What are the indications for the use of dual mobility bearing surface for patients undergoing primary total hip arthroplasty?

Shahi AS, Ebied A, Kocaoğlu H, Limas-Telles R, Ruslan N, Shahab WM, Silva R, Teloken M, Wang PW.

Response/Recommendation:

The literature does not support the routine use of dual mobility (DM) bearing surfaces in primary total hip arthroplasty (THA) due to the associated increased costs and specific complications inherent to DM bearings. However, DM bearings can enhance stability and reduce dislocation after THA and its use may be considered in specific high-risk populations. These include patients with neuromuscular disorders, dementia, severe hip deformities, and individuals with stiff lumbar spines such as those with prior lumbar spinal fusion or advanced lumbar degenerative disk disease.

Level of Evidence: Moderate

Rationale:

Rationale:

A comprehensive literature search was conducted using PubMed, Embase, and Cochrane Library databases. The search terms included "Arthroplasty, Replacement, Hip," "Hip Prosthesis," "Dual Mobility," "Dual Mobility Bearing," "Dual Mobility Cup," "Indications," "Patient Selection," "Prosthesis Design," "Joint Instability," "Dislocation," "Prosthesis Failure," "Postoperative Complications," "Reoperation," and "Range of Motion, Articular." Articles were limited to English language publications from the past 15 years. Inclusion criteria were studies involving adult patients undergoing primary THA with DM bearing surfaces, with outcomes related to indications, stability, and dislocation rates. Exclusion criteria included case reports, non-primary THA studies, and studies not involving DM bearings. Data extracted included study design, population characteristics, indications for DM use, outcomes, and complications. A total of 1,235 articles were identified, with 32 meeting the inclusion criteria after title and abstract screening and full-text review.

Based on our systematic review, it is clear that DM bearing surfaces confer significant advantages in specific patient populations at high risk of dislocation undergoing primary THA. These bearings offer dual articulation that enhances stability and minimizes dislocation risk, especially in patients with neuromuscular disorders such as Parkinson's disease or cerebral palsy, where compromised muscle control is prevalent. Cognitive impairments, including dementia, further increase dislocation risk due to potential non-compliance with postoperative protocols and DM bearings could help mitigate the risk. [1–5]

Patients with severe hip deformities, such as congenital hip dislocation or acetabular dysplasia, can also benefit from DM bearings, which can accommodate abnormal anatomy and provide stable articulation in complex reconstructions where other bearings may fail to deliver adequate stability.[1,6,7]

High-activity patients, particularly younger individuals or those engaged in physically demanding occupations, require implants that afford a broader range of motion and decrease dislocation risks during vigorous activities. DM bearings may also be considered in these patients, allowing greater movement without compromising stability.[8–11] Due to lack of long-term data on the modern generation of DM bearing surface, the advantages of DM should be weighed against other issues such as wear, potential for adverse local tissue reactions, and ceasing of the bearing surface in these young patients.

Obesity is another soft indication for the use of DM bearings, as increased body mass index (BMI) is associated with higher forces on the hip joint, thereby elevating dislocation risks. DM bearings' enhanced stability mechanisms render them an optimal choice for obese patients undergoing primary THA.[12–15]

Another group of patients that may particularly benefit from the use of DM bearing surface includes those with stiff lumbar spines. Patients who have undergone prior lumbar spine fusion or advanced lumbar degenerative disk disease, present unique challenges in THA. The altered biomechanics and diminished flexibility of the spine-pelvis-hip relationship in these patients heighten the risk of hip dislocation. DM bearings offer a distinct advantage here due to their dual articulation, enhancing stability and accommodating lack of spine movements. Studies indicate that DM bearings markedly reduce dislocation rates in patients with spinal stiffness, underscoring their superiority in managing these complex cases.[16–20]

DM bearings are not devoid of drawbacks. Intra-prosthetic dislocation, where the inner head dislocates from the polyethylene liner, is a notable complication that, while infrequent, can be challenging to manage and may necessitate revision surgery. The increased cost of DM bearings is another consideration limiting their routine use. Therefore, while DM bearings offer enhanced stability, their utilization should be judiciously considered against these potential risks and shortcomings.[21–23]

Overall, the use of DM bearing surfaces in primary THA demonstrates a significant reduction in dislocation rates and improved patient outcomes in high-risk populations. Long-term studies are warranted to further validate these findings and optimize patient selection criteria for DM bearings in primary THA.

References:

[1] Ko LM, Hozack WJ. The dual mobility cup: what problems does it solve? The Bone & Joint Journal 2016;98-B:60–3. https://doi.org/10.1302/0301-620X.98B1.36332.

[2] Abdelazim H, Michael F. Dual mobility cup for prevention of early total hip arthroplasty dislocation in patients with neurological disorders. Eur Orthop Traumatol 2015;6:427–32. https://doi.org/10.1007/s12570-015-0336-9.
[3] El-Deeb MA, Said MM, El-Rahman TMA, Attalah AHAA, Abdelaziz AM, Hassan YE-S. Dual Mobility Cup in Fractures of the Femoral Neck in Neuromuscular Disorders and Cognitive Dysfunction Patients above 60 years-old. Archives of Bone and Joint Surgery 2023;11:757. https://doi.org/10.22038/ABJS.2023.65924.3157.
[4] Patil N, Deshmane P, Deshmukh A, Mow C. Dual Mobility in Total Hip Arthroplasty: Biomechanics, Indications and Complications–Current Concepts. JOIO 2021;55:1202–7. https://doi.org/10.1007/s43465-021-00471-w.
[5] Graversen AE, Jakobsen SS, Kristensen PK, Thillemann TM. No dislocations after primary hip arthroplasty with the dual mobility cup in displaced femoral neck fracture in patients with dementia. A one-year follow-up in 20 patients. SICOT J n.d.;3:9. https://doi.org/10.1051/sicotj/2016050.
[6] Kim JS, Moon NH, Do MU, Jung SW, Suh KT, Shin WC. Comparative analysis of dislocation rates for total hip replacement arthroplasty using fixed bearing acetabular cup and dual mobility acetabular cup in patients with hip dysplasia 2023. https://doi.org/10.21203/rs.3.rs-2667797/v1.
[7] Kim JS, Moon NH, Do MU, Jung SW, Suh KT, Shin WC. The use of dual mobility acetabular cups in total hip replacement reduces dislocation rates in hip dysplasia patients. Sci Rep 2023;13:22404. https://doi.org/10.1038/s41598-023-49703-z.
[8] Heifner JJ, Keller LM, Fox YM, Sakalian PA, Corces A. The Performance of Primary Dual-Mobility Total Hip Arthroplasty in Patients Aged 55 Years and Younger: A Systematic Review. Arthroplasty Today 2023;24:101241. https://doi.org/10.1016/j.artd.2023.101241.
[9] Lawrie CM, Barrack RL, Nunley RM. Modular dual mobility total hip arthroplasty is a viable option for young, active patients: a mid-term follow-up study. The Bone & Joint Journal 2021;103-B:73–7. https://doi.org/10.1302/0301-620X.103B7.BJJ-2021-0145.R1.
[10] Viricel C, Boyer B, Philippot R, Farizon F, Neri T. Survival and complications of total hip arthroplasty using third-generation dual-mobility cups with non-cross-linked polyethylene liners in patients younger than 55 years. Orthopaedics & Traumatology: Surgery & Research 2022;108:103208. https://doi.org/10.1016/j.otsr.2022.103208.
[11] Nam D, Salih R, Nahhas CR, Barrack RL, Nunley RM. Is a modular dual mobility acetabulum a viable option for the young, active total hip arthroplasty patient? The Bone & Joint Journal 2019;101-B:365–71. https://doi.org/10.1302/0301-620X.101B4.BJJ-2018-0834.R1.
[12] Hernigou P, Trousselier M, Roubineau F, Bouthors C, Lachaniette CHF. Dual-mobility or Constrained Liners Are More Effective Than Preoperative Bariatric Surgery in Prevention of THA Dislocation. Clinical Orthopaedics and Related Research® 2016;474:2202. https://doi.org/10.1007/s11999-016-4859-3.
[13] Hernigou P, Auregan JC, Potage D, Roubineau F, Flouzat Lachaniette CH, Dubory A. Dual-mobility implants prevent hip dislocation following hip revision in obese patients. International Orthopaedics (SICOT) 2017;41:469–73. https://doi.org/10.1007/s00264-016-3316-y.
[14] Maisongrosse P, Lepage B, Cavaignac E, Pailhe R, Reina N, Chiron P, et al. Obesity is no longer a risk factor for dislocation after total hip arthroplasty with a double-mobility cup.

International Orthopaedics (SICOT) 2015;39:1251–8. https://doi.org/10.1007/s00264-014-2612-7.
[15] Rhind J-H, Baker C, Roberts PJ. Total Hip Arthroplasty in the Obese Patient: Tips and Tricks and Review of the Literature. JOIO 2020;54:776–83. https://doi.org/10.1007/s43465-020-00164-w.
[16] Bp C, M S, Tp S, Sa J, Dj M, Gh W. Dual-Mobility Constructs in Primary Total Hip Arthroplasty in High-Risk Patients With Spinal Fusions: Our Institutional Experience. Arthroplasty Today 2020;6. https://doi.org/10.1016/j.artd.2020.07.024.
[17] Jones CW, Martino ID, D'Apolito R, Nocon AA, Sculco PK, Sculco TP. The use of dual-mobility bearings in patients at high risk of dislocation. The Bone & Joint Journal 2019;101-B:41–5. https://doi.org/10.1302/0301-620X.101B1.BJJ-2018-0506.R1.
[18] Nessler JM, Malkani AL, Sachdeva S, Nessler JP, Westrich G, Harwin SF, et al. Use of dual mobility cups in patients undergoing primary total hip arthroplasty with prior lumbar spine fusion. International Orthopaedics (SICOT) 2020;44:857–62. https://doi.org/10.1007/s00264-020-04507-y.
[19] Issa TZ, Pearl A, Moore E, Maqsood HA, Saleh KJ. Dual-Mobility Cups in Patients Undergoing Primary Total Hip Arthroplasty with Prior Lumbar Spine Fusion: A Systematic Review. Surgeries 2024;5:125–34. https://doi.org/10.3390/surgeries5020014.
[20] Dhawan R, Baré JV, Shimmin A. Modular dual-mobility articulations in patients with adverse spinopelvic mobility. The Bone & Joint Journal 2022;104-B:820–5. https://doi.org/10.1302/0301-620X.104B7.BJJ-2021-1628.R1.
[21] De Martino I, D'Apolito R, Waddell BS, McLawhorn AS, Sculco PK, Sculco TP. Early intraprosthetic dislocation in dual-mobility implants: a systematic review. Arthroplast Today 2017;3:197–202. https://doi.org/10.1016/j.artd.2016.12.002.
[22] Fabry C, Langlois J, Hamadouche M, Bader R. Intra-prosthetic dislocation of dual-mobility cups after total hip arthroplasty: potential causes from a clinical and biomechanical perspective. International Orthopaedics (SICOT) 2016;40:901–6. https://doi.org/10.1007/s00264-015-3000-7.
[23] Philippot R, Boyer B, Farizon F. Intraprosthetic Dislocation: A Specific Complication of the Dual-mobility System. Clinical Orthopaedics and Related Research® 2013;471:965. https://doi.org/10.1007/s11999-012-2639-2.