

# Functional Outcomes of Dual-Mobility versus Fixed-Bearing Primary Total Hip Arthroplasty in Ankylosing Spondylitis Patients with Hip Involvement: A Retrospective Cohort Study

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**Purpose:** Hip involvement in ankylosing spondylitis (AS) can progress to bony or fibrous fusion, causing severe pain and disability. Total hip arthroplasty (THA) offers major benefits, but instability and implant choice remain key challenges. This study compared dual-mobility (DM) and fixed-bearing (FB) implants in AS patients with hip fusion.

**Methods:** We conducted a retrospective cohort study of 51 patients with AS and hip fusion who underwent primary THA between 2019 and 2023. Patients received either DM or FB implants. Functional outcomes (The Short Form 12 Health Survey (SF-12), Harris Hip Score (HHS), Oxford Hip Score (OHS)), disease activity by Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), and radiographic parameters were assessed preoperatively and postoperatively.

**Results:** Both DM and FB implants improved mobility, pain, and quality of life. DM implants provided significantly better functional outcomes at 3 and 6 months (all  $p < 0.01$ ). BASDAI scores improved in both groups, with no long-term difference. Patients with bony fusion achieved greater functional gains, while those with fibrous fusion reported more symptom relief. No dislocations or major complications were observed within the follow-up period.

**Conclusion:** THA proves to be an effective approach for managing hip fusion in patients with ankylosing spondylitis. While both implant types enhanced clinical outcomes, DM implants were associated with quicker recovery and better early functional results, suggesting an advantage for their use in this challenging patient population.

**Keywords:** ankylosing spondylitis, bony Hip fusion, fibrous Hip fusion, total Hip arthroplasty, dual-mobility implant, fixed-bearing implant, functional outcomes

## Introduction

For most people, movements like walking, sitting, or climbing stairs happen without a second thought. For patients with AS, however, these simple actions can become daily struggles. AS is a chronic, progressive inflammatory disease that primarily affects the spine and sacroiliac joints. Over time, the inflammation may extend to the hips, causing stiffness, severe pain, and in advanced cases, complete fusion of the joint.<sup>1,2</sup> When hip fusion occurs, whether bony or fibrous, the joint loses all mobility, forcing patients to adapt with awkward, exhausting movements that severely impact their independence and quality of life.<sup>3,4</sup>

Between 30% and 50% of individuals with AS experience hip involvement, with bilateral hip involvement in 47% to 90%.<sup>2,5,6</sup> THA becomes the most effective option to restore movement, reduce pain, and improve daily function.<sup>7</sup> Yet, performing THA in the context of AS presents unique technical challenges. Years of inflammation and abnormal posture can alter pelvic alignment, restrict surgical exposure, and increase the risk of postoperative complications, particularly

instability and dislocation.<sup>8–10</sup> Research indicates that. When the spinopelvic alignment is fixed, the likelihood of hip dislocation increases.<sup>11</sup> In such cases, selecting the most suitable implant is critical for long-term success.

DM implants have been developed to address instability by incorporating a larger effective head size and an additional articulation, which can increase the range of movement and reduce the risk of dislocation.<sup>12,13</sup> These features may be especially valuable in AS patients, who often have stiff spines and altered biomechanics. A systematic review found that DM cups had a strikingly low dislocation rate of 0.2%, compared with 7.1% for unipolar (UP) cups, which share a similar design and function to FB cups.<sup>14</sup> In contrast, FB implants remain a widely used and trusted option, supported by decades of reliable outcomes in standard THA populations.<sup>15,16</sup>

While both designs have theoretical advantages, Direct comparative evidence on the use of DM versus FB implants in AS patients with hip fusion remains limited. Most existing studies focus on general arthroplasty populations, where anatomical and biomechanical factors differ substantially. This gap in the literature leaves uncertainty about which implant type offers the most favorable outcomes in this particularly complex group of patients. The present study aims to address this gap by comparing functional outcomes, radiographic parameters, and early complication rates for primary THA between DM and FB with bony or fibrous hip fusion. Through this analysis, provide clearer evidence to guide implant selection and improve surgical planning for one of the most challenging scenarios in hip arthroplasty.

## Materials and Methods

This retrospective cohort study included AS patients with hip fusion who underwent primary THA at our institution between January 2019 and December 2023. Hip fusion was diagnosed based on medical history, X-ray, and physical examination, confirming a restricted range of motion, and was further classified as either bony or fibrous fusion.

Inclusion criteria: a confirmed diagnosis of AS, the presence of either bony or fibrous hip fusion, stable AS disease activity at the time of surgery, underwent THA with FB or DM implants, and a minimum follow-up period of six months. Exclusion criteria: follow-up period less than six months, incomplete medical or radiographic records, inadequate imaging quality preventing accurate measurement of cup implantation, previous spine or hip surgeries, and urgent surgeries due to trauma or fracture.

A total of 51 patients met the inclusion criteria. The mean age was  $42.3 \pm 11.6$  years, and the majority were male (43 patients, 84.3%) compared with female (8 patients, 15.7%). In terms of the operated side, 29 patients (56.9%) were on the left side and 22 patients (43.1%) on the right side. Unilateral procedures were performed in 21 patients (41.2%), while 30 patients (58.8%) underwent bilateral procedures. Osteoporosis was documented in 16 patients (31.4%), and the mean number of comorbidities per patient was  $2.4 \pm 1.3$ . Patients with severe spinal and hip stiffness were advised to consider a DM prosthesis, but the final choice of implant type was made by the patient after discussing both options. This approach combined clinical guidance with patient autonomy in the prosthesis selection process. All procedures were performed with the patient in the lateral position, using a posterolateral surgical approach. Cementless acetabular cups and stems were implanted in all cases. Intraoperative radiographs were obtained to verify cup positioning and depth. Patients were divided into two groups according to implant type: the DM group (22) and the FB group (29). Subgroups: 20 patients presented with bony fusion, and 31 patients with fibrous fusion.

Clinical and radiographic assessments were performed preoperatively, immediately after surgery, and during follow-up visits. Most imaging evaluations were conducted using standard anteroposterior pelvic X-rays. Functional outcomes were assessed preoperatively and at three and six months postoperatively using, SF-12 and HHS. Disease activity was measured using the BASDAI, which captures several parameters influencing surgical outcomes in AS patients. Continuous variables were expressed as median (variance). Data distribution was assessed, and group comparisons were performed using one-way analysis of variance and independent sample *t*-tests for normally distributed variables. Statistical significance was defined as  $p < 0.05$ . All analyses were performed using SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA). The study was approved by the Institutional Ethics Committee.

## Results

The baseline characteristics of the FB and DM groups were broadly similar, with no statistically significant differences observed in any variable. In the FB group, 22 patients (75.9%) were male and 7 (24.1%) were female, while in the DM group, 21 patients (95.5%) were male and 1 (4.5%) was female ( $p = 0.12$ ). The mean age in the FB group was  $44.2 \pm 10.7$  years

compared with  $39.7 \pm 12.5$  years in the DM group ( $p = 0.09$ ). Regarding the surgical side, left-sided accounted for 58.6% and right-sided for 37.9% in the FB group, compared with 50.0% left-sided and 45.5% right-sided in the DM group ( $p = 0.49$ ). For procedure type, bilateral procedures were performed in 69.0% and unilateral in 31.0% of FB patients, compared with 45.5% bilateral and 50.0% unilateral in the DM group ( $p = 0.16$ ). Osteoporosis was present in 27.6% of FB patients and 31.8% of DM patients ( $p = 0.66$ ). The mean number of comorbidities was  $3.0 \pm 2.3$  in the FB group and  $2.5 \pm 2.1$  in the DM group ( $p = 0.39$ ). These findings indicate that the two groups were well matched at baseline.

In this study, the DM and FB groups were assessed at separate time points. At baseline, there was no meaningful difference between the two groups. Regarding this study scoring system, lower scores indicate better function and recovery, while higher scores reflect poorer outcomes. This is important to clarify, as it differs from other studies. The figures presented results were designed specifically to reflect this scoring direction, making it visually clear that lower values correspond to improved patient performance over time. This approach ensures consistency with the way the data were collected and analyzed in this study. Additionally, according to the data, there were no readmissions within the follow-up period for either group due to dislocations or infections.

Tables 1 and 2 compare various surgical and clinical parameters across different patient groups. In most measures, such as leg length, pelvic tilt, anteversion, inclination, blood loss, surgery duration, cup size, head size, and femoral stem size, there were no significant differences between the groups. However, in Table 2, the only statistically significant difference was in the stiffness of the spine, which was more common in the bony fusion group. Overall, these findings suggest that while most surgical parameters were similar between groups, a few differences in implant sizing and spine stiffness were observed. Table 3 summarizes the baseline demographic and clinical characteristics.

**Table 1** The Initial Phase is Comparing DM and FB Implants. This Was Done by Analyzing the Mean Values of Clinical and Radiographic Variables Used to Assess Hip Involvement in AS Patients

Variables	DM (n= 22)	FB (n=29)	$\chi^2/t$	p
Leg Length	1.54±0.67	1.54±0.54	0.041	0.968
Pelvic tilt	10.80±16.14	15.69±11.05	-0.96	0.344
Anteversion	10.18±4.18	9.64±4.75	0.349	0.73
Inclination	44.20±7.38	42.00±5.52	1.06	0.296
Blood Loss	289.09±84.23	254.00±135.34	1.08	0.286
Surgery duration	136.59±57.41	120.26±63.11	0.907	0.37
Cup Size	53.82±2.54	51.83±3.66	2.111	0.041*
Femoral stem size	12.73±2.89	10.17±3.32	2.779	0.008**
Stiffness of the spine	19 (86.36)	18 (62.07)	3.708	0.054

Notes: \* $p < 0.05$ , \*\* $p < 0.01$ .

**Table 2** To Evaluate Hip Involvement in AS Patients, We Determined the Mean Clinical and Radiographic Scores and Subsequently Used Them to Compare Cases of Bony Fusion Against Fibrous Fusion

Variables	Bony Fusion (n=20)	Fibrous Fusion (n=31)	$\chi^2/z$	p
Leg Length	1.400 (1.1, 1.8)	1.550 (1.1, 2.0)	-0.636	0.525
Pelvic tilt	13.500 (1.0, 22.3)	12.000 (3.3, 24.6)	-0.294	0.769
Anteversion	8.000 (5.2, 10.0)	10.000 (7.0, 11.9)	-1.415	0.157
Inclination	42.300 (40.0, 45.0)	44.200 (40.3, 47.0)	-1.195	0.232
Blood Loss	300.000 (200.0, 300.0)	250.000 (200.0, 300.0)	-0.61	0.542
Surgery duration	120.000 (95.0, 145.0)	115.000 (80.0, 180.0)	-0.349	0.727
Cup Size	52.000 (52.0, 55.5)	52.000 (48.0, 54.0)	-1.578	0.115
Femoral stem size	12.500 (10.0, 14.8)	11.000 (7.8, 14.0)	-1.08	0.28
Stiffness of the spine	18 (90.00)	19 (61.29)	5.031	0.025*

Note: \* $p < 0.05$ .

**Table 3** Baseline Demographic and Clinical Characteristics of the Study Cohort

Characteristic	Total Cohort (n = 51)
<b>Age (years), mean ± SD</b>	42.3 ± 11.6
<b>Sex, n (%)</b>	
Male	43 (84.3%)
Female	8 (15.7%)
<b>Operated side, n (%)</b>	
Left	29 (56.9%)
Right	22 (43.1%)
<b>Procedure type, n (%)</b>	
Unilateral	21 (41.2%)
Bilateral*	30 (58.8%)
<b>Implant type, n (%)</b>	
Dual-mobility (DM)	22
Fixed-bearing (FB)	29
<b>Minimum follow-up duration (months)</b>	≥ 6

**Notes:** \*For patients classified as bilateral, only the index hip operated during the study period was included in the analysis. Any prior contralateral total hip arthroplasty performed before the study period or at another institution was not included.

## Functional Outcomes

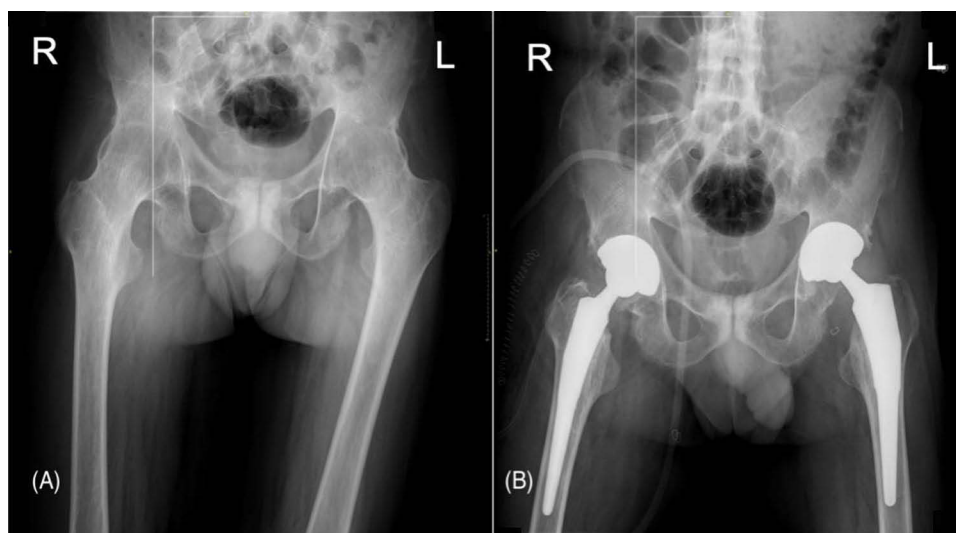
Preoperatively, SF-12, HHS and OHS scores were compared between the groups. At 3 months, DM patients showed significantly better results, with lower median HHS (14.0 [12.0–15.8] vs 18.0 [15.0–20.0];  $p = 0.001$ ), OHS (17.0 [15.0–21.0] vs 30.0 [21.0–32.8];  $p < 0.001$ ), and SF-12 scores (26.5 [25.0–29.0] vs 30.0 [29.0–32.8];  $p < 0.001$ ) compared with FB. At 6 months, this advantage persisted, with DM maintaining lower HHS (12.5 [12.0–13.0] vs 15.5 [13.0–16.8];  $p = 0.001$ ), OHS (14.0 [12.8–18.0] vs 21.5 [20.0–26.5];  $p < 0.001$ ), and SF-12 scores (19.0 [17.0–21.0] vs 26.0 [24.0–29.8];  $p < 0.001$ ), indicating sustained functional superiority.

BASDAI scores were similar between groups at baseline (89.0 [59.0–93.5] vs 92.5 [41.0–151.8],  $p = 0.934$ ). At 3 months, both groups improved, with the FB group showing a slightly lower median BASDAI score (40.0 [22.3–55.8] vs 52.0 [13.5–73.5]), suggestive of better early symptom control, though not statistically significant ( $p = 0.055$ ). By 6 months, BASDAI scores continued to improve in both groups, with no meaningful difference between DM (32.5 [8.3–75.3]) and FB (44.0 [26.8–80.3],  $p = 0.507$ ).

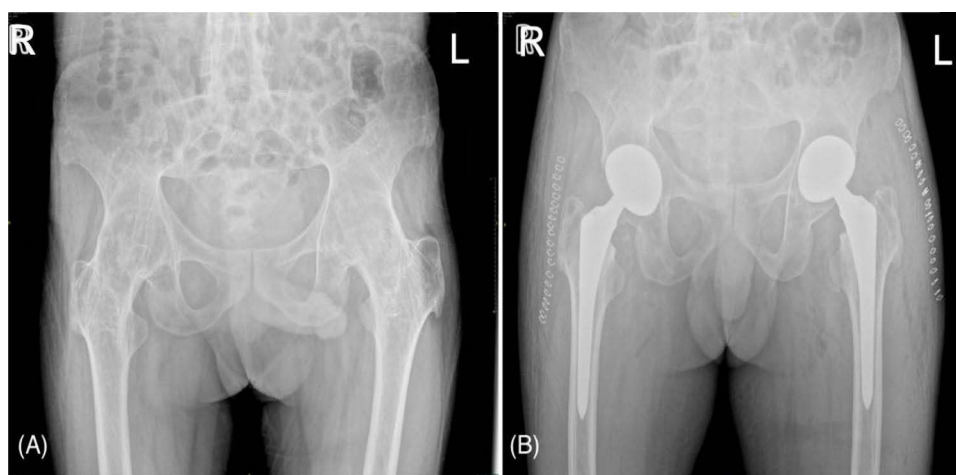
Figures 1 and 2 show pre- and post-operative X-rays used in this study to measure clinical parameters for each patient. Image (A) in both figures displays the pelvis pre-operative, showing bony fusion of the hips. Image (B) shows the post-operative view following bilateral THA, using either DM implants (Figure 1) or FB implants (Figure 2). These radiographs were used to evaluate surgical outcomes and to compare results between the two implant types. Across all follow-up periods, both the DM and FB groups showed marked functional improvement after surgery. However, DM consistently achieved better outcomes, with HHS, OHS, and SF-12 scores at 3 and 6 months, indicating faster recovery and greater functional gains. BASDAI scores improved in both groups, with a slightly greater early reduction in the FB group at 3 months, although this difference did not reach statistical significance, and by 6 months, the scores were similar (Figures 3–6). When comparing fusion types, patients with bony fusion generally experienced greater improvements in OHS, HHS, and SF-12 scores than those with fibrous fusion, suggesting better functional recovery. In contrast, BASDAI scores improved in both groups, but the fibrous fusion group showed a slightly greater reduction over time, indicating better perceived symptom relief, although the difference was not significant (Figures 7–10).

## Discussion

AS may seem uncommon, but it affects people worldwide, typically between 0.1% and 1.4% of the population, depending on region and ethnicity. AS usually starts in early adulthood, often between ages 15 and 40.<sup>17,18</sup> This variation



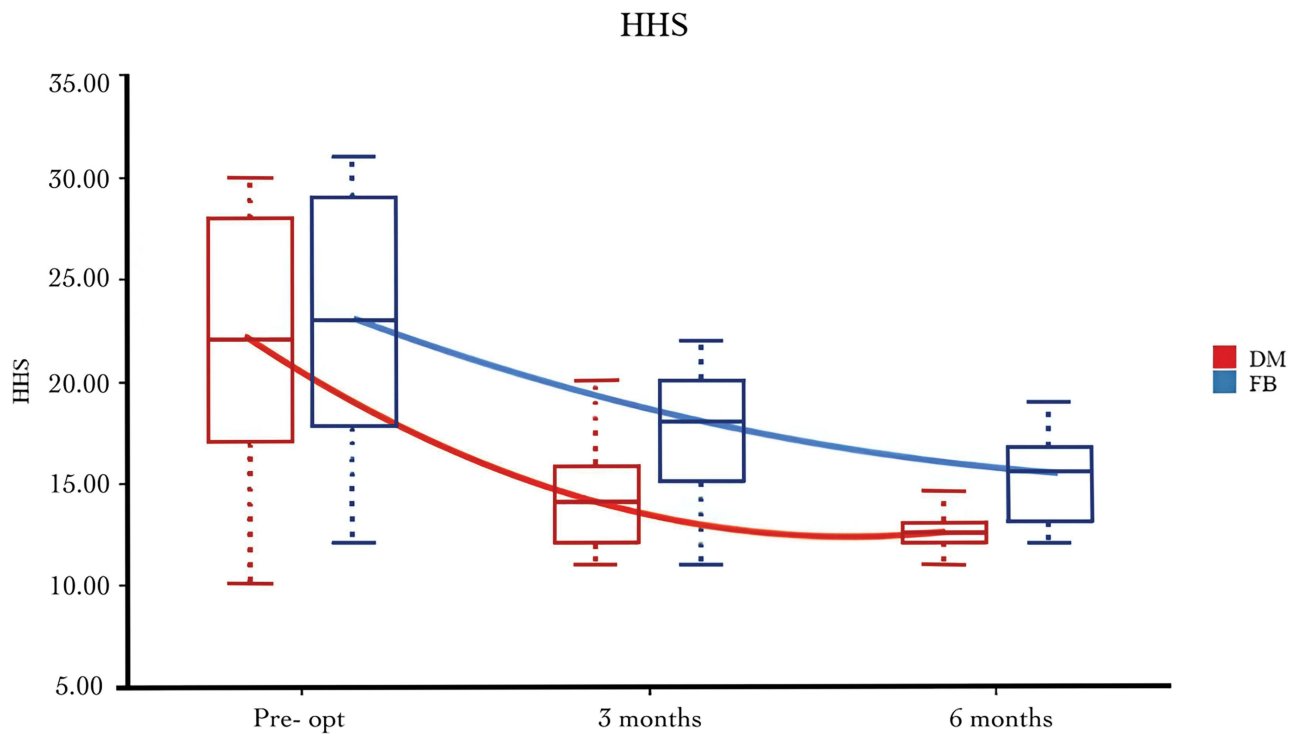
**Figure 1** (A) An anterior-posterior pelvic radiograph from a typical case, taken pre-operatively, reveals bony fusion. (B) Subsequent radiological follow-up after the patient underwent bilateral DM total Hip arthroplasty.



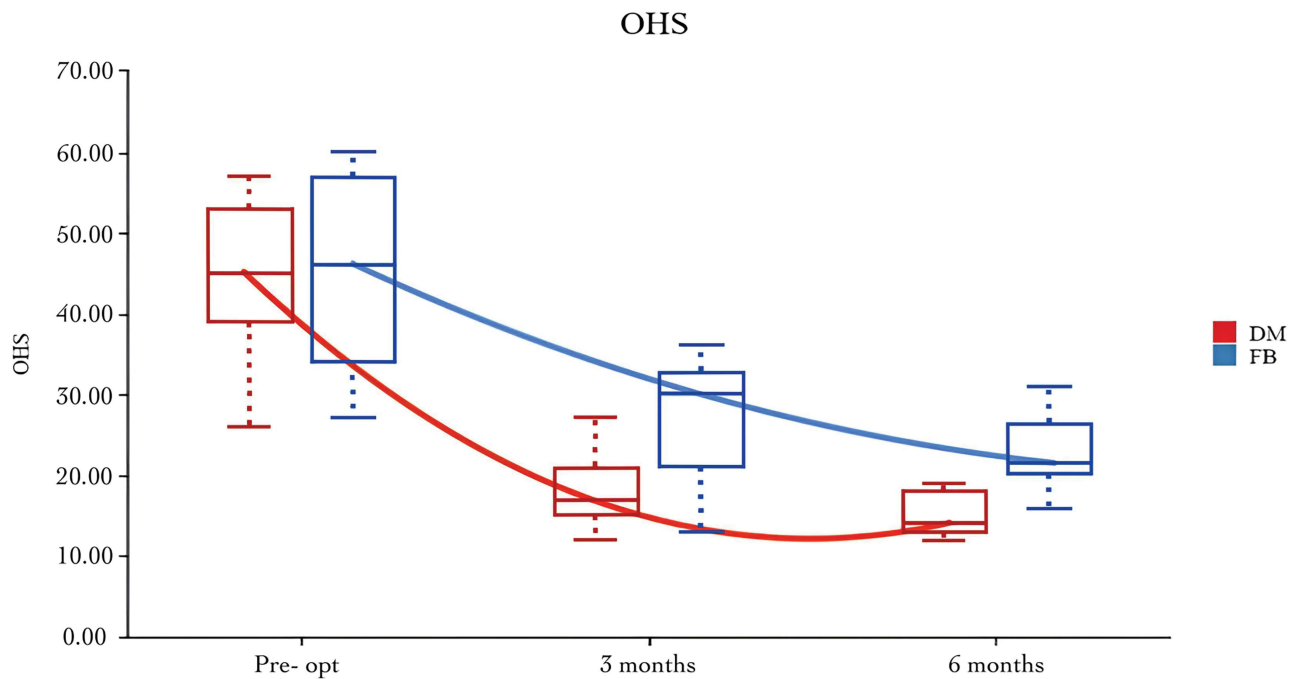
**Figure 2** (A) An anterior-posterior pelvic radiograph from a typical case, taken pre-operatively, reveals bony fusion. (B) Subsequent radiological follow-up after the patient underwent bilateral FB total Hip arthroplasty.

is largely due to how common the HLA-B27 gene is in different populations, which influences who is more likely to develop AS. A recent long-term study in South Korea found that AS cases climbed from about 27 per 100,000 people in 2010 to almost 82 per 100,000 in 2023, that's a threefold rise over just over a decade.<sup>19</sup> This increase is likely driven by improved disease detection, growing public and medical awareness, and the cumulative effect of new cases each year. Older estimates suggest continent-level differences. For instance, Europe saw 24 cases per 10,000 people, while Asia had about 16–17, North America had approximately 32, Latin America around 10, and Africa about 7 per 10,000.<sup>20,21</sup> Although men are more frequently diagnosed, new studies show that the gap between men and women may be narrowing, possibly due to better recognition and diagnosis of the disease in women.<sup>17,21</sup>

As the prevalence of THA continues to rise in the AS population, studies confirm that even patients with pre-existing hip fusion can achieve excellent functional outcomes post-surgery.<sup>22,23</sup> According to a study by Hamilton et al, the primary factor determining post-operative functional outcome after joint replacement is a reduction in limb discomfort.<sup>24</sup> Some scientists further argue that patient satisfaction following THA is primarily determined by improvements in claudication gait, the remission of residual pain, and overall functional enhancement.<sup>25,26</sup> This study compared functional

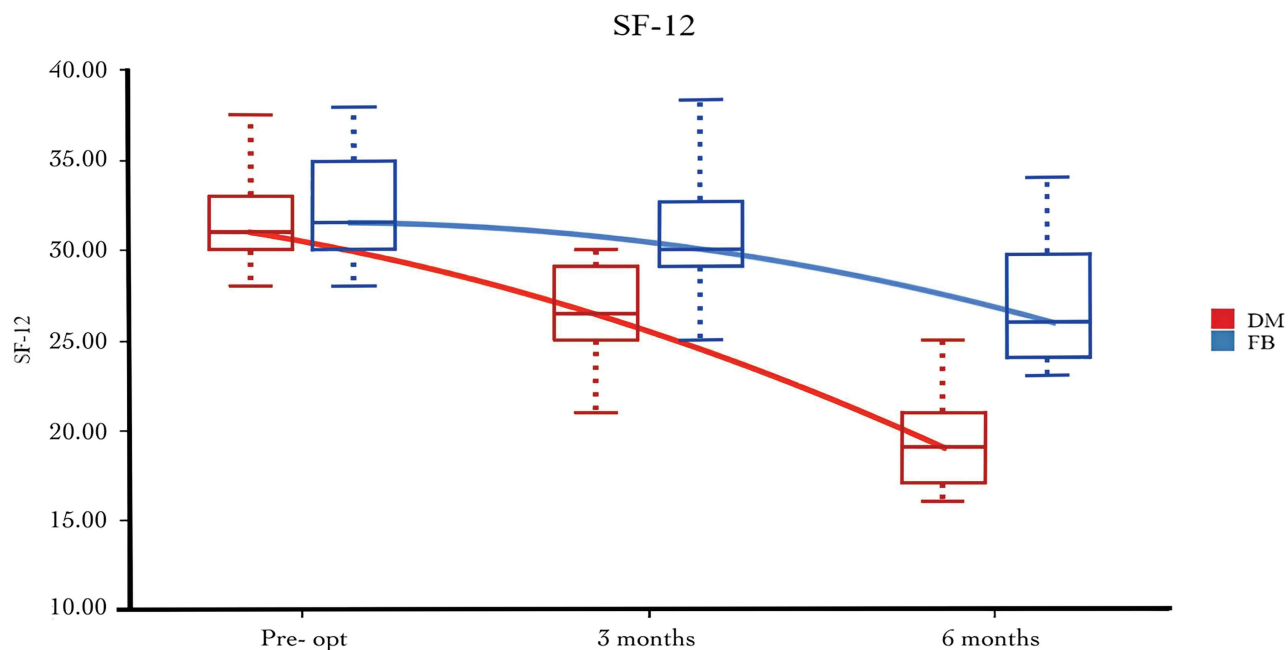


**Figure 3** Comparative analysis of HHS scores across multiple time points demonstrated significant improvement in the DM group.

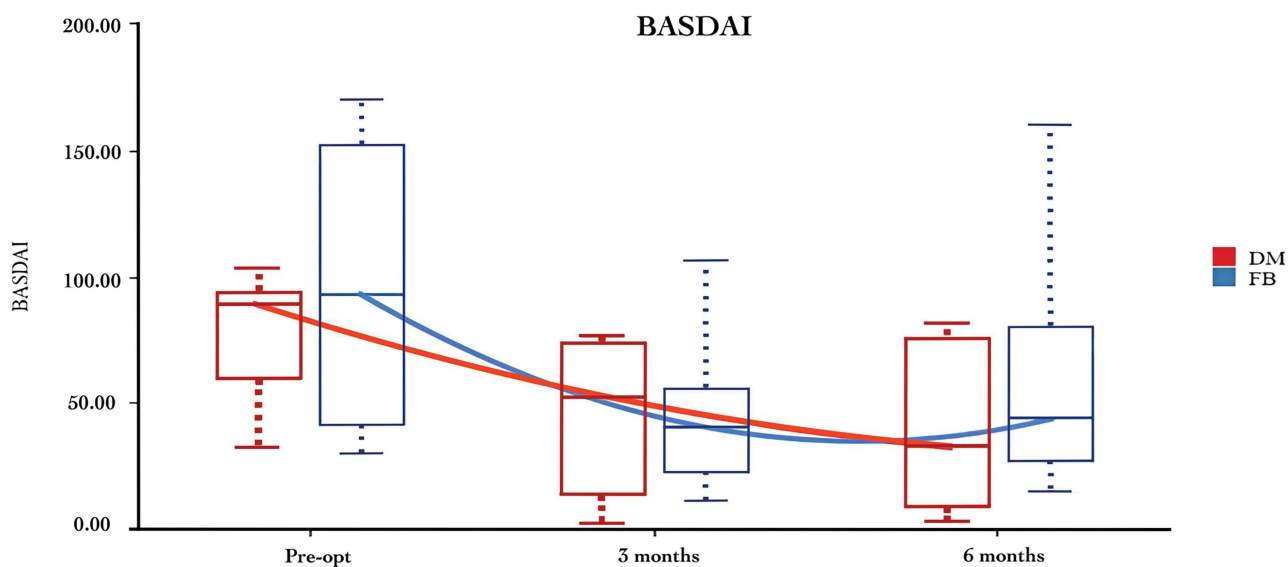


**Figure 4** The DM group showed a more significant improvement in OHS scores than the other group when measured across various time intervals.

and clinical outcomes between DM and FB THA in patients with AS and hip fusion, a surgical scenario known for its technical complexity and elevated risk of instability. Both implant designs produced substantial improvements in mobility, pain relief, and quality of life over the six-month follow-up period. However, Patients receiving DM implants demonstrated significantly higher HHS, OHS, and SF-12 scores at both 3 and 6 months postoperatively compared with

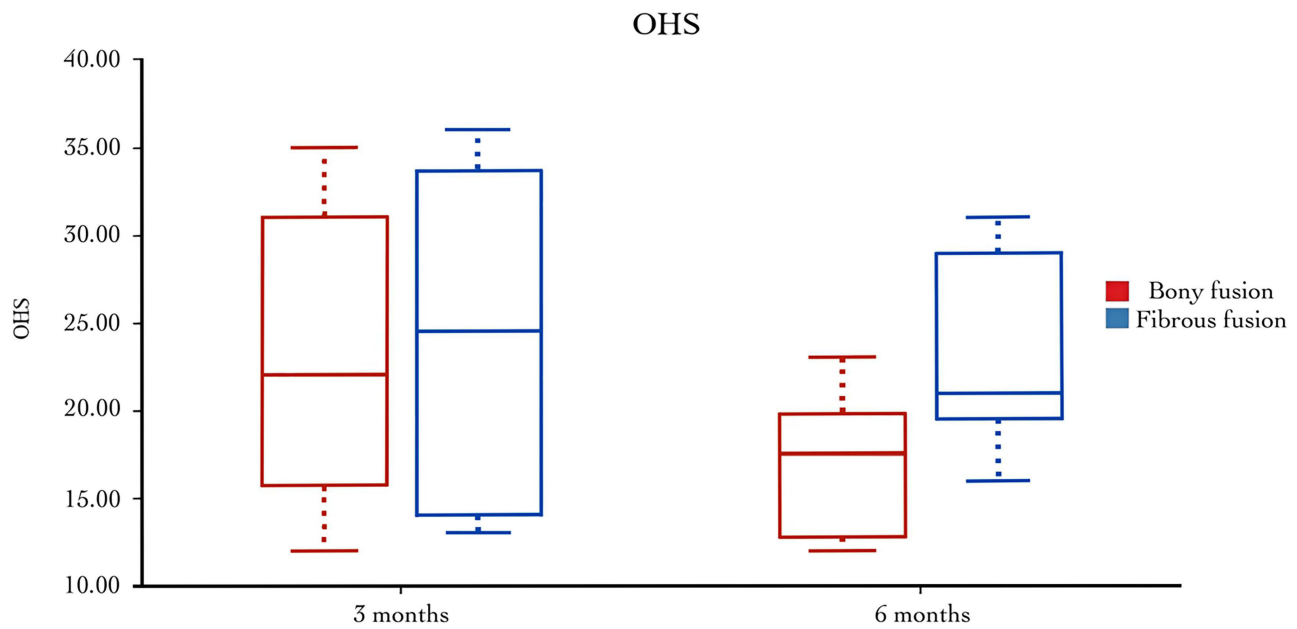


**Figure 5** A comparison of SF-12 scores at different time periods revealed a more substantial improvement, particularly in the DM group.

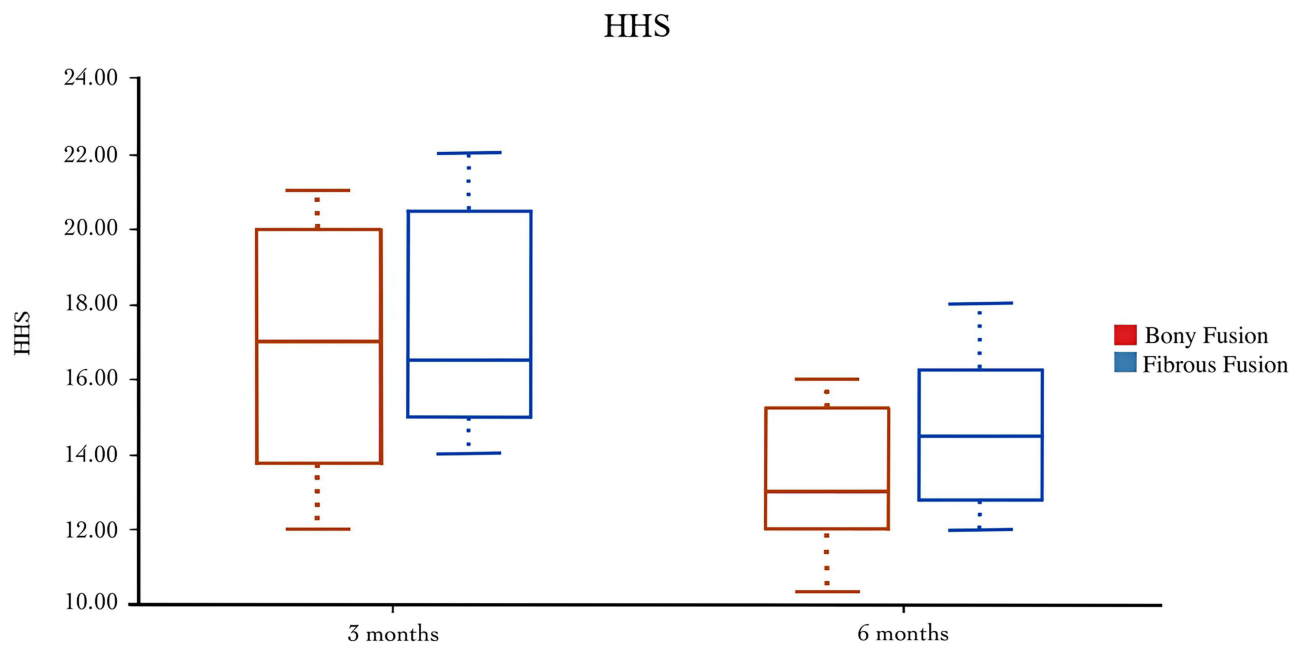


**Figure 6** The DM group showed a greater improvement in BASDAI scores across the follow-up periods compared to the other group.

those receiving FB implants. While the theoretical biomechanical advantages of DM constructs may apply broadly across THA populations, these benefits may be particularly relevant in patients with AS due to their characteristic spinal rigidity and fixed pelvic alignment. However, given the absence of a comparative non-AS cohort in the present study, disease-specific mechanisms should be interpreted cautiously. Importantly, this interpretation is based on functional outcome measures and does not imply superior long-term implant performance. A recent multi-center investigation comparing DM and FB prostheses found that patients receiving DM implants experienced an enhanced range of motion, along with a reduced incidence of dislocation, readmission, and revision compared to those with FB implants.<sup>27</sup> A recent publication supports the use of DM bearings in younger patients, who typically require higher-performing implants due to their



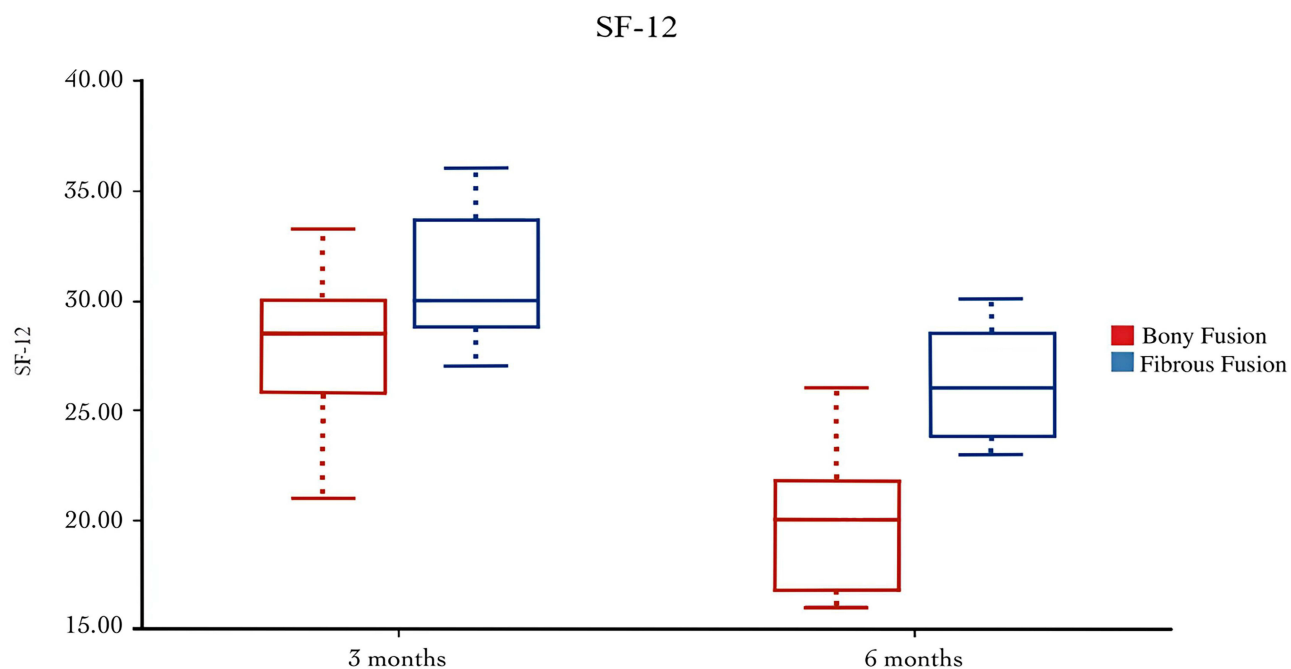
**Figure 7** A comparison of OHS scores at various time intervals revealed significantly greater improvement in the bony fusion group compared to the fibrous fusion group.



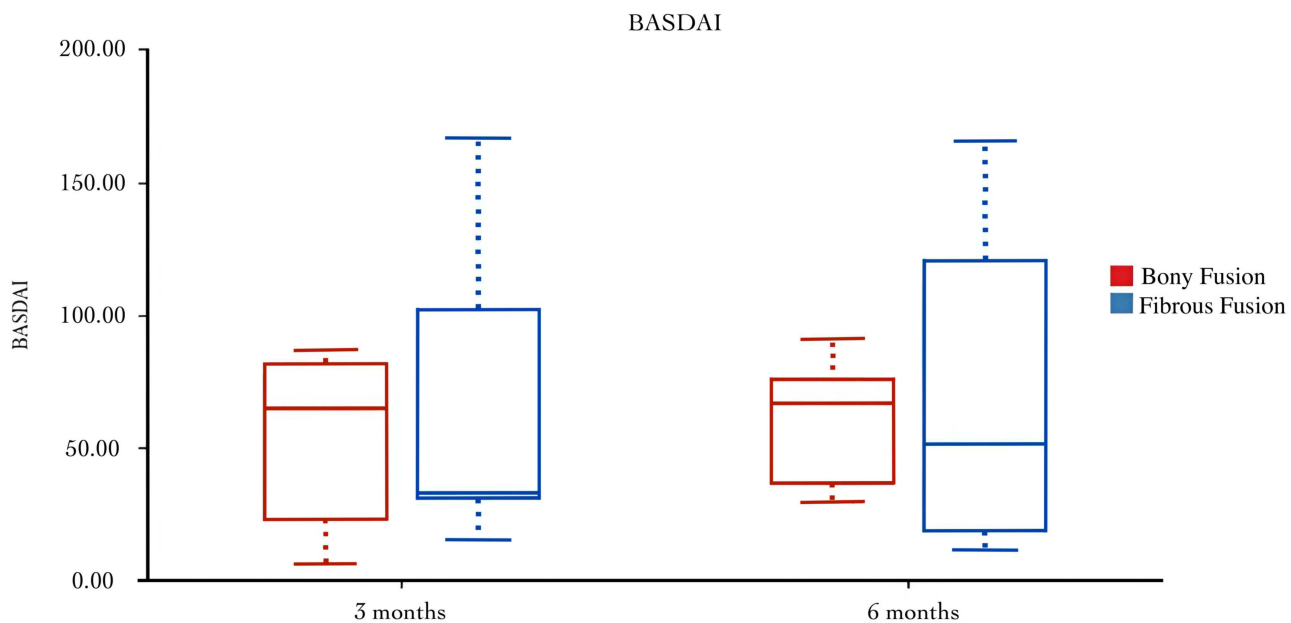
**Figure 8** A comparison of HHS scores at various time intervals revealed a more significant improvement in the bony fusion group compared to the fibrous fusion group.

greater physical activity levels and longer life expectancy.<sup>28</sup> Historical data consistently shows the superiority of DM implants over FB designs, with advantages in cost-effectiveness, dislocation rates, and overall survivorship.<sup>29</sup>

Our findings are consistent with previous reports suggesting that DM implants may reduce the risk of instability and support improved early functional recovery, particularly in patients with altered biomechanics or fixed spinopelvic alignment. In patients with AS, spinal stiffness and abnormal pelvic tilt restrict normal compensatory motion, which may increase susceptibility to impingement and functional instability following THA.<sup>30</sup> Within this biomechanical context, the design characteristics of DM implants may contribute to improved early functional stability; however, these potential advantages are not exclusive to AS and should be interpreted within the broader framework of implant biomechanics.



**Figure 9** A comparison of SF-12 scores at different time periods revealed a more substantial improvement, particularly in the bony fusion group.



**Figure 10** A comparison of BASDAI scores at various time intervals revealed greater improvement in the fibrous fusion group compared to the bony fusion group.

This interpretation focuses on functional performance and patient satisfaction rather than dislocation prevention alone and remains consistent with the outcomes measured in the present study. While FB implants remain a reliable choice in standard THA. Interestingly, BASDAI scores improved similarly in both groups, with the FB group showing a slightly greater early reduction at 3 months, although this was not statistically significant. This may reflect variations in subjective symptom perception rather than true differences in joint function, as objective functional scores consistently favoured DM. The lack of difference in BASDAI at six months suggests that both implant types ultimately achieve comparable control of disease-related symptoms over time. When stratified by fusion type, patients with bony fusion demonstrated

greater improvements in functional scores than those with fibrous fusion. This could be due to the more predictable restoration of joint mechanics after replacing a fully fused hip, compared with the subtler biomechanical changes in fibrous fusion. Conversely, patients with fibrous fusion reported slightly better improvements in BASDAI, possibly because they began with more residual mobility and experienced greater subjective relief from pain and stiffness.

This study has several strengths, including a well-defined patient cohort, direct comparison of two widely used implant types, and the use of multiple validated functional outcome measures. However, limitations should be acknowledged. The retrospective design introduces potential selection bias, particularly as patients were involved in implant choice after surgical counselling. The sample size, while adequate for detecting major functional differences, limits subgroup analyses. Additionally, the six-month follow-up captures only short-term outcomes; longer follow-up is needed to determine whether the early advantages of DM implants persist and translate into reduced long-term complication or revision rates.

Future prospective studies with longer follow-up are warranted to confirm these findings and to explore whether DM's early benefits lead to improved long-term implant survival and patient satisfaction.

## Conclusion

Both DM and FB prostheses led to substantial functional improvement in AS patients after THA. DM implants showed consistently better HHS, OHS, and SF-12 scores at 3 and 6 months, suggesting faster recovery and greater functional gains. BASDAI scores improved in both groups, with no significant long-term difference. Bony fusion patients achieved greater functional recovery, while fibrous fusion patients reported slightly better symptom relief.

## Data Sharing Statement

The datasets generated and analyzed during the current study are not publicly available due to hospital data protection policies but are available from the corresponding author on reasonable request.

## Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of The Second Affiliated Hospital of Harbin Medical University (Approval No. KY2024-210). All procedures were performed in accordance with the Declaration of Helsinki. Written informed consent to participate was obtained from all individual participants included in the study.

## Author Contributions

All authors made substantial contributions to the conception and design of the study, data acquisition, analysis, and interpretation. All authors were involved in drafting the manuscript or revising it critically for important intellectual content. All authors approved the final version of the manuscript to be published, agreed on the journal to which the article was submitted, and take responsibility for the accuracy and integrity of all aspects of the work.

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## Disclosure

The authors declare no competing interests in this work.

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## References

1. Murphy SN, Nguyen BA, Singh R, et al. A brief human history of ankylosing spondylitis: a scoping review of pathogenesis, diagnosis, and treatment. *Surg Neurol Int.* 2022;13:297. doi:10.25259/SNI\_294\_2022
2. Ni M, Wu B, Liu H, et al. Hip involvement in ankylosing spondylitis. In: *Surgical Treatment of Ankylosing Spondylitis Deformity*. Springer; 2019:191–193.
3. Sadek F, Abo-Elsoud M. Total Hip arthroplasty for fused hips: clinical and radiological outcome. *Egypt Orthop J.* 2017;52(3):230–235. doi:10.4103/eoj.eoj\_64\_17
4. Tokuyasu H, Kim Y, Vergari C, et al. Hip-lumbar mobility loss affects quality of life in patients undergoing both lumbar fusion and total hip arthroplasty. *Bone Joint J.* 2025;107(1):34–41. doi:10.1302/0301-620X.107B1.BJJ-2024-0406.R1
5. Panakkal JJ, Thilak J. Primary total Hip arthroplasty in ankylosing spondylitis—an analysis of 47 hips. *Kerala J Orthop.* 2014;27(2).

6. Tbini H, Slouma M, Rahmouni S, et al. AB0792 Hip involvement in spondyloarthritis: analysis of associated factors. *Ann Rheumatic Dis.* 2022;81:1523. doi:10.1136/annrheumdis-2022-eular.1465
7. Abrishami R, Aghili SH, Afshar C, et al. Long-term outcomes of converting fused hips to total Hip arthroplasty are satisfactory: a systematic review and meta-analysis. *Ann Med Surg.* 2024;86(6):3391–3399. doi:10.1097/MS9.0000000000002024
8. Reynolds J, Harper KD, Gokcen EC. Total hip arthroplasty in untreated ankylosing spondylitis: tips and tricks to avoid complications. *Tech Orthop.* 2020;35(1):67–72. doi:10.1097/BTO.0000000000000323
9. Chung BC, Steff M, Kang HP, et al. Increased dislocation rates following total Hip arthroplasty in patients with ankylosing spondylitis. *Hip Int.* 2023;33(6):1026–1034. doi:10.1177/11207000221126968
10. Kawde K, Khan KK, Pisulkar G, Taywade S, Jayasooraya A. Total hip arthroplasty in ankylosing spondylitis: a case report of ankylosed hip. *Cureus.* 2024;16(1).
11. Esposito CI, Carroll KM, Sculco PK, et al. Total Hip arthroplasty patients with fixed spinopelvic alignment are at higher risk of hip dislocation. *J Arthroplasty.* 2018;33(5):1449–1454. doi:10.1016/j.arth.2017.12.005
12. Saroha S, Raheman FJ, Jaiswal PK, et al. Dual-mobility implants in primary and revision total Hip arthroplasty: a systematic review and meta-analysis. *J Clin Orthopaedics Trauma.* 2024;54:102495. doi:10.1016/j.jcot.2024.102495
13. Cuthbert R, Wong J, Mitchell P, et al. Dual mobility in primary total Hip arthroplasty: current concepts. *EFORT Open Rev.* 2019;4(11):640–646. doi:10.1302/2058-5241.4.180089
14. Jonker RC, van Beers LW, van Der Wal BC, et al. Can dual mobility cups prevent dislocation without increasing revision rates in primary total Hip arthroplasty? A systematic review. *Orthop Traumatol.* 2020;106(3):509–517.
15. Singh V, Loloi J, Macaulay W, et al. Dual-mobility versus fixed-bearing in primary total Hip arthroplasty: outcome comparison. *Hip Pelvis.* 2022;34(2):96. doi:10.5371/hp.2022.34.2.96
16. Malviya A, Abdul N, Khanduja V. Outcomes following total Hip arthroplasty: a review of the registry data. *Indian J Orthop.* 2017;51(4):405–413. doi:10.4103/ortho.IJOrtho\_177\_17
17. Gong Y, Yang K, Geng Z, et al. Prevalence, influencing factors, and prediction model construction of anemia in ankylosing spondylitis based on real-world data: an exploratory study. *PLoS One.* 2025;20(2):e0318332. doi:10.1371/journal.pone.0318332
18. Wei Y, Zhang S, Shao F, et al. Ankylosing spondylitis: from pathogenesis to therapy. *Int Immunopharmacol.* 2025;145:113709. doi:10.1016/j.intimp.2024.113709
19. Jung Y-S, Cho S-K, Choi SR, et al. Evolving trends in the prevalence and treatment of ankylosing spondylitis in Korea from 2010 to 2023: a population-based study. *Sci Rep.* 2025;15(1):2561. doi:10.1038/s41598-025-86641-4
20. Dean LE, Jones GT, MacDonald AG, et al. Global prevalence of ankylosing spondylitis. *Rheumatology.* 2014;53(4):650–657. doi:10.1093/rheumatology/ket387
21. Mahakkanukrauh A, Suwannaraj S, Pongkulkiat P, et al. The incidence and prevalence of ankylosing spondylitis in Thailand using ministry of public health database. *Sci Rep.* 2024;14(1):16981. doi:10.1038/s41598-024-67666-7
22. Bhan S, Eachempati KK, Malhotra R. Primary cementless total Hip arthroplasty for bony ankylosis in patients with ankylosing spondylitis. *J Arthroplasty.* 2008;23(6):859–866. doi:10.1016/j.arth.2007.07.014
23. Saglam Y, Öztürk İ, Fevzi Çakmak M, et al. Total Hip arthroplasty in patients with ankylosing spondylitis: midterm radiologic and functional results. *Acta orthopaedica et traumatologica turcica.* 2016;50(4):443–447. doi:10.1016/j.aott.2016.06.010
24. Hamilton D, Lane JV, Gaston P, et al. What determines patient satisfaction with surgery? A prospective cohort study of 4709 patients following total joint replacement. *BMJ open.* 2013;3(4):e002525. doi:10.1136/bmjopen-2012-002525
25. Anakwe RE, Jenkins PJ, Moran M. Predicting dissatisfaction after total Hip arthroplasty: a study of 850 patients. *J Arthroplasty.* 2011;26(2):209–213. doi:10.1016/j.arth.2010.03.013
26. Mancuso CA, Jout J, Salvati EA, et al. Fulfillment of patients' expectations for total Hip arthroplasty. *JBJS.* 2009;91(9):2073–2078. doi:10.2106/JBJS.H.01802
27. Dubin J, Westrich G. Lack of early dislocation for dual mobility vs. fixed bearing total Hip arthroplasty: a multi-center analysis of comparable cohorts. *J Orthop.* 2020;21:1–5. doi:10.1016/j.jor.2020.02.006
28. Epinette J-A, Harwin SF, Rowan FE, et al. Early experience with dual mobility acetabular systems featuring highly cross-linked polyethylene liners for primary Hip arthroplasty in patients under fifty five years of age: an international multi-centre preliminary study. *Int Orthop.* 2017;41(3):543–550. doi:10.1007/s00264-016-3367-0
29. Tarasevicius S, Busevicius M, Robertsson O, et al. Dual mobility cup reduces dislocation rate after arthroplasty for femoral neck fracture. *BMC Musculoskeletal Disord.* 2010;11(1):175. doi:10.1186/1471-2474-11-175
30. Oommen AT, Hariharan TD, Kandagaddala M, Chandy VJ, Poonnoose PM, Shankar AA. Spinopelvic mobility pattern and acetabular anteversion in stiff hips with ankylosing spondylitis after total hip arthroplasty. *Arthroplast Today.* 2022;16:182–191. doi:10.1016/j.artd.2022.05.006

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