

CAIO CÉSAR DE CARVALHO

**EFFECTIVENESS IN RE-TEAR RATE AND IMPROVEMENTS IN
PATIENT-REPORTED OUTCOMES WITH LEUKOCYTE-POOR
PLATELET RICH PLASMA AS AN ADJUVANT IN
ARTHROSCOPIC ROTATOR CUFF REPAIR: A SYSTEMATIC
REVIEW AND META-ANALYSIS**

**Trabalho apresentado à Universidade Federal
de Santa Catarina, como requisito para a
conclusão do Curso de Graduação em
Medicina.**

Florianópolis

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DEDICATÓRIA

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LISTA DE SIGLAS E ABREVIATURAS

ARCR	Arthroscopic rotator cuff repair
LP-PRP	Leukocyte-poor platelet-rich plasma
PRP	Platelet-rich plasma
PROMs	Patient-reported outcome measures
VAS	Visual analog scale
UCLA	University of California, Los Angeles
ASES	American Shoulder and Elbow Surgeons
MD	Mean Difference
MCIDs	Minimal clinically important differences
MRI	Magnetic resonance imaging
US	Ultrasonography
CI	Confidence interval
MD	Mean difference
RR	Relative risk

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“Effectiveness in Re-Tear Rate and Improvements in Patient-Reported Outcomes with Leukocyte-Poor Platelet Rich Plasma as an Adjuvant in Arthroscopic Rotator Cuff Repair: A Systematic Review and Meta-Analysis”

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RESUMO

Introdução: O reparo artroscópico do manguito rotador (ARCR) é um procedimento amplamente realizado, mas as taxas de re-ruptura e os desfechos clínicos subótimos ainda são uma preocupação. Os benefícios do plasma rico em plaquetas com baixo teor de leucócitos (LP-PRP) como terapia adjuvante são indefinidos. Esta meta-análise avalia o efeito da terapia com LP-PRP nas taxas de re-ruptura e nos desfechos relatados pelos pacientes após ARCR.

Métodos: As bases de dados PubMed, Embase e Cochrane foram sistematicamente revisadas em busca de ensaios clínicos randomizados (ECR) que comparassem ARCR com LP-PRP versus ARCR isolado. O desfecho primário foi a taxa de re-ruptura, e os desfechos secundários incluíram escore de dor VAS, escores Constant, UCLA e ASES. A análise estatística utilizou modelos de efeitos aleatórios, com estatística I^2 para heterogeneidade e intervalos de confiança de 95%.

Resultados: Foram incluídos 11 ECRs, totalizando 430 pacientes no grupo LP-PRP e 431 no grupo controle. A análise da taxa de re-ruptura, em 10 estudos (733 pacientes), demonstrou que o LP-PRP reduziu significativamente essas taxas (RR 0,40; IC 95% 0,27–0,59; $P < 0,00001$). As análises por subgrupo segundo o tamanho da lesão também mostraram redução significativa para roturas < 3 cm (RR 0,41; IC 95% 0,20–0,86; $P = 0,02$) e > 3 cm (RR 0,39; IC 95% 0,24–0,63; $P = 0,0001$). Os escores VAS para dor não apresentaram redução significativa em nenhum dos pontos avaliados (3, 6, 12 e 24 meses). Quanto aos escores funcionais, o escore Constant melhorou significativamente aos 6 meses (MD 2,67; $P = 0,004$) e aos 12 meses (MD 2,84; $P = 0,01$); o escore UCLA melhorou aos 6 meses (MD 1,37; $P = 0,0003$); já o escore ASES não apresentou melhorias em nenhum dos períodos avaliados. Apesar das diferenças estatísticas, a magnitude das melhorias funcionais frequentemente não atingiu os limiares de diferença clinicamente importante.

Conclusão: O LP-PRP reduziu significativamente as taxas de re-ruptura na reparação artroscópica do manguito rotador. Embora os escores funcionais tenham apresentado melhorias estatisticamente significativas em alguns momentos, elas frequentemente não alcançaram relevância clínica. Estudos padronizados adicionais são necessários para otimizar o uso de LP-

PRP e maximizar desfechos clínicos positivos.

Palavras - chave: Reparação do Manguito Rotador; Plasma Rico em Plaquetas; Meta-analise; Artroscopia

ABSTRACT

Introduction: Arthroscopic rotator cuff repair (ARCR) is a widely performed procedure, but re-tear rates and suboptimal clinical outcomes remain a concern. The benefits of leukocyte-poor platelet-rich plasma (LP-PRP) as an adjunct therapy are unclear. This meta-analysis assesses the effect of LP-PRP therapy on re-tear rates and patient-reported outcomes after ARCR.

Methods: PubMed, Embase and Cochrane databases were systematically searched for randomized controlled trials (RCTs) comparing ARCR with LP-PRP versus ARCR alone. The primary outcome was re-tear rate, and secondary outcomes included VAS pain score, Constant, UCLA, and ASES scores. Statistical analysis used random-effects models, with I^2 statistic assessing heterogeneity and 95% confidence intervals.

Results: Eleven RCTs were included, totaling 430 patients in the LP-PRP group and 431 in the control group. Analysis of the re-rupture rate, across on 10 trials (733 patients), demonstrated that LP-PRP significantly reduced re-rupture rates (RR, 0.40; 95% CI, 0.27 - 0.59; $P < 0.00001$). Subgroup analyses by tear size also showed a significant reduction for tears < 3 cm (RR 0.41; 95% CI, 0.20 – 0.86; $P = 0.02$) and > 3 cm (RR 0.39; 95% CI, 0.24 - 0.63; $P = 0.0001$). VAS scores for pain showed no significant reduction with LP-PRP at any point (3, 6, 12, 24 months). For functional scores the Constant score showed a significant improvement at 6 months (MD 2.67; $P = 0.004$) and at 12 months (MD 2.84; $P = 0.01$); the UCLA score was significantly improved at 6 months (MD 1.37; $P = 0.0003$); the ASES score showed no improvement in any of the periods evaluated. Despite statistical differences, the magnitude of functional improvements often did not reach minimal clinically important differences thresholds.

Conclusion: LP-PRP significantly reduced re-rupture rates in arthroscopic rotator cuff repair. While functional scores showed statistically significant improvements at times, these often did not reach clinical significance. Further standardized studies are needed to optimize LP-PRP use and maximize positive clinical outcomes.

Key Terms: Rotator Cuff Repair, Platelet-Rich Plasma, Meta-Analysis, Arthroscopy

INTRODUCTION

Rotator cuff tears are a common musculoskeletal that often results in significant pain and functional limitation ⁽¹⁾. While acute trauma can precipitate these tears, chronic degeneration from aging and repetitive overhead activities are the most common culprits ^(2,3). When conservative management fails, arthroscopic rotator cuff repair (ARCR) is the standard treatment, yet postoperative re-tear rates remain high ^(4,5), highlighting the need for enhanced treatment options.

In this context, Platelet-Rich Plasma (PRP) has emerged as a biological adjunct, delivering concentrated platelets in a medium rich in growth factors, cytokines and bioactive molecules essential for cell proliferation, angiogenesis and matrix synthesis ⁽⁶⁾. Specifically, leukocyte-poor PRP selectively reduces inflammatory leukocytes while preserving platelet-derived mediators, thereby promoting tenocyte proliferation, collagen deposition, and neovascularization without exacerbating inflammation ⁽⁷⁾.

Previous studies investigating PRP in ARCR yielded mixed outcomes: several demonstrated reduced re-tear rates and improved patient-reported outcomes (PROMs) ^(8,9,10,11), whereas others reported no significant benefit ^(12,13,14). This heterogeneity reflects variations in PRP preparation, patient demographics, surgical techniques and rehabilitation. Key questions remain regarding the optimal PRP formulation, timing and administration method, and patient factors affecting clinical response.

This systematic review and meta-analysis will objectively evaluate whether adjunctive LP - PRP in ARCR reduces re-tear rates and improves PROMs compared with ARCR alone.

METHODS

This systematic review with meta-analysis was registered in the international prospective register of systematic reviews (PROSPERO) under protocol CRD420251015323. This study was designed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline ⁽¹⁵⁾.

Search Strategy

We systematically searched PubMed, Embase, and Cochrane Central Register of Controlled Trials from inception to February 2025 with the following search terms: ‘rotator cuff’, ‘supraspinatus’, ‘infraspinatus’, ‘subscapularis’, ‘arthroscopy’, ‘repair’, ‘surgery’, ‘platelet-rich plasma’, ‘PRP’, ‘leukocyte-poor platelet-rich plasma’ and ‘pure platelet-rich plasma’.

Eligibility criteria and data extraction

Inclusion in this meta-analysis was restricted to studies that met all the following eligibility criteria: (1) randomized clinical trials; (2) compare the use of LP-PRP with a control group without the use of LP-PRP in ARCR; (3) patients diagnosed with rotator cuff tears using imaging tests; (4) use of PRP during surgery and/or post-op. Furthermore, studies were included only if they reported any of the clinical outcomes of interest, the retear rate, visual analog scale (VAS) pain score, Constant shoulder score, University of California Los Angeles (UCLA) shoulder score, and American Shoulder and Elbow Surgeons (ASES) score. The minimum period necessary for the evaluation of primary or secondary outcomes was 3 months. We excluded records with (1) non-RCT; (2) no control group; (3) without an outcome of interest; (4) use of leukocyte-rich platelet-rich plasma; (5) surgical treatment not performed arthroscopically.

Two authors (C.C and O.T) independently extracted the data following predefined search criteria and quality assessment. We determined the final classification according to the number of white blood cells in the final PRP product. When the number of white blood cells in the PRP was lower than that of whole blood, the PRP was defined as leukocyte-poor PRP. In cases of uncertainty regarding inclusion or exclusion, relevant data from the PRP manufacturer and PRP kit were used to determine the leukocyte concentration. If uncertainty persisted, contact was made with the author of the article. Any potential discrepancies were addressed following mutual consultation among the authors.

Endpoints and subgroup analysis

This study evaluated the efficacy of leukocyte-poor PRP in arthroscopic rotator cuff repair. The primary endpoint was the re-tear rate. Additionally, pain and function scores, such as VAS, Constant, UCLA, and ASES, were analyzed. The VAS, Constant, and UCLA scores were measured at 3, 6, 12, and 24 months, while the ASES was evaluated at 3, 6, and 12 months. Subgroup analyses were conducted based on tear size, classifying them as smaller or larger than 3 cm. These analyses helped identify factors influencing treatment efficacy, providing a more detailed view of the effects of leukocyte-poor PRP in different clinical contexts.

Quality Assessment

The quality of the methodology included in each study was evaluated by 2 reviewers according to The Cochrane Collaboration risk-of-bias assessment tool (Rob 2)⁽¹⁶⁾. Two independent authors completed the risk of bias assessment (C.C and O.T). Disagreements were resolved through a consensus after discussing reasons for discrepancy. The following domains were evaluated: randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting. The evaluation of each part was divided into low, some concerns, and high risk to assess the risk of several biases that may occur in RCTs. Complete domain-level assessments are presented in Supplementary.

Statistical Analysis

This systematic review and meta-analysis was conducted and reported in accordance with the Cochrane Handbook for Systematic Reviews of Interventions⁽¹⁷⁾. Continuous outcomes were analyzed using mean differences, and minimal clinically important differences (MCIDs) were defined based on previous research as mean differences of 2.4 points on the 0–10 Visual Analog Scale, 6.7 points on the Constant Shoulder score, 6 points on the American Shoulder and Elbow Surgeons score, and 3 points on the University of California at Los Angeles score^(18,19,20). The risk ratio (RR) and 95% confidence interval (CI) were used in the statistical analysis of dichotomous variables. Meta-analyses were conducted using a DerSimonian–Laird random-effects model to estimate pooled effect sizes. All analyses were performed with Review

Manager version 5.4.1 (Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark).

RESULTS

Literature search

After a thorough search of all databases, a total of 1200 articles were retrieved, and 762 articles remained after duplicate studies were removed. After reviewing the records through titles and abstracts, 741 unrelated studies were excluded, and 21 articles were screened for full-text review. Of those, 10 articles were excluded (2 did not meeting the RCTs criteria, 6 due to the use of leukocyte-rich platelet-rich plasma and 2 for other causes). Finally, a total of 11 articles were included. Figure 1 shows the literature search flow chart.

Study characteristics

A total of 11 RCTs, comprising 430 patients in the LP-PRP group and 431 patients in the control group. A blank control group was reported in 10 studies, while in 1 study the control group received ropivacaine treatment. The specific characteristics of the studies are shown in detail in Table 1. PRP characteristics are available in Table 2.

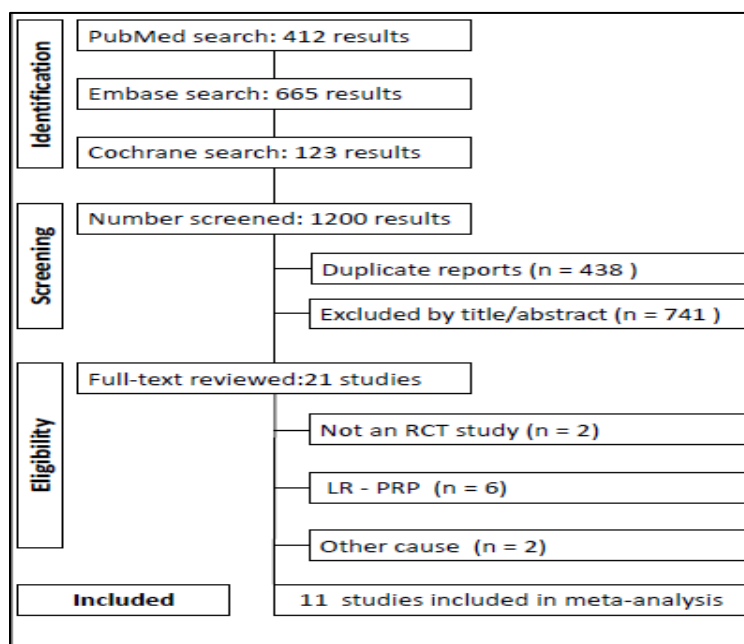


Figure 1. PRISMA flow diagram of study screening and selection.

Table 1. Baseline characteristics of included studies

Author (year)	Tear size	Repair type	Control	Follow-up, mo	Sample size		Male sex (total (%))			Age, mean $\pm$ SD, yr	
					LP-PRP	Control	LP-PRP	Control	Total (%)	LP-PRP	Control
JO, 2013	>3 cm	DR	ARCR only	12	24	24	10 (41.7%)	14 (58.3%)	24 (50%)	64.21 $\pm$ 6.09	61.92 $\pm$ 8.36
MONEO, 2013	NR	DR	ARCR only	12	32	31	14 (43.8%)	11 (56.2)	25 (39 %)	56 $\pm$ 8.8	55 $\pm$ 11.0
MALAVOLTA, 2014	< 3 cm	SR	ARCR only	60	27	27	8 (47.1%)	9 (52.9%)	17 (31%)	55.30 $\pm$ 8.30	54.07 $\pm$ 6.59
JO, 2015	1 - 5 cm	DR	ARCR only	12	37	37	8 (47.1%)	9 (52.9%)	17 (33%)	60.08 $\pm$ 4.88	60.92 $\pm$ 7.34
WANG, 2015	< 2 cm	DR	ARCR only	4	30	30	11 (39.3%)	17 (60.7%)	28 (46%)	59.8 $\pm$ 12.25	58.4 $\pm$ 9.5
FLURY, 2016	NA	DR	Ropivacaine	24	60	60	20 (52.6%)	18 (47.4%)	38 (63%)	57.8 $\pm$ 8.0	58.9 $\pm$ 8.2
PANDEY, 2016	1 - 5 cm	SR	ARCR only	24	52	50	38 (51.4%)	36 (49.1%)	74 (72%)	54.8 $\pm$ 8.4	54.1 $\pm$ 8.3
EBERT, 2017	< 2 cm	DR	ARCR only	42	27	28	11 (39.3%)	17 (60.7%)	28 (42%)	59.5 $\pm$ 11.0	59.7 $\pm$ 11.4
ZHANG, 2022	3.0 $\pm$ 0.7	DR	ARCR only	27.2	43	46	19 (57.6%)	14 (42.4%)	33 (37%)	57.4 $\pm$ 6.1	58.7 $\pm$ 6.8
YAO, 2024	NR	SR/DR	ARCR only	12	50	50	20 (57.1%)	15 (42.9%)	35 (35%)	56.4 $\pm$ 10.1	56.0 $\pm$ 8.2
ROSSI, 2024	< 3 cm	SR	ARCR only	12	48	48	28 (51.9%)	26 (48.1%)	54 (57%)	56.2 $\pm$ 2.49	56.1 $\pm$ 3.43

NR: Not reported; DR: Double row; SR: Single row; ARCR: arthroscopy rotator cuff repair

Table 2 - PRP characteristics

Author (year)	Platelet concentration, x 10 ⁹ /mL	Volume (mL)	Preparation Kit	Activating agent	Applied site	WBC concentration, x 10 ⁹ /mL
JO, 2013	1.096.000	3 $\pm$ 3	CS LRS Turbo	Calcium gluconate	Bone-tendon interface	0.04 $\pm$ 0.06
MONEO, 2013	600.000	NR	PRGF System1	Calcium chloride	Bone-tendon interface and intratendon	NR
MALAVOLTA, 2014	1.185.000	24	MCS1	Calcium chloride	Bone-tendon interface	NR
JO, 2015	1.218.000	3 $\pm$ 3	CS LRS Turbo	Calcium gluconate	Bone-tendon interface	0.04 $\pm$ 0.03
WANG, 2015	470.000	4 - 6 $\pm$ 2	ACP (Arthrex)	Calcium chloride	Bone-tendon interface	NR
FLURY, 2016	NR	4	ACP (Arthrex)	NR	Bone-tendon interface	NR
PANDEY, 2016	474.000	8	Heraeus Cryofuge	Calcium chloride	Bone-tendon interface	0.004 $\pm$ 0.001
EBERT, 2017	470.000	4 - 6	ACP (Arthrex)	Calcium chloride	Bone-tendon interface	NR
ZHANG, 2022	800.000	3	ZX Biotechnology	Calcium chloride	Bone-tendon interface	0.025
YAO, 2024	NR	5	ACP (Arthrex)	NR	Bone-tendon interface	0.1
ROSSI, 2024	1.750.000	5	NR	NR	Bone-tendon interface	NR

WBC: white blood cells

Clinical outcomes

Retear rate

In total, 10 trials (including 733 patients) reported the retear rate at the final follow-up time. Among these, 8 studies used MRI, 1 used MRI and US, and 1 used US. Heterogeneity analysis showed $P = .93$ and I^2 0%, indicating good homogeneity among the studies, and a random-effects model was therefore used. The pooled analysis showed that using LP-PRP reduced the retear rate compared with the control treatment (RR, 0.40; 95% CI, 0.27 - 0.59; $P < 0.00001$). The details are shown in figure 2.

To further clarify the effect of LP-PRP on the postoperative retear rate at different follow-up time points, we conducted a subgroup analysis of patients with different sizes of rotator cuff tears, since the extension of the lesion may have had an impact on the postoperative retear rate. By dividing them into tears smaller than 3 cm and tears larger than 3 cm. A total of 4 studies included patients with tears smaller than 3 cm, encompassing 130 patients in the LP-PRP group and 129 control participants. The heterogeneity test revealed low heterogeneity ($P = .96$, $I^2 = 0\%$). The pooled analysis showed that those treated with the LP-PRP had a significantly lower retear rate compared to the control group (RR, 0.41; 95% CI, 0.20 – 0.86; $P = .01$). For tears larger than 3 cm, 6 studies were included, with 233 patients in the LP-PRP group and 241 control participants. Heterogeneity was also low ($P = .63$, $I^2 = 0\%$). Using a random-effects model, the pooled analysis demonstrated that the LP-PRP group had a statistically lower retear rate than the control group (RR, 0.39; 95% CI, 0.24 - 0.63; $P = .0001$). Details are in figure 3.

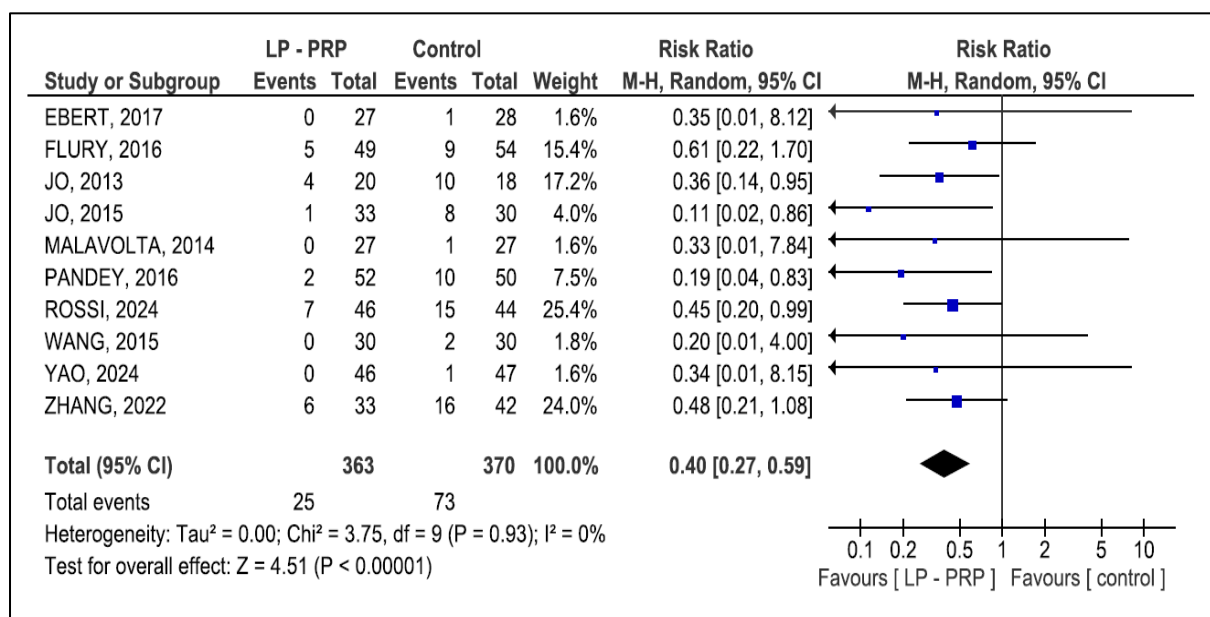


Figure 2. Forest plot displaying retear incidences among patients who were treated with and without leukocyte-poor platelet-rich plasma (LP-PRP). M-H, Mantel-Haenszel; CI, confidence interval.

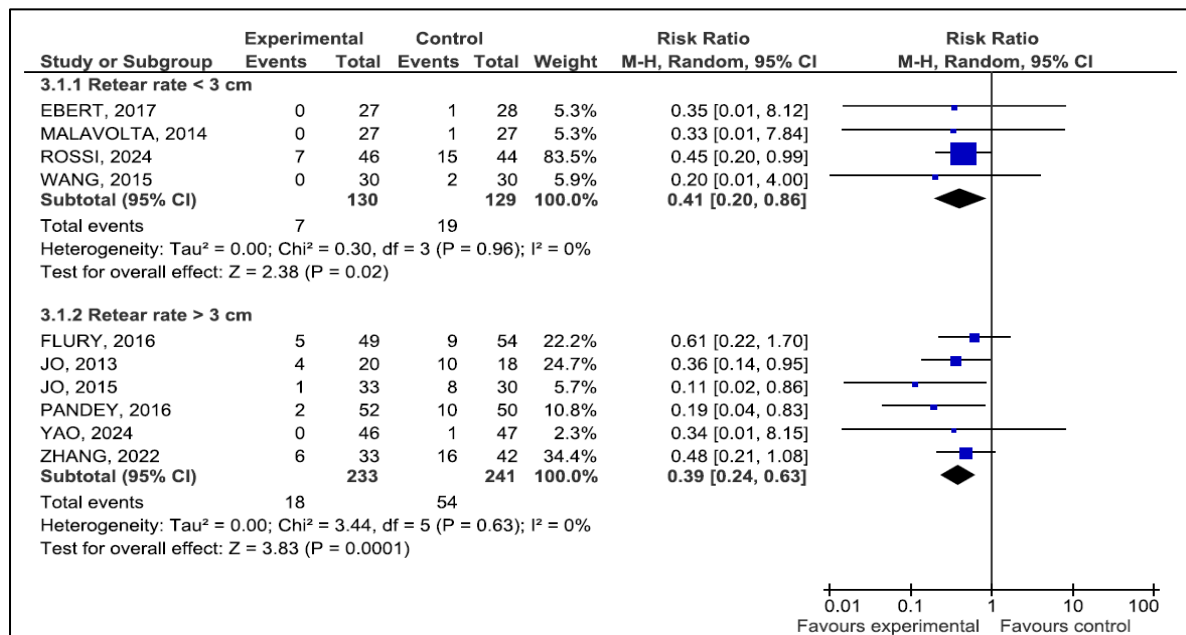


Figure 3. Forest plot of retear rates comparing leukocyte-poor PRP (LP-PRP) with the control group based on tear sizes.
M-H, Mantel-Haenszel; CI, confidence interval.

VAS score

VAS scores at 3 months follow-up were analyzed in four studies (316 patients), revealing a non-significant reduction in mean difference between the LP-PRP and control (MD - 0.34; 95% CI - 1.23 to 0.55; $P = 0.46$). High heterogeneity was observed ($I^2 = 90\%$; $\chi^2 = 30.10$, $P < 0.00001$), and the overall effect size ($Z = 0.74$, $P = 0.46$) did not significantly favor the LP-PRP group. At 6 months, were analyzed in four studies (352 patients), no statistically significant reduction in VAS scores with LP-PRP versus control (MD - 0.30; 95% CI - 0.65 to 0.05; $P = 0.10$). High heterogeneity was observed ($I^2 = 72\%$; $\chi^2 = 10.76$, $P < 0.01$), indicating a lack of overall effect and substantial between-study variability. At 12 months, data from six studies (474 patients) demonstrated a non-statistically significant reduction in VAS scores favoring LP-PRP (MD - 0.21; 95% CI - 0.43 to 0.02; $P = .07$), with moderate heterogeneity ($I^2 = 51\%$; $\chi^2 = 10.17$, $P = .07$), as summarized in Figure 4. At 24 months, three studies (245 patients) indicated a slight tendency towards reduction in pain with LP-PRP (MD - 0.10; 95% CI - 0.31 to 0.1; $P = .34$) and low heterogeneity ($I^2 = 11\%$; $\chi^2 = 2.25$, $P = .32$), although this result was not statistically significant. Further figures contained within the supplementary appendix.

Constant score

The Constant Scores at 3 months were evaluated in 4 studies across 335 patients. The meta-analysis showed a mean difference favoring the LP-PRP group (MD 2.84; 95% CI –0.09 to 5.78), although the result was not statistically significant ($P = .06$). Low heterogeneity was found among studies ($I^2 = 0\%$; $\chi^2 = 1.84$, $P = .61$), indicating consistent results. At 6 months, data from 5 studies involving 436 patients revealed a statistically significant improvement for the LP-PRP group (MD 2.67; 95% CI 0.86 to 4.48; $P = .004$) as summarized in Figure 5. The analysis showed no significant heterogeneity ($I^2 = 0\%$; $\chi^2 = 1.25$, $P = .87$). At 12 months, 5 studies across 378 patients demonstrated a significant benefit in favor of LP-PRP (MD 2.84; 95% CI 0.62 to 5.05; $P = .01$) with moderate variability among studies ($I^2 = 35\%$; $\chi^2 = 6.19$, $P = .19$). At 24 months, an analysis of 4 studies including 346 patients showed no statistically significant advantage for LP-PRP (MD 2.51; 95% CI –1.05 to 6.08; $P = .17$), with moderate heterogeneity ($I^2 = 55\%$; $\chi^2 = 6.61$, $P = .09$). Additional figures presented in the supplementary appendix.

UCLA score

The UCLA score at 3 months was evaluated in 3 studies with 228 patients comparing LP-PRP to control treatments. The meta-analysis indicated a slight improvement favoring LP-PRP (MD 1.31; 95% CI –0.02 to 2.65), although it did not reach statistical significance ($P = .05$). No heterogeneity was observed ($I^2 = 0\%$; $\chi^2 = 1.26$, $P = .53$). At 6 months, 4 studies with 330 patients showed a statistically significant improvement in favor of the LP-PRP group (MD 1.37; 95% CI 0.63 to 2.11; $P = .0003$), with no variability among studies ($I^2 = 0\%$; $\chi^2 = 2.17$, $P = .54$), as summarized in Figure 7. At 12 months, analysis from 6 studies involving 416 patients revealed a slight improvement favoring LP-PRP (MD 0.76; 95% CI –0.23 to 1.74), however, the result was not statistically significant ($P = 0.13$). This analysis showed moderate heterogeneity ($I^2 = 66\%$; $\chi^2 = 14.56$, $P = 0.01$). At 24 months, 3 studies with 245 patients demonstrated a slight improvement, not statistically significant, for the LP-PRP group (MD 1.19; 95% CI –0.33 to 2.70; $P = 0.12$), despite substantial variability across studies ($I^2 = 78\%$;

$\chi^2 = 9.05$, $P = .01$). Other graphical representations provided in the supplementary appendix.

ASES score

The ASES score at 3 months was analyzed in 3 studies with 285 patients (140 in the LP-PRP group and 145 in the control group) and revealed no statistically significant improvement favoring LP-PRP (MD 2.74; 95% CI - 0.23 to 5.71; $P = 0.07$), as summarized in Figure 7. Heterogeneity was low ($I^2 = 7\%$; $\chi^2 = 2.15$, $P = 0.34$). At 6 months, 4 studies with 383 patients showed no statistically significant difference between groups (MD 0.93; 95% CI - 2.53 to 4.39; $P = 0.60$). Heterogeneity analysis indicated moderate variability ($I^2 = 58\%$; $\chi^2 = 7.22$, $P = 0.07$). At 12 months, analysis from 5 studies with 420 patients (211 in the LP-PRP group and 209 in the control group) demonstrated no significant difference between LP-PRP and control (MD 0.24; 95% CI -1.30 to 1.77; $P = 0.76$). The heterogeneity was low ($I^2 = 2\%$; $\chi^2 = 4.07$, $P = 0.40$). Additional figures are presented in the supplementary appendix.

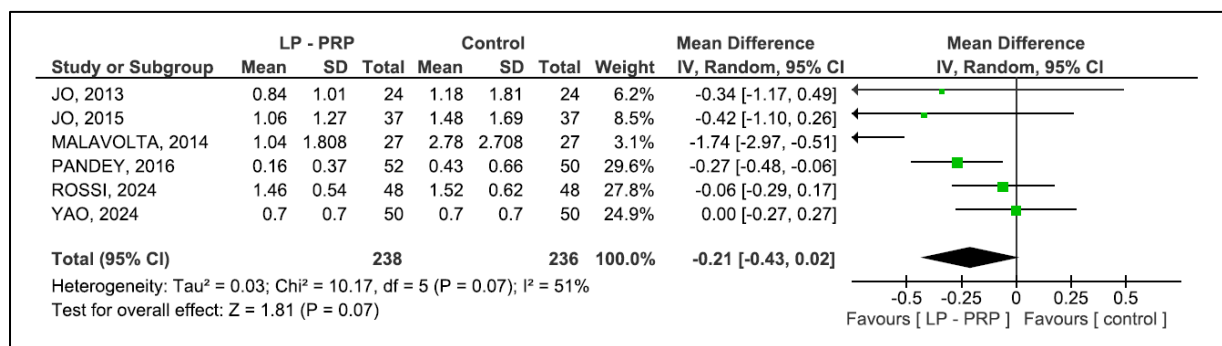


Figure 4. Forest plot of VAS scores at 12 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval

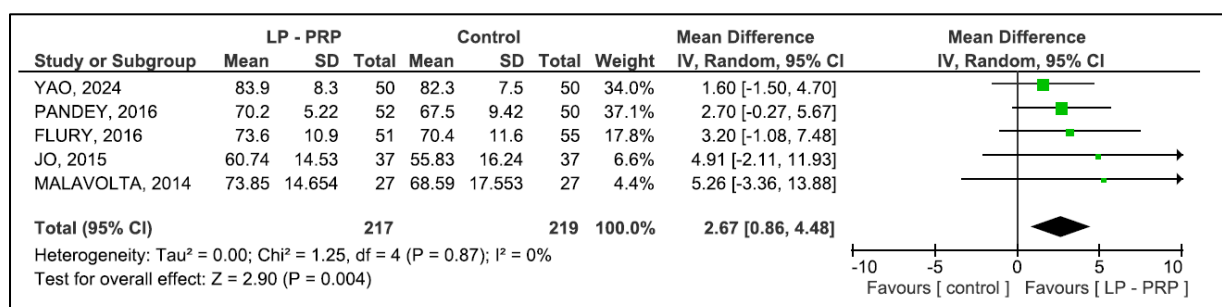


Figure 5. Forest plot of CS scores at 6 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

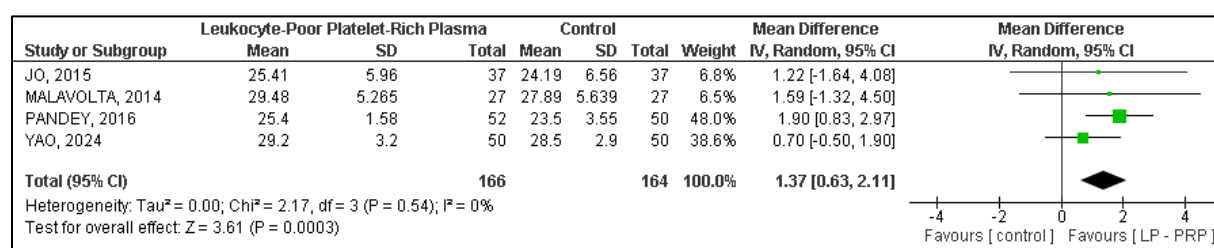


Figure 6. Forest plot of UCLA scores at 6 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

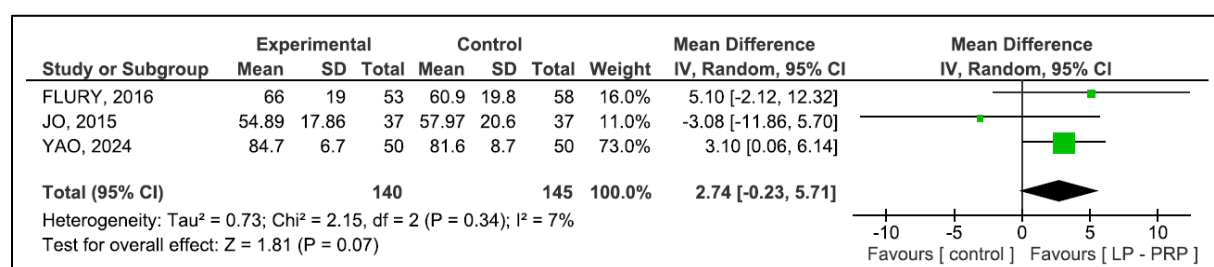


Figure 7. Forest plot of ASES scores at 3 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval

DISCUSSION

This meta-analysis aimed to evaluate the efficacy of LP-PRP as an adjunct to ARCR. The use of LP-PRP was associated with a significant reduction in postoperative retear rates at final follow-up (RR 0.40; 95% CI 0.27 – 0.59; $P = 0.00001$; $I^2 = 0\%$), with consistent effects in tears both < 3 cm (RR 0.41; 95% CI 0.20 – 0.86; $P = 0.02$) and > 3 cm (RR 0.39; 95% CI 0.24 – 0.63; $P = 0.0001$). Pain outcomes measured by VAS at 3, 6, 12 and 24 months showed non-significant differences and moderate-to-high heterogeneity, whereas functional scores demonstrated clinical benefits: the Constant score improved significantly at 6 months (MD 2.67; 95% CI 0.86–4.48; $P = 0.004$) and 12 months (MD 2.84; 95% CI 0.62 – 5.05; $P = 0.01$); the UCLA score was higher at 6 months (MD 1.37; 95% CI 0.63– 2.11; $P = 0.0003$); The ASES score demonstrated no differences between the LP-PRP and control groups across all evaluated periods. However, because these differences rely solely on statistical distinctions and vary over time, the results warrant cautious interpretation to avoid premature clinical decisions.

The primary endpoint of this meta-analysis was the evaluation of the retear rate following ARCR with adjunctive LP-PRP. Our analysis demonstrated a statistically significant

reduction in the retear rate in patients treated with LP-PRP compared to controls (RR, 0.29; 95% CI, 0.18 - 0.47; $P < 0.00001$). This finding, derived from a pooled analysis of 10 studies encompassing 798 patients, suggests a substantial benefit of LP-PRP in promoting structural integrity following rotator cuff repair. The importance of minimizing retear rates in rotator cuff surgery cannot be overstated. A higher postoperative retear rate after ARCR substantially lower patient satisfaction and dramatically increases the probability of a second operation. Therefore, interventions that can reliably reduce the risk of retear are of significant clinical value.

Analyses by tear size showed that LP-PRP significantly reduces retear rates: RR 0.32 (95% CI, 0.13–0.78; $P = 0.01$) for tears < 3 cm and RR 0.28 (95% CI, 0.15–0.50; $P < 0.0001$) for tears > 3 cm. These results suggest that LP-PRP may be effective in reducing retear rates across a spectrum of tear sizes, potentially addressing a critical challenge in the management of rotator cuff injuries.

Our findings are consistent with several other meta-analyses that have investigated the impact of PRP on retear rates. Li et al. reported a RR of 0.56 (95% CI, 0.43–0.73; $P < .0001$)⁽¹²⁾, Zhao et al. found that LP-PRP yielded an RR of 0.59 (95% CI, 0.45–0.77; $P = .0001$) with subgroup RRs of 0.64 for small/medium tears and 0.51 for medium/large tears⁽²¹⁾, and Yang et al. observed an RR of 0.38 (95% CI, 0.22–0.68; $P = .0009$), particularly in double-row repairs⁽²²⁾. Although our study did not examine surgical technique, these findings suggest a potential interaction between repair method and PRP efficacy.

However, it is essential to acknowledge that not all meta-analyses have reported positive effects of PRP on retear rates. Zhao et al. found no significant difference in retear rates between PRP and control groups (RR, 0.94; 95% CI, 0.70 to 1.25; $P = .66$)⁽²³⁾. This discrepancy may be attributed to the inclusion of studies using different types of PRP, including leukocyte-rich PRP, which may have different effects on tendon healing compared to LP-PRP. This highlights the importance of carefully considering the specific characteristics of PRP when evaluating its efficacy in rotator cuff repair.

The diagnostic modalities used to assess retears also varied across the included studies. While most studies used MRI, some used US or a combination of both. These differences in

diagnostic modalities may have introduced some heterogeneity in the assessment of retear rates. However, our heterogeneity test showed good homogeneity among the studies ($P = .93$ and $I^2 = 0\%$), suggesting that the impact of these differences was minimal.

We also evaluated the impact of LP-PRP on pain relief and functional outcomes after ARCR. Pain, measured by the VAS, did not show a significant reduction in the LP-PRP group at 3, 6, 12, or 24 months. These results are consistent with Xue et al.⁽²⁴⁾, who likewise found no difference between PRP and control groups (MD -0.37 ; 95% CI -0.86 to 0.12 ; $P = 0.14$). In contrast, Li et al. reported a modest but statistically significant improvement in VAS scores with PRP (MD -0.13 ; 95% CI -0.56 to -0.06 ; $P = 0.01$)⁽¹²⁾, and Zhao et al. reported greater pain relief both in the short term (MD -0.57 ; $P < 0.0001$) and in the medium- to long-term (MD -0.18 ; $P = 0.02$)⁽²¹⁾.

Regarding functional outcomes, the Constant score revealed statistically significant improvements in the LP-PRP group at 6 and 12 months, indicating enhanced shoulder function over time, while the 3 and 24 months assessment did not show a significant difference. As a composite measure that evaluates pain, daily activities, strength, and range of motion, the Constant score findings are corroborated by other meta-analyses that demonstrated superior functional recovery with PRP treatment^(21,26). Similarly, the UCLA score improved significantly with LP-PRP at 6 months, although results at 3, 12 months and 24 were not statistically significant. In line with other outcome measures, these improvements similarly fell short of the MCID established in prior research. The ASES score did not demonstrate a statistically significant improvement at any time point (3, 6, and 12 months). Although some meta-analyses have shown statistically significant differences in ASES scores with PRP treatment^(27,28), the magnitude of change often remains below the MCID, questioning the clinical relevance of the observed benefits. Consistent with parallel efficacy endpoints, the magnitude of improvement did not meet the predefined MCID threshold, possibly reflecting differences in preparation protocols, platelet concentrations, application techniques, and follow-up durations.

This systematic review has several limitations that should be acknowledged, notwithstanding the promising role of LP-PRP as an adjunct treatment in arthroscopic rotator cuff repair. First, there is a concern regarding the methodological heterogeneity of the conducted observations. The differences in PRP preparation and application protocols, variability in demographic patient profiles, diversity in surgical techniques and postoperative rehabilitation regimen introduce variability that could affect our results.

Moreover, the current literature is diverse regarding the use of specific outcome measures, such as VAS, Constant Score, UCLA Score, and the ASES Score which have all been utilized in different articles to quantify pain relief and shoulder function. This both reduces the extent to which the results can be generalized and makes direct comparisons between studies challenging. The second challenge concerning multi-purpose therapy is defining ideal PRP composition and elucidating the precise factors contributing to the participant's therapeutic effect. Finally, another challenge is to establish consistent application protocols that guarantee consistent results in terms of efficacy and reproducibility.

CONCLUSION

This systematic review and meta-analysis showed that LP-PRP, as an adjunctive treatment to arthroscopic rotator cuff tear repair, may provide benefits such as significant improvement in retear rate. Functional scores exhibited statistically significant changes at specific follow-up intervals; however, these alterations failed to reach the minimal clinically important difference, thereby limiting their practical relevance.

Despite the promising potential of LP-PRP, more studies with standardized protocols and large samples are needed to clearly elucidate the optimal conditions for the application of PRP, such as ideal formulation, timing, and method of administration, as well as individual patient factors that could modulate the therapeutic response. In summary, more data is needed to establish LP-PRP as a standard of care in arthroscopic rotator cuff repair and consequently maximize positive clinical outcomes for patients.

FINAL CONSIDERATIONS

This article is in the final stages of preparation for submission to *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. Our goal is to contribute to the field of study by offering perspectives that may guide future research. To meet the editorial requirements of the publication, the article was written in English, ensuring alignment with international standards.

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APPENDIX SUPPLEMENTARY DATA

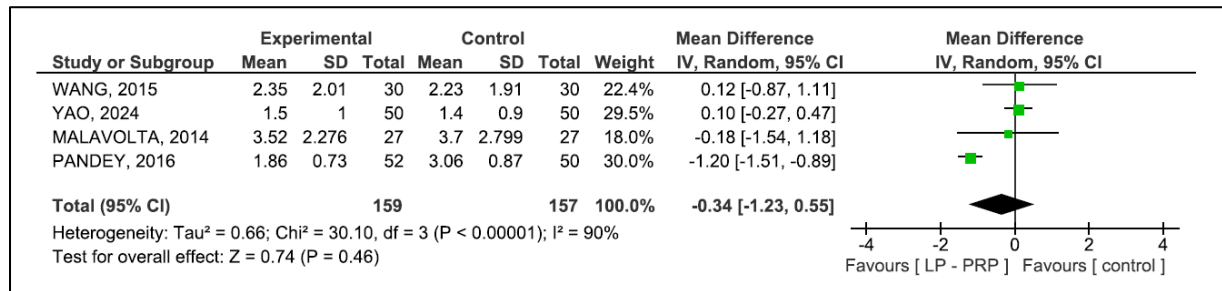


Figure S1. Forest plot of VAS scores at 3 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval

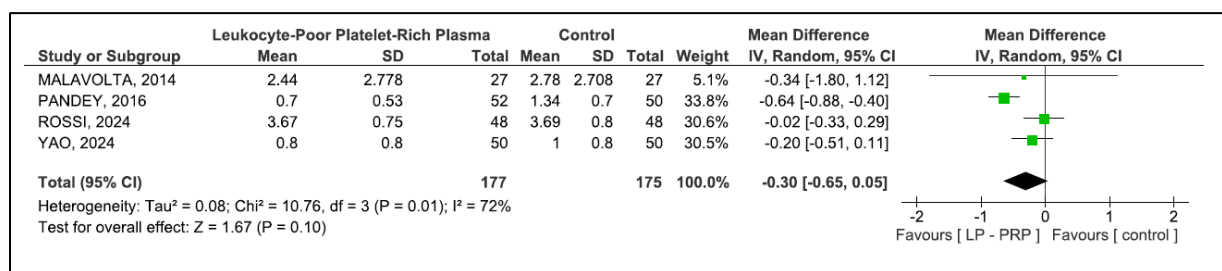


Figure S2. Forest plot of VAS scores at 6 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval

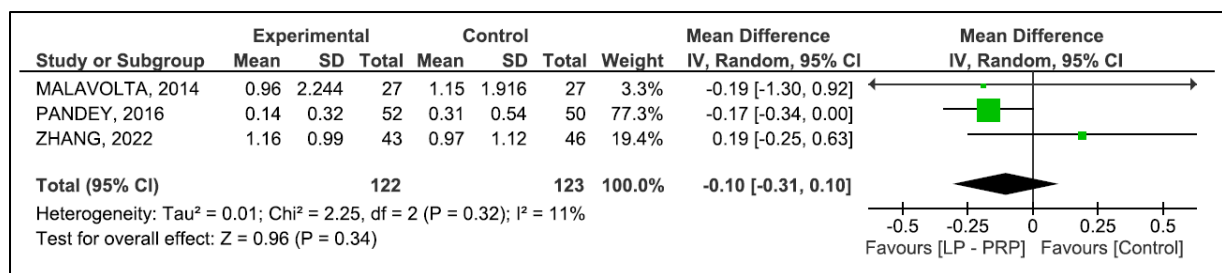


Figure S3. Forest plot of VAS scores at 24 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval

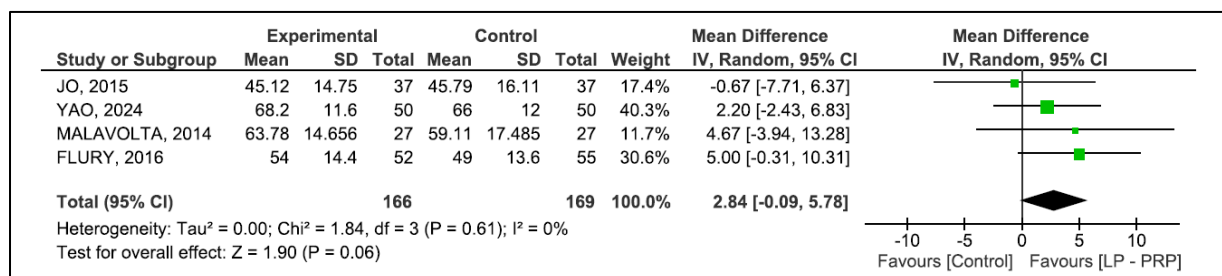


Figure S4. Forest plot of CS scores at 3 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

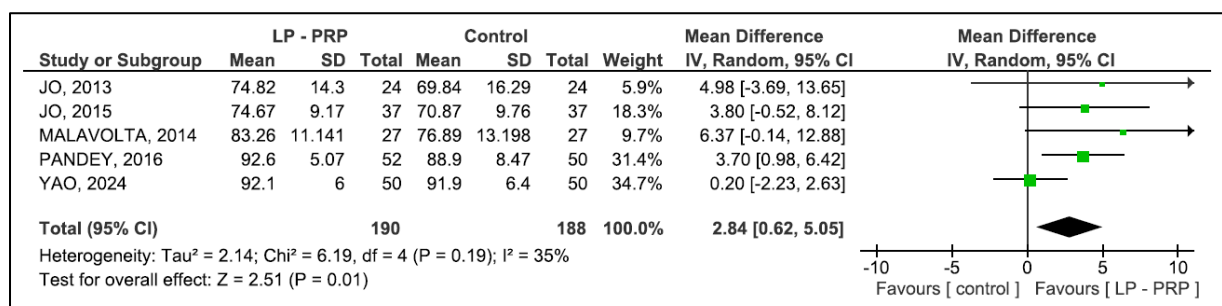


Figure S5. Forest plot of CS scores at 12 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

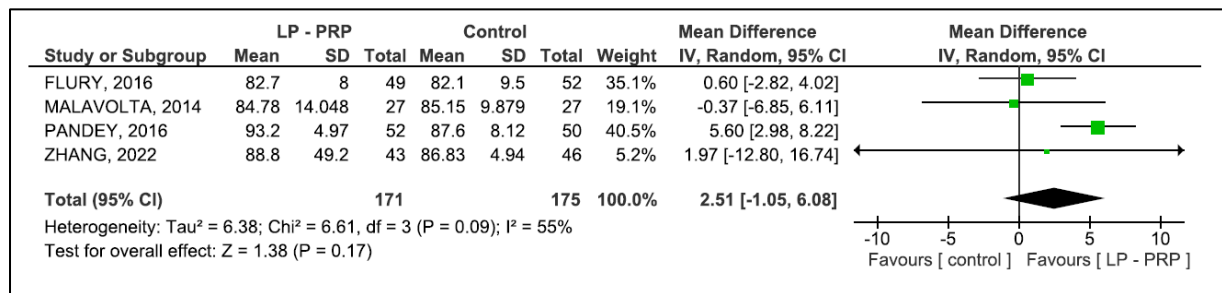


Figure S6. Forest plot of CS scores at 24 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

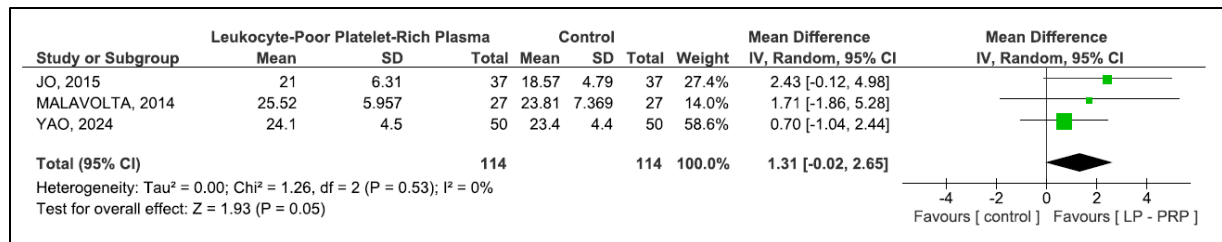


Figure S7. Forest plot of UCLA scores at 3 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

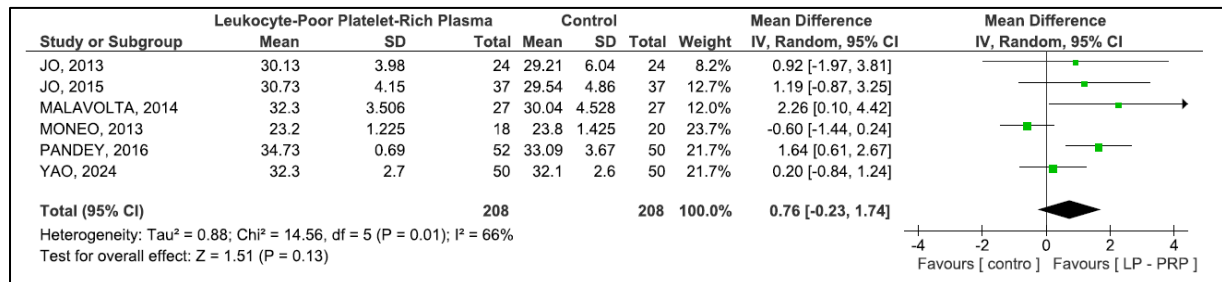


Figure S8. Forest plot of UCLA scores at 12 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

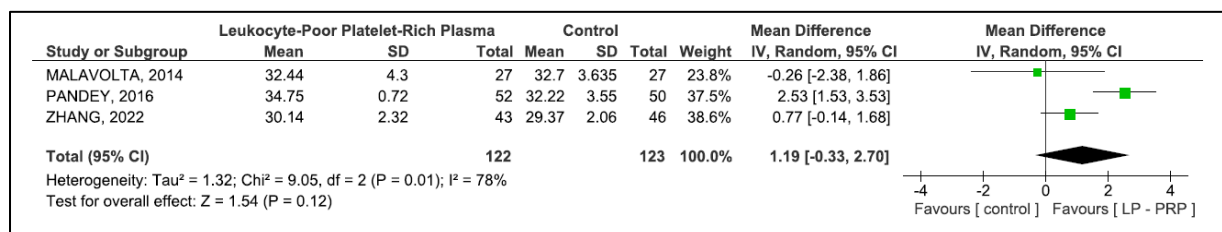


Figure S9. Forest plot of UCLA scores at 24 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

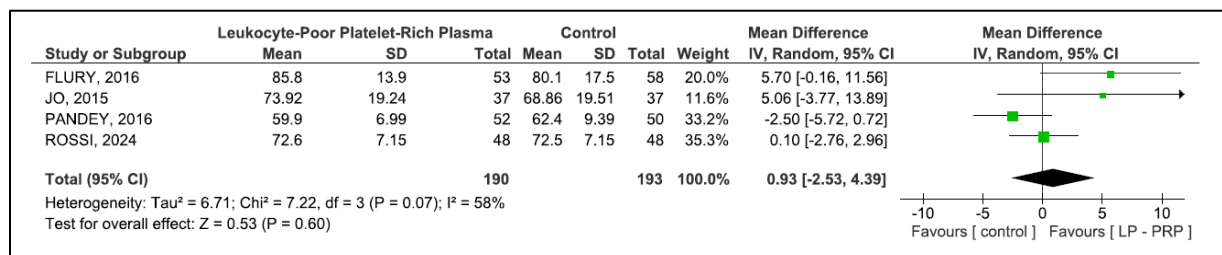


Figure S10. Forest plot of ASES scores at 6 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

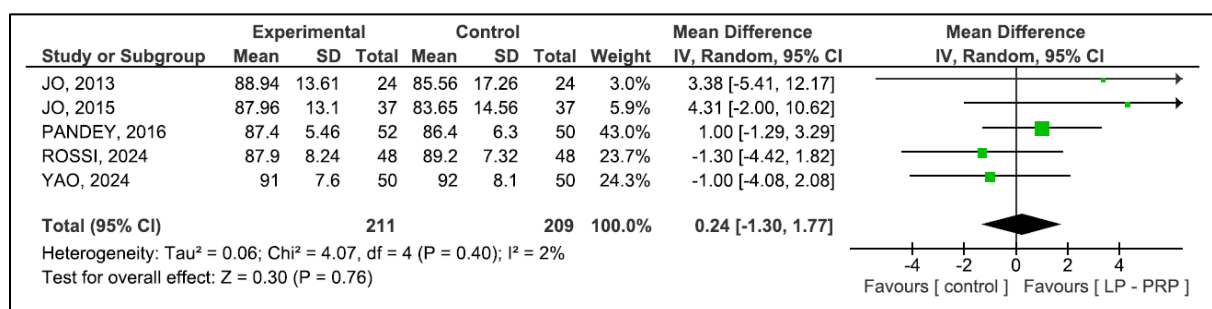


Figure S11. Forest plot of ASES scores at 12 months comparing leukocyte-poor PRP (LP-PRP) with the control group. IV, inverse variance; CI, confidence interval.

Figure S12 - Risk of bias assessment of included randomized controlled trials using the Cochrane RoB 2.0 tool

Risk of bias domains						
	D1	D2	D3	D4	D5	Overall
JO, 2013	⊖	⊖	⊕	⊕	⊕	⊖
MONEO, 2013	⊕	⊕	⊖	⊕	⊖	⊖
MALAVOLTA, 2014	⊕	⊖	⊕	⊕	⊕	⊖
JO, 2015	⊖	⊖	⊕	⊖	⊕	⊖
WANG, 2015	⊕	⊖	⊕	⊕	⊕	⊖
FLURY, 2016	⊕	⊕	⊕	⊕	⊕	⊕
PANDEY, 2016	⊕	⊕	⊕	⊕	⊕	⊕
EBERT, 2017	⊕	⊖	⊖	⊖	⊕	⊖
ZHANG, 2022	⊕	⊕	⊕	⊕	⊕	⊕
ROSSI, 2024	⊕	⊖	⊕	⊕	⊕	⊖
YAO, 2024	⊕	⊕	⊕	⊕	⊕	⊕

Domains:
 D1: Bias arising from the randomization process.
 D2: Bias due to deviations from intended intervention.
 D3: Bias due to missing outcome data.
 D4: Bias in measurement of the outcome.
 D5: Bias in selection of the reported result.

Judgement
 ⊖ Some concerns
 ⊕ Low

Search strategy

(“Arthroscopic rotator cuff repair” OR “Rotator Cuff Injuries” OR “Rotator Cuff Surgery” OR
 “Subscapularis” OR “Rotator cuff” OR “infraspinatus” OR “Supraspinatus”) AND
 (“Leukocyte - Poor Platelet-Rich Plasma” OR “PRP” OR “platelet-rich plasma”)

ANEXO 1: Normas de publicação da revista Arthroscopy: The Journal of Arthroscopic & Related Surgery

Introduction

All submissions to Arthroscopy: The Journal of Arthroscopic and Related Surgery must comply with these Instructions for Authors. Studies should be in compliance with human studies committees and animal welfare regulations at the authors' institutions and also in compliance with Food and Drug Administration guidelines. All manuscripts will be subject to peer review. Letters to the Editor and comments on the c's content or policies are always welcome and encouraged.

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It is original work, has been written by the stated authors, and has not been published elsewhere, including electronically, in the same form, in any language. Likewise, a similar manuscript has not been submitted to or published by any other journal, by any of the authors

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If the submission is accepted, it will not be published elsewhere, including electronically in the same form, in any language, without the written consent of the copyright holder.

Before you begin

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The below guidance only refers to the writing process, and not to the use of AI tools to analyse and draw insights from data as part of the research process.

Where authors use generative artificial intelligence (AI) and AI-assisted technologies in the writing process, authors should only use these technologies to improve readability and language. Applying the technology should be done with human oversight and control, and authors should carefully review and edit the result, as AI can generate authoritative-sounding output that can be incorrect, incomplete or biased. AI and AI-assisted technologies should not be listed as an author or co-author or be cited as an author. Authorship implies responsibilities and tasks that can only be attributed to and performed by humans, as outlined in Elsevier's AI policy for authors.

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Disclosure Instructions

Authors must disclose the use of generative AI and AI-assisted technologies in the writing process by adding a statement at the end of their manuscript in the core manuscript file, before the References list. The statement should be placed in a new section entitled 'Declaration of Generative AI and AI-assisted technologies in the writing process'.

Statement: During the preparation of this work the author(s) used [NAME TOOL / SERVICE] in order to [REASON]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

This declaration does not apply to the use of basic tools for checking grammar, spelling, references etc. If there is nothing to disclose, there is no need to add a statement.

Authorship

Arthroscopy generally limits the number of authors to 7. If there are more than 7 authors, we ask the corresponding author to justify each author's participation using the ICMJE criteria for authorship:

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND

Drafting the work or revising it critically for important intellectual content; AND

Final approval of the version to be published; AND

Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Copyright

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Registration of Clinical Trials

Clinical trial registration (prospective publication of clinical research study authors, title, purpose, hypothesis, methods including statistical methods, and confirmation of Institutional Review Board approval) mitigates against bias resulting from selective reporting of results. Clinical trials beginning patient enrollment after January 1, 2012, will not be accepted for publication in *Arthroscopy* without prospective registration of the trial (i.e., before enrollment of the first patient). Trials may be registered in any national or international registry. Include details on the separate title page *only*.

Except in rare circumstances where the temporal effect of the outcome being measured is brief, clinical trials will not be accepted for publication in *Arthroscopy* without 24 months' minimum follow-up for all subjects who are enrolled and reported. The Journal strongly encourages the use of the CONSORT (Consolidated Standards of Reporting Trials) guidelines when designing and reporting randomized controlled trials (RCTs). The criteria outlined by the CONSORT group are meant to assist in improving the overall quality of RCTs, and provides a minimum set of recommendations for reporting on RCTs. There is a 25-item checklist designed to facilitate study setup, reporting, and interpretation. The overall goal of using the CONSORT criteria is to facilitate the study design from the outset, and provide for a high-quality and prudently conceived RCT. The guidelines can be found at <https://www.equator-network.org/reporting-guidelines/consort/>.

SUBMISSION

After registering as an author through the Arthroscopy online submission and review system website (www.editorialmanager.com/arth), you will be guided step by step through the uploading of your own files and approving of the single PDF that will be created from them. You can track the progress of your manuscript through our website. Communications about a manuscript will be handled through e-mail. Please access the website for more specifics about online submission, including a tutorial for authors, artwork guidelines, and a link to author support by e-mail that is monitored around the clock.

Use of inclusive language

Inclusive language acknowledges diversity, conveys respect to all people, is sensitive to differences, and promotes equal opportunities. Content should make no assumptions about the beliefs or commitments of any reader; contain nothing which might imply that one individual is superior to another on the grounds of age, gender, race, ethnicity, culture, sexual orientation, disability or health condition; and use inclusive language throughout. Authors should ensure that writing is free from bias, stereotypes, slang, reference to dominant culture and/or cultural assumptions. We advise to seek gender neutrality by using plural nouns ("clinicians, patients/clients") as default/wherever possible to avoid using "he, she," or "he/she." We recommend avoiding the use of descriptors that refer to personal attributes such as age, gender, race, ethnicity, culture, sexual orientation, disability or health condition unless they are relevant and valid. When coding terminology is used, we recommend avoiding offensive or exclusionary terms such as "master", "slave", "blacklist" and "whitelist". We suggest using alternatives that are more appropriate and (self-) explanatory such as "primary", "secondary", "blocklist" and "allowlist". These guidelines are meant as a point of reference to help identify appropriate language but are by no means exhaustive or definitive.

Reporting sex- and gender-based analyses

Reporting guidance

For research involving or pertaining to humans, animals or eukaryotic cells, investigators should integrate sex and gender-based analyses (SGBA) into their research design according to funder/sponsor requirements and best practices within a field. Authors should address the sex and/or gender dimensions of their research in their article. In cases where they cannot, they should discuss this as a limitation to their research's generalizability. Importantly, authors should explicitly state what definitions of sex and/or gender they are applying to enhance the precision, rigor and reproducibility of their research and to avoid ambiguity or conflation of terms and the constructs to which they refer (see Definitions section below). Authors can refer to the Sex and Gender Equity in Research (SAGER) guidelines and the SAGER guidelines checklist. These offer systematic approaches to the use and editorial review of sex and gender information in study design, data analysis, outcome reporting and research interpretation - however, please note there is no single, universally agreed-upon set of guidelines for defining sex and gender.

Definitions

Sex generally refers to a set of biological attributes that are associated with physical and physiological features (e.g., chromosomal genotype, hormonal levels, internal and external anatomy). A binary sex categorization (male/female) is usually designated at birth ("sex assigned at birth"), most often based solely on the visible external anatomy of a newborn. Gender generally refers to socially constructed roles, behaviors, and identities of women, men and gender-diverse people that occur in a historical and cultural context and may vary across societies and over time. Gender influences how people view themselves and each other, how they behave and interact and how power is distributed in society. Sex and gender are often incorrectly portrayed as binary (female/male or woman/man) and unchanging whereas these constructs actually exist along a spectrum and include additional sex categorizations and gender identities such as people who are intersex/have differences of sex development (DSD) or

identify as non-binary. Moreover, the terms "sex" and "gender" can be ambiguous? Thus it is important for authors to define the manner in which they are used. In addition to this definition guidance and the SAGER guidelines, the resources on this page offer further insight around sex and gender in research studies.

Preparation

Peer Review

This journal operates a double-blind review process, which means the identities of the authors are concealed from the reviewers, and vice versa. All contributions are typically sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. More information on types of peer review.

General

Before you start, please review our Insider's Guide to Getting Medical Research Accepted for Publication.

Manuscripts should be typed double-spaced with continuous line numbering. Submit in this order; see details in the following sections: Separate (unblinded) title page, blinded title page, blinded text, references, figure and video legends, tables, figures, and conflict of interest forms. Arthroscopy follows style points for text and references of the AMA Manual of Style.

Maximums word and figure counts for Articles Submitted to the *Arthroscopy* Family of Journals (note that the maximum number of words is exclusive of the title page, blind title page, references and figure legends).

Authors must include the word count and number of figures and tables on the separate title page. Submissions that exceed the limits will be returned to the author for editing before review.

Original Article: 4000 words; 7 figures (15 figure parts); 4 tables

Systematic Review: 4500 words; 7 figures (15 figure parts); 4 tables

Meta-analysis: 4000 words; 7 figures (15 figure parts); 4 tables

Technical Note: 1500 words; no limit to figures; 4 tables (note that these are now published **only** in Arthroscopy Techniques. Video is required for submission. The video must be narrated and list disclosures on an opening slide. Submit as for Arthroscopy at www.editorialmanager.com/arth)

Letter to Editor and Reply: 500 words; 2 figures; 0 tables

Level V Evidence (submitted only at the invitation of the Editor in Chief or Assistant Editor in Chief): 1600 words; 0 figures; 0 tables

Separate Title Page

A separate (unblinded) title page of each manuscript should include the following essential information:

Title. Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.

All Authors' full names, degrees, and affiliations. Where the family name may be ambiguous (e.g., a double name), please indicate this clearly. Present each author's affiliation and address below the names.

Corresponding Author. The Journal of Arthroscopy and Related Surgery requires a limit of one corresponding author. Clearly indicate who will handle correspondence at all stages of reviewing and publication, and after publication. Ensure that telephone numbers (with country and area code) are provided in addition to the e-mail address and the complete postal address. Contact details must be kept up to date by the corresponding author.

In addition, include IRB and RCT information, as well as a short running title (maximum of 45 characters and spaces). Include any acknowledgment of persons who provided help during the research/writing (e.g., language help, writing assistance, or proof reading the manuscript, etc.).

Blinding the Manuscript

Because all manuscripts are blinded to reviewers, the first page of the blinded manuscript must be a blinded title page that lists *only the title*. Likewise, in the text, do not include any identifying information, such as an author's initials or the names of institutions where the study was done, or a phrase such as "our study" that, when followed by a citation, reveals authorship of the present manuscript in the reference list.

Manuscript Structure

1. Abstract

Original Articles, abstracts should be a maximum of 300 words and structured to include the following sections: **Purpose:** One or 2 sentences that simply state the purpose with no background information or hypothesis. **Methods:** Provide, with sufficient detail, the methods of the study including selection criteria. **Results:** Provide results, with data, P values, and standard deviation of mean or 95% confidence intervals. Present most important findings first.

Please provide exact P values (not $P <$) and numbers to support your methods findings. *Conclusions*: State only what your study found; do not include extraneous information not backed up by the results. *Level of Evidence* (for human studies) or *Clinical Relevance* (basic science or in vitro study: why is this study important from a clinical standpoint?).

Systematic Reviews and Meta-analyses, the abstract and text should be structured as an Original Article.

Technical Notes for Arthroscopy Techniques, the abstract should be an unstructured summary (maximum length, 200 words). The body of these manuscripts should consist of unstructured summary abstract, Introduction, Technique, and Discussion, plus references and figure legends and video legend.

Case Reports, the text should consist of unstructured summary abstract, Introduction, Case Report, and Discussion, plus references and figure legends.

Level V Evidence articles, the abstract should be an unstructured summary (maximum length, 300 words). See the Levels of Evidence table.

2. Introduction

The introduction of an Original Article should succinctly state the problem or controversy that led you to undertake the study, including a concise review of only the most relevant literature. Conclude the introduction by stating the *purpose* of the study and your *hypothesis*. The purpose in the Introduction should match that of the Abstract.

3. Methods

Describe the study design (prospective or retrospective, inclusion and exclusion criteria, duration). If prospective or a cadaver study, the number of enrolled subjects is reported in Methods. If retrospective, the study population (numbers, demographics, length of follow-up) should be in Results.

Include IRB and animal studies information. IRB approval is required for all human studies except retrospective and cadaver studies (unless the institution where the study was performed requires it).

The statistics that you have used to analyze the data should be described in detail. You cannot make the statement, "We found no significant difference between the two groups" unless a power study was done and you include in the text the value of alpha, beta, and standard deviation. Use of the word *significant* requires your reporting an exact P value. Confidence intervals of 95% are required whenever the results of survivorship analysis are given in the text, tables, or figures. Use of the word *correlation* requires you to report the correlation coefficient.

Arthroscopy encourages the use of validated outcome instruments. The use of both a general health outcome measure and a joint-specific, limb-specific, or condition-specific measure is

encouraged. If an outcome instrument leads to a categorical ranking (e.g., excellent or good or poor), the aggregate outcome score for each patient should be provided.

5. Results

Describe in detail the data obtained during the study following the order of the Methods to include final number of subjects, demographics, length of follow-up (mean and range). The overall final patient follow-up should be 80% or greater (less than 20% drop-out) in order to minimize follow-up bias. In general, scientific studies will not be accepted for publication without meeting this criterion. ***Results obtained with less than two years of follow-up are rarely accepted for publication by the Journal.*** All data in the text must be consistent with the rest of the manuscript, including data in tables, figures, and legends. Present comparison data in tables and present as mean $\pm$ standard error of the mean with confidence intervals.

5. Discussion

Be concise. The Discussion should start with the most important findings of your study. Is your hypothesis affirmed or refuted? Compare and contrast your study with others in the most relevant world literature, particularly the recent literature. A complete literature review is unnecessary.

At the end of the Discussion, under the subheading "Limitations," review the limitations of your study.

6. Conclusions

Briefly state your new (or verified) view of the problem you outlined in the Introduction. Take special care to draw your conclusions only from your results and verify that your conclusions are firmly supported by your data. Most importantly, do not make concluding statements that are not supported by your data, lie beyond the scope of your study, or are unnecessary (e.g., "further studies are warranted"). ***The conclusions in the text must match those in the abstract.***

7. References

The Journal follows AMA reference style. See examples below. Provide all authors' names when 6 or fewer; when 7 or more, list the first 3 and add et al. Provide article titles and inclusive page numbers (321-328, not 321-8). References to online-only material must list author, title, the URL, and the date accessed by the author. For abbreviations of journal names, refer to PubMed. Please ensure that every reference cited in the text is present in the reference list (and vice versa). The accuracy of reference data is the responsibility of all authors.

Data References

This journal encourages you to cite underlying or relevant datasets in your manuscript by citing them in your text and including a data reference in your Reference List. Data references should include the following elements: author name(s), dataset title, data repository, version (where available), year, and global persistent identifier. Add [dataset] immediately before the reference

so we can properly identify it as a data reference. This identifier will not appear in your published article.

Reference style

In text: Number references in the order in which they appear in the text. Unpublished results and personal communications (only if essential to your message) should be mentioned in the body of the text at the end the statement with the appropriate information in parentheses. For example: (J. Karlsson, M.D., personal communication, [month and year of communication]).

Formatting Examples

Periodical

Jackson TJ, Lindner D, El-Bitar YF, Domb BG. Effect of femoral anteversion on clinical outcomes after hip arthroscopy. *Arthroscopy* 2015;31:35-41.

Chapter in a book

Ruch DS, Poehling GG. Operative arthroscopy of the wrist. In: Andrews JR, Timmerman LA, eds. *Diagnostic and operative arthroscopy*. Philadelphia: WB Saunders, 1997;199-205.

Book

Burkhart SS, Lo IKY, Brady PC, Denard PJ. *The cowboy's companion: A trail guide for the arthroscopic shoulder surgeon*. Philadelphia: Lippincott Williams & Williams, 2012.

Article in Press

Note: Citation of an 'in press' article is permitted only if it has been accepted for publication.

Rosso F, Bisicchia S, Bonasia DE, Amendola A. Meniscal allograft transplantation: A systematic review. *Am J Sports Med* in press, available online 13 June, 2014. doi:10.1177/0363546514536021.

Dataset

[dataset] Oguro, M, Imahiro, S, Saito, S, Nakashizuka, T. Mortality data for Japanese oak wilt disease and surrounding forest compositions, Mendeley Data, v1; 2015. <https://doi.org/10.17632/xwj98nb39r.1>.

For further detail and examples, you are referred to the *AMA Manual of Style*.

8. Figure and Video Legends

Ensure that each illustration and each part of a multipart illustration has a legend (caption). Supply legends separately, not attached to the figure. Figure legends must be robust and "stand

alone" (i.e., contain a complete, take-home, educational message, as if a reader viewed only that Figure without looking at any other Figure or without reading the text). Orient the reader to the image by mentioning patient position, side, and viewing portal or MRI orientation as appropriate. Keep text in the illustrations themselves to a minimum but explain in the legend all symbols and abbreviations used.

9. Tables

Number tables consecutively in accordance with their appearance in the text. Include a short descriptive title with the table number. Place footnotes to tables below the table body and indicate them according to the symbol hierarchy (i.e., asterisk, dagger, double dagger, etc.). Define all abbreviations. Avoid vertical rules. Do not give the same information in tables that you give in the text or in figures.

10. Figures

Number figures consecutively in accordance with their appearance in the text. Figures must be submitted separately from the text. Arrows and labels should be added to figures as appropriate to orient the reader to the arthroscopic images. Previously published figures may be used if permission has been received from the source publisher.

11. Disclosures

All authors of a submission must disclose any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. All authors, including those without competing interests to declare, should use the tool at declarations.elsevier.com to create a statement then forward these forms to the corresponding author. Please be sure to include the applicable author's last name in the file name of the form. The corresponding author will upload one form per author to the submission system at the "Attach Files" step. The corresponding author is responsible for confirming the accuracy of all statements. Please do not convert the .docx template to another file type. Author signatures are not required. More information.

Systematic Reviews (with and without meta-analysis)

Refer to Harris JD, Brand JC, Cote MP, Dhawan A; *Research Pearls: The Significance of Statistics of Perils of Pooling: Pearls and Pitfalls of Meta-analyses and Systematic reviews*; Arthroscopy 2017; E-published April 27, 2017, for guidance in design, conduct, reporting, and publishing SR/MA in Arthroscopy.

General

Review authors are encouraged, but not required, to register the systematic review (SR) on PROSPERO (<https://www.crd.york.ac.uk/PROSPERO/>) after the review topic is conceived, but before the conduct of the review begins. Submission of a SR should follow the 27-item

PRISMA checklist (<http://www.prisma-statement.org/>). The following guidelines incorporate key elements of the PRISMA checklist and are intended to improve the quality of SR submissions:

Introduction

Rationale for why a SR is needed should be clearly described. What is already known about the topic, current gaps in knowledge, and why a SR is likely to produce evidence that will serve to address these gaps should be clearly stated. If a similar or identical SR/MA has been published in last 5 to 10 years, then the submitted SR/MA must show that the evidence has changed.

Define the specific research question, preferably in PICO format (Participants, Interventions, Comparisons, and Outcomes).

Example: In collision athletes, does open Bankart repair, in comparison to arthroscopic Bankart repair, result in lower rates of recurrent instability?

Methods

Study Eligibility (Inclusion and Exclusion Criteria)

Eligibility criteria should follow the PICO question defined in the Introduction.

Example: Studies that included collision athletes with a Bankart lesion undergoing primary repair, compared open to arthroscopic treatment, and reported recurrent instability rates at two years or greater follow up were eligible for inclusion.

Other pertinent criteria for determining eligibility including type of studies (Level of Evidence, study design, etc.) that was reviewed.

Example: Case series (Level IV evidence) or studies that did not specifically compare open to arthroscopic treatment were excluded.

Consult CEBM (<http://www.cebm.net/ocebmllevels-of-evidence/>) for thorough descriptions of level of evidence in therapeutic, diagnostic, prognostic, and economic studies.

Literature Search

The search strategy (terms, string) should be described with enough detail that it could be reproduced.

Indicate which databases were searched. Two or more databases should be used (the combination of MEDLINE, EMBASE, and Cochrane will capture 97% of all relevant studies in Orthopedic Surgery SR/MA).

The search should be performed independently by two or more study authors to ensure no

omission of potentially relevant subjects and resolution of disagreement in the setting of possible study inclusion.

Study Selection and Data Abstraction

The process for selecting studies, indicating who screened the studies and how were disagreements managed should be clearly described.

The specific data that were extracted from each study and information on who abstracted the data, what tools (data collections forms, etc.) were used to facilitate abstraction, and how were disagreements managed should be described.

Risk of Bias Assessment

The process used to appraise the methodological quality or risk of bias including the tools use for appraisal should be clearly described.

The tools used to evaluate the studies should be appropriate for the design of the included studies. Common tools include Cochrane's Risk of Bias for randomized clinical trials, Coleman, Modified Coleman, CONSORT, Newcastle-Ottawa or MINORS for observational non-randomized studies.

Multiple, independent raters for the risk of bias assessment are recommended. Rater statistics (kappa, ICC) should be reported to quantify the degree agreement between the raters and a description of how disagreements were handled, i.e. how the final score was arrived at, should be included.

Data Analysis

The primary outcome measure(s) should be clearly stated.

o Example: The primary outcome measure was the rate of recurrent instability. Risk ratios (rate in open group divided by the rate in arthroscopic) were calculated for each study.

If a meta-analysis is performed, the rationale or criteria used for determining that pooling data was appropriate should be provided.

In nearly all situations, meta-analysis should only be performed with level I or II evidence studies.

The methods used to analyze the data (fixed versus random effects), and measures of heterogeneity or consistency (I²) should be clearly described.

For a meta-analysis using a random effect model, prediction intervals are strongly

recommended.

Plans for exploring heterogeneity or inconsistency between studies, including subgroup analyses and meta-regressions should be clearly described.

Any additional analyses (sensitivity, publication bias) should also be clearly described.

Results

Presentation of the results should follow the Methods section.

The study selection process should be depicted in a PRISMA flow chart.

Risk of Bias scores should be presented for each item on the selected tools. Reporting aggregate scores is OK, however scores for each item are needed to determine the specific areas where studies were at risk for bias.

For SR without a meta-analysis, forest plots with the summary estimate suppressed are recommended as they allow the effects of the individual studies and their relative size and weight to be displayed together in the same figure.

Discussion and Conclusion should follow the Journal's guidelines for original research.

Common Errors

Including studies with duplicate patient populations.

In some instances, a SR turns up studies on the same patient group. Including these studies in any statistical analysis artificially inflates the number of patients and should be avoided.

Pooling diverse, heterogeneous studies with different designs. Combining non-randomized studies with randomized trials is typically not appropriate as these designs carry different risks of bias and are apt to distort the results. If a SR includes studies with different designs (randomize trials, cohort studies, etc.) these should be pooled separately. Typically, these are level III or IV evidence studies.

No rationale for provided for pooling non-randomized studies.

If the available literature is limited to observational studies, a rationale for why a meta-analysis will produce valid results that contribute to the understanding of the problem under question is needed. If one can not be reached, a meta-analysis should be avoided.

Quantifying heterogeneity but not failing to explore or discuss it.

Reporting the I² statistics has become more frequent, however it's important to discuss its impact on the results. If the results are heterogeneous, efforts should be undertaken to explore

this inconsistency. Techniques like subgroup analysis can be used to determine if I² values change when grouped according to co-variants. For example, I² values may change when the studies are analyzed according to a clinical characteristic (those that included patients with bone loss vs. those that did not) or a risk of bias item (those that adequately randomized patients versus those that did not). Lastly, I² is a relative measure. As recommended above, providing a prediction interval will assist in interpreting the effect of heterogeneity. A prediction interval provides a range of probable effects that reflects the variation in the different studies and settings, including what would be expected in future patients.

SUBMISSION CHECKLIST

The following checklist will be useful before sending a manuscript to the journal for review. Ensure that the following items are present:

One author has been designated as the corresponding author with the following contact details:

E-mail address

Full postal address

Telephone numbers

All necessary files have been uploaded, and contain:

All figure legends

All tables (including title, description, footnotes)

Separate files for figures

A combined summary declaration of conflict-of-interest form that includes all conflicts of interest for all authors

Further considerations:

Manuscript has been spell-checked and grammar-checked

References are in the correct format for *Arthroscopy*

All references included in the reference list are cited in the text, and vice versa

Permission has been obtained for use of copyrighted material from other sources, including the Web

RESEARCH DATA

This journal encourages and enables you to share data that supports your research publication where appropriate and enables you to interlink the data with your published articles.

Research data refers to the results of observations or experimentation that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other useful materials related to the project.

Data linking

If you have made your research data available in a data repository, you can link your article

directly to the dataset. Elsevier collaborates with a number of repositories to link articles on ScienceDirect with relevant repositories, giving readers access to underlying data that gives them a better understanding of the research described.

When available, you can directly link your dataset to your article by providing the relevant information in the submission system. For more information, visit the database linking page .

For supported data repositories a repository banner will automatically appear next to your published article on ScienceDirect.

In addition, you can link to relevant data or entities through identifiers within the text of your manuscript, using the following format: Database: xxxx (e.g., TAIR: AT1G01020; CCDC: 734053; PDB: 1XFN).

Mendeley Data

This journal supports Mendeley Data, enabling you to deposit any research data (including raw and processed data, video, code, software, algorithms, protocols, and methods) associated with your manuscript in a free-to-use, open access repository. Before submitting your article, you can deposit the relevant datasets to *Mendeley Data*. Please include the DOI of the deposited dataset(s) in your main manuscript file. The datasets will be listed and directly accessible to readers next to your published article online.

For more information, visit the Mendeley Data for journals page.

Data statement

To foster transparency, we encourage you to state the availability of your data in your submission. This may be a requirement of your funding body or institution.

If your data is unavailable to access or unsuitable to post, you will have the opportunity to indicate why during the submission process. The statement will appear with your published article on ScienceDirect. For more information, visit the Data statement page.