Outcome of Dual Mobility in Primary Total Hip Arthroplasty

Abstract

Introduction: Dual mobility (DM) implants have been increasingly adopted in total hip arthroplasty (THA) to reduce the risk of postoperative instability. However, evidence comparing DM and conventional THA in Middle Eastern populations remains limited.

Materials & Methods: In a retrospective case-control study the patients who had undergone primary unilateral THA in one year at two major medical centers were evaluated. The case-group received DM implants, and the control- group had conventional THA. Within a one-year follow-up, the pain (Numeric Rating Scale), hip function (Harris Hip Score), and quality of life (EQ-5D), and Postoperative complications were compared.

Results & Discussion: The 86 patients studied included 42 DM and 44 conventional THA cases. Both groups experienced significant improvement in pain, function, and quality of life at one-year follow-up. The DM group demonstrated greater improvements in EQ-5D scores and higher postoperative HHS compared to the conventional group. The only dislocation (4.6%) in the conventional-group had no statistically significance. Other postoperative complications, including infection and DVT, were comparable between the groups.

Conclusion: DM hip arthroplasty was associated with more favorable postoperative functional recovery and quality of life outcomes, without a significant increase in complications, in short-term follow-up. These findings support the broader application of DM implants in primary THA, although further prospective studies are needed to assess the long-term outcomes and also cost-effectiveness.

Keywords: Total Hip Arthroplasty, Hip Prosthesis, Treatment Outcome

Accepted: 42 days before printing

Mehdi Hadian, MD[1], Mehdi Motififard, MD[1], Alireza Assadi, MD[2], Maryam Karimi, MD[2], Mohammad Parhamfar, MD[1]

1. Department of Orthopaedic Surgery, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran
2. MD, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

Corresponding Author:
Mohammad Parhamfar, MD
Email:
Parhamfar@med.mui.ac.ir

Introduction

Total hip arthroplasty (THA) is widely recognized as a highly effective and economically efficient intervention for managing advanced hip joint disorders, offering substantial improvements in pain and mobility.[1, 2] Despite its success, postoperative instability remains a significant complication, especially among younger individuals or those at elevated risk, with reported dislocation rates ranging from 1% to 6%.[1] Dislocation is a leading contributor to early failure of THA and often necessitates revision surgery.[3] To address this issue, various surgical approaches and implant designs have been developed.[4] One such innovation is the dual mobility (DM) prosthesis, first introduced in 1974, which enhances stability by increasing the jump distance and minimizing impingement.[5] This design has emerged as a key strategy for both preventing and managing hip instability following arthroplasty.[1, 5, 6] Multiple studies and reviews have confirmed the stability benefit of DM implants in primary and revision THA.[7-13] Jones et al. reported that among 151 of their study patients who were considered high risk for dislocation, only one of them sustained intra-prosthetic dislocation.[7] Darrith et al. demonstrated that THA utilizing DM implants is associated with remarkably low rates of instability and outstanding long-term durability, with prosthesis survivorship exceeding 98% over an 8 to 16-year follow-up period.[10] In concordance with these findings, a recent analysis reported implant survival rates ranging from 96% to 98% at 10 to 15 years postoperatively, with dislocation and intra prosthetic dislocation occurring in only a negligible proportion of cases.[13] Notably, outcomes in patients younger than 50 years were comparable to older patients, with no age-specific complications or elevated failure risk identified, suggesting that younger age does not compromise implant performance in DM constructs.[13]

Furthermore, recent meta-analyses comparing DM systems to conventional THA in the context of femoral neck fractures have confirmed a significant reduction in both dislocation and revision rates with the use of DM designs.[11] In short, the literature suggests that DM implants are an effective strategy to enhance hip stability without compromising implant survival.

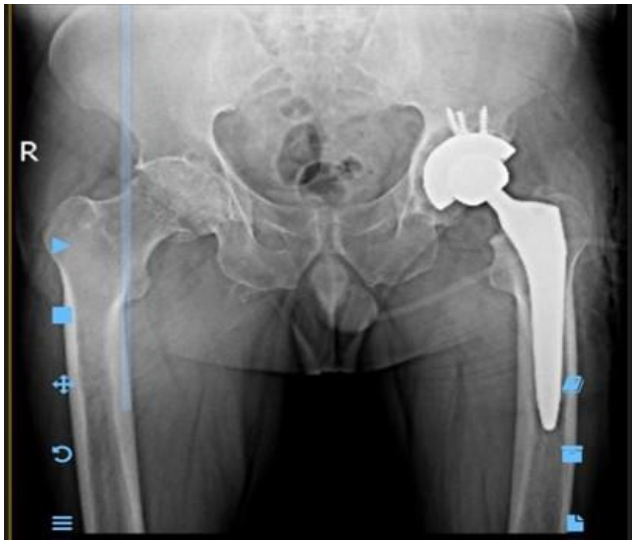

Figure 1: THA in 49y/o femail with sever DJD due to hip avascular necrosis

The use of DM is mostly used and studied on patients with high risk factors for dislocation (e.g., older patient age, spinopelvic pathology, neuro compromise, and revision cases) and its use as the primary treatment in THA in general population is still debated.[14-16] Also, although less common that conventional method several complications were reported in DM. including polyethylene wear, slightly reduced range of motion and higher initial costs, and more complex, revision surgery.[17, 18] What is more, dual mobility implants are not universally used. Data on their use in non-Western populations are limited, and the cost-effectiveness of DM THA can be debated. To our knowledge, there are few published studies of DM THA outcomes in Middle Eastern patients.[19] The patient demographics, activity levels, and healthcare resources in Iran may differ from Western cohorts, so it is important to evaluate the real-world results of DM THA locally.[8] The present study was undertaken to fill this gap. These results will help assess whether the favorable findings reported elsewhere hold true in Iranian community.

Materials & Methods

We conducted a retrospective comparative study (case-control design) of primary total hip arthroplasty patients. The case group consisted of patients who underwent THA with a dual mobility cup at two major medical centers in Isfahan, Iran, between 2021 and 2022. The control group underwent conventional THA in a similar timeframe. Ethical approval for the original data collection was obtained locally; the comparative analysis utilized published de-identified data for controls. All patients had surgery under general anesthesia using a direct lateral approach while lying laterally. The implant used in all cases was a first-generation dual mobility cup (SYMBOL, made by DEDIENNE SANTÉ, Nîmes, France). Clinical information was collected from medical records and follow-up records. Baseline demographics consisted of age, sex, body mass index (BMI), and disease duration. We recorded the primary presenting symptom (pain or limp) and whether intraoperative blood transfusion was required. Postoperative complications (infection, prosthesis dislocation, DVT, motion limitation) were noted through one year.

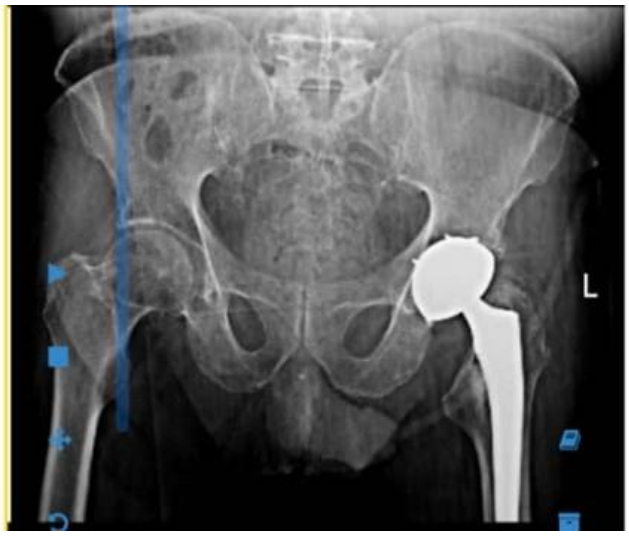

Figure 2: Dual Mobility arthroplasty in 61 y/o male with sever DjD due to hip avascular necrosis

The outcome measures were pain, hip function and quality of life. Pain was measured postoperatively (day 1) and at 6 and 12 months using the numeric rating scale (0=no pain and 10=worst pain). Hip function was also reported using the Harris Hip Score (HHS) pre-operatively and 1 year post-operatively; it ranges from 0-100 points and is a clinically valid scale measuring of pain and function.[20] The health-related quality of life was assessed using the Euroqol-5D.

We performed a retrospective analysis on all patients who had undergone unilateral THAs with a DM acetabular insert in major medical centers in Isfahan. Inclusion criteria were adults with hip disease

sufficiently severe to presage the need for THA; the specific ASI reasons for primary hip arthroplasties (e.g., OA, avascular necrosis) were consistent with typical hip arthroplasty indications.

Statistical Analysis

Following data collection, all statistical analyses were performed using IBM SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA). Descriptive statistics for continuous variables were reported as means, standard deviations, and medians, as appropriate. Group comparisons for normally distributed quantitative data were conducted using independent-samples t-tests. Categorical variables, expressed as frequencies and percentages, were compared using the Chi-square test. To evaluate differences between the dual mobility and conventional THA groups, various statistical tests were applied based on data distribution. These included independent t-tests for continuous variables, Wilcoxon signed-rank tests for paired data, and the Mann–Whitney U test for non-normally distributed outcomes such as dislocation rates and modified Harris Hip Scores (HHS). A two-tailed p-value of <0.05 was considered indicative of statistical significance in all comparisons.

Results

A total of 86 patients were analyzed, including 42 who underwent dual mobility (DM) THA and 44 who received conventional THA. (Figure 1, figure 2) The groups were comparable in age (63.1 ± 2.8 vs. 64.1 ± 2.8; p=0.072), BMI (25.8 ± 3.7 vs. 27.1 ± 2.5; p=0.061), and sex distribution (52.4% vs. 45.5% male; p=0.666). Pain was more commonly reported as the initial symptom in the conventional group (97.7% vs. 78.6%; p=0.015). Transfusion rates were similar (13.6% vs. 7.1%; p=0.485). No postoperative infections occurred (p=1.000), and prosthesis dislocation was observed only in one conventional case (p=1.000). One DVT occurred in the DM group (p=0.488).

Table 2 presents the comparison of pain intensity and Harris Hip Scores (HHS) between the two groups. Pain scores decreased in both groups over time, with the DM group consistently showing lower scores at each timepoint. Immediately post-operation, the mean pain score was 5.57 ± 1.19 in the DM group versus 5.9 ± 1.3 in the conventional group (p=0.084). At six months, scores declined to 1.43 ± 0.91 and 2.1 ± 1.0, respectively (p=0.095), and at one year to 0.38 ± 0.62 vs. 1.2 ± 0.9 (p=0.108). Although none of these differences reached statistical significance, a consistent trend favored the DM group. Preoperative HHS values were similar between groups (67.67 ± 15.31 vs. 68.2 ± 14.9; p=0.873). At one-year post-op, the DM group achieved a higher mean HHS (92.98 ± 4.06) compared to the conventional group (89.8 ± 5.3; p=0.062), suggesting slightly better functional outcomes.

Table 2: Pain and Harris Hip Scores (HHS) before and after surgery

Variable	Timepoint	Dual Mobility THA	Conventional THA	P-value
Pain Score	Immediately post-operation	5.57±1.19	5.9±1.3	0.084
	6 months after operation	1.43±0.91	2.1±1.0	0.095
	1 year after operation	0.38±0.62	1.2±0.9	0.108
HHS	Pre-operation	67.67±15.31	68.2±14.9	0.873
	Post-operation	92.98±4.06	89.8±5.3	0.062

Table 3 presents the distribution of EQ-5D dimension scores before and after surgery in both groups. Prior to surgery, most patients in both the DM and conventional THA groups reported moderate to severe limitations across the five dimensions. Following surgery, a marked improvement was observed, particularly in the DM group. In the DM group, the total EQ-5D score improved from –8.3 ± 1.69 before surgery to –4.11 ± 1.94 after surgery, and the mean score per dimension changed from –1.18 ± 0.38 to –0.82 ± 0.18. The median (IQR) scores shifted from –0.1 (–0.60, 0) to 0.8 (0.75, 1.00). In the conventional THA group, the total score improved from –9.5 ± 2.1 to –5.9 ± 2.9, and the mean score per dimension improved from –1.7 ± 0.22 to –0.39 ± 0.5. Median (IQR) scores changed from –1.9 (1.6, 2.2) before surgery to –0.5 (0.0, 1.0) after surgery. These findings indicate greater improvement across EQ-5D dimensions in the DM group compared to the conventional group, although both groups experienced substantial postoperative gains in health-related quality of life.

Table 3: EQ-5D dimension distribution before and after surgery (DM)									
Before					after				
Mobility	Self-care	Usual activity	Pain	depression	Mobility	Self-care	Usual activity	Pain	depression
2(4.8)	19(45.2)	1(2.4)	0(0)	5(11.9)	36(85.7)	42(100)	34(81)	29(69)	32(76.2)
34(81.0)	10(23.8)	23(54.8)	20(47.6)	30(71.4)	6(14.3)	0(0)	8(19)	13(31)	10(23.8)
6(14.3)	13(31.0)	18(42.9)	22(52.4)	7(16.7)	0(0)	0(0)	0(0)	0(0)	0(0)
Mean± SD=-8.3±1.69 Median, IQR=-.50(-2, 0)					Mean±SD=-4.11±1.94 Median, IQR=4(3.75, 5)				
Mean±SD=-1.18±0.38 Median, IQR=-0.1(-.60, 0)					Mean±SD=-0.82±0.18 Median, IQR=0.8(0.75, 1.00)				
Conventional									
2(4.5)	3(6.8)	1(2.3)	0(0)	2(4.5)	22(50)	30(68.2)	25(56.8)	18(40.9)	19(38.6)
35(79.5)	11(25)	25(56.8)	20(45.5)	19(43.2)	18(40.9)	12(27.3)	15(34.1)	20(45.5)	19(43.2)
7(15.9)	30(68.2)	18(40.9)	24(54.5)	23(53.2)	4(9.1)	2(4.5)	4(9.1)	6(13.6)	8(18.2)
Mean±SD=-9.5±2.1 Median, IQR=8(5, 9)					Mean±SD=-5.9 ±.2.9 Median, IQR=2.5(0, 5)				
Mean±SD=-1.7±0.22 Median, IQR=-1.6(1.0, 1.8)					Mean±SD=-0.39±0.5 Median, IQR=-0.5(0.0, 1.0)				

Discussion

This retrospective comparative study demonstrated that both dual mobility (DM) and conventional total hip arthroplasty (THA) significantly improved patients' postoperative outcomes in terms of pain, function, and health-related quality of life. Although both groups benefited from surgery, the DM group exhibited more favorable improvements across EQ-5D dimensions and a greater reduction in mean pain and disability scores. Notably, the dislocation rate was low overall, and the difference between groups was not statistically significant.

Our findings are consistent with existing literature suggesting that DM implants provide superior joint stability and are associated with lower dislocation risk. While conventional THA remains a highly effective intervention, dislocation remains a known complication, with annual rates ranging from 0.2% to 10%.[21]The DM construct, through its dual articulation mechanism, was designed to address this issue by enhancing prosthetic stability.[1] DM prostheses are typically indicated in populations at elevated risk for postoperative instability, including elderly individuals, those with neuromuscular disorders, a prior history of hip procedures, revision arthroplasty, femoral neck fractures, or tumor resections.[19] While previous research has predominantly concentrated on elderly patients[13, 19]—frequently those over 70 years of age—our study intentionally broadened the inclusion criteria to encompass patients across a wider age spectrum. This approach aimed to provide a more comprehensive assessment of DM and conventional THA outcomes in a more heterogeneous population.

The positive outcomes observed in our study are in line with previous research highlighting the enhanced biomechanical stability and long-term reliability of DM implants.[10, 19, 22-24] Nevertheless, our findings also revealed similar rates of postoperative complications—such as infections and thromboembolic events—between the DM and conventional THA groups. Parhamfar et al. similarly

reported no significant differences between dual mobility and conventional THA in terms of functional scores (Harris Hip Score and SF-36) and postoperative infection in patients with femoral neck fractures. However, unlike our findings, their study identified a significantly higher rate of dislocation in the conventional group.[25] In our study, although dislocation was only observed in the conventional group, the difference was not statistically significant. A recent systematic review and meta-analysis incorporating three randomized controlled trials and ten cohort studies—with a combined sample of 21,585 patients—found that DM implants were associated with reduced rates of dislocation and revision. However, the analysis also reported a inferior functional outcomes at six to nine months postoperatively in contrast to our findings.[11] Similarly, in a retrospective cohort study conducted at a single tertiary care center between January 2015 and May 2020, data from 129 patients revealed no instances of dislocation in the DM group, whereas the conventional THA group experienced four dislocations (4.6%).[26] In terms of postoperative function, both cohorts demonstrated comparable outcomes, with no statistically significant differences observed in patient-reported measures, including the Oxford Hip Score and SF-36, at both six-month and one-year follow-ups.[26]

A notable strength of our study lies in its focus on Iranian patient population, which remains underrepresented in the current literature, particularly when compared to Western cohorts. In one of the few investigations centered on the Middle Eastern population, Assi et al. reported no instances of instability, intra-prosthetic dislocation, or mechanical failure over a mean follow-up period of five years. The only major postoperative complication was a single case of infection, and the HHS achieved was 97.1.[19] More recently, Mozafari et al. documented a significant improvement in functional outcomes among high-risk patients—those with neuromuscular disorders and intracapsular femoral neck fractures—with mean HHS rising from 49 ± 8.5 preoperatively to 89 ± 2.4 at four-year follow-up.[8] These findings collectively suggest that DM implants confer substantial benefits in both general and high-risk populations, with consistently low dislocation rates and favorable functional recovery. These promising outcomes regarding implant stability and durability have led to broader indications and DMs are no longer limited to revision surgery or high risk patients.[12, 24] The Middle Eastern population presents unique functional demands following total hip arthroplasty, particularly due to cultural and religious practices that require deep hip flexion. Activities such as sitting cross-legged, using squat-style toilets, and kneeling during prayer are integral to daily life in this region and place substantial biomechanical demands on the hip joint.[19, 27] In alignment with our findings, Assi et al. reported that patients not only returned to occupational activities but also resumed culturally significant practices such as prayer and low sitting postures, expressing high levels of postoperative satisfaction.[19]

Table 1: Demographic and clinical characteristics of the patients

Variable		Dual Mobility THA (n=42)	Conventional THA (n=44)	P-value
Mean±SD/n(%)		63.08±2.8	64.1±2.8	0.072
Male/n(%)		22(52.4%)	20(45.5%)	0.666
(mean±std) BMI		25.81±3.74	27.1±2.5	0.061
Initial symptom	pain	33(78.6)	43(97.7%)	0.015
	limping	9(21.4)	1(2.3%)	
Intraoperative blood transfusion		3(7.1)	6(13.6%)	0.485
Postoperative infection		0(0)	0(0%)	1.000
Prosthesis dislocation		0(0)	1(2.3%)	1.000
Deep vein thrombosis		1(2.3%)	0(0%)	0.488

While the DM construct offers clear advantages in terms of stability and range of motion, existing literature also highlights potential drawbacks associated with its use.[23] These include concerns regarding polyethylene liner wear, which may contribute to aseptic loosening and, in rare cases, intra-prosthetic dislocation.[17, 23] However, none of these complications were observed in our study. Nevertheless, extended follow-up is necessary to determine the long-term safety and durability of DM implants with greater certainty. Another potential drawback of dual mobility implants is their higher cost compared to conventional THA. It remains uncertain whether the incremental clinical benefits they offer justify the added expense from a health economics perspective or translate into improved overall value for healthcare systems.[25]

This study has several strengths. This is one of the few comparative studies on DM versus conventional THA in a Middle Eastern population. Also, inclusion of real-world clinical data enhances generalizability. However, limitations must be acknowledged. Retrospective design may introduce selection bias. The follow-up was short (one year), so we cannot comment on longer-term issues like late aseptic loosening or intra prosthetic dislocation, which are rare but important over many years. Finally, as a

retrospective study, unmeasured confounders or selection biases could have influenced outcomes.

Both DM and conventional THA resulted in significant postoperative improvements in pain, function, and quality of life. The DM group demonstrated more favorable EQ-5D outcomes and lower observed dislocation rates, although differences in complications were not statistically significant. These findings suggest that DM implants may provide additional functional benefits without increasing complication risk. However, further prospective studies are warranted to assess long-term outcomes and cost-effectiveness in broader patient populations.

Conclusion

In this retrospective comparative study of an Iranian patient population, both dual mobility and conventional total hip arthroplasty resulted in substantial improvements in pain relief, hip function, and health-related quality of life at one-year follow-up. However, patients treated with dual mobility implants demonstrated more favorable gains in quality-of-life measures and slightly superior functional outcomes, without an associated increase in early postoperative complications. Although dislocation was observed only in the conventional THA group, the overall incidence of instability was low and did not reach statistical significance between groups.

These findings suggest that dual mobility cups may offer additional clinical benefits beyond stability alone, even in a broader primary THA population not limited to traditional high-risk categories. Importantly, this study adds evidence from a Middle Eastern cohort, addressing a notable gap in the literature and supporting the applicability of dual mobility constructs in populations with distinct cultural and functional demands

Given the retrospective design, limited sample size, and short-term follow-up, conclusions regarding long-term implant survivorship, polyethylene wear, and cost-effectiveness cannot be drawn. Prospective, randomized studies with extended follow-up are warranted to further define the role of dual mobility implants in primary total hip arthroplasty and to determine whether their clinical advantages justify broader routine use.

Acknowledgement

The current clinical trial study was financed by the IUMS Deputy Research, Isfahan, Iran. We appreciatively thank the Vice Chancellor for research, IUMS.

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