

Dual mobility total hip arthroplasty in osteonecrosis of femoral head: Is it suitable for Indian population?

¹Chirag Patel, ²Parth Patel, ³Baiju Patel, ⁴Saral Patel

¹Senior Resident, Department of Orthopaedics, Dr. ND Desai Faculty of Medical Science and Research, Nadiad, Gujarat, India

^{2,3}Assistant Professor, Department of Orthopaedics, Dr. ND Desai Faculty of Medical Science and Research, Nadiad, Gujarat, India

⁴Associate Professor, Department of Orthopaedics, Dr. ND Desai Faculty of Medical Science and Research, Nadiad, Gujarat, India

Corresponding Author:

Saral Patel (dr_saral244@yahoo.in)

Abstract

Background & Aim: Dual Mobility Total Hip Arthroplasty (DMTHA) is a reasonable treatment option for osteonecrosis of femoral head (ONFH), especially in active young patients who are at an increased risk of dislocation post-surgery. Moreover, lifestyle a religious habits of Indian patients require extreme flexion and rotation, making DMTHA a lucrative treatment option. The aim of our study is to evaluate the short-term results of DMTHA for ONFH in the Indian population and their ability to resume their daily activities after the surgery.

Material and Method: The study is a retrospective analysis of 23 DMTHA in 17 patients who underwent DMTHA for ONFH between March 2018 to March 2020 and with a minimum follow-up of one year. Patients were evaluated clinically using Harris Hip Score (HHS) and Patient-Reported Outcome Measures (PROMs), such as the ability to squat and sit cross-legged. Radiological evaluation was performed to detect implant migration, loosening, periprosthetic osteolysis, or heterotrophic ossification.

Result: In our study, the mean age of patient was 36.7 ± 9.1 years. The mean pre-operative HHS scores of 53.8 ± 15.4 improved to 97.0 ± 4.2 at one year post-surgery. 94.1% patients in our study could squat and sit cross-legged at a mean duration of 3.2 months post-surgery.

Conclusions: The use of DMTHA in Indian patients with ONFH showed good early clinical and functional results without major complications, and simultaneously meeting their high functional and cultural requirements.

Keywords: Total hip arthroplasty, dual mobility cup, dislocation, revision surgery

Introduction

Osteonecrosis of the femoral head (ONFH) typically affects the young, active population resulting in substantial loss of function due to subchondral collapse, femoral head deformation, and articular incongruence [1, 2]. Although conservative treatments can be attempted in the early stages of the disease, total hip arthroplasty (THA) is indicated when the

articular function is compromised [3,4].

THA in ONFH is known to have higher revision and infection rates and less favorable clinical outcomes [5, 6, 7, 8]. Moreover, there is a higher risk of dislocation after THA for ONFH compared to THA for primary osteoarthritis in young active patients [9]. Also, dislocation is the most common non-septic cause of revision within the first five years, with young and ONFH patients having a higher relative risk for revision [10]. Hence, THA implants for this population must ensure stability, mobility, solidity, and longevity [11].

Dual Mobility Total Hip Arthroplasty (DMTHA) has the advantage of high range of motion and low dislocation rates in primary THA, with wear and loosening comparable to the standard cup [12, 13, 14, 15]. Moreover, DMTHA performed for ONFH had a survival rate of 100% at ten years follow-up in a study by Martz *et al* [11].

The lifestyle and religious habits of the Indian population require extreme flexion and rotation, making DMTHA a good option for young patients with ONFH in this population. Our study aimed to evaluate the short-term results of DMTHA for ONFH in the Indian population and their ability to resume their daily activities after the surgery.

Material and Method

An approval from the institutional ethics committee was obtained for this retrospective case series prior to collecting data. The patients who underwent DMTHA for Ficat and Arlet stage three or four ONFH, between March 2018 to March 2020 and with a minimum follow-up of one year, were included in the study. Patients with a neurological motor disease, and a history of hip fracture/infection, were excluded from the study. Demographic details, risk factors, implant details, including bearing surfaces, stem size, sizes of head/ cup, and the use of cement, were collected from the database.

A total of 22 patients underwent DMTHA for ONFH during the study period, out of which 17 patients with 23 hips met the selection criteria and had complete medical records available for analysis. All patients underwent DMTHA using the posterolateral approach to the hip. Patients were encouraged to walk on the first post-operative day, and deep vein thrombosis prophylaxis in the form of Aspirin and intermittent calf compression was given to all patients. Physiotherapy was initiated after suture removal, and patients were allowed to sit cross-legged and squat after eight weeks. Patients were evaluated clinically and radiologically during the follow-up visits at one month, three months, one year, and yearly after that.

Clinical assessment was performed using Harris Hip Score (HHS) and Patient-Reported Outcome Measures (PROMs), such as the ability to squat and sit cross-legged. Radiological assessment was performed to record cup inclination, cement mantle adequacy, radiolucent lines, peri-prosthetic osteolysis, and the presence of heterotopic ossification.

Continuous variables were summarized using mean and standard deviation with ranges, and categorical values were summarized using frequencies and percentages. A two-sided student t-test estimated the changes in the average Harris Hip Score, and the result was interpreted at a 5% level of significance. Microsoft Excel 2019 was used for the statistical analysis.

Result

Seventeen patients with twenty-three operated hips met the selection criteria were included in the study. The mean age of the patients was 36.7 ± 9.1 years, ranging between 21 and 50 years. The demographic characteristics, pre-operative data and distribution of implant used in the study are highlighted in Table 1. The intraoperative course was unremarkable in all the patients. One patient had a superficial stitch infection treated with antibiotics and local debridement post-operatively. The average duration of hospital stay was 5.5 ± 1.2 days.

Table 1: Demographic, pre-operative data and distribution of implants used.

Number Of Patients N=17	Number Of Treated Hips N=23
Age of Patients (Years; Mean±SD)	36.7±9.1
Sex Ratio (Female/Male)	4/13(30.8%)
Aetiology	
Idiopathic	7(41.2%)
Alcohol	4(23.5%)
Corticosteroid Therapy	3(17.6%)
Femoral Neck Fracture	3(17.6%)
Ficat And Arlet Stage	
Stage-3	13
Stage-4	10
Hip Side Affected	
Unilateral	11
Right	5
Left	6
Bilateral	6
Dorr Classification	
Type 1	17
Type 2	4
Type 3	2
Femoral Stem	
Uncemented	21
Cemented	2
Femoral Head	
28 mm head	21
22 mm head	2

The mean duration of follow-up was 1.4 ± 0.4 years, ranging from 1 to 2 years. The mean pre-operative HHS scores of 53.8 ± 15.4 improved to 97.0 ± 4.2 at one-year post-surgery ($p < 0.001$). All the patients could resume their routine work at a mean follow-up of 3.2 ± 0.4 months. There was no dislocation event in the follow-up duration. At the last follow-up, the radiologic evaluation did not reveal signs of migration, radiolucent lines, periprosthetic osteolysis, or heterotopic ossification over the femoral and acetabular components (fig-1). The mean acetabular cup inclination was 42.9 ± 3.5 . Social and religious customs in the Indian population require extreme degrees of flexion and rotation around the hip. All except one patient (94.1%) in our study could perform these activities at a mean duration of 3.2 months post-surgery (fig-2).

**Fig 1:** Pre-operative and post-operative x-rays.



Fig 2: Clinical picture at last follow-up.

Discussion

The demographic characteristics and the risk factors seen in our study are comparable to other published studies [11, 16, 17]. The mean pre-operative and post-operative HHS score is similar to the study by Martz *et al.*, indicating good clinical outcome at the final follow up [11].

Historically, THA with a conventional cup had a high failure rate of more than 30% at ten years of follow-up for young patients, especially for ONFH [5, 6, 18]. However, the cumulative survival rate of implants has improved to over 90% at 10-15 years follow-up for THA in ONFH, even in young patients [16, 19, 20]. The cumulative survival rate of DMTHA for ONFH in the study by Martz *et al.* was 100% at 11 years of follow-up in accordance with other studies for DMTHA survival, which is comparable if not better than THA with conventional acetabular cup [11]. The survival rate for DMTHA implants in our study was 100% at 1.4 years follow-up, similar to the study by Assi *et al.* [21].

THA use with the conventional acetabular cup for ONFH, especially in the younger population, is associated with higher revision rates [7, 10]. Furthermore, dislocation is the leading cause of failure after THA in young patients with a relative risk of 3.7, as noted by Hailer *et al.* [9]. DMTHA is known for low dislocation rates even in young patients [12, 13, 22]. Similarly, no incidence of dislocation was noticed at 11-year follow-up in a study by Martz *et al.* on the use of DMTHA for ONFH [11]. The dislocation rate in our study was 0% at 1.4 years follow-up, similar to the study by Assi *et al.* [21].

In the study by Assi *et al.*, there were no revisions for osteolysis/wear or cement loosening during 45 months of follow-up, similar to our findings [21]. Martz *et al.* Reported radiological signs of premature loosening in cemented femoral stems at follow-up in 11/16 patients (68.75%) [11]. A long-term study is required to assess the radiological signs of implant/cement loosening and polyethylene wear in our study population. One case of superficial post-operative wound infection was observed in our study, similar to the study by Martz *et al.* [11].

The lifestyle, cultural, and religious habits of the Indian population requires a joint that can allow more flexion and rotation of the hip without any risk of dislocation. It plays an essential factor in deciding the mode of surgery and implant. In our study, 16/17 (94.1%) patients could squat and sit cross-legged at a mean duration of 3.2 months post-surgery. In the study by Assi *et al.*, 38% of the patients who experienced pain during their prayer pre-operatively had a mean mHHS of 95 ± 2.5 at three months follow up [21]. Agarwala *et al.* studied early results of DMTHA for various indications in Indian patients. In his study, 93.4% of patients could squat and sit cross-legged at a mean follow-up period of 13 weeks [23]. However, no subgroup analysis is available for the study.

The study's limitations include its small sample size, retrospective design, short-term follow-up and lack of a control group. There is a paucity of literature on the results of DMTHA in Indian patients with ONFH. The young age of the patient with ONFH and the religious and cultural practice make DMTHA, which provides a higher degree of range of motion and stability, a viable treatment option. To the best of our knowledge, this is the only study that studies the outcomes of DMTHA in Indian patients with ONFH.

Conclusion

DMTHA showed excellent early functional and radiological results with no episode of dislocation or revision, which is comparable to conventional THA. It meets the expectations of the Indian population by allowing them to squat and sit cross-legged without compromising on stability, especially in the active young patients with ONFH. DMTHA is an effective and safe treatment option for young Indian patients diagnosed with ONFH, meeting their high functional and cultural requirements.

References

1. Herndon JH, Aufranc OE. Avascular necrosis of the femoral head in the adult. A review of its incidence in a variety of conditions. *Clin Orthop Relat Res.* 1972 Jul-Aug;86:43-62.
2. Mwale F, Wang H, Johnson AJ, Mont MA, Antoniou J. Abnormal vascular endothelial growth factor expression in mesenchymal stem cells from both osteonecrotic and osteoarthritic hips. *Bull NYU Hosp Jt Dis.* 2011;69(1):S56-61.
3. Wang BL, Sun W, Shi ZC, Zhang NF, Yue DB, Guo WS, *et al.* Treatment of nontraumatic osteonecrosis of the femoral head using bone impaction grafting through a femoral neck window. *Int Orthop.* 2010 Jun;34(5):635-9.
4. Hernigou P. Avascular necrosis of head of femur. *Indian J Orthop.* 2009 Jan;43(1):1-2.
5. Cornell CN, Salvati EA, Pellicci PM. Long-term follow-up of total hip replacement in patients with osteonecrosis. *Orthop Clin North Am.* 1985 Oct;16(4):757-69.
6. Mont MA, Hungerford DS. Non-traumatic avascular necrosis of the femoral head. *J Bone Joint Surg. Am.* 1995 Mar;77(3):459-74. Doi: 10.2106/00004623-199503000-00018.
7. Bergh C, Fenstad AM, Furnes O, Garellick G, Havelin LI, Overgaard S, Pedersen AB, Mäkelä KT, Pulkkinen P, Mohaddes M, Kärrholm J. Increased risk of revision in patients with non-traumatic femoral head necrosis. *Acta Orthop.* 2014 Feb;85(1):11-7.
8. Stavrakis AI, SooHoo NF, Lieberman JR. A comparison of the incidence of complications following total hip arthroplasty in patients with or without osteonecrosis. *J Arthroplasty.* 2015 Jan;30(1):114-7.
9. Hailer NP, Weiss RJ, Stark A, Kärrholm J. The risk of revision due to dislocation after total hip arthroplasty depends on surgical approach, femoral head size, sex and primary diagnosis. An analysis of 78,098 operations in the Swedish Hip Arthroplasty Register. *Acta Orthop.* 2012 Oct;83(5):442-8.
10. Ulrich SD, Seyler TM, Bennett D, Delanois RE, Saleh KJ, Thongtrangan I, *et al.* Total hip arthroplasties: what are the reasons for revision? *Int Orthop.* 2008 Oct;32(5):597-604.
11. Martz P, Maczynski A, Elsair S, Labattut L, Viard B, Baulot E. Total hip arthroplasty with dual mobility cup in osteonecrosis of the femoral head in young patients: over ten years of follow-up. *Int. Orthop.* 2017 Mar;41(3):605-610.
12. Boyer B, Philippot R, Geringer J, Farizon F. Primary total hip arthroplasty with dual mobility socket to prevent dislocation: a 22-year follow-up of 240 hips. *Int Orthop.* 2012 Mar;36(3):511-8.
13. Caton JH, Prudhon JL, Ferreira A, Aslanian T, Verdier R. A comparative and retrospective study of three hundred and twenty primary Charnley type hip replacements with a minimum follow up of ten years to assess whether a dual mobility cup has a decreased dislocation risk. *Int. Orthop.* 2014 Jun;38(6):1125-9.
14. Vielpeau C, Lebel B, Ardouin L, Burdin G, Lautridou C. The dual mobility socket concept: experience with 668 cases. *Int. Orthop.* 2011 Feb;35(2):225-30.
15. Philippot R, Camilleri JP, Boyer B, Adam P, Farizon F. 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 Aug;33(4):927-32.

16. Johansson HR, Zywiell MG, Marker DR, Jones LC, McGrath MS, Mont MA. Osteonecrosis is not a predictor of poor outcomes in primary total hip arthroplasty: a systematic literature review. *Int Orthop*. 2011 Apr;35(4):465-73.
17. Schmolders J, Amvrazis G, Pennekamp PH, Strauss AC, Friedrich MJ, Wimmer MD, *et al*. Thirteen year follow-up of a cementless femoral stem and a threaded acetabular cup in patients younger than fifty years of age. *Int Orthop*. 2017 Jan;41(1):39-45.
18. Ortiuguera CJ, Pulliam IT, Cabanela ME. Total hip arthroplasty for osteonecrosis: matched-pair analysis of 188 hips with long-term follow-up. *J Arthroplasty*. 1999 Jan;14(1):21-8.
19. Bedard NA, Callaghan JJ, Liu SS, Greiner JJ, Klaassen AL, Johnston RC. Cementless THA for the treatment of osteonecrosis at 10-year follow-up: have we improved compared to cemented THA? *J Arthroplasty*. 2013 Aug;28(7):1192-9.
20. Kim SM, Lim SJ, Moon YW, Kim YT, Ko KR, Park YS. Cementless modular total hip arthroplasty in patients younger than fifty with femoral head osteonecrosis: minimum fifteen-year follow-up. *J Arthroplasty*. 2013 Mar;28(3):504-9.
21. Assi C, Kheir N, Samaha C, Kouyoumjian P, Yammine K. Early results of total hip arthroplasty using dual-mobility cup in patients with osteonecrosis of the femoral head. *SICOT J*. 2018;4:4.
22. Epinette JA, Béracassat R, Tracol P, Pagazani G, Vandebussche E. Are modern dual mobility cups a valuable option in reducing instability after primary hip arthroplasty, even in younger patients? *J Arthroplasty*. 2014 Jun;29(6):1323-8.
23. Agarwala S, Shetty V, Taywade S, Vijayvargiya M, Bhingraj M. Dual mobility THR: Resolving instability and providing near normal range of movement. *J Clin Orthop Trauma*. 2020 Aug;13:40-45.