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Short-Term Functional Outcomes and Zero Dislocation with Dual-Mobility Cups in Primary Total Hip Arthroplasty: A Single-Surgeon Case Series in Young High-Risk Indian Patients

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ABSTRACT

Background: Dislocation is a leading cause of early revision after primary total hip replacement (THR), particularly in young high-risk patients from high-demand settings like India where extreme hip motions are common. Dual-mobility (DM) cups may mitigate this risk, but data on short-term outcomes in young Indian cohorts remain limited
Methods: We conducted a retrospective single-surgeon case series of 35 consecutive primary THRs using cementless DM cups at a tertiary centre in New Delhi, India. Inclusion criteria were elective primary THR for non-oncological indications with minimum one-year follow-up. Patients (mean age 45.8 ± 12.7 years; 20 males) had avascular necrosis (n=18), secondary osteoarthritis (n=14), or fracture neck femur (n=3). Outcomes included Harris Hip Score (HHS), complications, and radiographic parameters (acetabular inclination, loosening). Descriptive statistics were used.
Results: At mean follow-up of 12 ± 2 months, mean HHS improved from 45 ± 7 preoperatively to 88 ± 7. All patients were ambulatory and pain-free. Radiographically, mean acetabular inclination was 44.7° ± 10.6° (all within Lewinnek safe zone); no radiolucent lines, migration, or limb-length discrepancy >1 cm occurred. No dislocations, infections, aseptic loosening, or mechanical failures were recorded despite recognised instability risk factors.
Conclusions: Dual-mobility cups in primary THR for young high-risk Indian patients provided excellent short-term functional recovery and zero dislocation at one year, supporting their use in this demanding cohort when precise component positioning is achieved.

Keywords: Dual Mobility Cup; Total Hip Arthroplasty; Harris Hip Score; Dislocation; Avascular Necrosis; Orthopedic Procedures.

INTRODUCTION

Dislocation remains a leading cause of early revision after total hip replacement (THR), with reported rates of 2–5% in primary THR and up to 20% in high-risk groups such as those with neuromuscular disease, femoral neck fractures, or avascular necrosis. Dual-mobility (DM) cups, featuring a large-diameter femoral head within a mobile polyethylene liner, increase the effective head-neck ratio and jump distance, thereby enhancing stability and reducing

impingement risk without compromising range of motion. Systematic reviews and meta-analyses over the past 15 years have consistently demonstrated that DM constructs lower dislocation rates to 0.8–2.2% in primary THR and 1–4% in revisions, with good survivorship (90–98% at 5–10 years) and functional outcomes comparable to conventional bearings. These benefits are particularly pronounced in high-risk populations, including young patients and those with spinopelvic pathology or fracture neck of femur **[1,2,3,4,5,6]**.

In India, THR outcomes are influenced by unique patient demographics and cultural expectations. Patients are often younger at surgery (mean age 40–55 years for avascular necrosis) and demand resumption of squatting, cross-legged sitting, and floor-level activities, which challenge conventional bearing stability. Indian series report higher dislocation rates with standard THR in high-risk cases, prompting increased DM adoption. However, data on DM THR in young Indian cohorts with non-degenerative indications remain sparse, with most reports focusing on older fracture patients or revisions, and short-term follow-up predominating **[1,4,7,8]**.

This study addresses a key research gap: the short-term functional outcomes and stability of DM cups in primary THR performed by a single surgeon for a young, high-risk Indian population with avascular necrosis, secondary osteoarthritis, and post-traumatic pathology. The rationale is to provide real-world evidence from a high-demand setting to guide implant selection amid rising DM use in India. The novelty lies in its focus on a younger cohort (mean age <50 years), uniform technique, and systematic radiological/clinical assessment at one year, adding to limited Indian primary DM data. These findings have significance for surgeons managing young patients where instability could lead to early revision and functional limitation.

Research question: What are the short-term functional outcomes, radiological positioning, and complication rates (particularly dislocation) of dual-mobility cups in primary THR for high-risk young Indian patients?

METHODS

Study design and setting

This retrospective single-surgeon case series was conducted at Max Institute of Musculoskeletal Sciences and Orthopaedics, New Delhi, India. All primary total hip replacements using dual-mobility cups performed by the senior author were included. Informed consent was waived due to the retrospective nature and anonymised data analysis.

Participants

Consecutive adult patients undergoing elective primary THR with dual-mobility cups were included. Inclusion criteria were: age ≥18 years, primary THR for non-oncological indications, minimum one-year radiographic and clinical follow-up available, and complete preoperative and postoperative Harris Hip Score (HHS) documentation. Exclusion criteria included revision THR, pathological fractures, concomitant bilateral procedures, or incomplete records. Thirty-five hips in 35 patients met criteria, with diagnoses including avascular necrosis (n=18), secondary osteoarthritis (n=14), and fracture neck of femur (n=3).

Surgical technique

All procedures were performed by the senior surgeon using a lateral approach under spinal anaesthesia with routine anterior capsulorrhaphy. A cementless dual-mobility acetabular system (Bi-MENTUM Dual Mobility Cup]) was implanted, targeting 45° ± 10° inclination and 15° ± 5° anteversion, confirmed intraoperatively with fluoroscopy. A cementless femoral stem (CORAIL Hip System) with variable size femoral head was used in all cases. Limb lengths were equalised to within 1 cm using preoperative templating and intraoperative measurement.

No constrained liners or augments were required.

Variables and data sources

Preoperative data included age, sex, diagnosis, and baseline HHS. Postoperative outcomes at final follow-up (mean 12 ± 2 months) comprised HHS, functional status (ambulation, pain), and complications (dislocation, infection, loosening). Radiographic parameters included acetabular inclination, component migration, radiolucent lines, and osteolysis, assessed on standardised anteroposterior pelvis radiographs using Trauma Cad software. Limb-length discrepancy was measured clinically and radiographically. Data were extracted from electronic medical records and picture archiving and communication system (PACS).

Bias and quantitative variables

To minimise selection bias, all eligible consecutive cases were included. Information bias was reduced through standardised surgical technique, prospective data collection for HHS and radiographs, and blinded radiographic assessment by two independent observers [if applicable]. Quantitative variables (age, HHS, inclination) were reported as mean ± standard deviation and range; categorical variables as frequencies and percentages.

Statistical methods

Descriptive statistics were used given the case-series design. No formal hypothesis testing was performed due to lack of comparator group. Data analysis was conducted using SPSS version 20.0.

RESULT

Study population

Thirty-five hips in 35 consecutive patients met the inclusion criteria. The mean age at surgery was 45.8 ± 12.7 years (range 22–70), with 20 males and 15 females, indicating a predominantly middle-aged cohort (Table 1, Figure 1). The most frequent indications for total hip replacement were avascular necrosis of the hip (18 hips), followed by secondary osteoarthritis (14 hips) and fracture neck femur (3 hips), reflecting a high proportion of non-degenerative pathology (Table 1, Figure 2).

Baseline clinical status

Preoperatively, patients had substantial functional limitation, with a mean Harris Hip Score (HHS) of 45 ± 7, consistent with poor hip function in the study cohort (Table 1).

Radiological and implant parameters

Postoperative radiographs demonstrated a mean acetabular inclination of 44.7° ± 10.6°, with all cups positioned within the Lewinnek safe zone for inclination and anteversion (Table 2, Figures 5 and 6). No limb-length discrepancy greater than 1 cm was observed clinically or radiologically in any patient, and there were no radiolucent lines, migration, or signs of loosening around the components during the follow-up period (Table 2). The mean follow-up duration was 12 ± 2 months (Table 2).

Functional outcomes

At the latest follow-up, the mean postoperative HHS improved to 88 ± 7, corresponding to a mean gain of +43 ± 9 points compared with baseline, indicating a large and clinically meaningful improvement in hip function (Table 3, Figure 4). All patients were ambulatory and reported being pain-free at one year, with no patient requiring walking aids at final follow-up (Table 3). As exact p-values were not recorded in the dataset, statistical significance could not be explicitly reported; however, the magnitude of change in HHS is consistent with a robust treatment effect.

Complications and dislocation risk

Despite the presence of recognized risk factors for instability in the cohort (Figure 3), there were no postoperative dislocations recorded during the follow-up period (Table 3, Figure 3). Furthermore, there were no cases of superficial or deep infection, aseptic loosening, or mechanical failure of the dual-

mobility construct (Table 3). These findings suggest that dual-mobility cups provided stable fixation and effective dislocation prevention in this at-risk, relatively young population over the short term.

Table 1. Patient Demographics and Baseline Characteristics

Parameter	Value
Total Patients (n)	35
Mean Age (years)	45.8 ± 12.7
Sex Distribution	Males:20, Females: 15
Common Diagnoses	Avascular Necrosis hip (18), Secondary OA Hip (14), Fracture Neck Femur (3)
Mean Pre-op HHS	45 ± 7

Table 2. Radiological and Implant Parameters

Radiological Parameter	Result
Mean Acetabular Inclination (°)	44.7 ± 10.6
Cup Orientation Target	45° ± 10° inclination, 15° ± 5° anteversion
Limb Length Discrepancy (>1 cm)	None
Follow-up Duration (months)	12 ± 2
Component Alignment	Within Lewinnek Safe Zone in all cases

Table 3. Clinical Outcomes and Complications

Clinical Parameter	Result
Mean Post-op HHS	88 ± 7
Change in HHS (Δ)	+43 ± 9
Dislocation	0
Infection	0
Aseptic Loosening	0
Functional Status	All patients ambulatory and pain-free at last follow-up

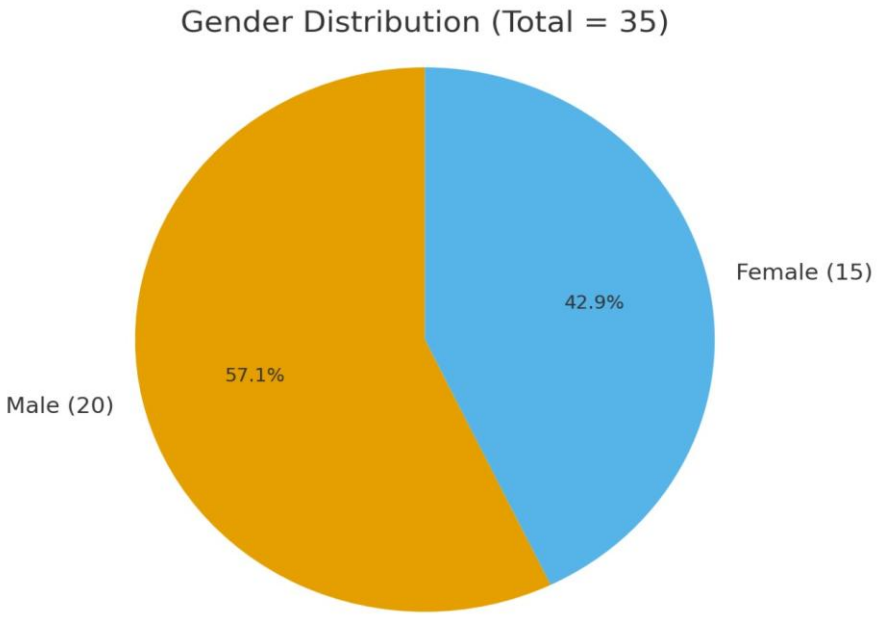

Figure 1. Gender Distribution of Patients

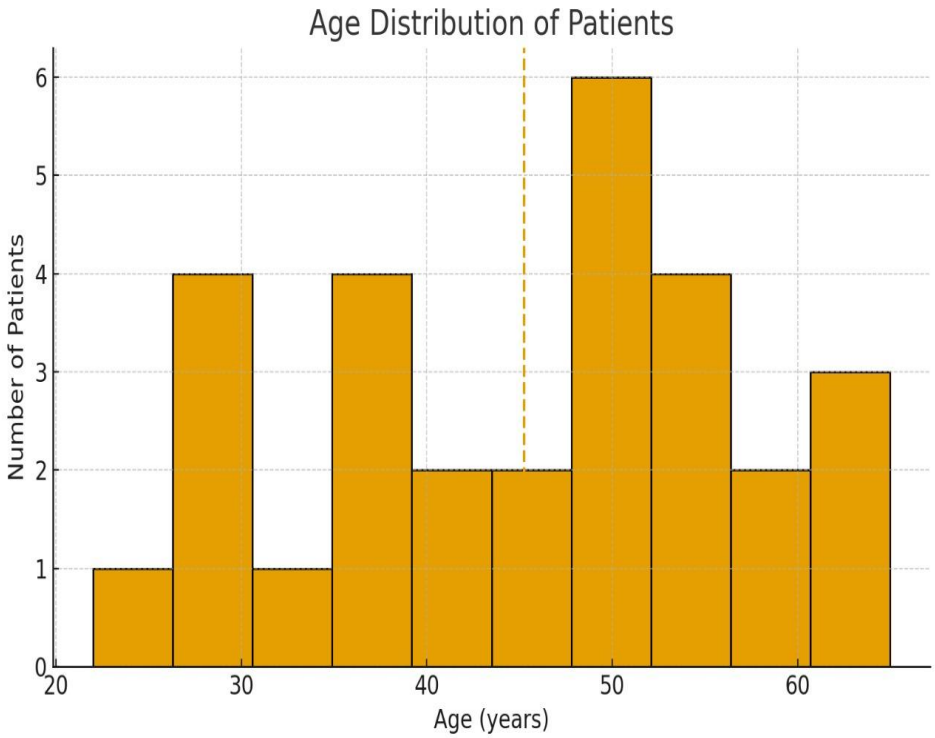

Figure 2. Age Distribution of Patients

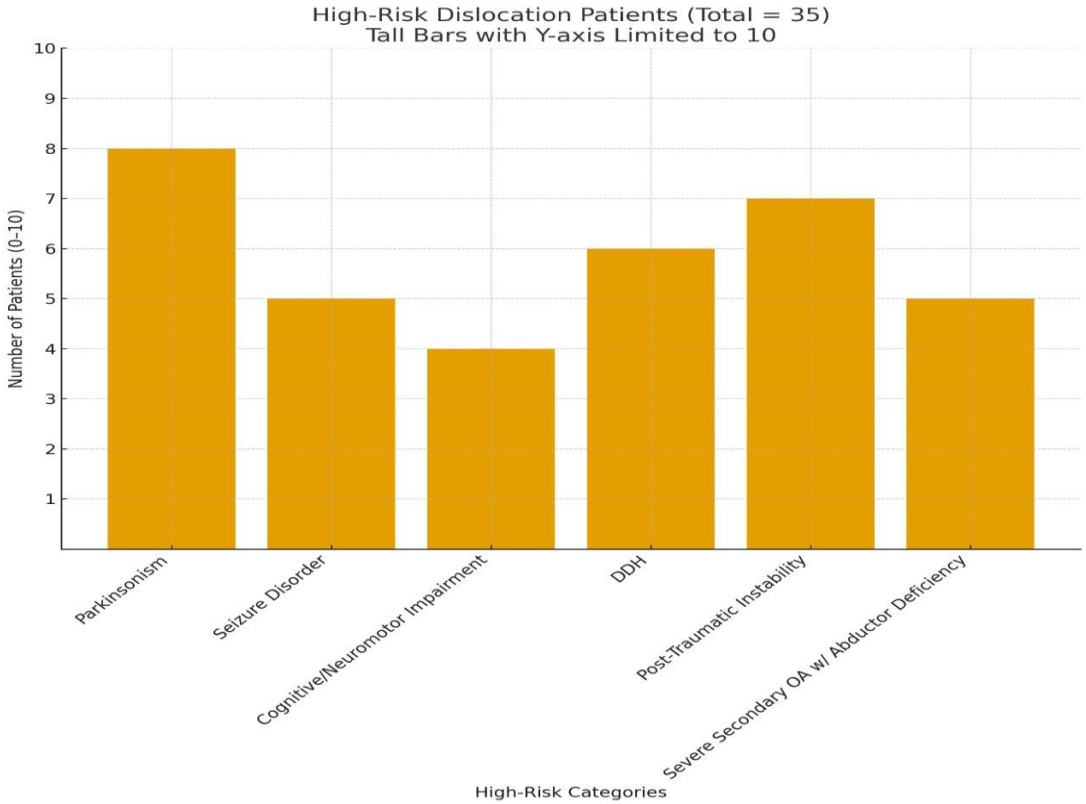

Figure 3. Associated high risks for dislocation in operated patients.

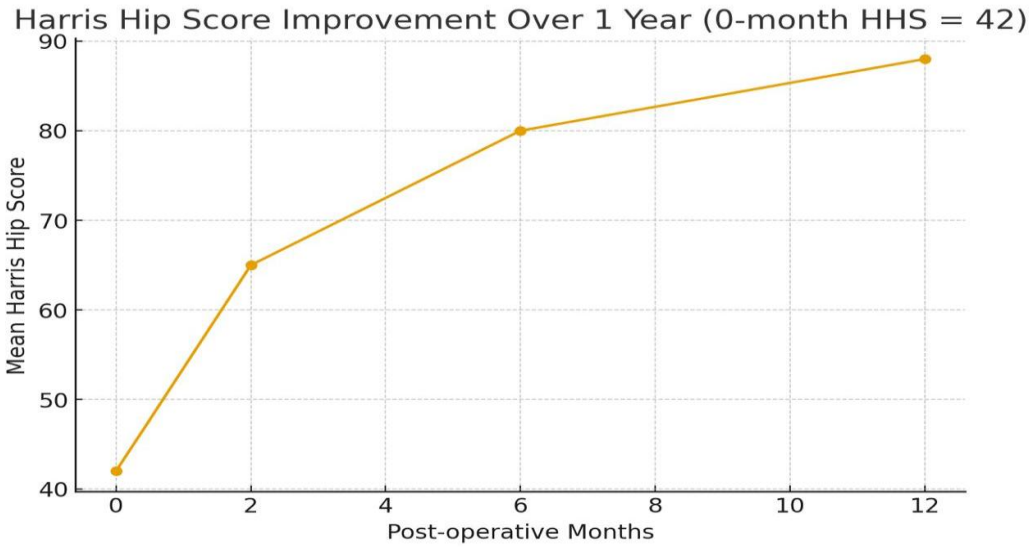

Figure 4. One-year postoperative improvement in Harris Hip Scores in operated patients.

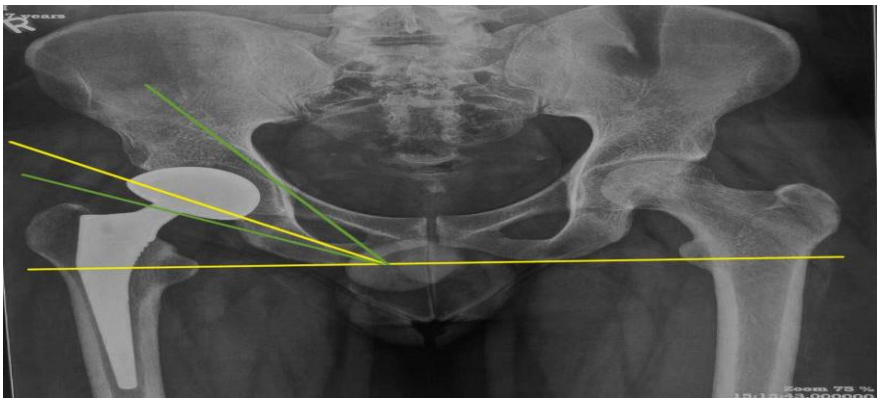

Figure 5. Post-op Xray of patient showing acetabular inclination (38 degrees) between the yellow lines with green lines depicting the safe zone for inclination (30-50 degrees).

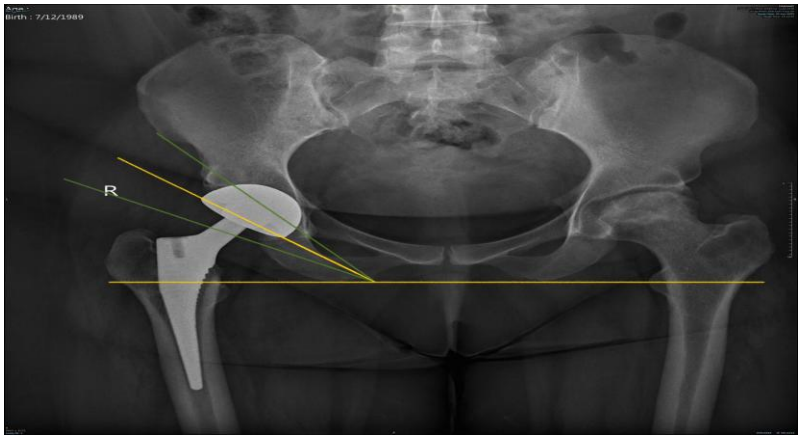

Figure 6. Post-op Xray of patient showing acetabular inclination (40 degrees) between the yellow lines with green lines depicting the safe zone for inclination (30-50 degrees).

Comparative Radiographic Assessment of Acetabular Inclination

Figures 5 and 6 demonstrate postoperative radiographs following right total hip arthroplasty with acetabular cup inclination angles of 38° and 40°, respectively. Compared with Figure 5, Figure 6 shows a slight increase in acetabular inclination, indicating a relatively more vertical orientation of the acetabular component. Despite this difference, both inclination angles remain within the accepted safe zone

(30°–50°), suggesting satisfactory cup positioning and acceptable postoperative biomechanical alignment.

DISCUSSION

Our single-surgeon case series demonstrates that dual-mobility (DM) cups in primary total hip replacement (THR) for a relatively young, high-risk Indian cohort are associated with excellent short-term functional recovery and an absence of dislocation, in line with much of the contemporary DM literature but with some differences in patient profile and follow-up duration. The mean improvement in Harris Hip Score (HHS) from 45 ± 7 preoperatively to 88 ± 7 at 12 ± 2 months, with no dislocations, infections, or aseptic loosening, supports the role of DM constructs as a stability-enhancing option in patients at increased risk of instability **[4,9,10]**.

Our zero-dislocation rate at approximately one year in 35 primary THRs is consistent with multiple international and Indian series reporting very low instability with DM cups in high-risk settings. A systematic review and meta-analysis by De Martino et al. found that DM acetabular components substantially reduced dislocation risk in both primary and revision THA, with a pooled dislocation rate of 0.8% and revision rate of 3.3%, reinforcing the stability advantage of this design. Similarly, a meta-analysis of comparative studies reported a risk ratio of 0.16 for dislocation in favor of DM cups versus conventional bearings, across primary and revision indications. Our finding of no dislocations in a cohort including avascular necrosis and post-traumatic pathology is therefore compatible with this evidence, albeit in a smaller, shorter-term series **[4,9,10,11,12,]**.

In an Indian context, Dharmesh Patel et al. reported on high-risk primary THR with DM cups and observed no dislocations over a mean follow-up of 18 months, concluding that DM is an effective solution for instability-prone patients. Another Indian series on DM THR showed significant HHS improvement over 12 months, with excellent or good functional outcomes in the majority and low complication rates, again supporting the functional benefits seen in our study. Our mean postoperative HHS of 88 ± 7 is comparable to these reports, even though our cohort is younger (mean age 45.8 years versus 60–70 years in many series), suggesting that DM constructs can produce robust functional gains even in a high-demand population **[8,12,13]**.

Internationally, Kim et al. demonstrated that in dysplastic hips—a classic high-risk group—DM cups achieved a 0% dislocation rate compared with 9% in fixed-bearing cups, with similar functional outcomes as measured by modified HHS. Recent work on DM cups in femoral neck fractures and post–proximal femur fracture fixation has also shown reduced dislocation rates and excellent functional scores, including a mean modified HHS around 90 and a large proportion of patients describing a "forgotten hip." These data resonate with our observation that all patients were ambulatory and pain-free at one year, which is clinically meaningful considering the baseline disability and risk profile **[14,15,16]**.

However, not all reports are uniformly favourable. A large series of complex revision THA with DM cups noted higher-than-expected dislocation and revision rates compared with earlier reports, highlighting that DM designs do not completely abolish instability risk in very complex cases and that outcomes may depend on indication, implant generation, and surgical technique. In addition, revision series have reported dislocation rates around 1–4% and survivorship around 80–90%, which, while better than many alternative strategies, indicate that DM constructs are not failure-proof, particularly in heavily revised hips. Our zero-dislocation rate must therefore be interpreted in the context of a modestly sized primary THR cohort with short-term follow-up; longer-term data will be needed to confirm whether these favourable results persist **[17,18,19,20]**.

Another important area of contrast is implant-related complications such as

intraprosthetic dislocation and metal debris in modular DM constructs. Systematic reviews of modular DM systems have raised concerns regarding fretting corrosion at the metal-metal interface and modestly elevated metal ion levels in a minority of patients, even though dislocation rates remained low (around 0.8%). Our series, using radiographic follow-up at one year, did not identify intraprosthetic dislocation, loosening, or mechanical failure; however, we did not systematically assess metal ion levels, and the follow-up duration is too short to fully evaluate wear-related complications. This underscores the need to balance the clear stability benefits of DM designs with careful long-term surveillance for device-specific failure modes **[11]**.

Clinical implications

For clinicians managing relatively young patients with avascular necrosis, secondary osteoarthritis, or post-traumatic sequelae, our findings support DM THR as a pragmatic strategy to simultaneously optimise stability and early function. The absence of dislocation despite the presence of recognised risk factors illustrated in our cohort (Figure 3) is clinically reassuring, particularly in settings where squatting, sitting cross-legged, and floor-level activities are common, as highlighted in Indian DM series. Correct component positioning within the Lewinnek safe zone in all cases, as confirmed radiologically, also reinforces the need for meticulous surgical technique to fully exploit the stability potential of DM constructs.

In resource-constrained environments and high-volume centres, DM cups may reduce the burden of revision for instability, which carries substantial cost and morbidity. For surgeons in India and similar settings, these results add to the growing local evidence base that DM THR is a viable option in high-risk or high-demand populations, provided that careful patient selection and technical execution are maintained.

Future research directions and recommendations

Our study highlights several priorities for future research. First, adequately powered prospective comparative studies are needed to directly compare DM and conventional bearings in similar high-risk Indian populations, focusing on dislocation, functional outcomes, cost-effectiveness, and patient-reported outcome measures beyond HHS. Second, longer-term follow-up is essential to evaluate survivorship, wear, intra-prosthetic dislocation, and potential metal-related issues, particularly in younger patients with anticipated high activity levels and longer implant life expectancy. Third, stratified analyses by indication (avascular necrosis, dysplasia, post-traumatic arthritis, fracture neck of femur) and by risk factors for instability could help refine indications and provide more nuanced guidance to surgeons. We recommend that future Indian studies incorporate standardised radiographic assessment, patient-reported outcome measures, and, where modular DM constructs are used, periodic monitoring for metal ion levels in selected cases. Multicentre registries capturing DM utilisation and outcomes in India would also be valuable in benchmarking performance against international cohorts and in identifying rare complications earlier.

Strengths and limitations

The strengths of our study include its focus on a relatively young, high-risk population, uniform surgical technique by a single experienced surgeon, and systematic documentation of both clinical and radiological outcomes at approximately one year. The absence of dislocation and mechanical failure, combined with substantial improvement in HHS, provides internally consistent evidence that DM THR can perform well in this context.

However, several limitations must be acknowledged. The case-series design without a control group precludes direct causal inference or comparison with conventional THR, and the sample size (35

hips) limits precision of estimates for rare complications such as dislocation or intra-prosthetic failure. The follow-up duration of 12 ± 2 months is relatively short and does not allow assessment of medium- or long-term survivorship, wear, or metal-related issues, which have been highlighted in modular DM literature. We did not perform formal statistical hypothesis testing or multivariable adjustment, so confounding and chance cannot be completely excluded. Finally, being a single-surgeon, single-centre study, the external validity to other surgeons, implant systems, and healthcare settings may be limited.

Despite these limitations, our findings add to the growing body of Indian and international evidence suggesting that dual-mobility cups in THR can offer excellent early function and very low dislocation rates in high-risk and high-demand patients. Until higher-level comparative data with long-term follow-up become available, DM constructs represent a rational option for surgeons aiming to mitigate instability while preserving good functional outcomes in selected patients.

CONCLUSION

In this single-surgeon case series of 35 primary total hip replacements using dual-mobility cups in a relatively young Indian cohort (mean age 45.8 ± 12.7 years), short-term outcomes were excellent, with a mean Harris Hip Score improving from 45 ± 7 preoperatively to 88 ± 7 at a mean follow-up of 12 ± 2 months. All acetabular components were accurately positioned within the Lewinnek safe zone (mean inclination 44.7° ± 10.6°), with no radiolucent lines, migration, or limb-length discrepancy exceeding 1 cm observed radiographically. Clinically, all patients were ambulatory and pain-free at final follow-up, with zero cases of dislocation, infection, aseptic loosening, or mechanical failure despite the presence of recognised instability risk factors. These findings demonstrate that dual-mobility constructs can deliver substantial functional recovery and exceptional early stability in high-risk patients undergoing primary THR for avascular necrosis, secondary osteoarthritis, and post-traumatic pathology.

Declaration

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Conflict of Interest: The authors declare no conflict of interest.

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