Review Article

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Hip Labral Repair versus Reconstruction: Meta-analysis

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The purpose of this meta-analysis is to compare the postoperative outcomes and complications of labral repair with those of labral reconstruction. An electronic search strategy was conducted from 1986 until August 2023 using the following databases: PubMed, Cochrane, and Google Scholar (pages 1-20). The primary objectives included the postoperative clinical outcomes determined by the number of patients who reached minimal clinical important difference (MCID) on the visual analog scale (VAS), modified Harris hip score (mHHS), Hip Outcome Score-Sports Subscale (HOS-SS), Hip Outcome Score-Activities of Daily Life (HOS-ADL), and International Hip Outcome Tool-12 (iHOT-12). In addition, analysis of the rate of revision arthroscopy, the rate of conversion to total hip arthroplasty (THA), the postoperative VAS, mHHS, HOS-SS, HOS-ADL, iHOT-12, nonarthritic hip score (NAHS), patient satisfaction, lower extremity function scale (LEFS), and the SF-12 (12-item short-form) was also performed. Any differences arising between the investigators were resolved by discussion. Seventeen studies were relevant to the inclusion criteria and were included in this meta-analysis. A higher rate of patients who reached MCID in the mHHS (P=0.02) as well as a higher rate of revision arthroscopy was observed for labral repair (P=0.03). The remaining studied outcomes were comparable. Despite the greater predictability of success in the reconstruction group, conduct of additional studies will be required for evaluation of the benefits of such findings. In addition, labral reconstruction is more technically demanding than a labral repair.

Keywords: Hip labrum, Labral repair, Labral reconstruction, Labral refixation

INTRODUCTION

Apart from where it transitions into the transverse acetabular ligament, the labrum of the hip is a triangular-shaped fibrocartilage structure surrounding most of the acetabulum[1]. This structure is believed to support proprioception, fluid dynamics maintenance, and hip stability. An ineffective or damaged labrum can lead to development of hip micro-instability, which was recently recognized as a pathological entity[2]. In fact, labral tears of the hip can be detected in 22% to 55% of individuals with hip and groin pain[3].

The popularity of hip arthroscopy has shown a steady increase in the last two decades[4,5]. In addition, conservation and restoration of normal labral function has been emphasized in performance of labral preservation surgery as a result of enhanced knowledge regarding the role of the acetabular labrum in normal hip joint biomechanics[6-8]. Arthroscopic debridement has traditionally been used in treatment of labral tears. However, the relevance of repairing labral anatomy and architecture in the effort to reestablish a more stable hip joint is supported by biomechanical studies[8,9]. This can be achieved either by repair or reconstruction of the damaged labrum.

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Regardless of the origin of the tear, arthroscopic labral repair has become the preferred method for treatment of most labral injuries. Excellent short-term results have been achieved with use of multiple primary repair techniques in treatment of athletes, with reported return to sport rates of 94% and 88% for recreational and high school or college athletes, respectively[10]. High rates of return to the game have also been reported for professional basketball, football, and baseball players[11-13] and nearly 70% of patients who received workers' compensation were able to resume their jobs without restrictions[14]. Labral reconstruction, first introduced by Philippon et al.[15] in 2010, has become an important tool utilized by seasoned hip arthroscopy surgeons. Use of segmental and circumferential techniques in cases of severe labral insufficiency has been reported with good to exceptional results[16-18]. Despite the remarkable success achieved with labral reconstruction, there is still debate regarding the proper indications[17].

Compared to labral reconstruction, performance of a repair has been reported to result in more efficient restoration of the hip joint fluid seal in cadaveric hip models[19]. However, no difference between these two techniques has been demonstrated[17,20]. There is still controversy regarding labral preservation versus labral reconstruction surgery. Thus, the primary objective of this systematic review and meta-analysis is to review the relevant literature and compare the differences in postoperative outcomes between these two treatment modalities.

MATERIALS AND METHODS

1. Search Strategy

This study was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards. Cochrane, PubMed, and Google Scholar (pages 1-20) searches were updated from 1986 to August 2023. Boolean Operators were used with a combination of the following keywords "labr*" AND "hip" AND "repair" OR "reconstruction" OR "refixation". Analysis of references from papers and online searches was also performed during the literature search. Extraction of data was performed by one researcher, and selected articles were verified by another. A summary of the article selection process is provided in the PRISMA flowchart (Fig. 1).

Inclusion criteria were as follows: (1) clinical studies where patients underwent treatment for labral injuries whether primary or revision; (2) comparative studies: randomized controlled trials, prospective clinical trials, retrospective studies; (3) clinical studies comparing patients who underwent treatment using labral repair or labral reconstruction. Exclusion criteria were as follows: (1) case reports, narrative or systematic reviews, theoretical research, conference reports, meta-analysis, cadaveric studies, expert comment, and economic analysis.

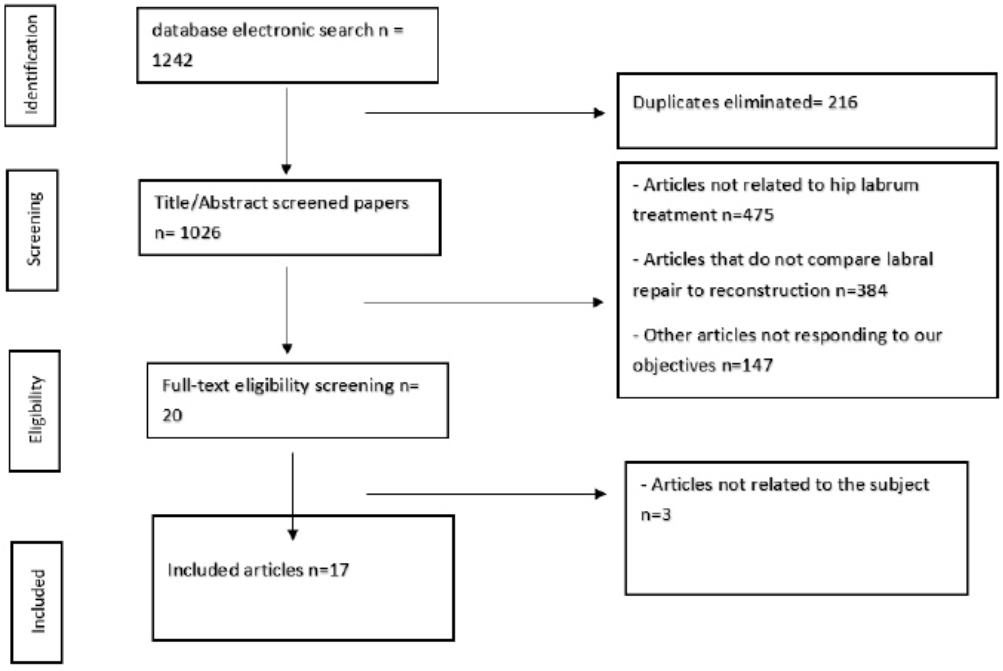

Fig. 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart for the article selection process.

2. Data Extraction

Study eligibility was determined by two authors independently. Extraction of the analyzed data included basic information (including authors, title, year, journal, study design, sample size, and the different suspected biases). In addition, extracted data consisted of postoperative clinical outcomes including the number of patients who reached minimal clinical important difference (MCID) on the visual analog scale (VAS), modified Harris hip score (mHHS), Hip Outcome Score-Sports Subscale (HOS-SS), Hip Outcome Score-Activities of Daily Life (HOS-ADL), and International Hip Outcome Tool-12 (iHOT-12). The rate of revision arthroscopy, the rate of conversion to total hip arthroplasty (THA), the postoperative VAS, mHHS, HOS-SS, HOS-ADL, iHOT-12, nonarthritic hip score (NAHS), patient satisfaction, lower extremity function scale (LEFS), and the 12-item short-form (SF-12) were also extracted. Any differences arising between the investigators were resolved by discussion.

3. Risk of Bias Assessment

Assessment of the risk of bias was performed by two authors independently using the ROBINS-I tool for assessing risk of bias in non-randomized studies of interventions[21]. Studies showing a critical risk of bias were excluded.

4. Statistical Analysis

Statistical analyses were performed using Review Manager 5.4 (The Cochrane Collaboration). Standardized mean differences (SMD) and 95% confidence intervals (CI) were used for continuous data. Risk ratio (RR) with a 95% CI was used for dichotomous data. Q tests and I^2 statistics were used for evaluation of heterogeneity. A result showing $P \leq 0.10$ or $I^2 > 50\%$ indicated considerable heterogeneity, thus random effects were used. The fixed-effect model was used when $P > 0.10$ or $I^2 < 50\%$. Statistical significance was defined as a P-value of 0.05.

RESULTS

1. Characteristics of the Included Studies

Seventeen studies[17,20,22-36] were included in this meta-analysis. All included studies had a retrospective design. The reconstruction group included 919 subjects and the repair group included 1,259 subjects. A summary of the primary characteristics of the included studies is shown in Table 1.

2. MCID

The results of comparison of labral repair and reconstruction showed no statistical difference in the rate of patients who reached MCID for postoperative VAS (P=0.59, odds ratio [OR] 0.90, 95% CI 0.63-1.30, Fig.

Table 1. Main Characteristics of the Included Studies

Study	Methods	Participant (n)		Mean age (yr)		Follow-up (mo)
		Reconstruction	Repair	Reconstruction	Repair	
Bodendorfer et al.[23] (2021)	Retrospective	55	40	34.4	30	24
Bodendorfer et al.[22] (2022)	Retrospective	104	312	43.2	42	24
Chandrasekaran et al.[24] (2019)	Retrospective	34	68	37.3	38.4	40
Domb et al.[25] (2019)	Retrospective	17	51	36.1	36	60
Domb et al.[26] (2020)	Retrospective	37	111	45.6	45.6	24
Jimenez et al.[28] (2021)	Retrospective	17	35	22.6	NA	24
Jimenez et al.[27] (2022)	Retrospective	30	30	28.5	29.9	24
Maldonado et al.[29] (2021)	Retrospective	53	106	48	48.6	24
Matsuda and Burchette[30] (2013)	Retrospective	8	46	41.9	55.4	24
Nakashima et al.[31] (2019)	Retrospective	25	126	52.6	36.5	24
Perets et al.[32] (2018)	Retrospective	15	30	27	27.5	40
Philippon et al.[33] (2018)	Retrospective	66	33	29	29	40
Scanaliato et al.[17] (2018)	Retrospective	58	94	43.4	29.5	24
Scanaliato et al.[20] (2022)	Retrospective	62	68	38.3	29.9	60
White et al.[34] (2016)	Retrospective	79	7	34.6	27.8	31
White et al.[35] (2018)	Retrospective	29	20	33.3	32	56
White et al.[36] (2020)	Retrospective	230	82	41.3	47	50

NA: not available.

2A), HOS-SS (P=0.17, OR 0.79, 95% CI 0.56-1.11, Fig. 2B), HOS-ADL (P=0.20, OR 0.61, 95% CI 0.29-1.29, Fig. 2C), and iHOT-12 (P=0.43, OR 0.85, 95% CI 0.58-1.27, Fig. 2D). However, the rate of patients who reached MCID in postoperative mHHS was lower in the labral reconstruction group (P=0.02, OR 0.71, 95% CI 0.53-0.95, Fig. 2E).

3. Revision and THA Conversion

The results of comparison of labral repair and reconstruction showed no statistical difference in the rate of conversion to THA (P=0.45, OR 1.28, 95% CI 0.67-2.47, Fig. 3A). However, the rate of arthroscopic revision was lower in the labral reconstruction group (P=0.03, OR 0.54, 95% CI 0.31- 0.95, Fig. 3B).

4. Functional Scores

The results of comparison of labral repair and reconstruction showed no statistical difference in mHHS (P=0.10, mean difference –1.35, 95% CI –2.96 to 0.26, Fig. 4A), HOS-SS (P=0.49, mean difference –1.20, 95% CI –4.58 to 2.18, Fig. 4B), HOS-ADL (P=0.59, mean difference –0.76, 95% CI –3.54 to 2.03, Fig. 4C), NAHS (P=0.71, mean difference –0.84, 95% CI –5.27 to 3.59, Fig. 4D), iHOT-12 (P=0.35, mean difference –1.41, 95% CI –4.37 to 1.54, Fig. 4E), and LEFS (P=0.61, mean difference –0.82, 95% CI –4.01 to 2.36, Fig. 4F).

5. Pain and Satisfaction

The results of comparison of labral reconstruction and labral repair showed no statistical difference in postoperative VAS (P=0.09, mean difference 0.23, 95% CI –0.04 to 0.49, Fig. 5A), Satisfaction (P=0.35, mean difference –0.40, 95% CI –1.23 to 0.43, Fig. 5B), and SF-12 (P=0.08, mean difference –1.60, 95% CI –3.39 to 0.19, Fig. 5C).

DISCUSSION

Labral injuries of the hip are common, affecting approximately 22%-55% of individuals with hip pain[3]. Labral injuries have been reported as a cause of microinstability of the hip and were previously managed with arthroscopic debridement[2]. However, as the superiority of labral preservation compared with simple debridement has been demonstrated[37], two modalities, labral repair and labral reconstruction, have emerged. However, when comparing labral reconstruction to reinsertion there is still no strict consensus regarding the most suitable technique. In this meta-analysis different aspects of labral repair were compared with those of labral reconstruction in the management of labral injuries of the hip and similar outcomes were obtained with use of both modalities.

In fact, improved postoperative outcomes were achieved with performance of labral reconstruction procedures. However, when compared with labral repair, all of the included studies reported similar improvements[17,20,22-32,34-36] and one study even reported better postoperative outcomes with labral augmentation[33]. These similar findings were observed in both primary and revision arthroscopy, in athletes, patients older than 40 years old, and even in patients who underwent bilateral hip arthroscopy[17,20,22-32,34-36]. In this study, similar postoperative outcomes with no statistically significant differences were observed, except for the higher rate of patients who reached MCID in the mHHS in the labral repair group (P=0.02). In fact, indications for labral reconstruction constitute part of an ongoing debate. Age older than 40 years was regarded as an indication regardless of the quality of labral tissue[36] due to more favorable outcomes and a lower rate of revision surgery in labral reconstruction. However, this finding could not be reproduced in another study comparing these two techniques with a population of similar age[29]. Another indication is the presence of an irreparable labral tear[38,39] which is more likely in revision surgeries[32]. Irreparable labral tissue can be described as severe labral intrasubstance injury, insufficient labral tissue (defined as less 2 mm in width), and labral ossification[40]. However, no statistically significant difference was observed when these two techniques used in management of irreparable labral injuries were compared[24,26,27]. In fact, in these three studies, labral repair was compared with labral reconstruction in the setting of irreparable labral injuries showing no difference between patient reported outcomes and complications/revision.

White et al.[34,35], who reported a 31% risk of failure in labral repair, which could even reach 50% in a revision setting, proposed performance of a systematic labral reconstruction in the primary setting. However, this high rate of failure in primary cases does not reflect the majority of results reported in the literature[26,41,42]. A systematic review by Maldonado et al.[37] reported no difference in revision arthroscopy between the two techniques. However, the results of our analysis showed a higher rate of revision arthroscopy in the setting of

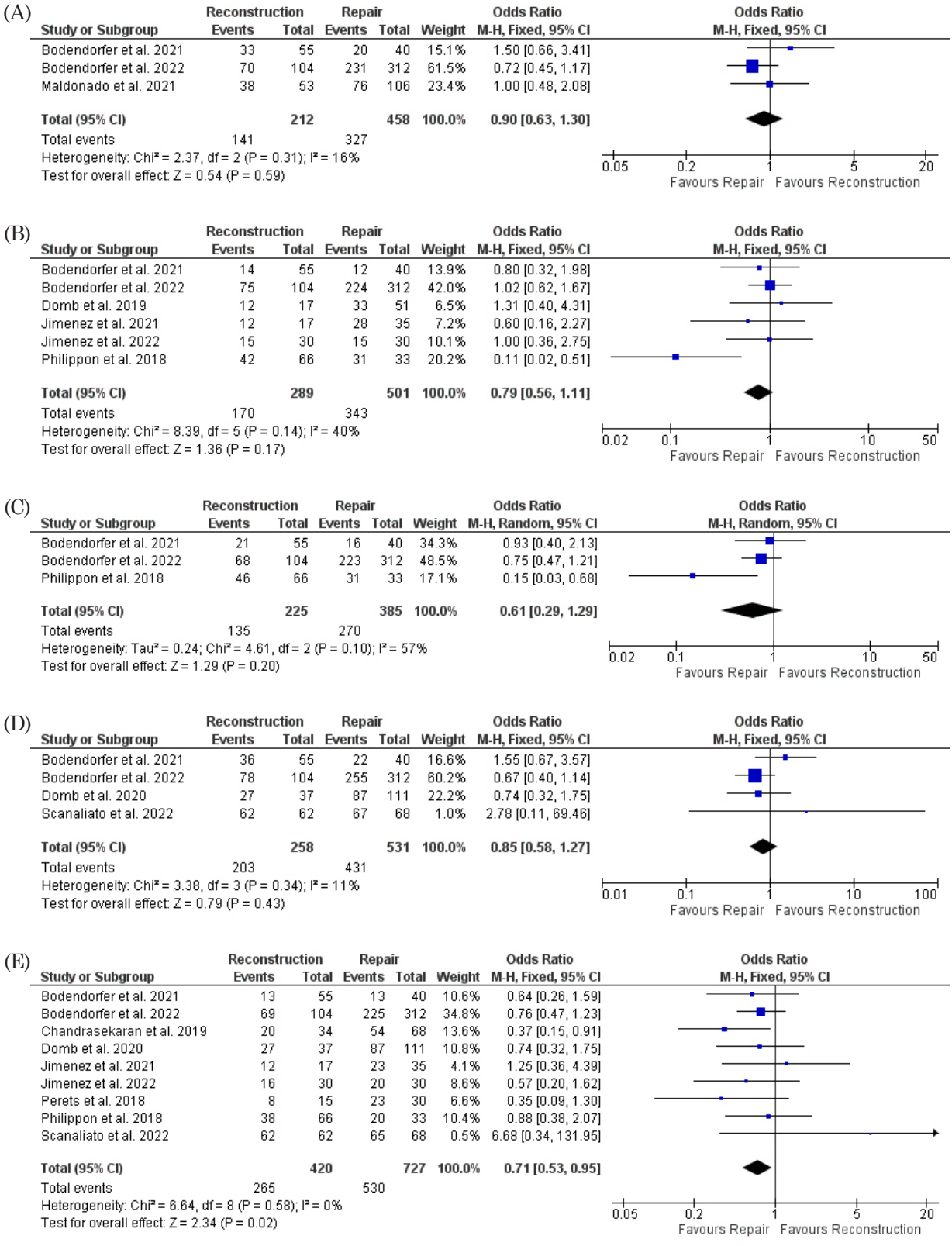

Fig. 2. (A) Forest plot showing the rate of patients who reached MCID in postoperative VAS in labral reconstruction and repair. (B) Forest plot showing the rate of patients who reached MCID in postoperative HOS-SS in labral reconstruction and repair. (C) Forest plot showing the rate of patients who reached MCID in postoperative HOS-ADL in labral reconstruction and repair. (D) Forest plot showing the rate of patients who reached MCID in postoperative iHOT-12 in labral reconstruction and repair. (E) Forest plot showing the rate of patients who reached MCID in postoperative mHHS in labral reconstruction and repair. MCID: minimal clinical important difference, VAS: visual analog scale, HOS-SS: Hip Outcome Score-Sports Subscale, HOS-ADL: Hip Outcome Score-Activities of Daily Life, iHOT-12: International Hip Outcome Tool-12, mHHS: modified Harris hip score, M-H: Mantel-Haenszel, CI: confidence interval.

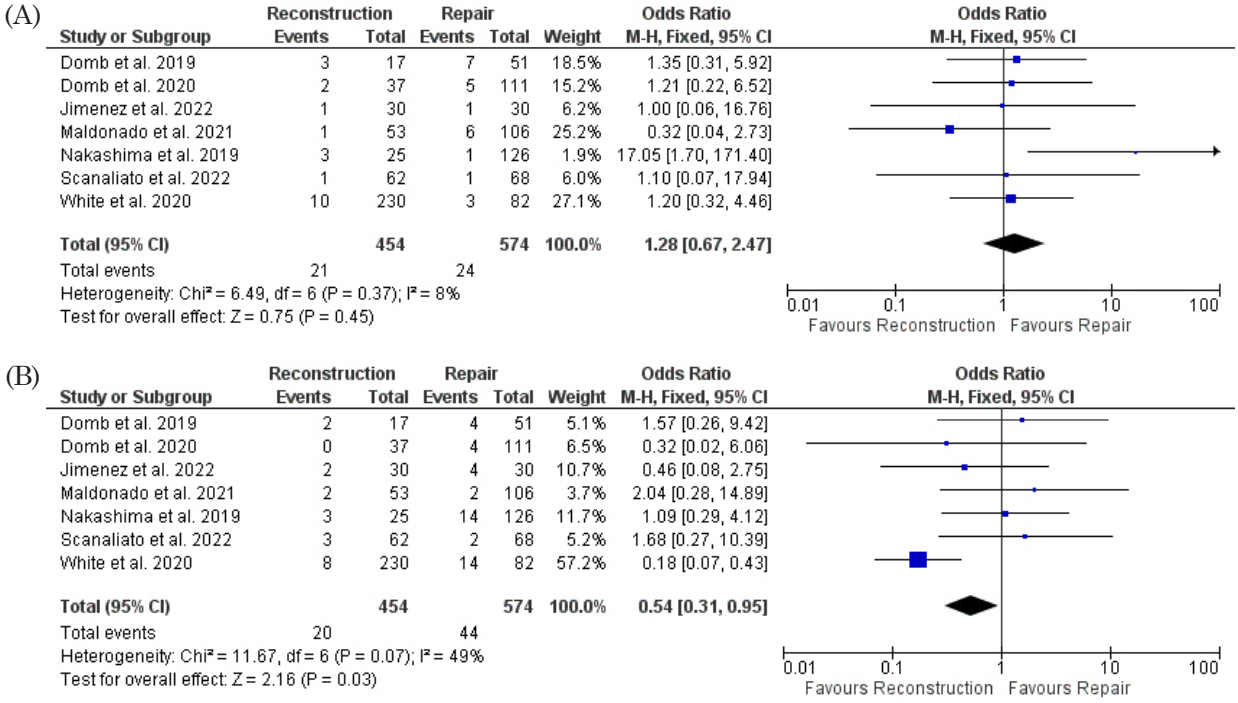

Fig. 3. (A) Forest plot showing the rate of conversion to THA in labral reconstruction and repair. (B) Forest plot showing the rate of arthroscopic revision in labral reconstruction and repair. THA: total hip arthroplasty, M-H: Mantel-Haenszel, CI: confidence interval.

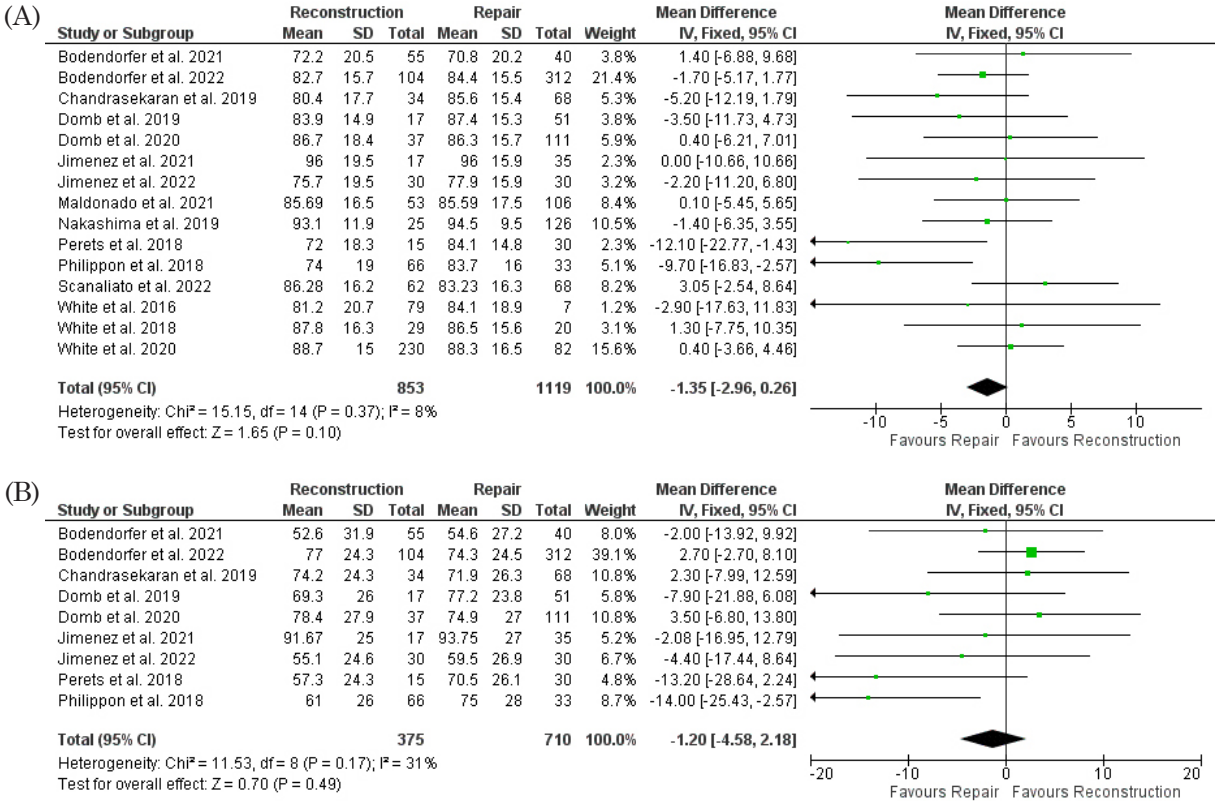

Fig. 4. (A) Forest plot showing the postoperative mHHS in labral reconstruction and repair. (B) Forest plot showing the postoperative HOS-SS in labral reconstruction and repair. (C) Forest plot showing the postoperative HOS-ADL in labral reconstruction and repair. (D) Forest plot showing the postoperative NAHS in labral reconstruction and repair. (E) Forest plot showing the postoperative iHOT-12 in labral reconstruction and repair. (F) Forest plot showing the postoperative LEFS in labral reconstruction and repair. mHHS: modified Harris hip score, HOS-SS: Hip Outcome Score-Sports Subscale, HOS-ADL: Hip Outcome Score-Activities of Daily Life, NAHS: nonarthritic hip score, iHOT-12: International Hip Outcome Tool-12, LEFS: lower extremity function scale, SD: standard deviation, IV: inverse variance, CI: confidence interval.

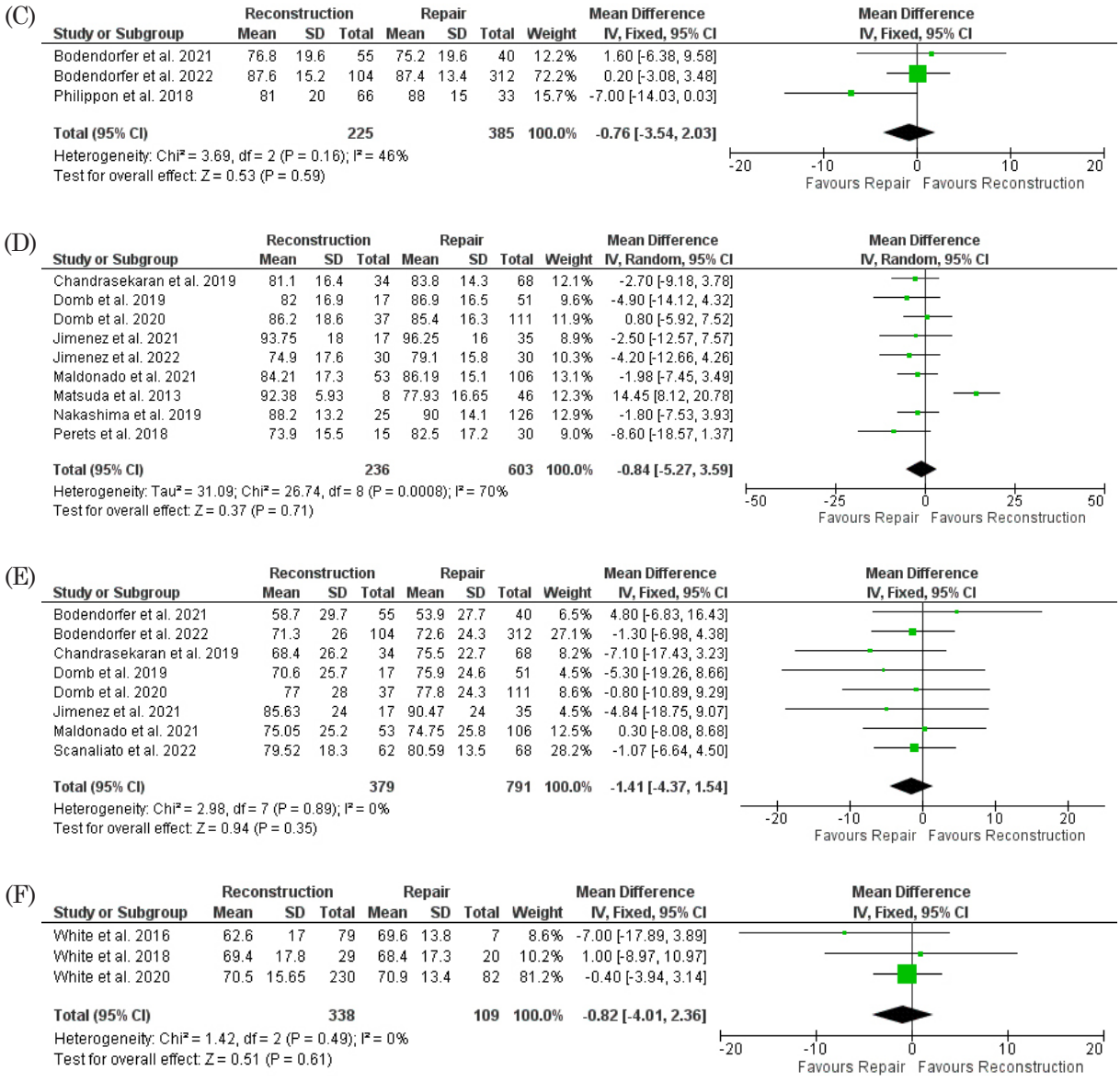

Fig. 4. Continued.

labral repair (*P*=0.03). Most of the difference observed on the forest plot comparing the rates of revision arthroscopy for labral repair and reconstruction can be attributed to the study by White et al.[36] with a weight of 57.2% (Fig. 3B). In addition, in this study[36], a population consisting of patients older than 40 years in the repair group were included compared to patients aged 30 years and older in the reconstruction group. In fact, the result after omitting this study from the analysis would not show a statistically significant difference in revision arthroscopy (*P*=0.94) (Fig. 6). Nevertheless, another study comparing repair and reconstruction in patients older than 40 years in both groups did not report a significant difference in revision rates, thus, a conclusion that labral repair should be avoided in patients older than 40 years cannot be reached[29]. Therefore, although the rate of revision arthroscopy favored reconstruction, this result may be premature since it was significantly influenced by only one study comparing these two techniques in patients with different demographics. The statistically insignificant difference in the rate of conversion to THA recorded by the same systematic review[37] was similar to our findings.

Nevertheless, further evaluation of the benefit of the expected success achieved with use of labral reconstruction compared to its steeper learning curve,

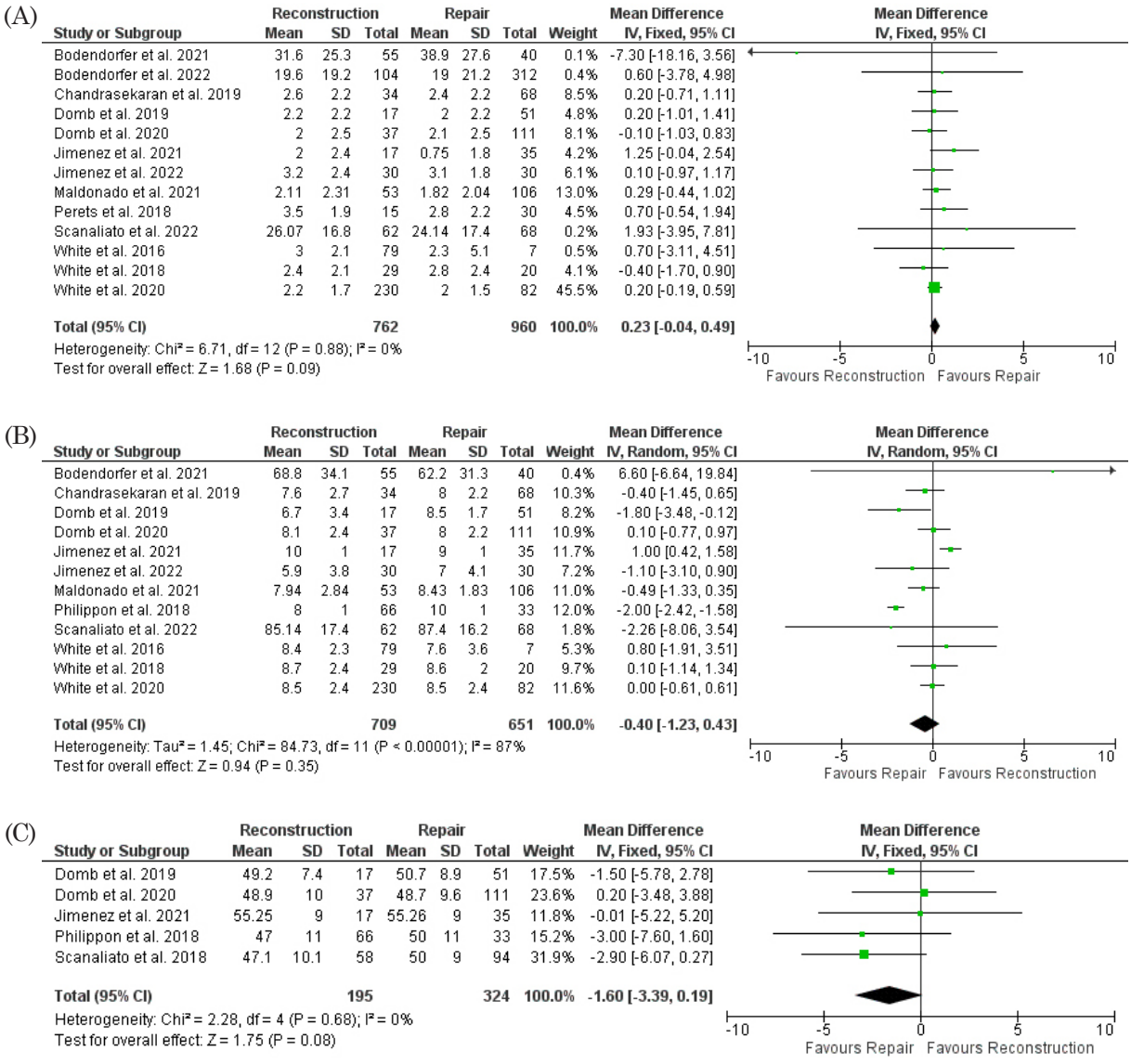

Fig. 5. (A) Forest plot showing the postoperative VAS in labral reconstruction and repair. (B) Forest plot showing the postoperative satisfaction with labral reconstruction and repair. (C) Forest plot showing the postoperative SF-12 in labral reconstruction and repair. VAS: visual analog scale, SF-12: 12-item short-form, SD: standard deviation, IV: inverse variance, CI: confidence interval.

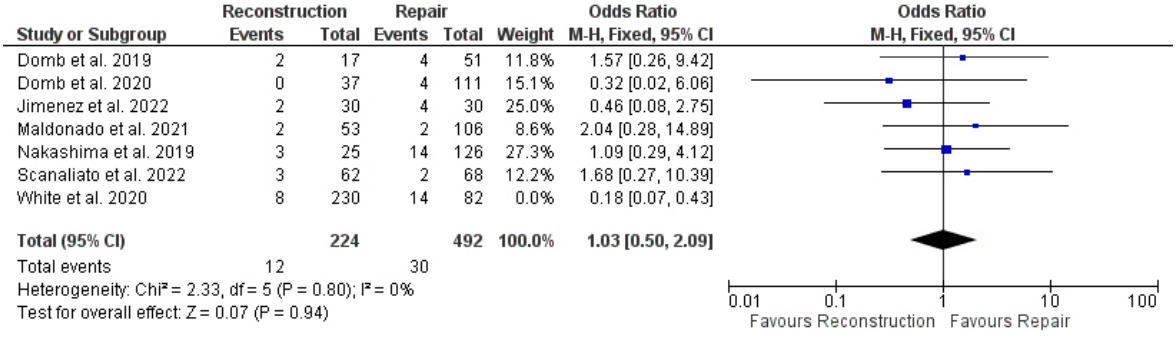

Fig. 6. Forest plot showing the rate of arthroscopic revision in labral reconstruction and repair without the study by White et al.[36]. M-H: Mantel-Haenszel, CI: confidence interval.

the more complex technique, and longer operative time[34,41,43-45], will be needed before any conclusion can be reached with regard to its systematic application in the management of labral injuries.

This study has some limitations, mainly the fact that the data used for analysis was pooled and data on individual patients were unavailable, which could limit further comprehensive analyses. In addition, the indications for reconstruction or repair differed between studies, which could limit the validity of the results. Furthermore, all studies were conducted retrospectively and none were randomized. However, only comparative studies were included, thereby reducing the risk of operative and matching bias and the selection process was meticulous and discerning, reducing the heterogeneity of the study as well as the risk of bias. This is the first study comparing labral reconstruction with labral repair in the management of labral injuries of the hip. In addition, 17 studies were included in this meta-analysis, which is sufficient to obtain reliable results.

CONCLUSION

This study represents the first meta-analysis comparing labral repair with labral reconstruction. Compared with the reconstruction group, a higher rate of patients who reached MCID in mHHS was observed in the repair group. However, a higher rate of arthroscopic revision was also observed. In addition, greater long-term success was achieved with use of labral reconstruction. Nevertheless, similar outcomes were obtained with use of both repair and reconstruction and the latter showed an association with a steeper learning curve and challenging maneuvers. Conduct of additional studies will be required for evaluation of the benefits of the high success rate in labral reconstruction when confronted with its associated complexities.

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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