Santiago *et al.*
Journal of Orthopaedic Surgery and Research (2025) 20:405
https://doi.org/10.1186/s13018-025-05764-6

Journal of Orthopaedic Surgery and Research

REVIEW

Open Access

Outcomes of dual mobility versus conventional total hip arthroplasty for patients with femoral neck fractures: a systematic review and meta-analysis including registry data

Michael Silveira Santiago[1*†], Fatemeh Akbarpoor[2†], Felipe J. Aidar[3,10], José Morais Sirqueira Neto[3], Marcus Vinicius Vieira de Matos Pereira Silva[3], Sohaib Darwish[2], Mohammed Ayman Khokar[2], Zainulabideen Ahmed[2], Fernanda Valeriano Zamora[4], Reuthemann Esequias Teixeira Tenorio Albuquerque Madruga[3], Alfonso López Díaz-de-Durana[5], María Merino-Fernandez[6], Leonardo da Costa Lima[7], Erick Sobral Porto[8], Davi Teixeira de Souza[9] and Rosana Cipolotti[1,11]

Abstract

Background This study compared the long-term efficacy and safety of dual mobility (DM) prostheses versus conventional total hip arthroplasty (c-THA) in femoral neck fracture (FNF) patients. FNFs have a high rate of post-surgical complications, with no consensus on the optimal prosthetic design. This analysis synthesizes the available evidence to address this gap.

Methods We systematically searched Cochrane, PubMed, and Embase databases for studies comparing DM and c-THA in FNF patients. Outcomes included dislocation, revision, heterotopic ossification, infection, mortality, periprosthetic fracture, quality of life, and functional scores. Relative risk (RR) was used for binary endpoints, while mean differences (MD) or standardized mean differences (SMD) were calculated for continuous endpoints. A random-effects model with a 95% confidence interval (CI) was applied. Statistical analyses were conducted using R version 4.4.0.

Results We included three randomized controlled trials and ten cohort studies, amounting to 21,585 patients, of which 4887 received and 16,698 received c-THA. Compared to c-THA, DM showed lower dislocation (RR 0.47; 95% CI: 0.34–0.65; $p < 0.001$) and revision rates (RR 0.77; 95% CI: 0.67–0.89; $p < 0.001$) but higher heterotopic ossification (RR 1.98; 95% CI: 1.22–3.20; $p < 0.05$) and worse functional scores at six to nine months (SMD 1.65; 95% CI: 0.75–2.55; $p < 0.001$). Meta-regression analysis showed no impact of the posterior approach on dislocation outcomes ($p = 0.76$).

†Michael S. Santiago and Fatemeh Akbarpoor have contributed equally to this work.

*Correspondence:
Michael Silveira Santiago
michaelquadril1308@gmail.com; michael.santiago@ebserh.gov.br
Full list of author information is available at the end of the article

Conclusion DM reduces dislocation and revision risks but increases heterotopic ossification and shows worse short-term functional outcomes. Larger randomized trials are needed to validate long-term efficacy and safety.

Keywords Dual articulation, Dual mobility, Femoral neck fractures, Hip replacement, Total hip arthroplasty

Background

Femoral neck fractures (FNF) are debilitating injuries, particularly prevalent among the elderly population [1]. Total hip arthroplasty (THA) has become the preferred treatment for displaced femoral neck fractures, particularly in elderly patients with poor bone quality or osteoporosis, offering improved functional outcomes and durability compared to other surgical options. This preference is attributed to THA's ability to provide effective pain relief, promote early mobilization, and support a faster return to pre-injury functional levels [2]. Additionally, it offers better prosthetic implant longevity by reducing acetabular erosion and maintaining a low revision rate [3].

However, the decision approach to FNF varies depending on the extent of the injury. It must be chosen carefully as it is associated with post-surgery complications such as dislocation and the need for revisions [4]. In order to avoid these events, there has been an increasing interest in the use of dual mobility (DM) prostheses to enhance the stability of hip replacements in femoral neck fractures [5, 6]. These prostheses aim to reduce dislocation rates by combining two articular surfaces, with cementless or cemented options available depending on bone stock and surgeon preference [7]. Reports highlight the superiority of DM in enhancing stability, particularly in high-risk patients, such as those over 65 years old or with muscular weakness. [8, 9]. However, the cost-effectiveness ratio of prosthetic implants is a limiting factor for the widespread use of DM in FNF [10]. Considering the accumulated costs associated with the pricing of prosthetic implants and the indirect costs due to patient absenteeism, there is a positive cost–benefit relationship. However, DM is not cost-effective when the annualized incremental probability of unforeseen revision implants exceeds 0.29% of the initial value [11].

Given the uncertainty of which approach is best suited for FNF, the current study provides an analysis of a substantial number of studies and patients, including national registries in a field lacking a published meta-analysis for this population. Therefore, we conducted a systematic review and meta-analysis of DM against c-THA in patients with FNF in order to provide concise insights for guiding clinical decisions and enhancing patient endpoints.

Methods

This systematic review and meta-analysis was registered in the International Prospective Register of Systematic Reviews and Clinical Trials (PROSPERO) under protocol CRD42024611764 to promote transparency and reduce the risk of bias. The study adhered to the guidelines of the Cochrane Collaboration Handbook for Systematic Reviews of Interventions and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement [12–14].

Eligibility criteria

In the study selection process, we started with deduplication and independently screened all potentially eligible studies. Three independent reviewers (F.J.A., F.V.Z, F.M.D.) and one validator (M.S.S.) collaborated in combining outcomes from three databases and evaluated the studies for inclusion. We excluded based on title and abstract if they did not pertain to the subject of interest. The remaining studies were then reviewed in full to verify eligibility. We excluded trials not concluded, narrative reviews, systematic reviews, non-comparative research, scientific posters, study protocols, conference abstracts not peer-reviewed, and any pre-clinical studies or those not published in English.

We finished with a full independent reading of the papers by two authors with the following inclusion criteria: (1) peer-reviewed articles; (2) compared c-THA versus DM; (3) involved neck femur fracture patients. Studies were excluded if they (1) were ongoing trials, not concluded; (2) were basic science research; (3) did not provide data on FNF. We made no exclusions related to the publication date. Data extraction was manually performed.

Discrepancies were resolved through consensus between the reviewers, and a third author (F.A.) made the final decision in the event that divergence was reached.

Search strategy and data extraction

We systematically searched PubMed, Scopus, and Cochrane Central Register of Controlled Trials databases from inception to October 2024. We included a combination of Medical Subject Headings terms and keywords relating to "dual mobility", "dual articulation", "arthroplasty", "replacement", "femoral", "femur", "intracapsular", "neck" and "hip" (Supplementary Table 1). The references from all included studies, previous systematic reviews, and meta-analyses were also searched manually for any additional studies. Two authors (M.S.S and F.A.) independently extracted the data following predefined search criteria and quality assessment.

Endpoints (outcomes) and sub-analyses

The main outcomes analyzed in this meta-analysis were: (1) dislocation infection, (2) revision surgery, (3) infection, (4) heterotopic ossification, (5) periprosthetic fracture, (5) mortality, (6) functional score, (7) quality of life (EQ-5D and SF 36 scores), and (8) mortality. According to the available data in the studies, we stratified for follow-up at 3, 6, and 12 months in (6) functional score outcomes.

Statistical analysis

Relative Risk (RR) with the Mantel Haenszel method was used to calculate binary outcomes. Mean differences (MD) were used when scales were the same; otherwise, a standardized mean difference (SMD) was applied, both using the inverse method. The Restricted Maximum Likelihood random effects were applied to synthesize the pooled analysis along with 95% confidence intervals. Cochran Q test and I^2 statistics were used to assess for heterogeneity; P values inferior to 0.10, and $I^2 > 25\%$ were considered significant for heterogeneity [15]. A 0.5 continuous correction was applied to the data analysis in the presence of zero events, and it was added when performing the meta-regression and funnel plot. R (version 4.4.0) was used for all statistical analysis [16–18].

Meta-regression

A meta-regression analysis was conducted to evaluate the effect of the posterior approach in total hip replacement on dislocation rates. The analysis employed restricted maximum likelihood estimation and included Knapp-Hartung adjustments to address small sample sizes. Statistical significance was defined as a p-value of less than 0.05 [19].

Trial sequential analysis (TSA)

We conducted a TSA on the included studies to evaluate whether the cumulative evidence had sufficient statistical power. Using the most prevalent dislocation outcome, we analyzed binary data with a two-sided testing approach, applying a 5% type I error rate and 80% power (1-β). The analysis incorporated a variance-based correction for heterogeneity within a random-effects model. A z-score curve was generated to assess the confidence and adequacy of the evidence. Furthermore, we performed a sample size calculation to estimate the required sample size for the meta-analysis to confidently accept or reject the intervention [20, 21].

Quality assessment

Two review authors (F.V. Z; D.V.S.C.) assessed the risk of bias in each study by using the revised Cochrane risk of bias (RoB2/ROBINS-I tools). The examination domains included biases arising from the randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. After responding to the signalling questions, one of three types of bias judgments was selected, namely "low," "high," and "some concerns." In the case of conflicts, a third author (A.L.D.) was contacted as an unbiased arbitrator. The layout was generated using Robvis [22, 23].

The overall quality of evidence was evaluated using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) guidelines [24]. Outcomes were categorized as very low, low, moderate, or high-quality evidence based on factors such as risk of bias, consistency of results, directness, precision, and potential publication bias. Downgrades were applied for issues such as methodological limitations, heterogeneity, or indirectness, while upgrades were considered for large effect sizes, dose–response relationships, or adjustments for plausible confounding factors. This structured approach ensured a robust assessment of the certainty of evidence supporting the study's conclusions [25].

For the dislocation outcome, reported in nine studies with data above zero (the most prevalent endpoint), we assessed publication bias by visually inspecting the funnel plot for asymmetry and conducting Egger's regression test. A p-value < 0.05 was considered indicative of significant asymmetry, suggesting the presence of small-study effects [26]. These methods provided an additional layer of rigor in evaluating the reliability and generalizability of the findings.

Results

Study selection and characteristics

The initial search identified 1651 studies, of which 900 duplicates and 998 ineligible studies were excluded. Following a full-text review of the remaining 53 articles, 40 studies were excluded based on predefined criteria (Supplementary Fig. 1).

Ultimately, 13 studies comparing DM and c-THA for fragility femoral neck fractures in the elderly were included in the analysis [27–39]. A total of 4887 (22,64%) patients received DM and 16,698 (77,36%) received THA. The baseline characteristics are summarized in Table 1. Of the 13 studies included in our systematic review, three were three randomized clinical trials; ten

Table 1 Baseline characteristics of the included studies

Author and year	Study design	Group	Female	Mean follow-up(months)	Sample size	Mean age (years)	Cup fixation	Posterior approach	Hardinge approach
Achudan, 2022	Retrospective Cohort	DM	91	24,1	42	68	Uncemented	129	0
		THA		42,7	87	70,9			
Agarwala, 2021	Prospective Cohort	DM	53	12	52	75,5	Mixed cases (uncemented/cemented)	0	103
		THA			51	73,3			
Cnudde, 2022	Retrospective Cohort	DM	102	12	172	77,9	MD	103	69
		THA	379		605	72,3		262	372
Alberio, 2021	Retrospective Cohort	DM	42	23	24	77	Uncemented	48	0
		THA			24	78,3			
Griffin, 2016	RCT	DM	MD	12	9	N/A	Uncemented	MD	MD
		THA			10				
Hoggett, 2023	Retrospective Cohort	DM	MD	41	106	76	Cemented	102	4
		THA		42	189	73		140	49
Hoskins, 2021	Retrospective Cohort	DM	1265	24	1778	75	MD	MD	MD
		THA	7123	40	8582	73			
Parhamfar, 2023	RCT	DM	42	18	40	63	MD	0	84
		THA			44	64			
Rashed, 2020	RCT	DM	32	12	31	66,3	Cemented	62	0
		THA			31	68			
Rashed, 2020	Retrospective Cohort	DM	240	12	223	72,3	MD	334	0
		THA			111	72,1			
Rogmark, 2022	Retrospective Cohort	DM	1374	60	2242	76	Mixed cases (uncemented/cemented)	1114	4234
		THA	4120		6726	75,2		2492	1128
Sadozai, 2021	Retrospective Cohort	DM	MD	37	127	N/A	Mixed cases (uncemented/cemented)	MD	MD
		THA			195				
Tarasevicius, 2013	Prospective Cohort	DM	61	12	41	75	Cemented	84	0
		THA			43	76			

RCT, randomized clinical trial; DM, dual mobility; THA, total hip arthroplasty; MD, missing data

were cohorts from which two were prospective, and eight were retrospective. In all cohorts included for analysis, most patients were more than 68 years of age with a cumulative average age of 72.9 years in the DM group and 72.4 years in the c-THA group. Only three studies reported neurological disorders and obesity as the main comorbidities before the femoral neck fracture [32, 37, 39]. On the other hand, Tarasevicius et al. [38] reported the previous functional status, classifying it as independent with or without supervision [38]. Considering cup fixation, nine studies reported the use or not of cement and four studies did not make any reference to prosthetic fixation (Table 1).

Pooled analysis of all studies

DM was associated with a significantly lower risk of dislocation (RR 0.47; 95% CI: 0.34–0.65; $p<0.001$; $I^2=0\%$; Fig. 1) based on data from all included studies and a lower risk of revision surgery (RR 0.77; 95% CI: 0.67–0.89; $p<0.001$; $I^2=0\%$; Fig. 2) based on eight studies. The posterior and lateral surgical approach was preferred according to the surgeon's experience, and there were 3 studies with missing data [25, 28, 33].

Heterotopic ossification was reported in three studies, all of which utilised the posterior approach [30, 31, 39]. We found significantly higher rates in the DM group compared to c-THA (RR 1.98; 95% CI: 1.22–3.20; $p<0.05$; $I^2=0\%$; Fig. 3).

Functional score analysis was reported in five studies, depending on the follow-up analysis. We found statistical significance at 6–9 months follow-up favouring c-THA approach (SMD 1.65; 95% CI: 0.75–2.55; $p<0.001$; $I^2=0\%$; Fig. 4). However, we found no significant difference between groups at 3 months (SMD 4.23; 95% CI: − 0.71 to 9.18; $p=0.09$; $I^2=91\%$;

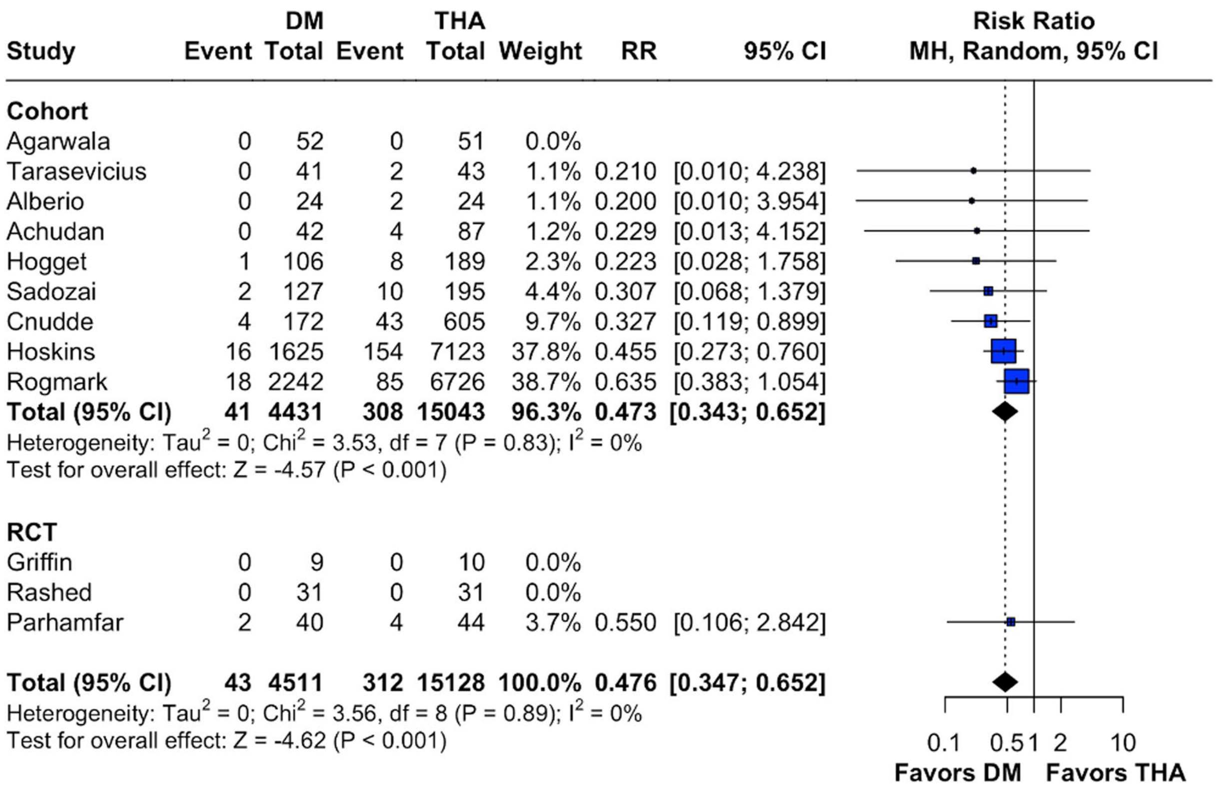

Fig. 1 Forest plot of comparison. DM × THA. Dislocation outcome Subgroup analysis: RCT and Cohort studies

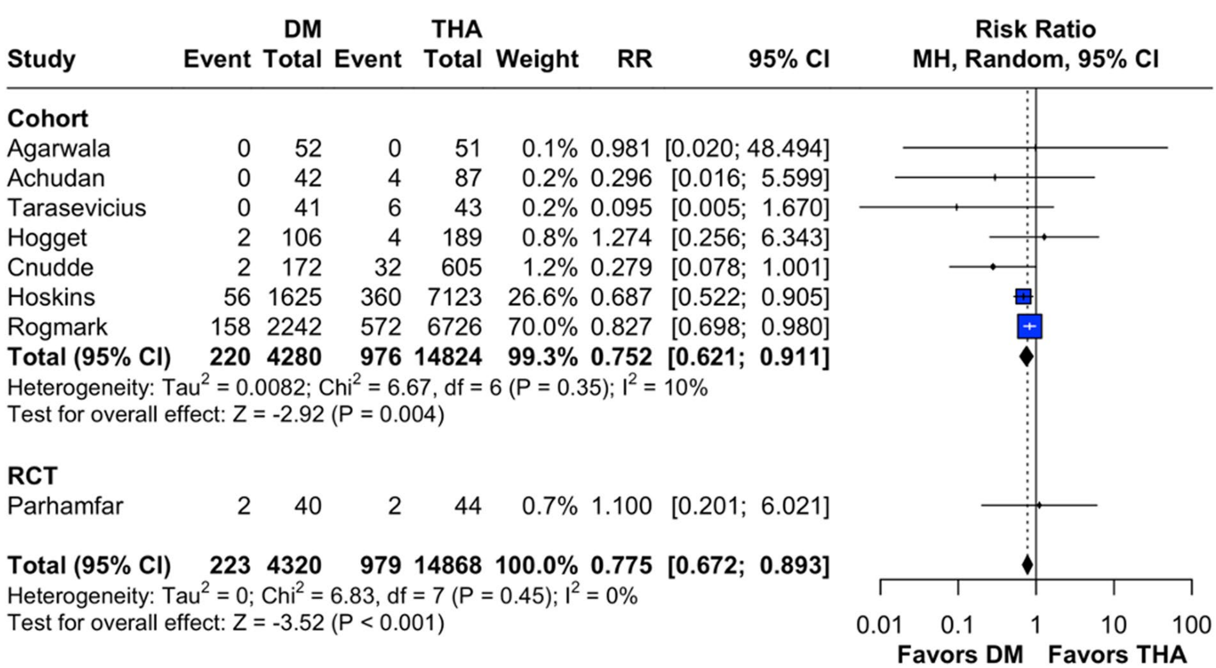

Fig. 2 Forest plot of comparison. DM × THA. Revision surgery outcome Subgroup analysis: RCT and Cohort studies

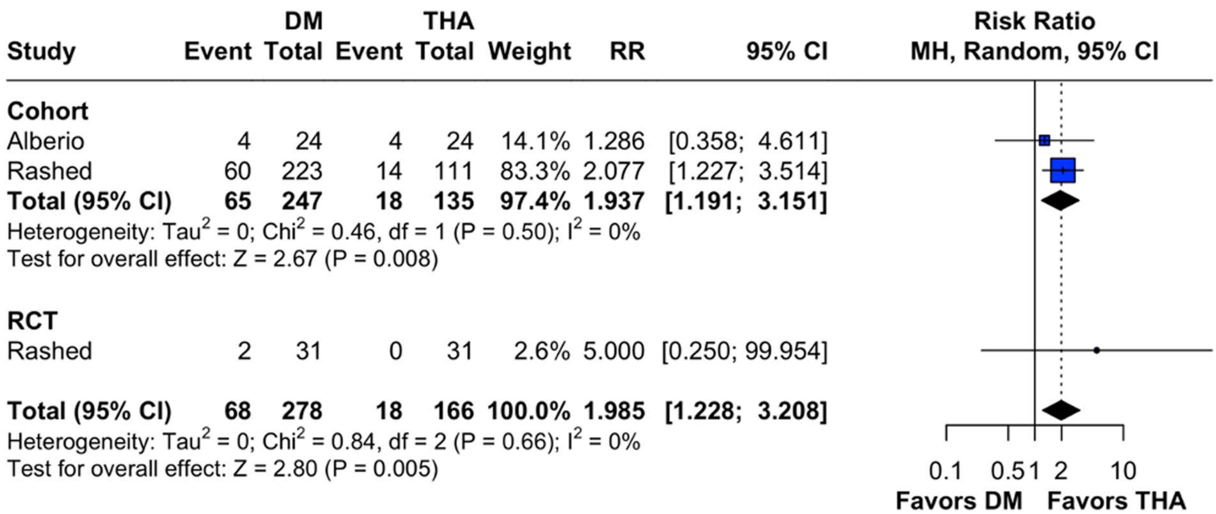

Fig. 3 Forest plot of comparison. DM × THA. Heterotopic Ossification outcome

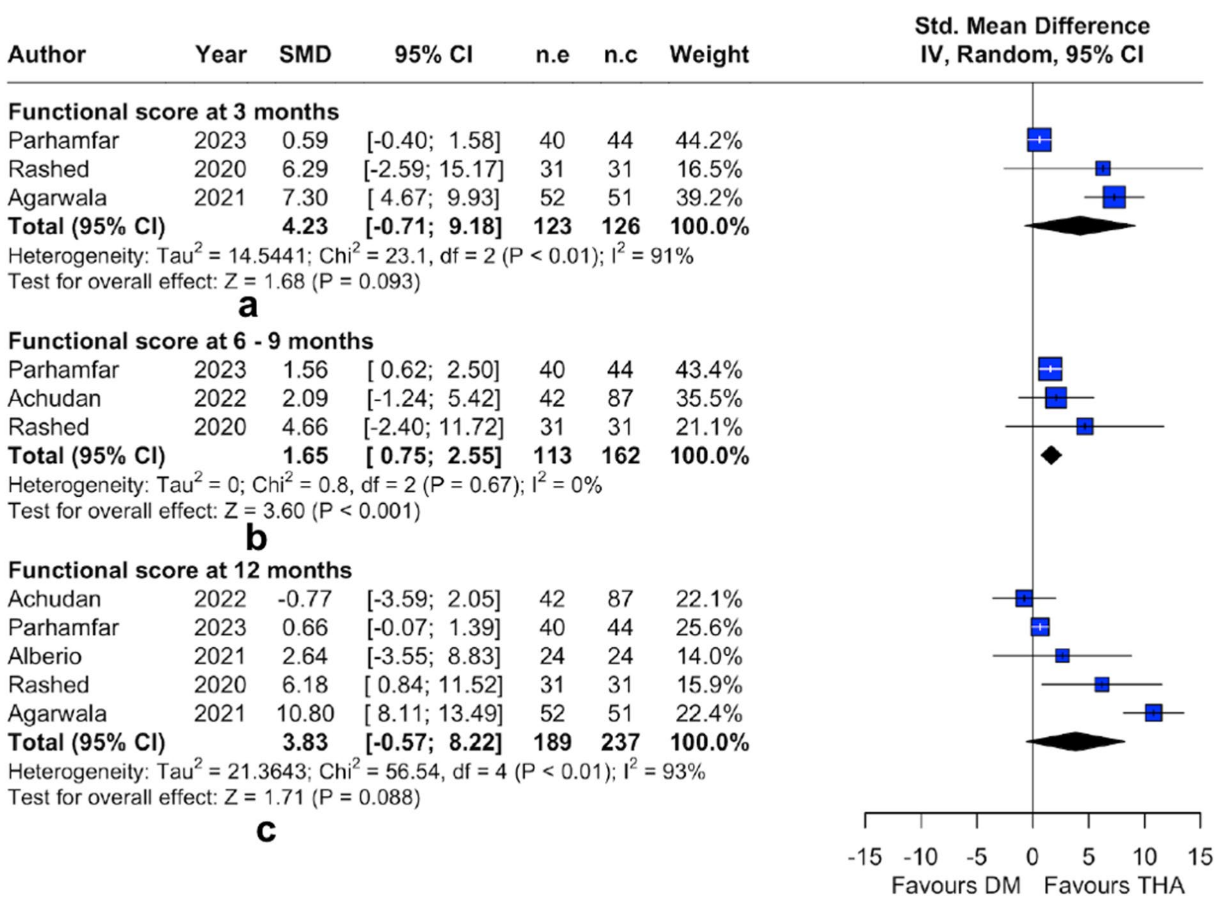

Fig. 4 Forest plot of comparison. DM × THA. Functional Score outcome at 3 **a**, 6/9 **b**, and 12 months **c**

Fig. 4) and 12 months (SMD 3.83; 95% CI: − 0.57 to 8.22; $p = 0.08$; $I^2 = 93\%$; Fig. 4) of follow-up.

Revision rate surgery was reported in eight studies. We found significantly lower rates in the DM group compared to c-THA (RR 0.77; 95% CI 0.67–0.89; $P \leq 0.001$; I^2:0%; Fig. 2). The leading causes of revision surgery were dislocation for recurrent instability, infection, peri-prosthetic fracture and loosening.

We found no significant differences in infection (RR 0.98; 95% CI: 0.81–1.18; $P = 0.84$; $I^2 = 0\%$; Fig. 5a), peri-prosthetic fracture (RR 0.80; 95% CI: 0.48–1.31; $P = 0.38$; $I^2 = 0\%$; Fig. 5b), mortality (RR 1.54; 95% CI: 0.93 to 2.56; $P = 0.08$; $I^2 = 42\%$; Fig. 5c) and quality of life (MD 0.05; 95% CI: − 4.06 to 4.16; $P = 0.984$; $I^2 = 28\%$; Fig. 5d) outcomes.

Subgroup analysis

We performed a sensitivity analysis stratified by study design. We found significantly lower rates for the DM group in the observational subgroups for dislocation (RR 0.47; 95% CI 0.34–0.65; $P < 0.001$; I^2:0; Fig. 1) and heterotopic ossification (RR 1.93; 95% CI 1.19–3.15; $P < 0.05$; I^2:0%; Fig. 3). However, these results were not significant in the randomized subgroup for dislocation and heterotopic ossification.

Meta-regression

We analyzed data from multiple studies to assess whether the dislocation outcome influences the relationship with the posterior surgical approach across studies. Our meta-regression analysis showed no statistically significant association between the covariates and the pooled effect size. These findings suggest that the posterior approach was not a significant predictor of dislocation, with a regression coefficient of 0.23 (95% CI: − 2.94 to 0.72; $p = 0.72$), implying that other unmeasured factors may contribute to the variability in the effect size, as shown in Supplementary Fig. 2.

Trial sequential analysis (TSA)

Considering our main outcome, we performed a TSA for the dislocation endpoint. While our analysis did not meet the required information size (RIS) calculated for 4,639 patients, the cumulative Z-curve crossed the superior monitoring boundary. This indicates that the effect of DM is statistically significant for lower rates of dislocation, with sufficient evidence to conclude a benefit without the need for further observational trials in this specific *PICOTT* (Supplementary Fig. 3). Still, more RCTs are needed to confirm these findings at the level of causality.

Quality assessment and publication bias

The GRADE evaluation for various clinical outcomes revealed high-quality evidence from both randomized controlled trials (RCTs) and non-randomized studies of interventions (NRSI) in several domains: (1) dislocation (12 studies), (2) revision rates (8 studies), (3) heterotopic ossification (3 studies), and (4) infection (3 studies). (5) Mortality data, however, were of low quality, based on 4 NRSI studies, indicating significant limitations. (6) Functional outcomes measured by the Western Ontario and McMaster Universities Osteoarthritis Index (*WOMAC*) or the Harris Hip Score (*HHS*) demonstrated a contrast in evidence quality [40, 41]; studies assessing functional scores at 12 months had very low-quality evidence, whereas those at 6–9 months provided high-quality evidence. These findings highlight a strong evidence base for certain clinical outcomes, with variability in the quality of evidence for functional measures and mortality, as demonstrated in Supplementary Fig. 4.

The Rob2 evaluation indicated a low risk of bias for studies by Griffin et al. [35], Pahamfar et al. [34], and Rashed et al. [30] (Supplementary Fig. 5a). In the ROBINS-I assessment, studies by Achudan et al. [27], Cnudde et al. [32], and Hoggett et al. [36] showed some concerns in Domains D1, D2, and D5, while Hoskins et al. [28] showed concerns in Domain D1. Conversely, studies by Rashed et al. [35], Rogmark et al. [37], Sadozai et al. [33], Alberio et al. [39], Agarwala et al. [29] and Tarasevicius et al. [38] demonstrated a low risk of bias, as illustrated in Supplementary Fig. 5b.

We found evidence of a small study effect in our meta-analysis. Our assessment with Egger's test showed the presence of funnel plot asymmetry, which may indicate significant publication bias ($p = 0.018$), as illustrated in Supplementary Fig. 6. The Egger's test showed the presence of funnel plot asymmetry, which indicates significant publication bias ($p = 0.018$; 95% CI: − 1.47 to − 0.41).

Discussion

In this systematic review and meta-analysis, we included 3 RCTs and 10 observational studies comprising a total of 2121,585 patients, of which 4887 underwent dual-mobility (DM) repair and 16,698 underwent conventional total hip arthroplasty (c-THA). Although DM demonstrated a significant advantage over THA in reducing the incidence of posterior dislocation, it was associated with a higher incidence of heterotopic ossification. Functional score analysis revealed no difference between groups at 3 and 12 months, with the DM showing inferior results at 6–9 months. We found no

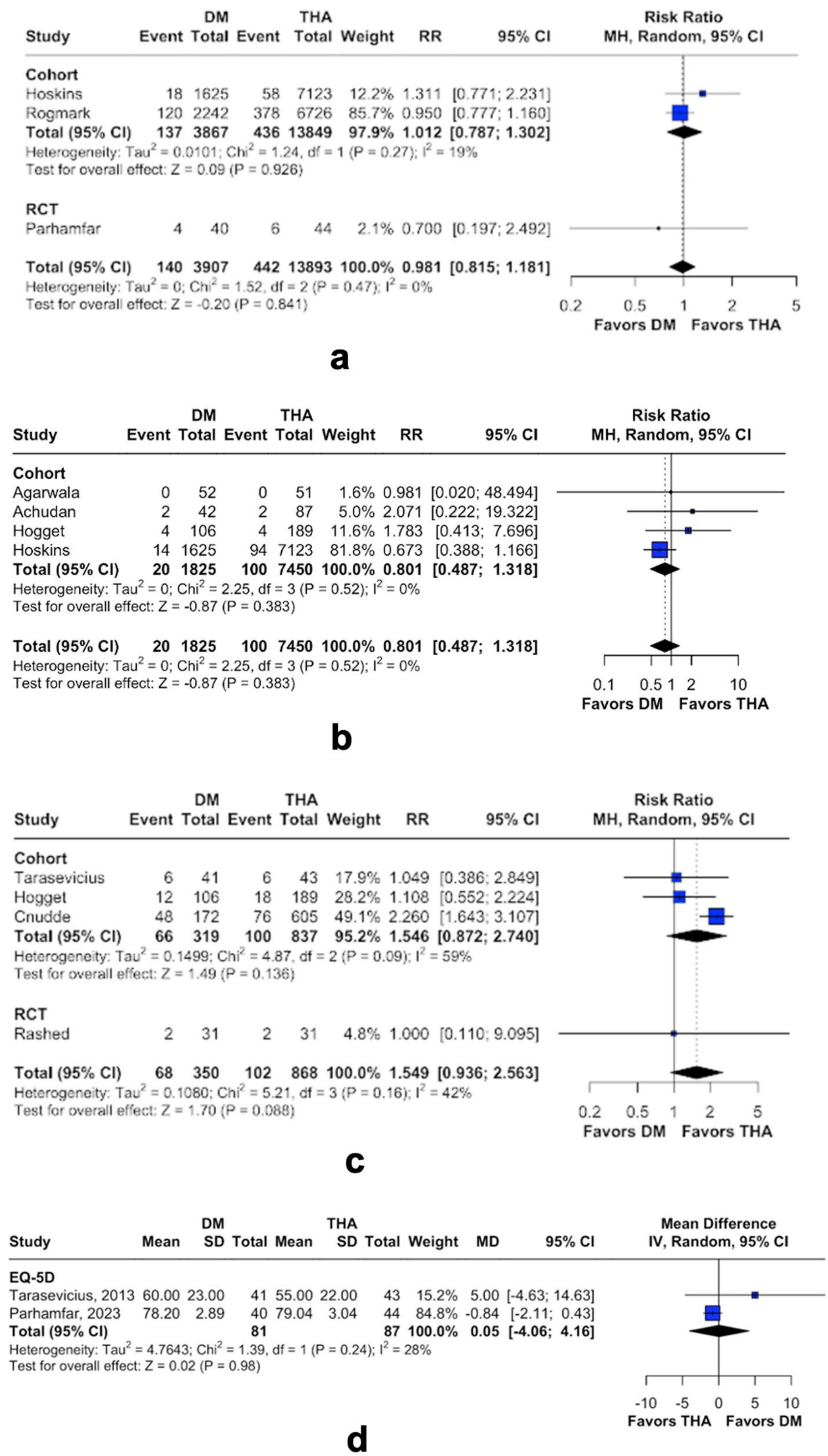

Fig. 5 Forest plots comparing outcomes between dual mobility (DM) and total hip arthroplasty (THA) for **a** Infection, **b** Peri-prosthetic fracture, **c** Mortality, and **d** Quality of life

difference in revision and infection rates between groups or quality of life measures.

Whilst c-THA is widely regarded as one of the safest and most effective orthopaedic procedures, dislocation remains a significant complication, with an estimated rate to range between 0.2 and 10% annually [42, 43]. To address the issue of instability following THA, DM cups were developed by employing a dual articulation mechanism consisting of a smaller inner bearing and a larger outer bearing designed to enhance joint stability [44, 45]. A recent meta-analysis has demonstrated that DM cups significantly reduce the risk of instability and dislocation, regardless of the surgical approach used [46–48]. These findings are consistent with our results, which showed a reduced rate of dislocation with DM in a significantly larger sample size, likely attributed to the superior stability provided by the dual articulation mechanism. Furthermore, our meta-regression analysis confirmed that the posterior approach did not influence the dislocation outcome, underscoring the robust effect of DM implants on joint stability across a bigger number of studies.

On the other hand, hip arthroplasty is a well-recognized risk factor for HO, as the trauma inflicted on soft tissues during surgery accelerates this pathological process [49–51]. There is ongoing debate regarding whether different surgical approaches—such as the direct lateral, posterolateral, and anterolateral—result in varying rates of HO [52, 53]. Additionally, available data suggest that DM cups may be associated with a higher risk of HO, although evidence remains limited [30]. Our meta-analysis, which included three studies reporting this outcome, demonstrated an increased incidence of HO with DM implants, which is similar to what we find in clinical practice. This may be attributed to the larger implant size of DM cups, which necessitates additional manipulation during surgery, as well as the greater range of motion they provide.

Periprosthetic joint infection (PJI) remains a serious and undesirable complication following total hip arthroplasty [54]. Even considering the occurrence of PIJ as a potential risk in joint reconstruction with or without dual mobility, our study did not find an increased risk of PJI with DM implants compared to c-THA, likely because infection risk is more heavily influenced by sterility and surgical technique rather than implant type. Dislocation, heterotopic ossification, and infection are among the leading causes necessitating revision surgery. Although revision surgery is typically considered a last resort due to its technical challenges, high cost, and significant impact on a patient's quality of life, it remains a critical option when standard treatments fail to address infections or mechanical complications. This is particularly relevant in cases of PJI requiring revision [55]. Our findings indicated a lower risk of revision surgery, aligning with the results of the meta-analysis by Mufarrih et al. [48], which compared dual mobility cups to hemiarthroplasty.

Studies have reported improved quality of life and functional outcomes, such as higher Harris Hip Scores, in patients with DM cups [56, 57]. Additionally, one study highlighted better functional outcomes, specifically in patients with failed internal fixation of a proximal femoral fracture who underwent revision surgery with DM implants [58]. The concept of dual mobility is centered on reducing the risk of prosthetic dislocation by providing a greater range of motion without compromising joint stability. However, our findings differ from the existing literature, as we observed improved functional scores in the c-THA group at 6–9 months follow-up. When analyzing the mortality register in the use of primary hip prostheses, we did not observe statistical significance when comparing the two prosthetic groups in our systematic review.

This study demonstrates several notable strengths. Independent screening, data extraction, and quality assessment by multiple reviewers, with a structured resolution process for discrepancies, enhanced the reliability and objectivity of the findings. Rigorous quality assessment tools, including RoB2, ROBINS-I, and GRADE, were employed to systematically evaluate the risk of bias and the strength of evidence. Statistical techniques, such as meta-regression, trial sequential analysis, and sensitivity analyses, were used to address heterogeneity, explore the influence of study-level factors, and assess the robustness of the results. At the end of the analysis of the results, the data from this systematic review corroborate the findings in clinical practice, as there is a lower number of dislocation events and surgical revision rate in the DM group.

A significant limitation of our meta-analysis is the strong evidence of publication bias, as indicated by the asymmetry observed in the funnel plot for dislocation, supported by Egger's test results. These discrepancies pose challenges in ensuring study comparability and may limit the generalizability of our findings to broader populations. Additionally, the lack of a statistically significant association between covariates and the pooled effect size in the meta-regression further highlights that the tested covariates do not account for the observed heterogeneity. This implies that other unmeasured or confounding factors could be contributing to the variability, complicating the interpretation of the results. These limitations emphasize the need for cautious interpretation and suggest the necessity of further subgroup or sensitivity analyses to explore the sources of heterogeneity and enhance the robustness of our findings.

Finally, while we advocate for an individualized approach to patients with FNF, the lack of detailed demographic data in each study presents a limitation, hindering our ability to stratify recommendations effectively.

Conclusion

Our findings indicate that while DM implants demonstrate better efficacy in reducing dislocations and revision rates, this benefit comes at the expense of higher adverse events and without significant impact on the quality of life. Specifically, the DM approach is associated with increased rates of heterotopic ossification and lower functional hip scores compared to c-THA. Given the substantial financial costs associated with DM implants, we advocate for a more individualized approach when selecting the surgical method. Using a subgroup for a posterior approach to the dislocation outcome in more studies could allow better analysis with meta-regression. Further large-scale, randomized clinical trials with a larger number of patients and extended follow-ups are essential to understand better the long-term survival, safety, and feasibility of DM implants in the management of femoral neck fractures.

Abbreviations

CI	Confidence interval
c-THA	Conventional total hip arthroplasty
Cochrane	Cochrane central register of controlled trials
DM	Dual mobility
EQ-5D	EuroQoL five-dimension
FNF	Femoral neck fractures
GRADE	Grading of recommendations, assessment, development, and evaluations
HHS	Harris hip score
HRT	Hormone replacement therapy
I^2	I-squared
MD	Mean difference
PICOTT	Population, intervention, control group, outcome, type of study, time of follow-up
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
PROSPERO	International prospective register of systematic reviews and clinical trials
RCT	Randomized controlled trial
ROBINS-I	Risk of bias in non-randomized studies of interventions
RoB2	Risk of bias 2
RR	Relative risk
SF-36	Short form health survey 36
SMD	Standardized mean difference
TSA	Trial sequential analysis
THA	Total hip arthroplasty
WOMAC	Western Ontario and McMaster Universities Osteoarthritis index

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13018-025-05764-6.

Below is the link to the electronic supplementary material.Supplementary file1 (DOCX 751 KB)

Supplementary file2 (DOCX 9 KB)

Acknowledgements

The authors would like to thank the research sector of the health sciences program at the Federal University of Sergipe for providing access to the databases for the literature review. We also recognize the important role of the senior advisor, Rosana Cipolotti, in the final evaluation of the manuscript.

Author contributions

Conceptualization was performed by M.S.S., F.A., F.J.A., and R.C. Methodology was developed by M.S.S., F.A., F.J.A., J.M.S.N., M.V.V.M.P.S., and R.C. Formal analysis and investigation were conducted by M.S.S., F.A., F.J.A., J.M.S.N., M.V.V.M.P.S., R.E.T.T.A.M., and R.C. Writing of the original draft was carried out by M.S.S., F.A., and F.J.A., while review and editing were conducted by M.S.S., F.A., F.J.A., J.M.S.N., S.D., M.A.K., Z.A., F.V.Z., R.E.T.T.A.M., A.L.D.D., M.M.F., L.C.L., E.S.P., D.T.S., and R.C. Visualization was contributed by M.S.S., F.A., F.J.A., F.V.Z., and M.M.F. Supervision was provided by F.J.A., R.E.T.T.A.M., A.L.D.D., M.M.F., and R.C. Project administration was undertaken by M.S.S., F.A., F.J.A., and R.C. All authors have read and approved the final version of the manuscript.

Funding

This research received no external funding.

Availability of data and materials

All data supporting the findings of this study are included in the manuscript.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Obtained from all authors.

Competing interests

The authors declare no competing interests.

Author details

[1]Health Sciences Graduate Program, Federal University of Sergipe, St. Cláudio Batista s/nº Bairro: Sanatório to Aracaju, Aracaju, SE CEP: 49.060-110, Brazil. [2]College of Medicine, Mohammed Bin Rashid University of Medicine and Health Sciences, Dubai, UAE. [3]Federal University of Sergipe, Aracaju, Brazil. [4]Department of Medicine, Rio de Janeiro State University, Rio de Janeiro, Brazil. [5]Sports Department, Faculty of Physical Activity and Sports Science - INEF, Universidad Politécnica de Madrid, España, Madrid, Spain. [6]Facultad de Ciencias de la Salud, Universidad Francisco de Vitoria, Madrid, España, Madrid, Spain. [7]Catholic University of Brasilia, Brasília, Brazil. [8]Ribeirao Preto Medical School, University of Sao Paulo, Sao Paulo, Brazil. [9]Tiradentes University, Aracaju, SE, Brazil. [10]Department of Physical Education, Federal University of Sergipe, São Cristóvão, Brazil. [11]Department of Medicine, Federal University of Sergipe, Aracaju, Brazil.

Received: 21 January 2025 Accepted: 26 March 2025
Published online: 23 April 2025

References

1. Veronese N, Maggi S. Epidemiology and social costs of hip fracture. Injury. 2018;49(8):1458–60.
2. Luo S, et al. Total hip arthroplasty versus hemiarthroplasty in the treatment of active elderly patients over 75 years with displaced femoral neck fractures: a retrospective study. BMC Musculoskelet Disord. 2023;24(1):745.
3. Florschutz AV, et al. Femoral neck fractures: current management. J Orthop Trauma. 2015;29:121.
4. Randelli F, et al. Femoral neck fractures: key points to consider for fixation or replacement a narrative review of recent literature. Injury. 2021;54:S70–7.

5. Albanese KM, et al. Dual-mobility articulations in femoral neck fractures: a systematic review of the literature and meta-analysis of the outcomes. J Am Acad Orthop Surg. 2021;29(12):e618–27.
6. Tigani D, et al. Use of dual-mobility cup in primary total hip arthroplasties: an Italian regional register (RIPO) study on three thousand, seven hundred and ten cases. Int Orthop. 2023;47(1):99–106.
7. Vielpeau C, et al. The dual mobility socket concept: experience with 668 cases. Int Orthop. 2011;35(2):225–30.
8. Kim YT, et al. Dual mobility hip arthroplasty provides better outcomes compared to hemiarthroplasty for displaced femoral neck fractures: a retrospective comparative clinical study. Int Orthop. 2018;42(6):1241–6.
9. Rowan FE, et al. Dual-mobility vs fixed-bearing total hip arthroplasty in patients under 55 years of age: a single-institution. Matched-Cohort Anal J Arthroplast. 2017;32(10):3076–81.
10. Montgomery S, et al. Cost-effectiveness of dual-mobility components in patients with displaced femoral neck fractures. Bone Joint J. 2021;103-B(12):1783–90.
11. Barlow BT, McLawhorn AS, Westrich GH. The cost-effectiveness of dual mobility implants for primary total hip arthroplasty. J Bone Joint Surg. 2017;99(9):768–77.
12. Hutton B, et al. The PRISMA extension statement for reporting of systematic reviews incorporating network meta-analyses of health care interventions: checklist and explanations. Ann Intern Med. 2015;162(11):777–84.
13. Page MJ, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71.
14. Liberati A, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. J Clin Epidemiol. 2009;62(10):e1-34.
15. Borenstein M, et al. A basic introduction to fixed-effect and random-effects models for meta-analysis. Res Synth Methods. 2010;1(2):97–111.
16. Egger M, et al. Bias in meta-analysis detected by a simple, graphical test. BMJ. 1997;315:629–34.
17. Duval S, Tweedie R. Trim and fill: a simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. Biometrics. 2000;56:455–63.
18. Palmer TM, et al. Contour-enhanced funnel plots for meta-analysis. The Stata J: Promot Commun Stat Stata. 2018;8(2):242–54.
19. Geissbuhler M, et al. Most published meta-regression analyses based on aggregate data suffer from methodological pitfalls: a meta-epidemiological study. BMC Med Res Methodol. 2021;21(1):123.
20. Thorlund, K., et al., Thorlund K, Engstrøm J, Wetterslev J, Brok J, Imberger G, Gluud C. User manual for trial sequential analysis (TSA) [Internet]. 2017. [Internet], (2017).
21. Darrith B, Courtney PM, Della Valle CJ. Outcomes of dual mobility components in total hip arthroplasty: a systematic review of the literature. Bone Joint J. 2018;100-B(1):11–9.
22. Sterne JA, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ. 2016;355:i4919.
23. McGuinness LA, Higgins JPT. Risk-of-bias VISualization (robvis): An R package and Shiny web app for visualizing risk-of-bias assessments. Res Syn Meth. 2020;12:1–7.
24. Mercuri M, Gafai A. The evolution of GRADE (part 3): a framework built on science or faith? J Eval Clin Pract. 2018;24(5):1223–31.
25. Higgins JPT et al., Cochrane handbook for systematic reviews of interventions version 6.5 (updated August 2024). Cochrane (2024).
26. Sterne JAC, Egger M. Funnel plots for detecting bias in meta-analysis: Guidelines on choice of axis. J Clinical Epidemiology. 2001;54(10):1046–55.
27. Achudan S, et al. Comparing outcomes of total hip arthroplasty for displaced neck of femur fractures in elderly patients utilizing dual mobility cups and conventional implants: a single center retrospective study of 129 Patients. indian J Orthop. 2023;57(1):62–70.
28. Hoskins W, et al. THA for a fractured femoral neck: comparing the revision and dislocation rates of standard-head, large-head, dual-mobility, and constrained liners. Clin Orthop Relat Res. 2021;479(1):72–81.
29. Agarwala S, et al. Superior functional outcome with dual mobility THR as compared to conventional THR in fracture neck femur: a prospective cohort study. SICOT J. 2021;7:42.
30. Rashed RA, et al. Is dual mobility cup total hip replacement associated with increased incidence of heterotopic ossification compared to conventional total hip replacements in fracture neck of femur patients? Injury. 2020;51(11):2676–81.
31. Rashed RAM, et al. Comparison of functional outcome of cemented total hip replacement versus cemented dual-mobility cup total hip replacement for the management of displaced femoral neck fractures in the active elderly patients. HIP Int. 2020;31:1–8.
32. Cnudde PHJ, et al. Total, hemi, or dual-mobility arthroplasty for the treatment of femoral neck fractures in patients with neurological disease : analysis of 9,638 patients from the Swedish Hip Arthroplasty Register. Bone Joint J. 2022;104-B(1):134–41.
33. Sadozai Z, et al. Dual mobility versus unipolar total hip arthroplasty for neck of femur fractures :a single centre study. Acta Orthop Belg. 2021;87:35–9.
34. Parhamfar M, et al. Evaluating the effectiveness of conventional prostheses against dual-mobility prostheses in the treatment of femoral neck fractures in two separate groups of patients: a clinical trial study. Adv Biomed Res. 2023;12:228.
35. Griffin XL, et al. A randomised feasibility study comparing total hip arthroplasty with and without dual mobility acetabular component in the treatment of displaced intracapsular fractures of the proximal femur: The Warwick Hip Trauma Evaluation Two: WHiTE Two. Bone Joint J. 2016;98-B(11):1431–5.
36. Hoggett L, et al. Post-operative complications following total hip arthroplasty for trauma: a multicentre cohort study comparing dual mobility with conventional acetabular bearings. J Orthop. 2023;40:34–7.
37. Rogmark C, Naucler E. Dual mobility cups do not reduce the revision risk for patients with acute femoral neck fracture: a matched cohort study from the Swedish arthroplasty register. Injury. 2022;53(2):620–5.
38. Tarasevicius S, et al. A comparison of outcomes and dislocation rates using dual articulation cups and THA for intracapsular femoral neck fractures. Hip Int. 2013;23(1):22–6.
39. Alberio RL, et al. Total hip arthroplasty (THA) for femoral neck fractures: comparison between standard and dual mobility implants. Geriatrics (Basel). 2021;6(3):70.
40. Bellamy N, et al. Validation study of WOMAC: a health status instrument for 933 measuring clinically important patient relevant outcomes to 934 antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. J Rheumatol. 1988;15:1833–40.
41. Guimarães R, et al. Translation and cultural adaptation of the Harris Hip Score into portuguese. Acta Ortop Bras. 2010;18(3):142–7.
42. Dargel J, et al. Dislocation following total hip replacement. *REVIEW ARTICLE*. Dtsch Arztebl Int. 2014;111:884–90.
43. Charissoux JL, Asloum Y, Marcheix PS. Surgical management of recurrent dislocation after total hip arthroplasty. Orthop Traumatol Surg Res. 2014;100(1 Suppl):S25-34.
44. Philippot R, et al. The use of a dual-articulation acetabular cup system to prevent dislocation after primary total hip arthroplasty: analysis of 384 cases at a mean follow-up of 15 years. Int Orthop. 2009;33(4):927–32.
45. Patil N, et al. Dual mobility in total hip arthroplasty: biomechanics, indications and complications-current concepts. Indian J Orthop. 2021;55(5):1202–7.
46. De Martino I, et al. Dislocation following total hip arthroplasty using dual mobility acetabular components: a systematic review. Bone Joint J. 2017;99-B(ASuppl1):18–24.
47. Butler JT, et al. Comparing dislocation rates by approach following elective primary dual mobility total hip arthroplasty: a systematic review. J Orthop Surg Res. 2023;18(1):226.
48. Mufarrih SH, et al. Outcomes of total hip arthroplasty using dualmobility cups for femoral neck fractures: a systematic review and meta-analysis. HIP Int. 2020;31:1–12.
49. Purcell KF, Lachiewicz PF. Heterotopic ossification after modern total hip arthroplasty: predisposing factors, prophylaxis, and surgical treatment. J Am Acad Orthop Surg. 2023;31(10):490–6.
50. Balboni TA, Gobezie R, Mamon HJ. Heterotopic ossification: pathophysiology, clinical features, and the role of radiotherapy for prophylaxis. Int J Radiat Oncol Biol Phys. 2006;65(5):1289–99.
51. Xu Y, et al. Heterotopic ossification: clinical features, basic researches, and mechanical stimulations. Front Cell Dev Biol. 2022;10:770931.
52. Legosz P, et al. Heterotopic ossification and clinical results after total hip arthroplasty using the anterior minimally invasive and anterolateral approaches. Arch Med Sci. 2020;16(3):613–20.

53. Olivero M, et al. Heterotopic ossification following total hip arthroplasty. Which is the predominant risk factor: surgical approach or post-operative prophylaxis? Int Orthop. 2024;48:2853–61.
54. Senthi S, Munro JT, Pitto RP. Infection in total hip replacement: meta-analysis. Int Orthop. 2011;35(2):253–60.
55. Motomura G, et al. Contemporary indications for first-time revision surgery after primary cementless total hip arthroplasty with emphasis on early failures. J Orthop Surg Res. 2021;16(1):140.
56. Rashed RA, et al. Functional outcome and health related quality of life after dual mobility cup total hip replacement for displaced femoral neck fractures in middle aged Egyptian patients. Injury. 2018;49(3):667–72.
57. Uriarte I, et al. Dual-mobility cups in total hip arthroplasty after femoral neck fractures: a retrospective study comparing outcomes between cemented and cementless fixation. Injury. 2021;52(6):1467–72.
58. Assi C, et al. Outcomes of total hip arthroplasty using dual mobility cups following failed internal fixation of proximal femoral fractures at a mean follow-up of 6 years. SICOT J. 2024;10:3.

Publisher's Note