the tendon in its most lateral part, using a single row technique (Figure 3).

Complete lesion of the supraspinatus tendon in a crescent configuration. Repair with a transosseous technique, adequate coverage of the footprint can be observed. Complete lesion of the infraspinatus tendon. Repair with two anchors in a single row, in this case the anchors are placed in the most lateral portion of the footprint.

Postoperative care and rehabilitation

After surgery, all patients used a universal shoulder immobilizer for a period of four weeks. The first two weeks were strict, favoring active and passive exercises for the elbow, wrist and hand. In the third week, pendulum exercises and passive scapular control movements were

initiated at home. In the fourth week, rehabilitation guided by a physiotherapist commenced, completing a three-phase program with 10 sessions each, focusing on stretching exercises, followed by active mobilization to regain forward elevation and external rotation. Full release for daily activities was dependent on each patient's progress.

Outcome measurement

All patients were evaluated preoperatively and postoperatively through outpatient consultations, with a minimum follow-up of 12 months from surgery to final assessment. Clinical evaluations were conducted, supplemented by functional questionnaires.

Clinical assessment was quantified based on the range of motion obtained in degrees during preoperative and postoperative examinations, evaluating forward elevation, abduction and external rotation, while internal rotation was measured using shoulder internal rotation score (SIRS).

Functional assessment was conducted at 6 and 12 months respectively, using internationally standardized questionnaires employed in other similar studies.[10,17] Each patient completed the Constant score and the American Shoulder and Elbow Surgeons (ASES) score.

This study was approved by the hospital's research committee, it was conducted following the principles of the Declaration of Helsinki, all included patients authorized their participation through informed consent.

Statistical analysis

All demographic data and clinical measurements were recorded in a database using IBM® SPSS version 24, where they were analysed using descriptive statistics to calculate frequencies, percentages, central tendency measures and dispersion, with no missing data.

The dependent variables (pain, range of motion and function) were quantitative with a normal distribution and therefore, the parametric Student's t-test (for a single sample) was used to determine the difference in means between groups. For qualitative data, the non-parametric Chi-square (X^2) test was employed to assess the degree of association of nominal variables according to the surgical technique. In both tests, a 95% confidence interval (CI), a 5% error margin and a significance level of $p<0.05$ were applied.

RESULTS

This retrospective study evaluated 60 patients and 60 shoulders, consisting of 40 (66.7%) women and 20 (33.3%) men. The dominant side was the right in 56 (93.3%) cases, with the affected side being the right in 43 (71.7%). Thirty patients formed the transosseous arthroscopic fixation (TO) group and 30 formed the single row anchor (SR) group (Table 1). The average age at the time of surgery was 60.4±8.57 years for the TO group, while for the SR group it was 59.2±9.69 years, with no significant difference (t=0.508, p=0.307, 95% CI). Patients with comorbidities were not excluded, resulting in a distribution of 6 cases (20%) of type 2 diabetes mellitus for the TO group and 5 cases (16.7%) for the SR group, also without statistical difference (X^2=0.111, p=0.500, 95% CI).

In all cases (n=60), subacromial decompression of the acromioclavicular osteophyte was performed and the long head of the biceps was addressed via subpectoral tenodesis using an inlay technique in 3 of the 30 patients in the TO group and 17 of the 30 in the SR group. In the remaining cases for both groups, tenotomy was performed. For this study, it was decided not to preserve the biceps at its origin in any case. The mean operative time was 127.6±19.7 minutes for the TO group and 107.3±20.0 minutes for the SR group, showing a statistically significant difference (t=3.958, p<0.001, 95% CI).

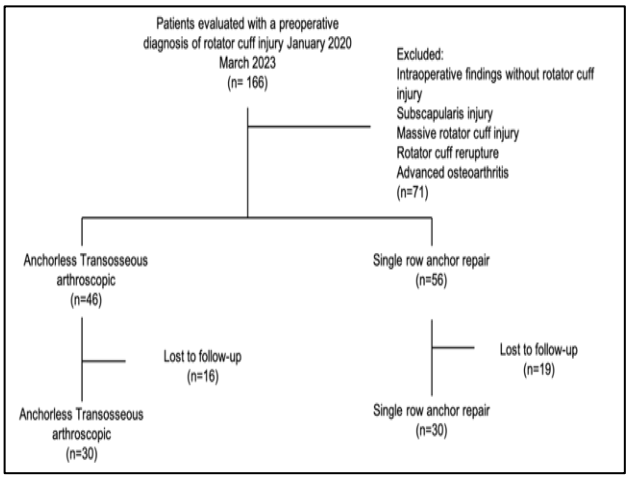

Figure 1: Selection diagram for patients participating in the study.

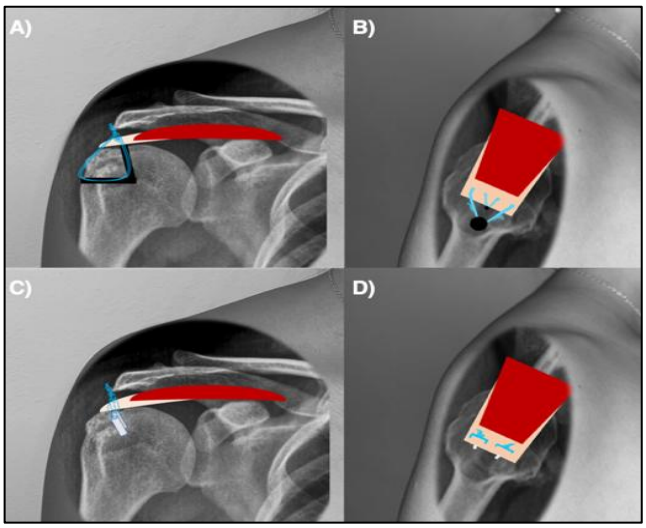

Figure 2 (A-D): Rotator cuff repair techniques.

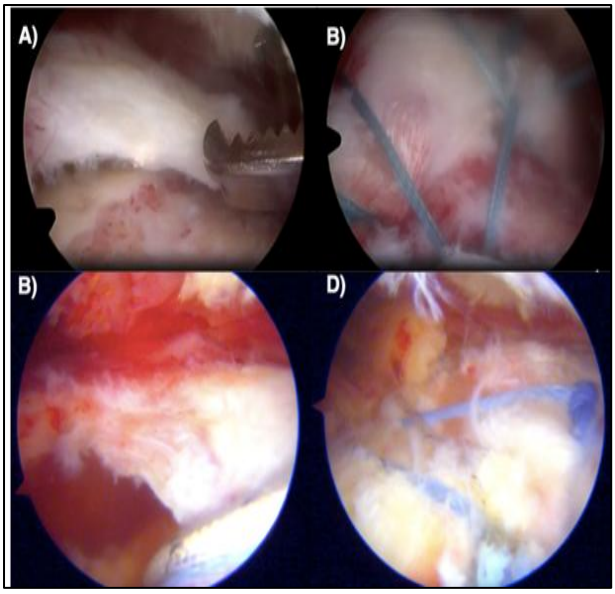

Figure 3 (A-D): Arthroscopic view of rotator cuff repair.

Pain

Based on the visual analog scale for pain (VAS), the mean score of both groups showed a clinically reported improvement, achieving statistical significance when comparing the preoperative state with follow-ups at 6 and 12 months (Table 2).

However, when comparing between groups, there were no significant differences in VAS values at 6 months (t=0.244, p=0.404, 95% CI) and 12 months (t=0.220, p=0.413, 95% CI).

Range of motion

Active forward flexion, external rotation and abduction were assessed using a goniometer. Patients in both groups were able to regain degrees in each of the evaluated movements, but when comparing the results obtained at the 12-months follow-up, no group showed statistical superiority over the other (Table 3). Regarding internal rotation, it was clinically assessed using the SIRS scale. It was found that 53.2% of patients in group 1 improved by at least one vertebral level, while in group 2, this was achieved by 80% of patients.

Functional outcomes

When evaluating the ASES scoring system and the Constant-Murley score, the mean score of both groups showed an improvement in functional outcomes, achieving statistical significance when comparing the preoperative state with the follow-ups at 6 and 12 months (Table 4). When comparing between groups, there were no significant differences in the Constant score values at 6 months and 12 months of follow-up (t=0.175, p=0.173, IC 95%) (t=0.572, p=0.285, IC 95%), while the ASES score also did not reach statistical difference between groups in the same follow-up periods (t=0.891, p=0.188, 95% CI) and (t=0.153, p=0.439, 95% CI).

During patient follow-up, 1 case (3.3%) with a complication was identified in the SR group, involving intraoperative avulsion of the anchor due to poor quality, which was resolved by placing two anchors in different areas of tendon´s footprint. Additionally, there was 1 case (3.3%) of adhesive capsulitis at the 12-months follow-up in the TO group.

Table 1: Demographics of patients included in the study.

Demographics	Total (%)	TO (%)	SR (%)
Total number	60 (100)	30 (100)	30 (100)
Age	59.8±9.09	60.4±8.57	59.2±9.69
Male	20 (33.3)	7 (23.4)	17 (56.6)
Female	40 (66.7)	23 (76.6)	13 (43.4)
Right affected side	43 (71.1)	23 (76.6)	20 (66.6)
Left affected side	17 (28.9)	7 (23.4)	10 (33.3)
Right dominant side	56 (93.3)	27 (90)	29 (96.6)
Left dominant side	4 (6.7)	3 (10)	1 (3.3)
Type 2 diabetes mellitus	11 (18.3)	6 (20%)	5 (16.7)

Table 2: Comparison of VAS before, at 6 and 12 months after surgery by group.

	TO			SR		
	Before	**6 months**	**12 months**	**Before**	**6 months**	**12 months**
VAS	7.4±1,2	1.53±1.7 t=19.871 p≤0.001*	0.7±1.2 t=24.840 p≤0.001*	6.7±1.4	1.63±1.4 t=14.563 p≤0.001*	0.7±1.0 t=19.083 p≤0.001*

*p<0.05, CI 95%

Table 3: Clinical difference before and 12 months after surgery between groups.

	TO		SR		Differences between groups (pqx 12m)
	Before (Degrees)	12 months (Degrees)	Before (Degrees)	12 months (Degrees)	
Forward flexion	92.0±30.0	156.6±28.2	100.8±33.1	161.7±24.6	t=0.732
					p=0.234
External rotation	30.3±10.4	41.6±4.8	27.2±9.8	38.8±8.4	t=1.608
					p=0.057
Abduction	80.8±27.5	148.0±36.9	93.5±32.6	153.3±34.0	t=0.583
					p=0.281

*p<0.05, CI-95%

Table 4: Comparison of functional scales before 6 and 12 months after surgery by group.

	TO			SR		
	Before	6 months	12 months	Before	6 months	12 months
Constant murley	43.5±11.8	86.9±8.28	87.7±3.9	46.9±14	85.0±8.5	87, 1±3, 5
		t=-19.281	t=-20.493		t=-13.166	t=-15.821
		p≤0.001*	p≤0.001*		p≤0.001*	p≤0.001*
ASES	44.7±12.0	83.2±7.24	91, 6±4, 17	48.7± 14.1	81.3±8.0	91,7±4,2
		t=-20.003	t=-23.268		t=-14.978	t=-17.768
		p≤0.001*	p≤0.001*		p≤0.001*	p≤0.001*

*p<0.05, CI-95%

DISCUSSION

This retrospective study demonstrates that transosseous arthroscopic fixation is equivalent to arthroscopic repair with single-row anchors in the medium and long term when evaluating postoperative pain, ranges of motion and functional scales.

Arthroscopic fixation with anchors emerged to replace traditional transosseous techniques, relegating them to a secondary role and being adopted among less experienced surgeons as the new gold standard. However, despite the development of increasingly optimal devices, superiority over the open transosseous repair technique has not been demonstrated. This has been a topic of interest for authors like Hasler et al, who in a randomized controlled study of 40 patients compared arthroscopic repair with open repair, finding similar clinical and radiological results at a 2-years follow-up with a high satisfaction rate and a similar complication rate, with an overall re-rupture rate of 30%.[18]

Furthermore, the transosseous repair technique has shown other benefits; its cost is lower compared to the use of arthroscopic anchors. Studies such as that of Adla et al. describe savings of up to $1248.75 USD when performing the procedure via open technique.[19] Similarly, Seidl et al, in 2016, demonstrated the benefit of transosseous fixation via arthroscopy with an average savings of $946.91 USD per procedure compared to a four-anchor technique.[20] In the hospital center where this study was conducted, we have also found cost benefits of up to 50%, which will be analyzed in a subsequent report. Based on the parameters evaluated in this statistical sample, this study found no statistically significant difference in postoperative pain at 6 and 12 months of follow-up when comparing the transosseous technique against the anchor technique in a single row, a result similar to that reported by Firat et al, in their retrospective study of 83 cases, where the only variant was the double row.[21]

Randelli, in his randomized controlled trial, reported lower pain rates using the transosseous fixation technique in the early stages of the postoperative period.[10] These data could not be corroborated in this sample as records were made in the late postoperative period.

When evaluating the range of mobility achieved (anterior flexion, abduction, external rotation) at 6- and 12-months post-treatment, no statistical superiority was identified when comparing the results of both groups in this study. This aligns with findings reported by Srikumaran et al, who in 2020 published results from a non-randomized retrospective database showing similar mobility ranges at a 2-years follow-up in repairs with anchors in multiple configurations versus the transosseous technique.[22]

The functional reintegration of the participants in this study was high according to the ASES score and the Constant-Murley score. Both groups showed improvement when comparing preoperative scores with follow-up at 12 months, correlating with a high rate of postoperative satisfaction.

Authors like Flanaging et al. have previously described isolated results of the transosseous technique, reporting excellent outcomes (ASES 90-100) in 87.1% of their sample at 38 months of follow-up in a retrospective study of 107 patients.[1] Similarly, Liu et al, in a retrospective

follow-up of 27 patients with an average of 2 years of follow-up, showed a favorable trend in evaluating the Constant score, improving from 54.5±11.8 to 73.7±8.5 when using the arthroscopic transosseous technique.[23]

These data are relevant as, in the results of this study, it translated to most patients not reporting limitations in performing their routine activities, equivalent to what was reported by Binder et al, who reported statistically significant results in all functional scores in their series of 70 patients.[24] The hypothesis of this study is confirmed; when comparing both techniques, there was no significant difference in any of the evaluated parameters. This supports the findings published in 2018 by Gafalo et al, in their retrospective study of 96 patients evaluating the transosseous technique against the single-row anchor technique, reporting similar functional outcomes at a two-year follow-up.[25] Additionally, Giorgi et al. published a meta-analysis in 2023 that included six studies comparing the same techniques with a two-year follow-up, concluding that the results were equivalent.[26]

It is important to note that the transosseous arthroscopic fixation technique resulted in longer operative times, approximately 20 minutes longer than the single-row anchor technique. This may be attributed to greater intraoperative difficulty in configuring the free sutures and their retraction through the transosseous tunnel; however, this did not correlate with a higher complication rate or worse functional outcomes. Among the limitations of the study are the finite number of patients and the 12-months follow-up period. Although a convenience sample was used, all patients who met the inclusion criteria and underwent surgery within the declared period were included.

The allocation of patients to the study groups was carried out using simple randomization according to the surgical technique employed, without considering age, gender or comorbidities; however, both groups had a similar mean age, with no statistically significant difference (t=0.508, p=0.307, 95% CI).

Despite having a similar distribution of type 2 diabetes (X^2=0.111, p=0.500, 95% CI) in both groups, the impact of this pathology and other comorbidities such as smoking and hypercholesterolemia on clinical outcomes was not evaluated. We consider it optimal to extend the follow-up period to 24 months and to match the groups by age, gender and comorbidities. Due to a lack of resources, postoperative MRI could not be performed, which prevented us from obtaining data to assess the degree of structural reintegration at the tendon-bone interface; we suggest including this in future studies.

CONCLUSION

In conclusion, this study demonstrates that, when evaluating functional outcomes, pain and range of motion at 12 months postoperatively, the transosseous repair technique is comparable in effectiveness to the single-row anchor repair for rotator cuff repair. These findings advocate for the routine implementation of the transosseous technique, particularly in patients with limited access to healthcare resources. However, further comparative studies with extended follow-up periods and larger sample sizes are warranted. Additionally, a cost-effectiveness analysis is essential to assess the economic viability and benefit-to-cost ratio of both therapeutic approaches.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Flanagin BA, Garofalo R, Lo EY, Feher L, Castagna A, Qin H, et al. Midterm clinical outcomes following arthroscopic transosseous rotator cuff repair. Int J Shoulder Surg. 2016;10(1):3-9.
2. Beauchamp JÉ, Beauchamp M. Functional outcomes of arthroscopic transosseous rotator cuff repair using a 2-mm tape suture in a 137-patient cohort. JSES Int. 2021;5(6):1105-10.
3. Cole BJ, ElAttrache NS, Anbari A. Arthroscopic rotator cuff repairs: an anatomic and biomechanical rationale for different suture-anchor repair configurations. Arthroscopy. 2007;23(6):662-9.
4. Chhabra A, Goradia VK, Francke EI, Baer GS, Monahan T, Kline AJ, et al. In vitro analysis of rotator cuff repairs: a comparison of arthroscopically inserted tacks or anchors with open transosseous repairs. Arthroscopy. 2005;21(3):323-7.
5. Cobaleda Aristizabal, A., Barber, F. Rotator cuff repair: technical considerations influencing optimum anchor choice in rotator cuff repair. Annals of Joint, North America. 2020.
6. Salata MJ, Sherman SL, Lin EC, Sershon RA, Gupta A, Shewman E, et al. Biomechanical evaluation of transosseous rotator cuff repair: do anchors really matter? Am J Sports Med. 2013;41(2):283-90.
7. Castagna A, Garofalo R, Conti M, Khair Y, Gumina S, De Giorgi S. Arthroscopic transosseous versus suture anchor repair: clinical outcomes in patients with bilateral rotator cuff tears. J Biol Regul Homeost Agents. 2020;34(3):51-7.
8. Benson EC, MacDermid JC, Drosdowech DS, Athwal GS. The incidence of early metallic suture anchor pullout after arthroscopic rotator cuff repair. Arthroscopy. 2010;26(3):310-5.
9. Li X, Xiao Y, Shu H, Sun X, Nie M. Risk Factors and Corresponding Management for Suture Anchor Pullout during Arthroscopic Rotator Cuff Repair. J Clin Med. 2022;11(22):6870.
10. Randelli P, Stoppani CA, Zaolino C, Menon A, Randelli F, Cabitza P. Advantages of Arthroscopic Rotator Cuff Repair with a Transosseous Suture

Technique: A Prospective Randomized Controlled Trial. Am J Sports Med. 2017;45(9):2000-9.
11. Plachel F, Traweger A, Vasvary I, Schanda JE, Resch H, Moroder P. Long-term results after arthroscopic transosseous rotator cuff repair. J Shoulder Elbow Surg. 2019;28(4):706-14.
12. Li L, Bokshan SL, Ready LV, Owens BD. The primary cost drivers of arthroscopic rotator cuff repair surgery: a cost-minimization analysis of 40,618 cases. J Shoulder Elbow Surg. 2019;28(10):1977-82.
13. Tocci SL, Tashjian RZ, Leventhal E, Spenciner DB, Green A, Fleming BC. Biomechanical comparison of single-row arthroscopic rotator cuff repair technique versus transosseous repair technique. J Shoulder Elbow Surg. 2008;17(5):808-14.
14. Yang G, Li S, Jiang C, Zhang H, Lu Y. The role of bone marrow stimulation in rotator cuff repair: a systematic review and meta-analysis. J Exp Orthop. 2023;10(1):27.
15. Zhang L, Zhu Y, Xu T, Fu W. Bone marrow stimulation in arthroscopic rotator cuff repair is a cost-effective and straightforward technique to reduce retear rates: A systematic review and meta-analysis. Front Surg. 2023;10:1047483.
16. Kawamata J, Suenaga N, Oizumi N. Relationship between hematoma-like tissue on the footprint and structural outcome of arthroscopic rotator cuff repair with a transosseous technique. JSES Int. 2023;7(2):324-30.
17. Srikumaran U, Huish EG Jr, Shi BY, Hannan CV, Ali I, Kilcoyne KG. Anchorless arthroscopic transosseous and anchored arthroscopic transosseous equivalent rotator cuff repair show no differences in structural integrity or patient-reported outcomes in a matched cohort. Clin Orthop Relat Res. 2020;478(6):1295-303.
18. Hasler A, Beeler S, Götschi T, Catanzaro S, Jost B, Gerber C. No difference in long-term outcome between open and arthroscopic rotator cuff repair: a prospective, randomized study. JSES Int. 2020;4(4):818-25.
19. Black EM, Lin A, Srikumaran U, Jain N, Freehill MT. Arthroscopic transosseous rotator cuff repair: technical note, outcomes and complications. Orthopedics. 2015;38(5):352-8.
20. Seidl AJ, Lombardi NJ, Lazarus MD, Black EM, Maltenfort MG, Pepe MD, et al. Arthroscopic Transosseous and Transosseous-Equivalent Rotator Cuff Repair: An Analysis of Cost, Operative Time and Clinical Outcomes. Am J Orthop (Belle Mead NJ). 2016;45(7):415-20.
21. Fırat A, Aydın M, Tecimel O, Öçgüder A, Sanisoğlu Y, Uğurlu M. Comparison of the clinical and radiological outcomes of arthroscopic transosseous and transosseous-equivalent double-row rotator cuff repair techniques. Acta Orthop Traumatol Turc. 2020;54(2):178-85.
22. Srikumaran U, Huish EG Jr, Shi BY, Hannan CV, Ali I, Kilcoyne KG. Anchorless Arthroscopic Transosseous and Anchored Arthroscopic Transosseous Equivalent Rotator Cuff Repair Show No Differences in Structural Integrity or Patient-reported Outcomes in a Matched Cohort. Clin Orthop Relat Res. 2020;478(6):1295-303.
23. Liu XN, Yang CJ, Lee GW, Kim SH, Yoon YH, Noh KC. Functional and Radiographic Outcomes After Arthroscopic Transosseous Suture Repair of Medium Sized Rotator Cuff Tears. Arthroscopy. 2018;34(1):50-7.
24. Binder H, Buxbaumer P, Steinitz A, Waibl B, Sonnenschein M, Hackl M, et al. Arthroscopic Anchorless Transosseous Rotator Cuff Repair Produces Equivalent Clinical Outcomes and Imaging Results as a Standard Suture Bridge Technique with Anchors. Arthrosc Sports Med Rehabil. 2022;4(6):2025-34.
25. Garofalo R, Calbi R, Castagna A, Cesari E, Budeyri A, Krishnan SG. Is there a difference in clinical outcomes and repair integrity between arthroscopic single-row versus transosseous (anchorless) fixation? A retrospective comparative study. J Orthop Sci. 2018;23(5):770-6.
26. De Giorgi S, Ottaviani G, Bianchi FP, Delmedico M, Suma M, Moretti B. Single-row versus transosseous technique in the arthroscopic treatment of rotator cuff tears: a meta-analysis. Eur J Orthop Surg Traumatol. 2024;34(1):31-8.

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