Clinical Sports Medicine Update

Remplissage May Decrease the Redislocation Rate After Arthroscopic Bankart Repair in Patients With an Engaging Hill-Sachs Defect

A Systematic Review and Meta-analysis of Studies With Minimal 2-Year Follow-up

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Background: The redislocation rate after arthroscopic Bankart repair (BR) among patients with a Hill-Sachs lesion (HSL) may be reduced with the use of remplissage.

Purpose: To investigate the outcomes of adding remplissage to an arthroscopic BR in patients with concomitant HSL.

Study Design: Meta-analysis; Level of evidence, 3.

Methods: PubMed and ScienceDirect databases were searched between February 2022 and April 2023 with the terms ''remplissage'' and ''shoulder instability'' according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The inclusion criteria were formed using the population, intervention, control, and outcome method; the investigation included studies that compared BR with and without remplissage and had ≥24 months of follow-up.

Results: From 802 articles found during the initial search, 7 studies with a total of 837 patients—558 receiving isolated BR (BR group) and 279 receiving BR with remplissage (BR + REMP)—were included. The probability of recurrence of instability among patients with an engaging HSL was significantly diminished in the BR + REMP group compared with the BR group (odds ratio, 0.11; 95% CI, 0.05 to 0.24; $P < .001$). Regarding shoulder range of motion, the BR + REMP group achieved increased forward flexion (mean difference [MD], 1.97°; 95% CI, 1.49° to 2.46°; $P < .001$) and decreased external rotation in adduction (MD, –1.43°; 95% CI, –2.40° to –0.46°; $P = .004$) compared with the BR group. Regarding patient-reported outcome measures, the BR + REMP group had Rowe (MD, 2.53; 95% CI, –1.48 to 6.54; $P = .21$) and Western Ontario Shoulder Instability Index (WOSI) (MD, –61.60; 95% CI, –148.03 to 24.82; $P = .162$) scores that were comparable with those of the BR group.

Conclusion: Remplissage resulted in a 9-fold decrease in the recurrence of instability after arthroscopic BR in patients with HSL. Remplissage not only led to an increase in forward flexion but also only slightly limited patients' external rotation in adduction. WOSI and Rowe scores after remplissage at the final 24-month follow-up were comparable with those obtained after isolated Bankart repair.

Keywords: shoulder instability; Bankart repair; Hill-Sachs lesion; remplissage

Arthroscopic Bankart repair (BR) is commonly performed to treat anterior shoulder instability with minimal bone loss; however, redislocations after isolated arthroscopic BR may occur in up to 30% of patients.[10,13,18,42] According to the glenoid track concept presented by Yamamoto et al,[37] an "off-track" Hill-Sachs lesion (HSL) may be a major cause of isolated arthroscopic BR failure. When concomitant HSL occurs, the so-called *bipolar lesion* significantly increases the recurrence rate of instability and may be responsible for a recurrence rate of 30%.[26] When a bipolar lesion occurs with glenoid bone loss (GBL) in the range

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of 20% to 25%, the traditional approach is to perform the Latarjet procedure.[7] However, the precise extent of this bone loss remains a subject of debate.[31] If a bipolar lesion occurs with GBL <20% to 25% and an off-track HSL, the usual recommendation is BR with an additional procedure known as remplissage.[8,29] Former meta-analyses have indicated superiority of BR with remplissage over isolated BR mainly in terms of recurrence of instability (RoI)[3,7,13,18,24] but also according to patient-reported outcome measures (PROMs).[3,18] However, these meta-analyses did not present data pertaining to long-term follow-up. Further, glenoid and humeral bone losses were insufficiently reported and could not be quantitatively compared.

Generally, remplissage is thought to be a safe procedure with significantly fewer complications than bone block stabilization procedures.[34] However, remplissage might not be free of possible complications. Some authors have reported a late complication due to the nonanatomic nature of remplissage: that is, allegedly, a loss of range of motion (ROM) in the shoulder joint.[21,24] A systematic review of biomechanical studies showed that the ROM that is most probably limited may be external rotation in adduction (ERad)—from 9° to 14° compared with the contralateral side.[21] Due to the high heterogeneity and low level of evidence of studies included in recent meta-analyses, drawing significant conclusions is limited. Additionally, glenoid and humeral bone loss were insufficiently measured and reported; thus, homogeneity of the compared groups was doubtful. Because of the aforementioned issues, we set out to address some of the most troublesome questions pertaining to the remplissage procedure.

The main objectives of the study were to evaluate whether adding remplissage to an arthroscopic BR in patients with concomitant off-track HSL would (1) decrease the chance of RoI, (2) influence ROM of the shoulder joint, and (3) show superior outcomes in PROMs. It was hypothesized that arthroscopic BR with remplissage would be superior to isolated BR in terms of RoI and PROMs and would not limit ROM of the shoulder joint.

METHODS

Literature Search Strategy

PubMed and ScienceDirect databases were systematically searched between February 2022 and April 2023 according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.[27] The following terms were used: "remplissage" AND "shoulder instability." Medical Subject Headings terms were used in the PubMed database to increase sensitivity of the search.

Study Screening

All titles and abstracts were screened by 2 independent investigators (N.P., A.F.), who assessed all studies separately. Those studies selected by both investigators were included in the second stage of screening with the assessment of full text of the article. All full-text screening was performed independently by the 2 investigators. Disagreements at both stages were reviewed by another author (M.K.). At the end of the screening stage, all included studies were arbitrated by the senior author (A.K.) for the final eligibility assessment.

Study Eligibility

The inclusion criteria were defined a priori by the second author (M.K.) using the population, intervention, control, and outcome (PICO) model.

1. P – Population: adults (mean age of study population >18 years) of either sex who qualified for surgical management of shoulder instability.
2. I – Intervention: BR with remplissage procedure and minimal follow-up of 24 months.
3. C – Control: BR without remplissage procedure and minimal follow-up of 24 months.
4. O – Outcomes: RoI, ROM, and PROMs.
5. S – Studies eligible for data extraction had to be peer-reviewed and written in the English language.

The following study designs were considered exclusion criteria: (1) case reports or case series, (2) consensus statements, (3) cadaveric studies, (4) editorial commentaries, (5) reviews, (6) meta-analyses, and (7) technical notes.

Quality Assessment

Methodological quality of the included studies was assessed with the methodological index for nonrandomized studies (MINORS) tool.[32] This checklist assesses articles on 12 items, with the last 4 items being specific only to comparative studies. Scoring is as follows: 0, not reported; 1, reported but poorly done and/or inadequate; and 2, reported in a well-done and adequate manner. The highest possible score is 16 for noncomparative studies and 24 for comparative studies. Interpretation of

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the methodological quality according to MINORS was taken from previous literature.[30] A score of 8 was defined as poor quality, 9 to 14 as moderate quality, and 15 or 16 as good quality for studies that were noncomparative. Cutoff points were 14, 15 to 22, and 23 or 24, respectively, for comparative studies.

For articles that were randomized controlled trials, the modified Jadad scale was used.[41] This scale includes 8 questions concerning randomization, blinding, withdrawals and dropouts, inclusion and exclusion criteria, adverse effects, and statistical analysis. The ideal score is 8 points. High-quality studies achieve scores 4 to 8 and low quality 0 to 3. Assessments with the MINORS tool and the modified Jadad scale were performed by 2 researchers (N.P. and A.F.) independently, and the mean value was drawn. Any disagreement was solved by the senior author.

Data Abstraction

Data from eligible studies were abstracted into a Microsoft Excel spreadsheet (Microsoft Excel for Microsoft 365 MSO). Data for each study included the name of the first author, year of publication, and study design. Descriptive statistics consisted of data such as interventions, sample size, mean age, sex distribution, mean follow-up time, and mean GBL as a percentage (mean ± SD for each group). Outcome measures that were recorded included clinical and functional outcomes such as RoI after the procedure (percentage of occurrences in each group), final forward flexion (mean ± SD for each group), final ERad (mean ± SD for each group), postoperative Rowe score (mean ± SD for each group), and postoperative Western Ontario Shoulder Instability Index (WOSI) (mean ± SD for each group). In the absence of any given information, the publication was omitted from a single analysis.

Statistical Analysis

Statistical analyses were performed using Statistica 13.3 (StatSoft). Descriptive statistics comprising means, ranges, standard deviations, and confidence intervals were presented where applicable as reported at final follow-up in the individual study. For studies in which the standard deviation was missing, the method described by Czaja et al[4] was used; that is, the standard deviation was estimated as 0.25 of the reported minimum-maximum range. Heterogeneity across studies was assessed with the Cochran heterogeneity statistic and Higgins I^2 coefficients. Results of the I^2 test were categorized as follows: 0.0% to 24.9%, no heterogeneity; 25.0% to 49.9%, low heterogeneity; 50.0% to 74.9%, moderate heterogeneity; and 75.0% to 100.0%, high heterogeneity.[15] To analyze the parameters that achieved low heterogeneity and insignificant P values in the Cochran Q test, we used a fixed-effects model. Because we obtained $P < .05$ in the Cochran Q test and $I^2 > 50\%$ for 4 of the investigated parameters (mean follow-up time, mean GBL, mean Rowe score, and mean WOSI score), which suggest a statistically significant heterogeneity, random-effects modeling was used in those analyses. Effect measure was presented with odds ratio (OR) for the dichotomous outcome (RoI) and mean difference (MD) for continuous outcomes (ROM, PROMs, and GBL). A confidence interval of 95% was used, and the level of statistical significance was set at $\alpha = .05$. Pooled data were reported in forest plots. Review Manager 5 software (Nordic Cochrane Centre; Cochrane) was used to generate forest plots. MINORS criteria were used to evaluate study bias.[32]

RESULTS

Literature Search

During the initial search, 802 articles were identified. After removal of duplicates, 628 studies underwent screening based on title and abstract. Subsequently, 123 records were deemed eligible for full-text assessment, resulting in the inclusion of 7 studies in the review. The detailed process of study selection is illustrated in the flow diagram (Figure 1).

Study Characteristics

A total of 837 patients were enrolled, with 558 undergoing isolated BR (BR group) and 279 undergoing BR with remplissage (BR + REMP group). Detailed summaries of the designs of the included studies are presented in Table 1. The mean age of patients at the time of surgery, mean follow-up time, and sex distribution appeared homogeneous across the studies, except for the study by Lin et al,[23] in which men outnumbered women (P = .0197). However, the meta-analysis revealed statistically significant differences between the BR and BR + REMP groups regarding mean follow-up time in months, which was longer in the BR group (MD, 3.0; 95% CI, 0.26-5.75; P = .032). No statistically significant differences between the BR and BR + REMP groups were found regarding mean age at the time of surgery (MD, 0.1 years; 95% CI, –0.99 to 1.19 years; P = .85) or sex distribution (OR, 1.25; 95% CI, 0.80 to 1.97; P = .32). Only in the study by Lin et al was there an imbalance in sex distribution among the groups. Of the total number of patients included in the meta-analysis, 85.5% (719/841) were men.

Quality Assessment

Among the included studies, 1 study was a randomized controlled trial, providing level 1 evidence,[25] whereas 6 studies were retrospective cohort studies of level 3 evidence.[11,12,16,22,23,28] All of the nonrandomized studies demonstrated moderate methodological quality. Factors such as prospective data collection, prospective calculation of study size, and unbiased assessment of study endpoints received the lowest scores in the analyzed studies. Only 1 study included a post hoc calculation of the study size,[12] and none of the studies included an a priori calculation. Detailed results of methodological quality assessment for nonrandomized studies, using the MINORS tool, are presented in Figure 2A. Regarding the randomized controlled trial, the assessment using the modified Jadad scale is

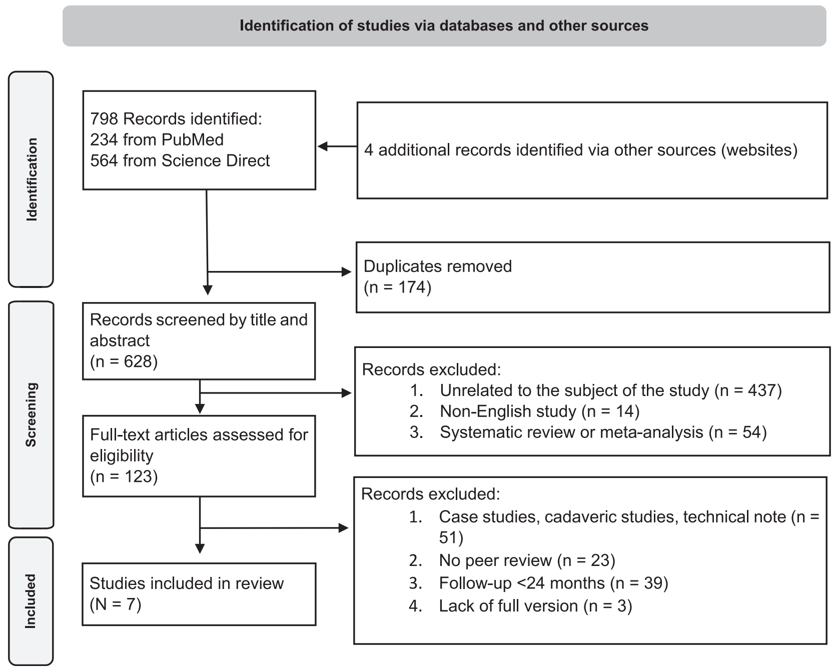

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 flow diagram for new systematic reviews.

TABLE 1
Summary of the Design of the Included Studies[a]

	Patients, n		Age, y			Sex, M/F, n			Follow-up, mo		
Lead Author (Year)	BR	BR + REMP	BR	BR + REMP	*P*	BR	BR + REMP	*P*	BR	BR + REMP	*P*
Lin[23] (2023)	127	56	24.8 ± 7.8	25.8 ± 8.1	.43	94/33	50/6	**.0197**	38.4 ± 21.6	33.3 ± 17.6	.12
Horinek[16] (2022)	75	48	25.3 ± 8.9	27.4 ± 8.7	.2	59/16	40/8	.6429	30 (24-45.6)	30 (24-45.6)	NA
Lee[22] (2021)	186	27	24.9 ± 5.6 (19-44)	25.9 ± 5.4 (16-47)	.38	177/9	25/2	.6345	50.1 ± 24.3 (24-108)	47.7 ± 25.6 (24-96)	.63
MacDonald[25] (2021)	54	54	27.8 (15.4-55.2)	27.3 (14.4-53.6)	NA	48/6	46/8	.7755	24.3 (23-64)	26.5 (21-53)	NA
Pandey[28] (2020)	77	59	31.6 ± 8.7	29.9 ± 6.2	.20	71/6	55/4	≥.999	54 (24-109)	44 (24-69)	NA
Garcia[12] (2015)	14	10	26.03	24.39	NA	12/2	6/4	.1921	40.72 (26.3-51.2)	31.55 (24.1-39.9)	NA
Franceschi[11] (2012)	25	25	27.4 ± 5.2	26.3 ± 8.1	.83	17/8	19/6	.5494	25.4 ± 1.5	24.8 ± 1.1	.11

[a]All continuous data are expressed as mean ± SD (range). Boldface value indicates statistical significance. BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage; F, female; M, male; NA, not applicable.

provided in Figure 2B.[25] This study met all the criteria, achieving a maximum score of 8/8 points, indicating high quality.

Evaluation of Mean Glenoid Bone Loss and Humeral Bone Loss

Mean GBL was assessed in all included studies. Six studies used the best-fit circle method, as described by Sugaya et al.[33] Among them, 3 studies used 3-dimensional magnetic resonance imaging[12,23,25] following the approach outlined by Huijsmans et al.[17] Horinek et al[16] evaluated GBL but did not specify the method used. Five studies presented results suitable for meta-analysis. The GBL was significantly greater in the BR + REMP group compared with the BR group (MD, 3.33%; 95% CI, 0.59%-6.08%; *P* = .02). The measurement methods used to evaluate GBL and the values reported in the included studies are provided in Table 2.

A

	Lin et al. (2023)	Horinek et al. (2022)	Lee et al. (2021)	Pandey et al. (2020)	Garcia et al. (2015)	Franceschi et al. (2012)
1. A clearly stated aim	1	2	2	2	1	2
2. Inclusion of consecutive patients	2	2	2	2	2	2
3. Prospective collection of data	1	0	0	0	0	0
4. Endpoints appropriate to the aim of the study	2	2	2	2	2	2
5. Unbiased assessment of the study endpoint	0	0	1	0	0	2
6. Follow-up period appropriate to the aim of the study	2	2	2	2	2	2
7. Loss to follow up less than 5%	2	2	2	0	2	2
8. Prospective calculation of the study size	0	0	0	0	0	0
Item 9-12 only for comperative studies						
9. An adequate control group	2	2	1	2	2	2
10. Contemporary groups	0	2	2	2	0	0
11. Baseline equivalence of groups	2	2	2	2	2	2
12. Adequate statistical analyses	2	2	2	2	2	2
TOTAL MINORS score	**16**	**18**	**18**	**16**	**15**	**18**
Maximum possible score	24	24	24	24	24	24

B

	MacDonald et al. (2021)	
1. Was the study described as randomized?	**YES**	+1
	NO	0
2. Was the method of randomization appropriate?	**YES**	+1
	NO	-1
	ND[a]	0
3. Was the study described as blinding?[b]	**YES**	+1
	NO	0
4. Was the method of blinding appropriate?	**YES**	+1
	NO	-1
	ND	0
5. Was there a description of withdrawals and dropouts?	**YES**	+1
	NO	0
6. Was there a clear description of the inclusion/exclusion criteria?	**YES**	+1
	NO	0
7. Was the method used to assess adverse effects described?	**YES**	+1
	NO	0
8. Was the methods of statistical analysis described?	**YES**	+1
	NO	0
Todal modified JADAD score	**8**	
Maximum possible score	8	

a: not described; b: double-blind got 1 score, single-blind got

Figure 2. Results of methodological quality assessment for (A) the nonrandomized studies, using the methodological index for non-randomized studies (MINORS) tool, and (B) the randomized study, using the modified Jadad scale. [a]Not described. [b]Double-blind was scored as 1, single-blind as 0.5.

TABLE 2
Evaluation Methods and Percentage for Glenoid Bone Loss[a]

Lead Author (Year)	Method of GBL Evaluation	BR	BR + REMP	*P*
Franceschi[11] (2012)	CT, Sugaya index	16.1 (10.3-24.2)	14.9 (11.5-23.6)	>.05
Garcia[12] (2015)	MRI, Sugaya index	<1	5.3	.95
Horinek[16] (2022)	Not clearly defined	2.5 ± 4.1	6.1 ± 4.9	<.001
Lee[22] (2021)	CT, Sugaya index	13.7 ± 5.9	20.7 ± 2.3	<.001
Lin[23] (2023)	MRI, Sugaya index	3.2 ± 4.2	5.3 ± 4.8	.004
MacDonald[25] (2021)	MRI, Sugaya index	<15	<15	NA
Pandey[28] (2020)	CT, Sugaya index	8.8 ± 5.4 (0-22)	13.8 ± 4.7 (2-22)	<.001

[a]Values are presented as percentages and data are expressed as mean ± SD (range). BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage; CT, computed tomography; GBL, glenoid bone loss; MRI, magnetic resonance imaging; NA, not applicable.

The assessment of humeral bone loss (HBL) varied across the studies. Five studies calculated the mean HBL,[11,12,16,23,25] whereas 2 studies[22,28] only categorized HBL according to the on/off-track theory by Di Giacomo et al.[8] Due to this heterogeneity in measurement methods, a meta-analysis for HBL could not be conducted. A detailed summary of the measurement methods used to evaluate HBL, along with the reported values, can be found in Table 3.

Recurrence of Instability After Procedures

All of the included studies reported RoI in both analyzed groups. However, reports often used different outcomes; thus, the term *RoI* was defined widely as dislocation, subluxation, or apprehension. Not all of the studies analyzed homogeneous groups of patients in accordance with glenoid track concept. Five studies[11,12,22,25,28] presented results for RoI among patients with an engaging HSL, whereas 4 studies[16,22,23,28] presented results for RoI without assessing the on/off-track status. Therefore, the meta-analysis for RoI was performed twice, and these analyses were named RoI–Off Track and RoI–General, respectively.

Recurrent instability among patients with an engaging HSL occurred in 30% of the BR patients and 4.6% of the BR + REMP patients. The BR + REMP group had a 9 times lower probability of RoI, and this result was statistically significant (OR, 0.11; 95% CI, 0.05-0.24; $P < .001$). The analysis of RoI–Off Track is shown in Figure 3.

Recurrent instability among patients from studies where the on/off-track status was not assessed occurred in 10.1% of the BR group and 3.3% of the BR + REMP group. Patients from the BR + REMP group had a 3 times lower probability of experiencing RoI after the surgery compared with the BR group, and this result reached statistical significance (OR, 0.34; 95% CI, 0.14-0.8; $P = .01$). The analysis of RoI–General is shown in Figure 4.

TABLE 3
Evaluation Methods for Humeral Bone Loss and Results[a]

Study (Year)	Method of HBL Evaluation	BR	BR + REMP	*P*
Franceschi[11] (2012)	Plain radiograph in internal rotation, depth/radius index, %	30.1 (15-68)	30.6 (11.6-73.5)	NA
Garcia[12] (2015)	MRI, volume measurement, mm^3	310.22	283.79	.95
Horinek[16] (2022)	Width on axial CT scan, mm	2.7 ± 4.5	14.5 ± 3.7	<.001
	Depth on axial CT scan, mm	1.5 ± 2.5	8.6 ± 3.6	<.001
Lee[22] (2021)	CT, on/off-track status, Di Giacomo et al[8] method	NA	NA	NA
Lin[23] (2023)	MRI, Hill-Sachs interval, mm	4.3 ± 5.1	14.9 ± 2.9	<.001
MacDonald[25] (2021)	MRI/CT, depth/diameter, %	15.8 (4.3)	15.1 (4.2)	NA
Pandey[28] (2020)	CT, on/off-track status, Di Giacomo et al[8] method	NA	NA	NA

[a]Data are expressed as mean ± SD (range). BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage; CT, computed tomography; HBL, humeral bone loss; MRI, magnetic resonance imaging, NA, not applicable.

	BR		BR + REMP			
Study	Events	Total	Events	Total	Weight	Odds Ratio
Garcia et al (2015)	8	14	2	10	18.94%	0.19 [0.03, 1.22]
MacDonald et al (2021)	9	50	2	52	26.49%	0.18 [0.04, 0.89]
Franceschi et al (2012)	5	25	0	25	7.65%	0.07 [0.00, 1.40]
Lee et al (2021)	9	15	2	27	21.24%	0.05 [0.01, 0.31]
Pandey et al (2020)	9	30	2	59	25.68%	0.08 [0.02, 0.41]
Total	**40**	**134**	**8**	**173**	**100.00%**	**0.11 [0.05, 0.24]**

Q = 1.30, *P* = .8609, I^2 = 0.0%, 95%CI (0.0%-39.9%)
Fixed-Effect Model

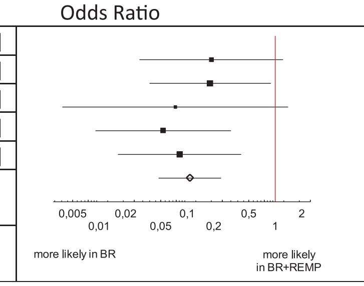

Figure 3. Summary of the outcomes pertaining to off-track recurrence of instability from the analyzed studies. BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage.

Range of Motion

Shoulder ROM was documented in all of the studies that were included. The reported ROMs included forward flexion, external/internal rotation in adduction, and external/internal rotation in abduction. However, only the measurements for forward flexion and ERad were adequately reported for inclusion in the meta-analysis.

Final Forward Flexion. Four of the 7 studies reported ROM for forward flexion. The summary and analysis of the final forward flexion in each of the included studies, along with the total score, are presented in Figure 5. The BR + REMP group achieved a higher forward flexion than the BR group (MD, 1.97°; 95% CI, 1.49°-2.46°; *P* < .001), and this result was statistically significant.

Final External Rotation in Adduction. Four of the 7 studies reported ROM of the final ERad. The summary of final ERad in each of the included studies, the meta-analysis, and the total score are presented in Figure 6. The BR + REMP group achieved a slightly lower ERad than the BR group (MD, –1.43°; 95% CI, –2.40° to –0.46°; *P* = .004), and this result was statistically significant.

Patient-Reported Outcome Measures

Rowe Score at Minimum 24 Months of Follow-up. Three studies used the Rowe score to evaluate final subjective functional outcomes. The BR + REMP group exhibited similar Rowe score at the final follow-up compared with the BR group (MD, 2.53; 95% CI, –1.48 to 6.54; *P* = .21). The summary of Rowe scores at the final follow-up in each of the included studies and the meta-analysis is provided in Figure 7.

WOSI Score at Minimum 24 Months of Follow-up. Three studies used the WOSI score to assess final subjective functional outcomes. The BR + REMP group presented similar WOSI score at the final follow-up compared with the BR group (MD, –61.60; 95% CI, –148.03 to 24.82; *P* = .162). The summary of WOSI scores at the final follow-up in each of the included studies and the meta-analysis is provided in Figure 8.

DISCUSSION

The most important finding of this meta-analysis was that adding remplissage to arthroscopic BR resulted in a 9-fold decrease in RoI in patients with an engaging HSL in comparison with those with isolated BR. Additionally, the results support our hypothesis that after remplissage, patients have enhanced forward flexion (MD, 1.97°; 95% CI, 1.49° to 2.46°; *P* < .001) and only slightly limited shoulder ERad (MD, –1.43°; 95% CI, –2.40° to –0.46°; *P* = .004) compared with those undergoing isolated BR.

	BR		BR + REMP			
Study	Events	Total	Events	Total	Weight	Odds Ratio
Horinek et al (2022)	7	75	1	48	16.91%	0.22 [0.03, 1.87]
Lin et al (2023)	14	127	1	48	18.14%	0.16 [0.02, 1.26]
Lee et al (2021)	13	186	2	27	32.14%	1.06 [0.23, 4.96]
Pandey et al (2020)	13	77	2	59	32.80%	0.20 [0.04, 0.92]
Total	**47**	**465**	**6**	**182**	**100.00%**	**0.34 [0.14, 0.80]**

$Q = 3.19$, $P = .3626$, $I^2 = 6.1\%$, 95% CI (0.0%-97.88%)
Fixed-Effect Model

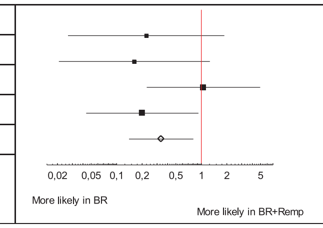

Figure 4. Summary of the outcomes pertaining to general recurrence of instability from the analyzed studies. BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage.

	FF			
Study	BR	BR+REMP	Weight	Odds Ratio
MacDonald et al (2021)	176.6 ± 1.7	178.6 ± 0.8	93.78%	2.00 [1.50, 2.50]
Horinek et al (2022)	175.2 ± 22	179 ± 3	0.92%	4.00 [-1.05, 9.05]
Lin et al (2023)	176 ± 7.5	177 ± 5.3	5.00%	1.00 [-1.17, 3.17]
Franceschi et al (2012)	165.9 ± 17.1	168.9 ± 15.1	0.30%	3.00 [-5.92, 11.92]
Total			**100.00%**	**1.97 [1.49, 2.46]**

$Q = 1.56$, $P = .6681$, $I^2 = 0.0\%$, 95%CI (0.0%-75.2%)
Fixed-Effect Model

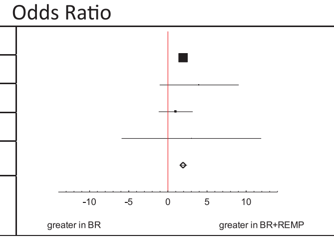

Figure 5. Summary of the outcomes pertaining to forward flexion (FF) in each analyzed study and total score. BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage.

	ERad			
Study	BR	BR+REMP	Weight	Odds Ratio
Lin et al (2023)	60.6 ± 12.2	62.3 ± 10.9	7.43%	1.70 [-1.86, 5.26]
Horinek et al (2022)	61 ± 15	62 ± 12	4.08%	1.00 [-3.80, 5.80]
MacDonald et al (2021)	55.6 ± 2.8	53.8 ± 2.7	87.39%	-1.80 [-2.84, -0.76]
Franceschi et al (2012)	58 ± 15.8	56 ± 17.6	1.09%	-2.00 [-11.27, 7.27]
Total			**100.00%**	**-1.43 [-2.40, -0.46]**

$Q = 4.46$, $P = .2157$, $I^2 = 32.76\%$, 95% CI (0.0%-76.1%)
Fixed-Effect Model

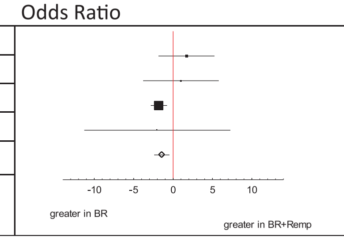

Figure 6. Summary of the outcomes pertaining to final external rotation in adduction in each analyzed study and total score. BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage; ERad, external rotation in adduction.

Why Is the Literature Inconsistent About Chances for RoI After Remplissage?

Our result regarding RoI after remplissage strongly confirms the results of previous research. However, the literature is inconsistent in reporting the effectiveness of remplissage, with RoI varying from 3.2% up to 20%.[3,7,13,18,24] This discrepancy may be attributed to different values of GBL among the studies as well as incorrect patient classification for soft tissue repair rather than bony augmentation. In other words, it is not remplissage (which addresses HSL) but rather BR (which targets the labrum rather than the glenoid) that addresses the shortcomings evident in cases of excessive GBL. The redislocation rate after isolated arthroscopic BR is decidedly unsatisfactory. According to reports from only the past 7 years, this rate starts at 16.8% and peaks at a concerning 30%.[10,13,18,42] The primary indication for BR versus a bony augmentation procedure is what is commonly referred to as *critical bone loss*. Generally, it is believed that GBL of 20% to 25% may be addressed with soft tissue repair.[8,38] However, some researchers challenge this statement, arguing that 25% may be too much and that this value could negatively affect patients' quality of life, even if they do not experience recurrent dislocations.[38]

In 2015, Shaha et al[31] attempted to redefine the concept of critical bone loss and successfully demonstrated that patients with less GBL who underwent isolated BR tended to have better functional outcomes. The authors introduced the term *subcritical bone loss* with a value of 13.5%. Two years later, Dickens et al[9] confirmed that none of their operated football players with GBL <13.5% experienced RoI. The flat anterior glenoid sign was proposed as a readily recognizable pattern for subcritical bone loss.[20] Over

	Rowe Score			
Study	BR	BR+REMP	Weight	Odds Ratio
Pandey et al (2020)	90.1 ± 8.7	91.83 ± 7.3	40.65%	1.73 [-1.02, 4.48]
Lee et al (2021)	91.1 ± 7.3	90.8 ± 8.2	39.30%	-0.30 [-3.29, 2.69]
Franceschi et al (2012)	73.1 ± 16.8	82.8 ± 5.6	20.05%	9.70 [2.76, 16.64]
Total			**100.00%**	**2.53 [-1.48, 6.54]**
Q = 6.54, P = .0380, I^2 = 69.4%, 95% CI (0.0%-91.1%) Random-Effect Model				

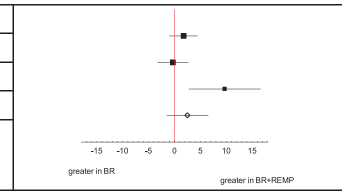

Figure 7. Summary of the outcomes pertaining to the Rowe score in each analyzed study. BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage.

	WOSI Score			
Study	BR	BR+REMP	Weight	Odds Ratio
Pandey et al (2020)	542.2 ± 200.81	544.7 ± 109.2	42.13%	2.50 [-50.30, 50.30]
Horinek et al (2022)	196.5 ± 432.9	42.7 ± 67.4	24.72%	-153.80 [-277.39, -30.21]
Lin et al (2023)	185.7 ± 312.8	111.4 ± 168.5	33.16%	-74.30 [-161.39, 12.79]
Total			**100.00%**	**-61.60 [-148.03, 24.82]**
Q = 8.35, P = .0154, I^2 = 76.0%, 95% CI (21.2%-92.7%) Random-Effect Model				

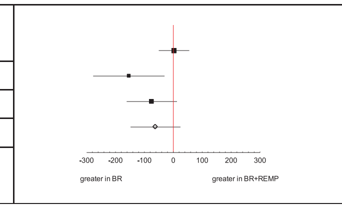

Figure 8. Summary of the outcomes pertaining to the Western Ontario Shoulder Instability Index (WOSI) score in each analyzed study. BR, isolated Bankart repair; BR + REMP, Bankart repair with remplissage procedure.

time, the term *subcritical bone loss* became associated with a GBL of approximately 10% to 15%.[5,36,39]

The current meta-analysis revealed that the mean GBL was greater in the BR + REMP group (MD, 3.33%; 95% CI, 0.59%-6.08%; P = .02). Only 5 articles provided GBL data suitable for inclusion in the meta-analysis. The GBL cutoff was an exclusion criterion in 6 of the 7 articles, with values of 15%,[4,16,25] 20%,[12] and 25%,[11,22] creating significant heterogeneity among the compared studies.

A wide range of RoI in the literature may also result from different values of HBL in diagnosed HSLs. As a recent systematic review presented, HBL is heterogeneously measured and, in fact, is rarely assessed.[13] It is said that 90% of authors report the existence of an HSL, but only 3.1% quantitatively report it.[40] Brejuin et al[2] reported that patients who underwent BR + REMP and were unstable at >5 years of follow-up had a deeper HSL (–25%) of the humeral head radius (P = .04) than patients without RoI (18%). Furthermore, studies rarely report whether the HSL is engaging or not.[13] In the current meta-analysis, 5 studies provided data about RoI among patients with an engaging HSL[11,12,22,25,28] and 4 studies[4,16,22,28] without introducing the glenoid track concept, not reporting on/off status (2 studies provided both results). These results perfectly present the inconsistency in the methods of orthopaedic research, which commonly results in discrepancy of results, as in the case of meta-analysis of RoI (RoI–Off Track vs RoI–General).

Shoulder ROM: Slight Changes After Remplissage

The literature states that remplissage may decrease shoulder ROM.[21,24] In a systematic review and meta-analysis of biomechanical studies, Lazarides et al[21] showed that the most commonly limited ROM after remplissage is ERad, ranging from 9° to 14°, when compared with the contralateral side. Two other studies provided data indicating a decrease in ERad after remplissage when comparing presurgical and postsurgical measurements.[7,24] However, in another meta-analysis, Hurley et al[18] presented postoperative ERad results after isolated BR or BR + REMP, and the outcomes were comparable (MD, 7.20°; 95% CI, 6.85° to 21.24°; P = .32). These findings contrast with the results of the current meta-analysis. We demonstrated that ERad after remplissage was only slightly limited, by 1.43°, which may be imperceptible to a patient.

According to the final forward flexion, the aforementioned meta-analysis conducted by Hurley et al[18] indicated no statistically significant differences between the procedures (MD, 3.11°; 95% CI, –1.30° to 7.52°; P = .17). These findings contrast with the results obtained in our meta-analysis, because we obtained a statistically significant result (MD, 1.97°; 95% CI, 1.49° to 2.46°; P < .001). The studies also presented varying values of Higgins I^2 coefficients,[15] with Hurley et al reporting I^2 = 46% (indicating low to moderate heterogeneity), whereas our meta-analysis showed I^2 = 0%, indicating extremely low heterogeneity among the included studies.

Increased forward flexion after remplissage was also reported in the meta-analysis by Davis et al[7] and remains a highly intriguing outcome. A more in-depth biomechanical analysis of the infraspinatus muscle is needed for a comprehensive understanding of this phenomenon. The specific tendons of the rotator cuff complex have a direct role in limiting the movement of the humeral head in specific directions. For instance, the infraspinatus tendon prevents excessive superior and posterior translation of the humeral head.[6] When this tendon is torn, the humeral head may partially elevate out of the glenoid fossa.[35] In a biomechanical study on cadavers, Argintar et al[1] demonstrated that BR + REMP did not result in a change in rotational ROM but did alter the kinematics of the glenohumeral joint. The Bankart injury and HSL shifted the apex of the humeral head posteriorly at 60° of abduction at maximum ERad relative to the intact condition. However, performing BR + REMP shifted the apex of the humeral head posteriorly and inferiorly relative to the intact condition.[1] Of course, remplissage cannot replicate a torn infraspinatus; however, the procedure does affect the function of the infraspinatus and probably changes the vector of its force. One could speculate that remplissage, akin to other nonanatomic techniques (such as the Putti-Platt operation) that enhance shoulder kinematics, may potentially lead to an accelerated progression of osteoarthritis.[14,19] However, this is our subjective viewpoint; studies with a follow-up period significantly longer than 24 months are necessary to either confirm or refute this hypothesis.

Patient-Reported Outcome Measures

In the 7 studies analyzed in our meta-analysis, a variety of different PROMs were used, with the Rowe score and the WOSI score being the most frequently used. In a meta-analysis conducted by Hurley et al,[18] the Rowe score showed a statistically significant difference after isolated BR compared with BR + REMP, with an MD of 7.13 in favor of BR + REMP (95% CI, 5.41-8.85; $P < .01$). A similar outcome was observed in the study by Camus et al,[3] where the MD was 9.33 in favor of BR + REMP, also showing a statistically significant difference (95% CI, 4.54-14.2; $P = .001$). However, in a meta-analysis by Davis et al,[7] the mean Rowe score increased significantly only when preoperative and postoperative results of remplissage were compared (43.9 ± 7.77 vs 92.2 ± 4.02; $P < .001$). Davis et al found no significant difference in Rowe scores between remplissage and surgical alternatives (comparison was made to a combined group of patients after isolated BR and Latarjet procedure) ($P = .54$).

Our observed Rowe and WOSI scores did not achieve a statistically significant differences between the groups (Rowe score: MD, 2.53; 95% CI, –1.48 to 6.54; $P = .21$; WOSI score: MD, –61.60; 95% CI, –148.03 to 24.82; $P = .162$). The absence of previous meta-analyses addressing the WOSI score hindered our ability to make direct comparisons with existing results. It is important to highlight that the analysis of both the WOSI score and Rowe score was based on only 3 studies, which diminishes the statistical robustness of these findings.

Limitations and Future Directions

This meta-analysis has potential limitations and biases, including the limitations of the included studies. The most frequently used study design was retrospective cohort (level of evidence 3). Although some patient characteristics among the study groups were comparable (such as mean age and sex distribution), final outcomes may have been affected by noncomparable factors such as follow-up time, GBL, or HBL (insufficient data for meta-analysis). Only 1 of the 7 studies assessed HBL before analysis and indicated it as an inclusion criterion.[12] In another study, HBL was calculated post hoc.[25] Additionally, not all of the included studies assessed the glenoid track status. However, performing 2 analyses (RoI–Off Track and RoI–General) resulted in interesting results. This may mitigate aforementioned limitations and increase the overall value of the study. The individual quality of the included studies, assessed with the MINORS tool and the Jadad scale, was deemed acceptable.

CONCLUSION

Remplissage resulted in a 9-fold decrease in RoI after an arthroscopic BR in patients with an engaging HSL. Remplissage not only slightly limited patients' ERad but also led to an increase in forward flexion. WOSI and Rowe scores after remplissage at the final 24-month follow-up were comparable with those obtained after isolated BR. Due to the moderate quality, heterogeneity, and mainly level of evidence 3 of the included studies, further research on the remplissage procedure is needed.

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REFERENCES

1. Argintar E, Heckmann N, Wang L, Tibone JE, Lee TQ. The biomechanical effect of shoulder remplissage combined with Bankart repair for the treatment of engaging Hill-Sachs lesions. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(2):585-592.
2. Brejuin A, Girard M, Barret H, Martinel V, Mansat P, Bonnevialle N. Long-term results of arthroscopic Bankart repair with Hill-Sachs remplissage. *JSES Int*. 2022;6(5):723-729.
3. Camus D, Domos P, Berard E, Toulemonde J, Mansat P, Bonnevialle N. Isolated arthroscopic Bankart repair vs. Bankart repair with ''remplissage'' for anterior shoulder instability with engaging Hill-Sachs lesion: a meta-analysis. *Orthop Traumatol Surg Res*. 2018;104(6):803-809.
4. Czaja R, Scheaffer RL, Mendenhall W, Ott L. Elementary survey sampling. *J Am Stat Assoc*. 1987;82(400):1185.
5. Dai F, Yang J, Zhang Q, Li Y, Xiang M. Arthroscopic autologous scapular spine bone graft for recurrent anterior shoulder dislocation with subcritical (10%-15%) glenoid bone loss. *Arthrosc Tech*. 2022;11(11):e1871-e1878.

6. David G, Magarey ME, Jones MA, Dvir Z, Türker KS, Sharpe M. EMG and strength correlates of selected shoulder muscles during rotations of the glenohumeral joint. *Clin Biomech Bristol Avon*. 2000;15(2):95-102.
7. Davis WH, DiPasquale JA, Patel RK, et al. Arthroscopic remplissage combined with Bankart repair results in a higher rate of return to sport in athletes compared with Bankart repair alone or the Latarjet procedure: a systematic review and meta-analysis. *Am J Sports Med*. 2023;51(12):3304-3312.
8. Di Giacomo G, Itoi E, Burkhart SS. Evolving concept of bipolar bone loss and the Hill-Sachs lesion: from ''engaging/non-engaging'' lesion to ''on-track/off-track'' lesion. *Arthroscopy*. 2014;30(1):90-98.
9. Dickens JF, Owens BD, Cameron KL, et al. The effect of subcritical bone loss and exposure on recurrent instability after arthroscopic Bankart repair in intercollegiate American football. *Am J Sports Med*. 2017;45(8):1769-1775.
10. Flinkkilä T, Knape R, Sirniö K, Ohtonen P, Leppilahti J. Long-term results of arthroscopic Bankart repair: minimum 10 years of follow-up. *Knee Surg Sports Traumatol Arthrosc*. 2018;26(1):94-99.
11. Franceschi F, Papalia R, Rizzello G, et al. Remplissage repair—new frontiers in the prevention of recurrent shoulder instability: a 2-year follow-up comparative study. *Am J Sports Med*. 2012;40(11):2462-2469.
12. Garcia GH, Park MJ, Zhang C, Kelly JD, Huffman GR. Large Hill-Sachs lesion: a comparative study of patients treated with arthroscopic Bankart repair with or without remplissage. *HSS J*. 2015;11(2):98-103.
13. Gowd AK, Liu JN, Cabarcas BC, et al. Management of recurrent anterior shoulder instability with bipolar bone loss: a systematic review to assess critical bone loss amounts. *Am J Sports Med*. 2019;47(10):2484-2493.
14. Hawkins RJ, Angelo RL. Glenohumeral osteoarthrosis: a late complication of the Putti-Platt repair. *J Bone Joint Surg Am*. 1990;72(8):1193-1197.
15. Higgins JPT. Measuring inconsistency in meta-analyses. *BMJ*. 2003;327(7414):557-560.
16. Horinek JL, Menendez ME, Callegari JJ, et al. Consideration may be given to lowering the threshold for the addition of remplissage in patients with subcritical glenoid bone loss undergoing arthroscopic Bankart repair. *Arthrosc Sports Med Rehabil*. 2022;4(4):e1283-e1289.
17. Huijsmans PE, Haen PS, Kidd M, Dhert WJ, van der Hulst VPM, Willems WJ. Quantification of a glenoid defect with three-dimensional computed tomography and magnetic resonance imaging: a cadaveric study. *J Shoulder Elbow Surg*. 2007;16(6):803-809.
18. Hurley ET, Toale JP, Davey MS, et al. Remplissage for anterior shoulder instability with Hill-Sachs lesions: a systematic review and meta-analysis. *J Shoulder Elbow Surg*. 2020;29(12):2487-2494.
19. Kiss J, Mersich I, Perlaky GY, Szollas L. The results of the Putti-Platt operation with particular reference to arthritis, pain, and limitation of external rotation. *J Shoulder Elbow Surg*. 1998;7(5):495-500.
20. Lansdown DA, Wang K, Yanke AB, Nicholson GP, Cole BJ, Verma NN. A flat anterior glenoid corresponds to subcritical glenoid bone loss. *Arthroscopy*. 2019;35(6):1788-1793.
21. Lazarides AL, Duchman KR, Ledbetter L, Riboh JC, Garrigues GE. Arthroscopic remplissage for anterior shoulder instability: a systematic review of clinical and biomechanical studies. *Arthroscopy*. 2019;35(2):617-628.
22. Lee YJ, Kim C, Kim SJ, Yoon TH, Cho JY, Chun YM. Does an ''off-track'' Hill-Sachs lesion that is misclassified as ''non-engaging'' affect outcomes from Bankart repair alone compared with Bankart repair combined with remplissage? *Arthroscopy*. 2021;37(2):450-456.
23. Lin A, Barrow AE, Charles S, et al. Remplissage reduces recurrent instability in high-risk patients with on-track Hill-Sachs lesions. *J Shoulder Elbow Surg*. 2023;32(6):S99-S105.
24. Liu JN, Gowd AK, Garcia GH, Cvetanovich GL, Cabarcas BC, Verma NN. Recurrence rate of instability after remplissage for treatment of traumatic anterior shoulder instability: a systematic review in treatment of subcritical glenoid bone loss. *Arthroscopy*. 2018;34(10):2894-2907.e2.
25. MacDonald P, McRae S, Old J, et al. Arthroscopic Bankart repair with and without arthroscopic infraspinatus remplissage in anterior shoulder instability with a Hill-Sachs defect: a randomized controlled trial. *J Shoulder Elbow Surg*. 2021;30(6):1288-1298.
26. Nakagawa S, Ozaki R, Take Y, Iuchi R, Mae T. Relationship between glenoid defects and Hill-Sachs lesions in shoulders with traumatic anterior instability. *Am J Sports Med*. 2015;43(11):2763-2773.
27. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:N71.
28. Pandey V, Gangadharaiah L, Madi S, et al. A retrospective cohort analysis of arthroscopic Bankart repair with or without remplissage in patients with off-track Hill-Sachs lesion evaluated for functional outcomes, recurrent instability, and range of motion. *J Shoulder Elbow Surg*. 2020;29(2):273-281.
29. Polio W, Brolin TJ. Remplissage for anterior shoulder instability. *Orthop Clin North Am*. 2022;53(3):327-338.
30. Schreve MA, Vos CG, Vahl AC, et al. Venous arterialisation for salvage of critically ischaemic limbs: a systematic review and meta-analysis. *Eur J Vasc Endovasc Surg*. 2017;53(3):387-402.
31. Shaha JS, Cook JB, Song DJ, et al. Redefining ''critical'' bone loss in shoulder instability: functional outcomes worsen with ''subcritical'' bone loss. *Am J Sports Med*. 2015;43(7):1719-1725.
32. Slim K, Nini E, Forestier D, Kwiatkowski F, Panis Y, Chipponi J. Methodological index for non-randomized studies (MINORS): development and validation of a new instrument: methodological index for non-randomized studies. *ANZ J Surg*. 2003;73(9):712-716.
33. Sugaya H, Moriishi J, Kanisawa I, Tsuchiya A. Arthroscopic osseous Bankart repair for chronic recurrent traumatic anterior glenohumeral instability. *J Bone Joint Surg Am*. 2005;87(8):1752-1760.
34. Williams HLM, Evans JP, Furness ND, Smith CD. It's not all about redislocation: a systematic review of complications after anterior shoulder stabilization surgery. *Am J Sports Med*. 2019;47(13):3277-3283.
35. Williams JM, Sinkler MA, Obremskey W. Anatomy, shoulder and upper limb, infraspinatus muscle. In: *StatPearls*. StatPearls Publishing; 2023. https://pubmed.ncbi.nlm.nih.gov/30020627/
36. Xiang M, Yang J, Chen H, et al. Arthroscopic autologous scapular spine bone graft combined with Bankart repair for anterior shoulder instability with subcritical (10%-15%) glenoid bone loss. *Arthroscopy*. 2021;37(7):2065-2074.
37. Yamamoto N, Itoi E, Abe H, et al. Contact between the glenoid and the humeral head in abduction, external rotation, and horizontal extension: a new concept of glenoid track. *J Shoulder Elbow Surg*. 2007;16(5):649-656.
38. Yamamoto N, Kawakami J, Hatta T, Itoi E. Effect of subcritical glenoid bone loss on activities of daily living in patients with anterior shoulder instability. *Orthop Traumatol Surg Res*. 2019;105(8):1467-1470.
39. Yang JS, Mehran N, Mazzocca AD, Pearl ML, Chen VW, Arciero RA. Remplissage versus modified Latarjet for off-track Hill-Sachs lesions with subcritical glenoid bone loss. *Am J Sports Med*. 2018;46(8):1885-1891.
40. Yiannakopoulos CK, Mataragas E, Antonogiannakis E. A comparison of the spectrum of intra-articular lesions in acute and chronic anterior shoulder instability. *Arthroscopy*. 2007;23(9):985-990.
41. Zhang Y, Zhou L, Liu X, et al. The effectiveness of the problem-based learning teaching model for use in introductory Chinese undergraduate medical courses: a systematic review and meta-analysis. *PloS One*. 2015;10(3):e0120884.
42. Zimmermann SM, Scheyerer MJ, Farshad M, Catanzaro S, Rahm S, Gerber C. Long-term restoration of anterior shoulder stability: a retrospective analysis of arthroscopic Bankart repair versus open Latarjet procedure. *J Bone Joint Surg Am*. 2016;98(23):1954-1961.