Effect of Capsular Closure After Hip Arthroscopy for Femoroacetabular Impingement Syndrome on Achieving Clinically Meaningful Outcomes

A Meta-analysis of Prospective and Comparative Studies

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Background: Recent literature has demonstrated conflicting evidence as to whether capsular closure after hip arthroscopy for femoroacetabular impingement syndrome (FAIS) results in superior outcomes compared with capsulotomy without repair. Additionally, these studies have not explored the effect of capsular management on clinically significant outcome improvement.

Purpose: To perform a meta-analysis of prospective and comparative studies to determine whether capsular management influences the rate of clinically significant outcome improvement after hip arthroscopy for FAIS.

Study Design: Systematic review; Level of evidence, 3.

Methods: PubMed, OVID/Medline, EMBASE, and Cochrane databases were queried in September 2020 for studies with evidence levels 1 to 3 that directly compared capsular management cohorts and reported rates of achieving the minimal clinically important difference (MCID) at a minimum follow-up of 2 years. Studies of level 4 evidence, those not describing or directly comparing capsular management techniques as well as those not reporting the MCID were excluded. Methodological quality was assessed using the methodological index for nonrandomized studies tool. Mantel-Haenszel fixed-effects models were constructed to quantitatively evaluate the association between capsular management and achievement of the MCID by generating effect estimates in the form of relative risk (RR) with 95% CIs.

Results: A total of 6 studies with 1611 patients were included. The overall pooled rate of MCID achievement for the modified Harris Hip Score (mHHS), Hip Outcome Score Activities of Daily Living (HOS-ADL), and HOS Sports Subscale (HOS-SS) were 84.4%, 80.3%, and 82.5%, respectively, at a mean follow-up of 40.8 months (range, 24-87.6 months). Capsular closure was associated with a significantly higher rate of MCID achievement for the mHHS (RR, 1.06; 95% CI, 1.01-1.10; $P = .001$) and trended toward statistical significance for the HOS-ADL (RR, 1.11; 95% CI, 1.0-1.24; $P = .055$) and the HOS-SS (RR, 1.09; 95% CI, 0.99-1.21; $P = .094$).

Conclusion: Although capsular closure appeared to result in higher rates of clinically significant outcome improvement in hip function, there was no definitively increased likelihood of achieving clinically significant improvement in relevant hip outcome scores with capsular closure.

Keywords: hip arthroscopy; femoroacetabular impingement syndrome; capsule; closure; repair; MCID; clinically significant outcome

Developments in the understanding of the role of the hip capsule during arthroscopic hip-preservation surgery have led to increased attention to capsular management and the evolution of contemporary methods of capsular repair. Recent biomechanical evidence suggested that the creation of an interportal capsulotomy and extension to a T-capsulotomy significantly jeopardizes the strength and function of the iliofemoral ligament, though complete repair can restore its inherent properties similar to that of a native hip.[33] Despite the existence of empirical evidence suggesting

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the importance of both capsulotomy type, size, and closure in restoring native hip biomechanics,[1,3,33,34] much debate still exists as to whether these findings translate into clinically important observations.

This debate is a function of variable results observed from previous attempts to comprehensively synthesize available evidence. Indeed, recent systematic reviews and meta-analyses have been published with conflicting results.[2,21,22] While some of these studies have reported no benefit with capsular closure,[21,22] others have reported that capsular repair may confer better results for particular patient-reported outcome measures compared with performing a capsulotomy without repair.[2] Though results remain mixed, it is important to note that these studies have assessed only raw patient-reported outcome measures and included all levels of evidence. As the importance of understanding and defining clinically meaningful improvement after hip arthroscopy has become widely adopted to assess procedural success,[4,12,20,28-30] it is imperative that the influence of capsular management on achieving a clinically meaningful outcome be explored.

Given the importance of understanding what outcomes patients perceive as meaningful, the purpose of the current study was to perform a meta-analysis of prospective and comparative studies to determine whether capsular management influences the rate of clinically significant outcome improvement after hip arthroscopy for femoroacetabular impingement syndrome (FAIS). We hypothesized that capsular repair would increase the likelihood of achieving the minimal clinically important difference (MCID) for commonly administered outcome measures after hip arthroscopy compared with leaving the capsulotomy unrepaired.

METHODS

Article Identification and Selection Process

Articles were extracted in accordance with the 2009 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement.[26] The query for studies was performed in September 2020 for literature pertaining to capsular management approaches and their influence on achieving clinically significant outcome utilizing the Boolean search phrase *hip arthroscopy AND outcomes and capsular*, OR *hip AND arthroscopy AND outcomes and capsular*, OR *hip AND arthroscopy AND outcomes and capsulotomy*. The query was performed using the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, EMBASE, PubMed (2008-2019), and OVID/Medline (2008-2019) databases. The protocol for this systematic review and meta-analysis was registered with PROSPERO (ID: 211412).

The inclusion criteria for the above search consisted of all studies published in the English language that had a level of evidence from 1 to 3, directly compared capsular management cohorts and reported raw MCID values, and had a minimum follow-up of 2 years. Exclusion criteria consisted of cadaveric studies, animal studies, basic science articles, editorial articles, surveys or case reports, less than 2-year follow-up, no clear description of capsular management, and studies that did not directly compare capsular management cohorts and had an evidence level of 4. No restriction was imposed on the size or type of capsulotomy, though these characteristics were recorded when available, and a capsulotomy was considered to be at least an interportal or periportal capsulotomy. Two investigators (K.N.K. and A.V.) independently reviewed the abstracts from all identified articles. Full-text articles were obtained for review to allow further assessment of the inclusion and exclusion criteria when necessary. A thorough review of references from the included studies was also performed to ensure that no studies were missed through the systematic search.

Methodological Quality Assessment

The methodological index for nonrandomized studies (MINORS) checklist[16] was used to evaluate the quality of all included studies. The checklist involves 12 items to assess quality, of which only 4 are applicable to comparative studies. The 4 additional criteria specific to comparative groups were used to assess the bias present in articles when selecting cohorts. The maximum MINORS score is 24 for comparative studies. Each study included was scored by a single author (A.V.).

Data Extraction and Statistical Analysis

Common outcome measures observed among the included studies were the modified Harris Hip Score (mHHS),[6] Hip Outcome Score Activities of Daily Living (HOS-ADL),[24] and the HOS Sports Subscale (HOS-SS).[24] The mHHS is an 8-item questionnaire based on pain and function (limp, use

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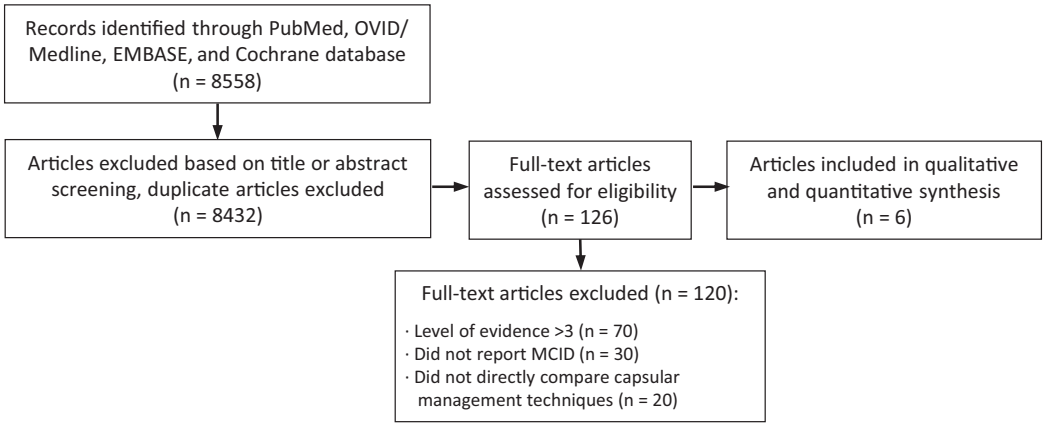

Figure 1. PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) flowchart for article selection. MCID, minimal clinically important difference.

of ambulatory assistance, walking distance, ability to use stairs, put on socks and shoes, use public transportation, and comfort with sitting).[7] The HOS-ADL is a 19-item questionnaire pertaining to basic daily activities such as getting into and out of a car, using stairs, and walking a distance.[23] The HOS-SS is a 9-item questionnaire pertaining to higher-level activities, such as those required in athletics, and include jumping, landing, and lateral/cutting movements.[23]

Mantel-Haenszel fixed-effects models were used to determine pooled effect sizes: Although studies were heterogeneous in their patient populations, patient selection criteria, and designs, all studies investigated the use of an interportal capsulotomy; therefore, the analysis was conducted under the assumption that the combined effects would be an appropriate estimate of common effect size.

The MCID threshold values and achievement rates were recorded from each included study, and relative risks (RR) were calculated from 2×2 tables for each individual study. Although MCID thresholds have been established for each of the aforementioned outcome measures in prior literature, they have been demonstrated to range widely across studies[18]; therefore, the thresholds for each specific study were recorded. The pooled effect size was calculated as a weighted mean of the effects estimated in the individual studies, with weights representing the amount of information from each study. The 95% CI was used to report all pooled statistics. Heterogeneity was assessed by the P value of chi-square statistics and the I^2 statistic using random-effects models. We regarded heterogeneity as possibly unimportant when the I^2 value was $<40\%$ and considerable when $>75\%$.[17] All statistical analyses and subsequent figures were produced via OpenMetaAnalyst, using metafor R console code.[32] A 2-tailed P value $\leq .05$ was considered statistically significant.[14]

RESULTS

A total of 6 studies with 1611 patients were included (Figure 1). The mean (± SD) age and body mass index were 32.2 ± 7.0 years and 25.0 ± 1.05 kg/m^2, respectively. A total of 71.6% of patients were male. The mean MINORS score was 23, indicating inclusion studies with high methodological quality. Study characteristics are outlined in Table 1.

Effect of Capsular Management on Clinically Significant Outcome Improvement

The overall pooled rate of MCID achievement for the mHHS, HOS-ADL, and HOS-SS were 84.4%, 80.3%, and 82.5%, respectively, at a mean follow-up of 40.8 months (range, 24-87.6 months).

Five studies[5,9-11,15] reported MCID achievement rates for the mHHS. For patients who underwent capsular closure, MCID achievement rates were in the range of 71% to 100%. For patients who underwent capsulotomy without repair, MCID achievement rates were in the range of 52% to 95.6%. Fixed-effects meta-analysis (Figure 2) demonstrated that capsular closure was associated with an increased risk of MCID achievement for the mHHS (RR, 1.06; 95% CI, 1.01-1.10; $P = .001$). Heterogeneity across studies was moderate but not statistically significant ($I^2 = 59.6$; $P = .067$).

Three studies[5,15,25] reported MCID achievement rates for the HOS-ADL. For patients who underwent capsular closure, MCID achievement rates were in the range of 79% to 98.3%. For patients who underwent capsulotomy without repair, MCID achievement rates were in the range of 55% to 87.7%. Fixed-effects meta-analysis (Figure 3) demonstrated that capsular closure was not associated with an increased risk of MCID achievement for the HOS-ADL (RR, 1.11; 95% CI, 1.0-1.24; $P = .055$) but trended toward significance. Heterogeneity was considered significant ($I^2 = 71.9$; $P = .028$).

Three studies[5,15,25] reported MCID achievement rates for the HOS-SS. For patients who underwent capsular closure, MCID achievement rates were in the range of 77% to 96.7%. For patients who underwent capsulotomy without repair, MCID achievement rates were in the range of 55% to 89.7%. Fixed-effects meta-analysis (Figure 4) demonstrated that capsular closure was not associated with an increased risk of MCID achievement for the HOS-SS (RR, 1.09; 95% CI, 0.99-1.21; $P = .094$) but trended toward

TABLE 1
Characteristics and Methodological Quality of Included Studies[a]

Author (year)	LOE	Inclusion Criteria	Exclusion Criteria	Capsular Management	MCID Reference Value	Mean Follow-up	MINORS Score
Domb et al (2018)	3	Primary hip arthroscopy for FAIS, minimum 5-y follow-up	Previous hip procedures, Legg-Calve-Perthes, SCFE, AVN, inflammatory disease, Tönnis grade >1	• IC (n = 65) vs IC with closure (n = 65) • Capsulotomy size: NR	• mHHS: 8	• IC: 75.7 mo • IC with closure: 64.8 mo	23
Bolia et al (2019)	3	Primary hip arthroscopy for FAIS, age >18 y	Age <18 y, previous hip procedures, Legg-Calve-Perthes, SCFE, AVN, inflammatory disease, LCEA <25° and joint space <2 mm on AP radiographs, microfracture or labral reconstruction, Beighton score >4	• IC (n = 84) vs IC with closure (n = 42) • Capsulotomy size: 2.5 cm	• mHHS: 8 • HOS-ADL: 9 • HOS-SS: 6	• IC: 87.6 mo • IC with closure: 76.8 mo	24
Economopolous et al (2020)	2	Primary hip arthroscopy for FAIS, age 18-55 y, MRI confirmed labral tear, alpha angle >55°, LCEA ≤40°, Tönnis grade ≤1	Hip dysplasia (LCEA ≤25°), hip hypermobility or microinstability, prior hip arthroscopy, history of ipsilateral hip dislocation or fracture, torn ligamentum teres, acetabular labrum articular disruption classification ≥2	• IC (n = 50) vs TC (n = 50) vs IC with closure (n = 50) • Capsulotomy size: NR	• mHHS: 8	• IC: 24 mo • IC with closure: 24 mo • TC: 24 mo	23
Filan and Carton (2020)	3	Primary hip arthroscopy for FAIS	Previous hip procedures, hip dysplasia (LCEA <20°), Legg-Calve-Perthes, SCFE, AVN, inflammatory disease, Tönnis grade >1, deficient labrums	• IC (n = 508) vs IC with closure (n = 458) • Capsulotomy size: NR	• mHHS: 7.2	• IC: 27.6 mo • IC with closure: 30 mo	23
Hassebrock et al (2020)	3	Primary hip arthroscopy for FAIS, competitive athletes, MRI confirmed labral tear, failed 3 mo of nonoperative management, minimum 2-y follow-up	Revision hip arthroscopy, prior hip surgery, history of femur or pelvis fracture, Tönnis grade >1, gross hip instability, inflammatory disorders	• IC (n = 49) vs IC with closure (n = 62) • Capsulotomy size: NR	• mHHS: 8 • HOS-ADL: 9 • HOS-SS: 6	• IC: 24 mo • IC with closure: 24 mo	23
McGovern et al (2021)	3	Primary hip arthroscopy for FAIS, age 12-70 y, minimum 2-y follow-up	Prior hip surgery, Tönnis grade >2	• PC (n = 60) vs IC with closure (n = 68) • Capsulotomy size: 4 cm (IC), 1 cm (PC)	• HOS-ADL: 9 • HOS-SS: 6	• PC: 24 mo • IC with closure: 24 mo	22

[a]AVN, avascular necrosis; AP, anteroposterior; FAIS, femoroacetabular impingement syndrome; HOS-ADL, Hip Outcome Score Activities of Daily Living; HOS-SS, Hip Outcome Score Sports Subscale; IC, interportal capsulotomy; LCEA, lateral center-edge angle; LOE, level of evidence; mHHS, modified Harris Hip Score; MINORS, methodological index for nonrandomized studies; MRI, magnetic resonance imaging; NR, not reported; PC, periportal capsulotomy; SCFE, slipped capital femoral epiphysis; TC, T-capsulotomy.

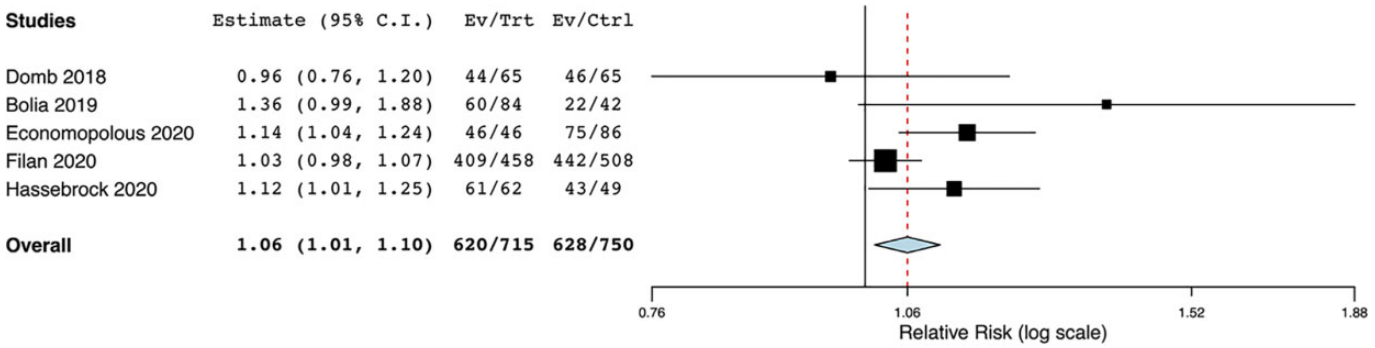

Figure 2. Fixed-effects model with relative risk estimation for effect of capsular management on achievement of MCID for the modified Harris Hip Score after hip arthroscopy for femoroacetabular impingement syndrome. Capsular closure (Trt) resulted in a significantly increased rate of MCID achievement compared with capsulotomy without repair (Ctrl). Ev, events; MCID, minimal clinically important difference.

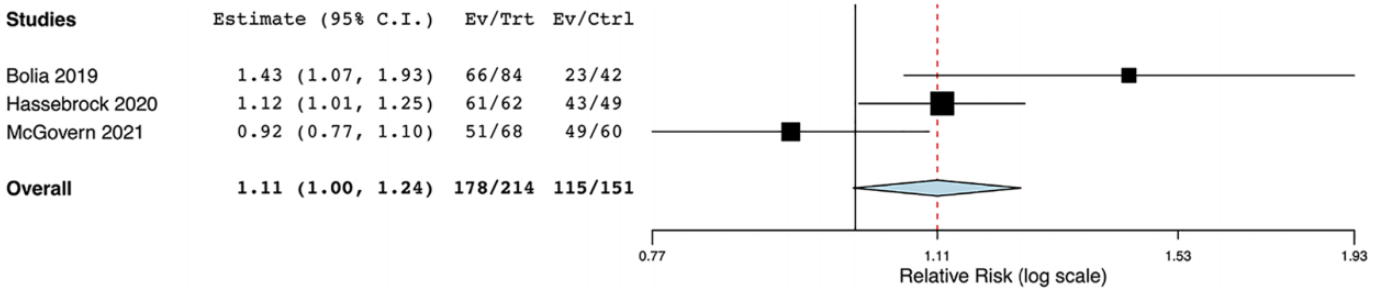

Figure 3. Fixed-effects model with relative risk estimation for effect of capsular management on achievement of MCID for the Hip Outcome Score Activities of Daily Living after hip arthroscopy for femoroacetabular impingement syndrome. Capsular closure (Trt) resulted in an increased risk of MCID achievement compared with capsulotomy without repair (Ctrl), though this did not reach statistical significance. Ev, events; MCID, minimal clinically important difference.

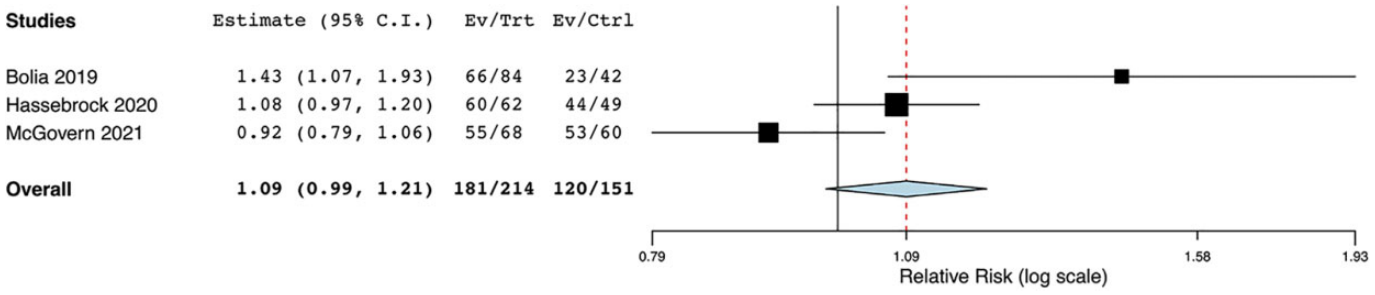

Figure 4. Fixed-effects model with relative risk estimation for effect of capsular management on achievement of MCID for the Hip Outcome Score Sports Subscale after hip arthroscopy for femoroacetabular impingement syndrome. Capsular closure (Trt) resulted in an increased risk of MCID achievement compared with capsulotomy without repair (Ctrl), though this did not reach statistical significance. Ev, events; MCID, minimal clinically important difference.

significance. Heterogeneity was considered significant ($I^2 = 77.1$; $P = .013$).

DISCUSSION

The main finding of the current study was that patients who underwent capsular closure after hip arthroscopy for FAIS had a higher probability of achieving a clinically significant improvement in hip-specific function compared with patients who underwent capsulotomy without repair. Clinically significant improvements in the activities of daily living and sports-specific function were not significantly influenced by capsular management given the available data.

Patients who underwent capsular closure after hip arthroscopy for FAIS had a higher chance of achieving the

MCID for the mHHS at a mean follow-up of 40.8 months. This finding is in accordance with previous literature that has investigated the influence of capsular closure on outcomes after hip arthroscopy for FAIS. Hassebrock et al[15] performed a retrospective cohort study of 62 patients who underwent capsular closure and compared them with 49 patients in whom the capsulotomy was unrepaired. The authors reported that patients who underwent capsular closure achieved the MCID for the mHHS at a higher rate than those without capsular closure (98.3% vs 87.7%; $P = .02$). Likewise, Bolia et al[5] reported that 71% of patients who underwent capsular closure reached the MCID for the mHHS, while only 52% of those with an unrepaired capsulotomy reached the MCID ($P = .007$) at a minimum 5-year follow-up.

Filan and Carton[11] found that 89.3% of patients who underwent capsular repair achieved the MCID for the mHHS, while 87.1% who had an unrepaired capsulotomy achieved the MCID for the mHHS, although this difference failed to reach statistical significance. Other comparative studies[10] have observed the trend toward increased yet nonsignificant rates of MCID achievement on the mHHS for patients with versus without capsular closure, while studies that have compared capsular management have reported significantly improved mHHS at latest follow-up when assessing raw scores but not MCID achievement.[8,31] Indeed, a recent meta-analysis of 10 studies with an evidence level of 4 or greater reported an improvement in the mHHS with capsular repair compared with nonrepair (mean difference, 4.01; $P = .03$), though it did not assess the MCID.[2] It is possible that the comparative studies were underpowered to detect a difference in MCID achievement rates and that the added statistical power of pooling data from multiple studies in the current meta-analysis resulted in a statistical difference and more accurate representation of the association between capsular closure and clinically significant improvement in hip-specific function.

Achieving the MCID for the HOS-ADL was positively associated with capsular closure after hip arthroscopy; however, this was not statistically significant ($P = .055$). This is likely the result of data availability from only 3 studies, and it is possible that this association would become statistically significant with the addition of more data. Furthermore, the study whose pooled effect estimate did not favor capsular closure over unrepaired capsulotomy performed by McGovern et al[25] compared an unrepaired periportal capsulotomy in which the authors minimally extended the arthroscopic portals and did not make a true capsulotomy with an interportal capsulotomy with closure. Therefore, though this represents valuable information, it does not likely represent the potentially negative effect of performing a true interportal capsulotomy and leaving it unrepaired. Both Bolia et al[5] and Hassebrock et al[15] compared a true interportal capsulotomy without repair with capsular closure and reported that the proportion of patients who reached the MCID for the HOS-ADL was significantly greater in patients who underwent capsular repair. Likewise, studies that evaluated raw HOS-ADL outcome scores without assessing the MCID have reported significantly improved HOS-ADL scores for patients who underwent capsular repair compared with those that had unrepaired capsulotomies.[8,13] As more prospective studies continue to assess the influence of capsular management on clinically significant outcome improvement, it will be important to reassess this association.

Capsular closure was not found to influence the rate of MCID achievement for the HOS-SS, though this analysis also trended toward significance. As this patient-reported outcome measure is intended to specifically capture sports-specific function on those patients who participate in formal sports, it is possible that the lack of association is secondary to the inappropriate application to patients in the study population or due to insufficient statistical power. Furthermore, similar to the model constructed for the HOS-ADL above, this analysis included the study performed by McGovern et al,[25] which may have also confounded the pooled effect estimate and increased the confidence interval. Previous evidence exists suggesting that capsular closure is associated with better sports-specific function after hip arthroscopy. Frank et al[13] compared 32 patients who underwent T-capsulotomy with partial capsular repair against 32 patients who underwent complete capsular repair and found that the capsular repair group experienced significantly better HOS-SS scores at 2.5 years postoperatively (87.3 ± 9.6 vs 83.6 ± 8.3; $P < .0001$). Similar to the current study, Acuña et al[2] pooled 3 studies that evaluated the raw HOS-SS after hip arthroscopy and found that capsular repair was favored, though it failed to reach statistical significance. Though it appears that capsular repair is consistently favored in the majority of studies, more high-quality data are needed to evaluate clinically significant outcome improvement for this particular measure.

The importance of capsular integrity after jeopardizing the structure and anatomic role of the hip capsule during arthroscopic hip preservation surgery has been realized in recent years. Indeed, recent biomechanical studies have demonstrated that capsular closure restores hip distraction and rotational stability and reduces intra-articular volume to magnitudes comparable with the intact state.[27] Despite this empirical evidence, recent systematic reviews and meta-analyses have reported that capsular closure does not confer a clear clinical benefit when compared with leaving the capsulotomy unrepaired.[21,22] However, concerns have been raised as to the accuracy and quality of the data presented in these studies,[19] and these studies have assessed only raw-outcome scores as opposed to clinically significant measures of outcome. Given the available data, the current study suggests a significant benefit to capsular closure in terms of hip-specific function as evidenced by the mHHS, and a positive trend for clinically significant improvements in performing activities of daily living, as evidenced by the HOS-ADL. At the time of this writing, no prospective, randomized trials evaluating the effect of capsular closure on clinically significant outcomes were identified, and future evidence of this quality will be required to help determine whether causation can be established between capsular closure and clinically significant outcome improvement.

Limitations to the current study should be discussed. First, as with all systematic reviews, the evidence is limited to that of the identified studies. For this reason, we restricted the inclusion criteria to comparative studies in

an attempt to increase the quality of evidence. Despite this attempt, there remain numerous sources of potential heterogeneity and confounding as evidenced by the I^2 values in the current meta-analysis and variation in patient populations, surgical technique, and MCID thresholds. For example, the studies performed by Economopolous et al[10] and Hassebrock et al[15] are from the same center during the same time periods and may have some degree of patient overlap. Additionally, few of the included studies represent sequential cohorts (investigation of a nonrepaired group, followed by a repaired group), and therefore, the improvement observed in some studies may be related more to increasing surgical experience with the procedure rather than the effect of capsular closure. Second, given the available evidence, the current study could assess only the influence of capsular management on 3 frequently administered outcome measures used in hip arthroscopy. It is plausible that additional associations may be found when evaluating other commonly administered tools, such as the international Hip Outcome Tool and visual analog scales for pain. Other data that may have influenced outcomes, such as articular cartilage status, concomitant procedures, workers' compensation status, athletic participation, and degree of CAM or pincer resection, were reported variably across studies and not amenable to or appropriate for subgroup analysis and should be taken to account when considering the results presented in this study. Finally, it is possible that the current analysis was underpowered to detect an association between capsular closure and the HOS-ADL and HOS-SS, as these both trended closely to significance. This may be attributed to the fact that no true difference exists when considering the effect of capsular management on achieving the MCID for these outcomes. One study in these analyses investigated the effect of closure of an interportal capsulotomy versus a periportal capsulotomy that was not closed.[25] Therefore, recommendations for the utility of capsular closure on achieving the MCID for the HOS-ADL and HOS-SS cannot be definitively made when considering repairing an interportal capsulotomy given the variability introduced by this particular study. It is notable that, though significance was met with respect to the MCID for the mHHS, it still remains unknown whether this truly represents a level of satisfaction for patients, as the Patient Acceptable Symptom State and substantial clinical benefit were not investigated.

CONCLUSION

Although capsular closure appears to result in higher rates of clinically significant outcome improvement in hip function, there is no definitively increased likelihood of achieving clinically significant improvement in relevant hip outcome scores with capsular closure.

REFERENCES

1. Abrams GD, Hart MA, Takami K, et al. Biomechanical evaluation of capsulotomy, capsulectomy, and capsular repair on hip rotation. *Arthroscopy*. 2015;31(8):1511-1517.
2. Acuña AJ, Samuel LT, Roth A, Emara AK, Kamath AF. How capsular management strategies impact outcomes: a systematic review and meta-analysis of comparative studies. *J Orthop*. 2020;19:237-243.
3. Bayne CO, Stanley R, Simon P, et al. Effect of capsulotomy on hip stability—a consideration during hip arthroscopy. *Am J Orthop (Belle Mead NJ)*. 2014;43(4):160-165.
4. Beck EC, Nwachukwu BU, Kunze KN, Chahla J, Nho SJ. How can we define clinically important improvement in pain scores after hip arthroscopy for femoroacetabular impingement syndrome? Minimum 2-year follow-up study. *Am J Sports Med*. 2019;47(13):3133-3140.
5. Bolia IK, Fagotti L, Briggs KK, Philippon MJ. Midterm outcomes following repair of capsulotomy versus nonrepair in patients undergoing hip arthroscopy for femoroacetabular impingement with labral repair. *Arthroscopy*. 2019;35(6):1828-1834.
6. Byrd JW. Hip arthroscopy: patient assessment and indications. *Instr Course Lect*. 2003;52:711-719.
7. Byrd JW, Jones KS. Prospective analysis of hip arthroscopy with 2-year follow-up. *Arthroscopy*. 2000;16(6):578-587.
8. Di Benedetto P, Zangari A, Giardini P, Mancuso F, Castriotta L, Causero A. Capsular closure after hip arthroscopy: our experience. *Acta Biomed*. 2020;91(4)(suppl):92-97.
9. Domb BG, Chaharbakhshi EO, Perets I, Walsh JP, Yuen LC, Ashberg LJ. Patient-reported outcomes of capsular repair versus capsulotomy in patients undergoing hip arthroscopy: minimum 5-year follow-up-a matched comparison study. *Arthroscopy*. 2018;34(3):853-863.e851.
10. Economopoulos KJ, Chhabra A, Kweon C. Prospective randomized comparison of capsular management techniques during hip arthroscopy. *Am J Sports Med*. 2020;48(2):395-402.
11. Filan D, Carton P. Routine interportal capsular repair does not lead to superior clinical outcome following arthroscopic femoroacetabular impingement correction with labral repair. *Arthroscopy*. 2020;36(5):1323-1334.
12. Flores SE, Sheridan JR, Borak KR, Zhang AL. When do patients improve after hip arthroscopy for femoroacetabular impingement? A prospective cohort analysis. *Am J Sports Med*. 2018;46(13):3111-3118.
13. Frank RM, Lee S, Bush-Joseph CA, Kelly BT, Salata MJ, Nho SJ. Improved outcomes after hip arthroscopic surgery in patients undergoing T-capsulotomy with complete repair versus partial repair for femoroacetabular impingement: a comparative matched-pair analysis. *Am J Sports Med*. 2014;42(11):2634-2642.
14. Grabowski B. "$P < 0.05$" might not mean what you think: American Statistical Association clarifies P values. *J Natl Cancer Inst*. 2016;108(8):DJW194.
15. Hassebrock JD, Makovicka JL, Chhabra A, et al. Hip arthroscopy in the high-level athlete: does capsular closure make a difference? *Am J Sports Med*. 2020;48(10):2465-2470.
16. Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ*. 2003;327(7414):557-560.
17. Higgins JPT, Thomas J, Chandler J, et al, eds. *Cochrane Handbook for Systematic Reviews of Interventions version 6.0 (updated July 2019).* Cochrane; 2019.
18. Kunze KN, Bart JA, Ahmad M, Nho SJ, Chahla J. Large heterogeneity among minimal clinically important differences for hip arthroscopy outcomes: a systematic review of reporting trends and quantification methods. *Arthroscopy*. 2021;37(3):1028-1037.
19. Kunze KN, Nwachukwu BU, Chahla J, Nho SJ. Case (and capsule) closed! Can we really claim that capsular repair may not influence outcomes after hip arthroscopy? *Hip Int*. 2020;30(3):363-364.
20. Levy DM, Kuhns BD, Chahal J, Philippon MJ, Kelly BT, Nho SJ. Hip arthroscopy outcomes with respect to patient acceptable symptomatic state and minimal clinically important difference. *Arthroscopy*. 2016;32(9):1877-1886.
21. Lin Y, Li T, Deng X, et al. Repaired or unrepaired capsulotomy after hip arthroscopy: a systematic review and meta-analysis of comparative studies. *Hip Int*. 2020;30(3):256-266.
22. Liu L, Zhang Y, Gui Q, et al. Effect of capsular closure on outcomes of hip arthroscopy for femoracetabular impingement: a systematic review and meta-analysis. *Orthop Surg*. 2020;12(4):1153-1163.

23. Martin RL, Kelly BT, Philippon MJ. Evidence of validity for the hip outcome score. *Arthroscopy*. 2006;22(12):1304-1311.
24. Martin RL, Philippon MJ. Evidence of validity for the hip outcome score in hip arthroscopy. *Arthroscopy*. 2007;23(8):822-826.
25. McGovern RP, Bucci G, Nickel BA, Ellis HB, Wells JE, Christoforetti JJ. Arthroscopic capsular management of the hip: a comparison of indications and clinical outcomes for periportal versus interportal capsulotomy. *Arthroscopy*. 2021;37(1):86-94.
26. Moher D, Liberati A, Tetzlaff J, Altman DG; the PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the PRISMA statement. *BMJ*. 2009;339:B2535.
27. Nho SJ, Beck EC, Kunze KN, Okoroha K, Suppauksorn S. Contemporary management of the hip capsule during arthroscopic hip preservation surgery. *Curr Rev Musculoskelet Med*. 2019;12(3):260-270.
28. Nwachukwu BU, Beck EC, Kunze KN, Chahla J, Rasio J, Nho SJ. Defining the clinically meaningful outcomes for arthroscopic treatment of femoroacetabular impingement syndrome at minimum 5-year follow-up. *Am J Sports Med*. 2020;48(4):901-907.
29. Nwachukwu BU, Chang B, Adjei J, et al. Time required to achieve minimal clinically important difference and substantial clinical benefit after arthroscopic treatment of femoroacetabular impingement. *Am J Sports Med*. 2018;46(11):2601-2606.
30. Nwachukwu BU, Chang B, Fields K, et al. Defining the "substantial clinical benefit" after arthroscopic treatment of femoroacetabular impingement. *Am J Sports Med*. 2017;45(6):1297-1303.
31. Thaunat M, Sarr S, Georgeokostas T, et al. Femoroacetabular impingement treatment using the arthroscopic extracapsular outside-in approach: does capsular suture affect functional outcome? *Orthop Traumatol Surg Res*. 2020;106(3):569-575.
32. Viechtbauer W. Conducting meta-analyses in R with the metafor package. *J Stat Software*. 2010;36(3):48.
33. Weber AE, Neal WH, Mayer EN, et al. Vertical extension of the T-capsulotomy incision in hip arthroscopic surgery does not affect the force required for hip distraction: effect of capsulotomy size, type, and subsequent repair. *Am J Sports Med*. 2018;46(13):3127-3133.
34. Wuerz TH, Song SH, Grzybowski JS, et al. Capsulotomy size affects hip joint kinematic stability. *Arthroscopy*. 2016;32(8):1571-1580.