Systematic Review

Neither Bone Marrow Aspirate Concentrate nor Platelet-Rich Plasma Improves Patient-Reported Outcomes After Surgical Management of Acetabular Labral Tears; However, Bone Marrow Aspirate Concentrate May Be Effective for Moderate Cartilage Damage: A Systematic Review

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Purpose: To (1) systematically assess which orthobiologic agents are being used in acetabular labral repairs and (2) report all available outcomes for patients undergoing operative management for labral repairs with orthobiologic agents. **Methods:** The PubMed, Embase, and Cochrane databases were queried in August 2023. Articles were included if they used an orthobiologic agent during hip arthroscopy for acetabular labral repair and reported functional outcomes. Each study was queried for demographic data, orthobiologic agent used, volume of agent used, imaging modality used to guide administration, follow-up period, and all reported outcomes. The following Boolean phrase was used to systematically search the current literature: ((Orthobiologics) OR (Platelet-rich plasma) OR (PRP) OR (Mesenchymal stem cells) OR (MSCs) OR (Hyaluronic acid) OR (Growth factors) OR (bone marrow aspirate) OR (BMAC)) AND (hip joint OR (acetabular labrum) OR (Chondrolabr* damage) OR (Chondrolabr* tear)) AND (outcome* OR function* OR PROM OR PRO OR arthr* OR image OR pain OR complication). **Results:** Three studies met the inclusion criteria and included 201 patients who received treatment with orthobiologic agents. Of these patients, 119 (59.7%) were women, with age ranging from 35 to 49 years. Ninety-seven patients (48.3%) received bone marrow aspirate concentrate (BMAC), and 104 (51.7%) received platelet-rich plasma (PRP). Both BMAC studies showed no significant improvements compared with controls; however, a subanalysis limited to patients with moderate cartilage damage who received BMAC showed significantly improved 2-year patient-reported outcome measures (International Hip Outcome Tool 33 score, 82.5 vs 69.5; $P = .03$). The one PRP study did not show significant improvements compared with controls. No complications were noted after either PRP or BMAC harvesting and application in any included study. **Conclusions:** Overall, BMAC and PRP do not significantly improve patient-reported outcome measures compared with controls. However, there is limited evidence that BMAC may help patients with moderate cartilage damage. **Level of Evidence:** Level III, systematic review of Level II and III studies.

Acetabular labral tears can lead to painful symptoms and substantial functional limitations in affected patients.[1,2] The acetabular labrum is a critical structure within the hip joint that serves as a seal and stabilizer while also enhancing joint congruence and reducing friction during movement.[3] Labral tears can

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disrupt the delicate balance of the hip joint and, if left untreated, potentially accelerate the progression of osteoarthritis.[4] Given these detrimental long-term effects, effective management of these injuries is crucial for improving daily pain, functional levels, and long-term preservation of the hip joint.[2]

Various treatments have been developed to address acetabular labral tears. Conservative therapeutic options, such as pharmacologic therapy and physical therapy, may offer symptomatic relief but often do not address the underlying cause of injury.[5] Traditional surgical procedures, such as arthroscopic repair, can be effective; however, new therapies are being sought to improve outcomes and slow the progression of osteoarthritis.[6,7] As such, in recent years, there has been a growing interest in the use of orthobiologics as a promising alternative therapeutic approach or as a complementary therapy to surgical procedures in various joints, such as the foot and ankle, as well as tendon and ligament injuries in the rotator cuff, elbow, and ankle, among others.[8,9]

The term "orthobiologics" refers to biologically active products derived from the patient's own body or external sources, capable of stimulating the repair, healing, and regenerating damaged tissues, promoting a decreased local inflammatory response.[9,10] These orthobiologics include platelet-rich plasma (PRP), mesenchymal stem cells (MSCs), hyaluronic acid, and growth factors.[11] MSCs can be derived from different tissues in the body and harbor varying levels of effectiveness depending on the tissue of origin.[12,13] In recent years, with the aim of overcoming the limitations of current traditional therapeutic options, interest in the use of orthobiologics to treat injuries to the chondrolabral junction of the hip has grown substantially, representing a fascinating and evolving avenue to improved patient outcomes.[14,15] However, despite the increasing interest in orthobiologics, there remains a need for a critical evaluation of the scientific evidence supporting their efficacy for patients undergoing labral repair of the hip. In the past, orthobiologics have shown exciting and encouraging results in other anatomic regions such as the knee and shoulder, making them an effective and safe option for a growing number of pathologies.[12,16]

The purposes of this study were to (1) systematically assess which orthobiologic agents are being used in acetabular labral repairs and (2) report all available outcomes for patients undergoing operative management for labral repairs with orthobiologic agents. We hypothesized that there would be few applicable studies and that bone marrow aspirate concentrate (BMAC), as an adjuvant to surgical treatment of acetabular labral tears, would lead to significantly improved functional outcomes relative to baseline and any other agent, such as PRP, would fail to do so.

Methods

This study was performed in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines.[17] The protocol was registered on the PROSPERO database (No. CRD42023451475).

Inclusion and Exclusion Criteria

The PICO (P: Patient, population, or problem; I: Intervention; C: Comparison, control, or comparator; O: Outcome(s)) framework was used in developing the literature search strategy.[18] The inclusion criteria were clinical studies with patients who received a diagnosis of labral tear of the hip, received an orthobiologic combined with hip arthroscopy or arthroscopy alone, and had patient-reported outcome measures (PROMs) and pain scores available with minimum 2-year follow-up.

The exclusion criteria were (1) less than 2-year follow-up, (2) missing information on follow-up, (3) non-hip labral damage or tear, (4) nonoperative management, (5) missing quantitative data, (6) preclinical studies, (7) non−English-language articles, (8) full-text unavailability, and (9) conference abstracts or reviews. No time-frame parameters were used for the search. Only articles published in peer-reviewed journals were eligible.

Outcome Measures

The outcome measures assessed in the included studies comprised measures of chondrolabral junction damage, pain relief, functional improvement, and adverse events. Pain scores were assessed using a visual analog scale (VAS). Specific combined hip scores were also used, such as the International Hip Outcome Tool 33 (iHOT-33) score, Harris Hip Score (HHS), modified HHS, Hip Outcome Score−Activities of Daily Living (HOS-ADL), Hip Outcome Score−Sport Specific Subscale (HOS-SSS), and Non-arthritic Hip Score (Table 1). In addition, functional improvement was assessed with the aforementioned scoring metrics using the standardized mean difference.

Data Source and Study Search

A database search was performed in PubMed, Embase, and Cochrane Library using appropriate medical subject headings. The following Boolean phrase was used to systematically search the current literature: ((Orthobiologics) OR (Platelet-rich plasma) OR (PRP) OR (Mesenchymal stem cells) OR (MSCs) OR (Hyaluronic acid) OR (Growth factors) OR (bone marrow aspirate) OR (BMAC)) AND (hip joint OR (acetabular labrum) OR (Chondrolabr* damage) OR (Chondrolabr* tear)) AND (outcome* OR function* OR PROM OR PRO OR arthr* OR image OR pain OR complication).

References of each included article were checked to screen for additional potentially relevant studies (i.e.,

Table 1. Baseline and Post-procedural Outcomes

Authors	Orthobiologic Agent Used	Baseline PROM (mean)	PROM at Latest Follow-Up (mean)	Statistical Significance: *P* Value
Martin et al.[14]	BMAC	iHOT-33: 40.6 (95% CI, 36.3-45.0)	iHOT-33: 77.9 (95% CI, 69.6-86.2)	.509
		HOS-ADL: 68.3 (95% CI, 63.6-73.0)	HOS-ADL: 91.3 (95% CI, 86.6-96.1)	.048*
		HOS-Sport: 40.4 (95% CI, 34.5-46.4)	HOS-Sport: 77.1 (95% CI, 67.6-86.6)	.264
Martin et al.[14†]	BMAC	iHOT-33: 41.3 (95% CI, 36.2-46.4)	iHOT-33: 82.5 (95% CI, 73.4-91.6)	.029*
		HOS-ADL: 67.4 (95% CI, 61.9-72.9)	HOS-ADL: 92.2 (95% CI, 87.0-97.4)	.004*
		HOS-Sport: 39.1 (95% CI, 32.2-46.1)	HOS-Sport: 79.0 (95% CI, 68.8-89.2)	.016*
Redmond et al.[26]	PRP	VAS score: 5.64	VAS score: 3.36	.005*
		mHHS: 62.77	mHHS: 78.58	.049*
		HOS-ADL: 64.69	HOS-ADL: 79.77	.108
		HOS-Sport: 41.31	HOS-Sport: 67.47	.654
		NAHS: 58.02	NAHS: 78.34	.193
Day et al.[27]	BMAC	mHHS: 59.5 (SD, 12.3)	mHHS: 80.6 (SD, 16.5)	.55
		HOS-ADL: 68.5 (SD, 20.5)	HOS-ADL: 88.4 (SD, 14.6)	.99
		HOS-Sport: 47.8 (SD, 28.4)	HOS-Sport: 75.7 (SD, 27.6)	.20
		iHOT-33: 36.8 (SD, 21.5)	iHOT-33: 73.5 (SD, 24.9)	.65

BMAC, bone marrow aspirate concentrate; CI, confidence interval; HOS, Hip Outcome Score; HOS-ADL, Hip Outcome Score—Activities of Daily Living; iHOT-33, International Hip Outcome Tool 33; mHHS, modified Harris Hip Score; NAHS, Non-arthritic Hip Score; PROM, patient-reported outcome measure; PRP, platelet-rich plasma; SD, standard deviation; VAS, visual analog scale.

*Statistically significant.

†Subanalysis of patients with moderate (Outerbridge grade 2 or 3) osteoarthritis.

snowballing method).[19,20] All searches were performed from inception of the relevant database up until all currently published literature. The last search date was August 10, 2023.

Selection of Studies and Data Extraction

Two reviewers (B.S.S. and R.G.) independently conducted the electronic literature search. The reference lists from the 3 databases (i.e., PubMed, Embase, and Cochrane Library) were merged, and the duplicates were removed using the Web-based collaboration software platform Covidence (Veritas Health Innovation, Melbourne, Australia). After initial screening of titles and abstracts, the full texts of pertinent articles underwent subsequent evaluation for eligibility. Discrepancies were discussed with the senior author (S.D.M.), and agreement was quantified by the κ statistic, followed by the Gwet AC1 statistic. Inter-reader agreement was calculated at both stages of study selection using the κ statistic, with κ values of 0.00 to 0.20 indicating slight agreement; 0.21 to 0.40, fair agreement; 0.41 to 0.60, moderate agreement; 0.61 to 0.80, substantial agreement; and 0.81 to 1.00, almost perfect agreement. Data extracted from selected articles were collected in Microsoft Office Excel (version 2019; Microsoft, Seattle, WA). Predefined variables were extracted by 2 authors (B.S.S. and R.G.) independently, and inconsistencies were discussed with the research team.

The following information was collected for each study if available: (1) study characteristics, consisting of author, publication year, study design, sample size, and follow-up duration; (2) patient demographic data, consisting of age, sex, and severity of hip osteoarthritis; (3) intervention details, consisting of type of orthobiologic agent, route of administration, dosage, and any concomitant therapies; (4) outcome measures, consisting of PROMs, cartilage repair scores, pain scores, standard deviation, standard error, 95% confidence interval, functional assessment tools, adverse events, and radiologic findings; and (5) complication rates, consisting of conversion to total hip arthroplasty and rate of revision hip arthroscopy.

Quality Assessment

The methodologic quality of included studies was assessed independently by 2 authors (B.S.S. and R.G.). The risk of bias was analyzed for each study with the Methodological Index for Non-randomized Studies (MINORS) criteria.[21] The MINORS tool is a validated instrument designed to assess the methodologic quality of nonrandomized studies. The maximum score for noncomparative studies is 24. Each MINORS metric was graded as follows: 0, not reported in the study; 1, reported but inadequately so; or 2, reported and adequate. Agreement was quantified with the intraclass correlation coefficient.

Results

Study Selection

A total of 2,217 articles were identified through the initial literature search. After the removal of 479 duplicates, 1,738 articles underwent title and abstract screening. Following this process, 1,726 studies were excluded whereas 12 studies were selected for full-text

review. Ultimately, 3 studies met the inclusion criteria and were included in this systematic review (Fig 1, Table 2). The κ values for the title and abstract review stage and the full-text review stage were 0.443 (moderate agreement) and 1 (perfect agreement), respectively.[22] The Gwet AC1 results for title and abstract screening and full-text review were 0.98 (almost perfect agreement) and 1 (perfect agreement), respectively.[23] The Gwet AC1 value was calculated because of its ability to generate a more stable inter-rater reliability coefficient than the more traditional Cohen κ value.[24] Additionally, the Cohen κ value is susceptible to the κ paradox, a phenomenon in which high agreement can paradoxically cause a lower agreement coefficient,[25] as was the case in our study. Thus, the Gwet AC1 value can provide a more accurate characterization of agreement statistics.

Characteristics of Included Studies

The included studies encompassed a range of study designs, including 1 prospective study,[14] 1 comparative study with randomization,[26] and 1 retrospective, comparative therapeutic trial.[27] The publication years of the included studies ranged from 2015 to 2023. A total of 201 patients undergoing intra-articular injections of orthobiologic agents were reported. Of these patients, 97 (48.3%) received BMAC and 104 (51.7%) received PRP. There were 119 female participants (59.7%). Because all studies followed up patients for 2 years, the minimum duration of follow-up in all included studies was 24 months.

Intervention Details

In the selected studies, 2 different types of orthobiologic agents were used: PRP and BMAC. The routes of administration for orthobiologic agents included direct arthroscopic visualization with or without fluoroscopy. The dosages of orthobiologic agents administered varied across studies (Table 3). Martin et al.[14] and Day et al.[27] both sought to test the efficacy of BMAC in hip arthroscopy using control and experimental groups. Redmond et al.[26] did the same but with PRP in the experimental group and bupivacaine in the control group.

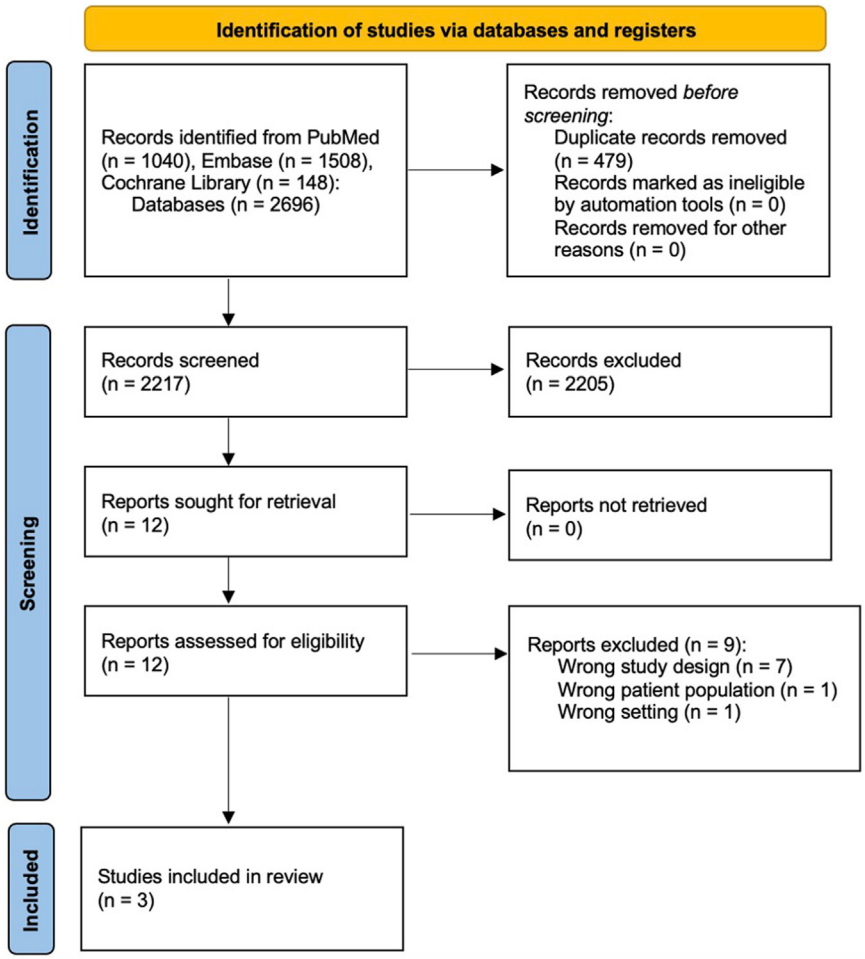

Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses diagram depicting study selection process. A review of the literature was performed using the PubMed, Embase, and Cochrane databases in August 2023. The goal was to identify studies investigating the use of any orthobiologic agent as an adjuvant treatment in the surgical management of acetabular labral tears.

Table 2. Characteristics of Included Studies

Authors (Year)	Study Type/LOE	Orthobiologic Agent Used*	No. of Study Participants	Treated Hips, n*	Age, Mean (Range), yr*	Female Sex, %*	BMI*	Follow-Up, mo*	PROMs Reported*
Martin et al.[14] (2022)	P/III	BMAC	124	62	35.2 (32.9-37.6)	23 (37.1)	25.5	24	iHOT-33 score HOS-ADL HOS-Sport
Martin et al.[14] (2022)[†]	P/III	BMAC	98	46	34.2 (31.5-37.0)	16 (35)	25.6	24	iHOT-33 HOS-ADL HOS-Sport
Redmond et al.[26] (2015)	P/II	PRP	306	104	36.0 (range not published)	73 (70.2)	24.7	24	VAS score mHHS HOS-ADL HOS-Sport NAHS
Day et al.[27] (2023)	R/III	BMAC	70	35	48.5 (36.9-60.1)	24 (68.6)	25.3	24	mHHS HOS-ADL HOS-Sport iHOT-33 score

BMAC, bone marrow aspirate concentrate; BMI, body mass index; HOS, Hip Outcome Score; HOS-ADL, Hip Outcome Score—Activities of Daily Living; iHOT-33, International Hip Outcome Tool 33; LOE, level of evidence; mHHS, modified Harris Hip Score; NAHS, Non-arthritic Hip Score; P, prospective; PROM, patient-reported outcome measure; PRP, platelet-rich plasma; R, retrospective; VAS, visual analog scale.

*Reported for experimental cohort.

†Subanalysis of patients with moderate (Outerbridge grade 2 or 3) osteoarthritis.

Risk-of-Bias and Study Quality Assessment

Risk-of-bias assessment of the studies was performed using MINORS criteria.[21] The MINORS scores ranged from 18 to 22, with an average score of 20. The major deficiencies were lack of prospective calculation of study size and insufficient reporting of loss to follow-up. All studies showed a clearly stated aim, prospective collection of data, appropriate endpoints, and adequate control groups. Most of the studies included consecutive patients. The MINORS scores for the included studies are shown in Figure 2. All included studies had high MINORS scores, thus indicating a low risk of bias. The intraclass correlation coefficient score for the assessment of inter-rater agreement was 0.854 (excellent reliability).[28]

Outcome Measures

All BMAC patients in the study by Martin et al.[14] improved significantly from baseline but not more so than control patients. However, a subanalysis limited to patients with moderate cartilage damage did show significant improvement in BMAC PROMs compared with controls. BMAC patients had a mean iHOT-33 score of 82.5 at 2 years compared with 69.5 for control patients ($P = .03$). The study by Day et al.[27] reported a similar finding, with BMAC patients improving significantly relative to their baseline levels but not differing significantly from the improvement seen in the control group. Finally, the PRP patients in the study by Redmond et al.[26] had mildly but significantly lower modified HHS scores than the control group but showed no differences in any other PROMs.

Safety

No severe adverse events during harvesting procedures, injections, or follow-up periods were reported other than revisions in 1 study (Redmond et al.[26]), which reported a revision rate of 10.6% (11 patients) in the study group compared with 6.4% (13 patients) in the control group ($P = .20$) (Table 4).

Discussion

PRP was not found to significantly improve outcomes in patients undergoing hip arthroscopy for acetabular labral repair compared with controls. BMAC was only found to improve outcomes in patients stratified by moderate cartilage damage. In recent years, orthobiologic interventions have gained attention as potential treatment options to augment acetabular labral repairs. This study aimed to evaluate the efficacy of these interventions through a comprehensive analysis of multiple studies. Notably, there is a paucity of studies with high levels of evidence in the literature; this work, although slightly limited in this regard, highlights the need for further studies with, first, higher levels of evidence and, second, more targeted patient populations.

Table 3. Study Characteristics, Procedure Details, and Complications

Authors	Study Period	Orthobiologic Agent Used	Volume of Orthobiologic Agent Used	Imaging Used for Guiding Administration of Agent
Martin et al.[14]	2013-2019	BMAC	120 mL of BMA (4 mL of BMAC)*	Fluoroscopy and arthroscopic visualization
Redmond et al.[26]	2010-2012	PRP	4-7 mL	Arthroscopic visualization
Day et al.[27]	2010-2019	BMAC	8-12 mL of BMA (3-7 mL of BMAC)*	Arthroscopic visualization

BMA, bone marrow aspirate; BMAC, bone marrow aspirate concentrate; PRP, platelet-rich plasma.
*The reported BMA amount was centrifuged to generate the reported BMAC amount.

The principal findings of this study were that although the administration of neither BMAC nor PRP significantly improved any of the investigated mean PROM scores relative to controls, stratifying BMAC outcomes by moderate cartilage damage did reveal significant improvements compared with controls. Our hypothesis was partially refuted: Although PRP was found to not significantly improve outcome scores, BMAC was found to be similarly deficient, unless stratifying patients with moderate cartilage damage.

The functional outcome analysis after arthroscopic labral repair with BMAC augmentation, as explored by Martin et al.,[14] provides valuable insights into managing labral injuries with early degenerative changes. Overall, the BMAC group showed no significant differences in mean iHOT-33, HOS-ADL, or HOS-SSS scores compared with the control group at any follow-up time point (3-, 6-, 12- and 24-month follow-up). BMAC patients did, however, experience a greater improvement relative to their baseline scores as measured by the HOS-ADL at 12- and 24-month follow-up. However, when patients with moderate cartilage damage (Outerbridge grade 2 or 3) were analyzed, the BMAC group reported significantly superior mean iHOT-33, HOS-ADL, and HOS-SSS scores at 12 months. This difference held at 24 months for the iHOT-33 score. These BMAC patients also experienced greater improvements in all 3 scores relative to baseline, as compared with the control cohort, at the 12- and 24-month follow-up time points. These findings suggest that BMAC application could lead to more significant functional improvements in patients with moderate cartilage damage undergoing arthroscopic labral repair. This result may indicate that the regenerative potential of MSCs depends on the severity of cartilage damage that the patient presents with at the time of surgical intervention. In a previous study conducted on the hip, Natali et al.[29] showed that intra-articular injections with autologous micro-fragmented adipose tissue achieved favorable clinical outcomes in patients with early to moderate hip osteoarthritis. These combined findings highlight the importance of identifying individuals who are ideal candidates for adjuvant orthobiologic treatment during hip arthroscopy, especially labral repair.

The retrospective study by Day et al.[27] aimed to evaluate the effect of intra-articular BMAC injection during hip arthroscopy in patients with symptomatic labral tears and early radiographic degenerative changes. PROMs were assessed preoperatively and up to 2 years postoperatively. The BMAC group, composed of patients with Tönnis grade 1 or 2 changes, showed significant improvements in PROMs that were comparable to controls without arthritis undergoing hip

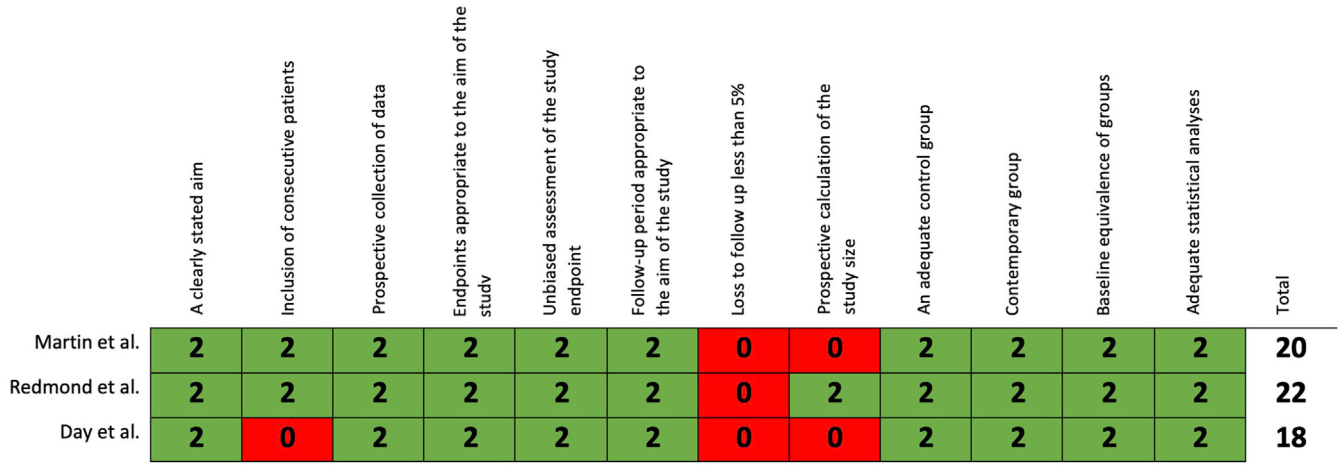

Fig 2. Methodological Index for Non-randomized Studies scoring system. This ranking system was used to rigorously assess publication bias among the included studies.

Table 4. Complication Rates in Patients Receiving Orthobiologic Agents Compared With Controls

		THA Conversion			Revision Hip Arthroscopy		
Authors	Orthobiologic Agent Used	Orthobiologic Group, n (%)	Control Group, n (%)	*P* Value	Orthobiologics Group, n (%)	Control Group, n (%)	*P* Value
Redmond et al.[26]	PRP	3 (2.9)	10 (5.0)	.40	11 (10.6)	13 (6.4)	.20
Day et al.[27]	BMAC	5 (14.3)	1 (2.9)	.09	0 (0)	1 (2.9)	.31
Martin et al.[14]	BMAC	Complications were not reported					

BMAC, bone marrow aspirate concentrate; PRP, platelet-rich plasma; THA, total hip arthroplasty.

arthroscopy. No significant differences in rates of PROM improvement, conversion to total hip arthroplasty, or reaching clinical thresholds were found between the BMAC and control cohorts. Of note, all patients receiving BMAC had a Tönnis grade of 1 or 2, whereas all control patients had a Tönnis grade of 0; thus, BMAC patients all had more advanced disease. As such, the results may underestimate the true restorative value of BMAC given that this cohort began the study with a more advanced disease state and thus a lower baseline. In line with this observation, BMAC patients did experience a shorter time to conversion to total hip arthroplasty than did control patients.

Previous work has shown that PRP can foster a conducive environment for the survival, proliferation, and differentiation of stem cells.[30,31] PRP operates as a biologically active scaffold, actively promoting the repair and regeneration of tissues. Furthermore, PRP has the ability to not only stimulate the body's own stem cells but also recruit advantageous cells to the site of injury.[32] The comparative study by Redmond et al.[26] analyzed patients undergoing hip arthroscopy for labral tears, dividing them into 2 groups: The experimental group received intra-articular PRP, and the control group received bupivacaine. After 2 years, the PRP group showed slight increases in pain scores and slightly significantly lower modified HHS values compared with the control group. No significant differences were observed in HOS-ADL, HOS-SSS, or Non-arthritic Hip Score at any time point. Intraoperative PRP injection thus does not appear to improve clinical outcomes in hip arthroscopy for labral injuries and may contribute to slightly worse long-term pain outcomes.

Overall, the high MINORS scores across all studies indicate a low risk of bias. The MINORS criteria have been lauded as an excellent tool for assessing the risk of bias, and their external validity has been thoroughly tested.[21,33] All included studies lost points in the category of loss to follow-up of less than 5%.[14,26,27] However, these studies all lost points not because they did, indeed, lose more than 5% of patients but simply because they did not report their loss to follow-up. Additionally, the study by Day et al.[27] lost points for not reporting on whether patients were enrolled in a consecutive fashion. Overall, the combination of not only high MINORS scores for all 3 studies but also the degree to which the final scores were closely clustered led to high confidence of having low publication bias, which makes the studies amenable to meaningful comparisons. Overall, on the basis of all studies included in this review, BMAC appears to be the most promising orthobiologic treatment, a conclusion upheld by the significant improvement seen in patients with moderate cartilage damage who were administered BMAC. Further fine-tuning of the optimal patient population may serve to enhance these improvements to bolster significance, not only for BMAC but also for other promising and emerging orthobiologics.

A low rate of complications associated with orthobiologic agents' injections in acetabular labral repairs of the hip was reported. No severe adverse events were reported during harvesting procedures, injection treatments, or post-injection follow-up periods. This is an important finding that suggests the safety of using orthobiologic agents. Furthermore, the rates of conversion to total hip arthroplasty in the orthobiologic and control groups did not differ significantly. Redmond et al.[26] and Day et al.[27] reported differences in conversion rates, but these did not reach the level of statistical significance. These data suggest that the use of orthobiologic agents does not increase the risk of total hip arthroplasty conversion compared with control procedures. Regarding revision of hip arthroscopy, the data vary among different studies. Redmond et al. and Day et al. reported different revision rates between the orthobiologic and control groups, but again, the differences were not statistically significant.

These studies contribute to the growing knowledge of orthobiologic therapies for acetabular labral injuries, but the field remains dynamic and evolving with a notable paucity of randomized controlled trials. Research should focus on further defining the role of orthobiologics within the broader spectrum of treatment options and delineating which patients would benefit the most from these unique interventions.

Limitations

There are relevant limitations that can influence the interpretation and applicability of the findings. First, it is unclear whether patients were made aware of whether they were receiving an adjuvant treatment; thus, the

placebo effect may be prevalent in these studies. Second, although the follow-up period was consistent at 2 years, continued follow-up at 5 and 10 years was not available for the reported studies. This limitation prevents a truly comprehensive assessment of the long-term effects of orthobiologic therapies, including their sustainability over time and the possible emergence of late complications. Third, the lack of standardization in treatment protocols, injection doses, and administration methods could have impacted consistency and homogeneity. For instance, PRP can be harvested from multiple sites and created at varying centrifugal speeds. The heterogeneity of the therapies themselves could make it difficult to draw generalized conclusions. Our analysis also reveals slight differences in administration methods, which can further influence results given that injection depth and precision may vary, potentially affecting therapy distribution and efficacy. Finally, this review is limited by the inclusion of only 3 studies without any Level I evidence included. This limits the strength of our conclusions. To date, no Level I trials on the use of BMAC in acetabular labral tears have been completed, thus limiting the highest available level of evidence to Level II. The included studies were Level II and III evidence. In summary, despite the encouraging results of these studies on orthobiologic interventions for acetabular labral injuries, the aforementioned limitations emphasize the need for caution in interpreting the findings.

Conclusions

Overall, BMAC and PRP do not significantly improve PROMs compared with controls. However, there is limited evidence that BMAC may help patients with moderate cartilage damage.

Disclosures

All authors (B.S.S., R.G., S.M.G., J.S.L., K.S.D., N.J.C., S.D.M.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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