Revision of metal-on-metal hip replacements with dual-mobility bearings and acetabular component retention

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Aims

In metal-on-metal (MoM) hip arthroplasties and resurfacings, mechanically induced corrosion can lead to elevated serum metal ions, a local inflammatory response, and formation of pseudotumours, ultimately requiring revision. The size and diametral clearance of anatomical (ADM) and modular (MDM) dual-mobility polyethylene bearings match those of Birmingham hip MoM components. If the acetabular component is satisfactorily positioned, well integrated into the bone, and has no surface damage, this presents the opportunity for revision with exchange of the metal head for ADM/MDM polyethylene bearings without removal of the acetabular component.

Methods

Between 2012 and 2020, across two centres, 94 patients underwent revision of Birmingham MoM hip arthroplasties or resurfacings. Mean age was 65.5 years (33 to 87). In 53 patients (56.4%), the acetabular component was retained and dual-mobility bearings were used (DM); in 41 (43.6%) the acetabulum was revised (AR). Patients underwent follow-up of minimum two-years (mean 4.6 (2.1 to 8.5) years).

Results

In the DM group, two (3.8%) patients underwent further surgery: one (1.9%) for dislocation and one (1.9%) for infection. In the AR group, four (9.8%) underwent further procedures: two (4.9%) for loosening of the acetabular component and two (4.9%) following dislocations. There were no other dislocations in either group. In the DM group, operating time (68.4 vs 101.5 mins, $p < 0.001$), postoperative drop in haemoglobin (16.6 vs 27.8 g/L, $p < 0.001$), and length of stay (1.8 vs 2.4 days, $p < 0.001$) were significantly lower. There was a significant reduction in serum metal ions postoperatively in both groups ($p < 0.001$), although there was no difference between groups for this reduction ($p = 0.674$ (cobalt); $p = 0.186$ (chromium)).

Conclusion

In selected patients with Birmingham MoM hips, where the acetabular component is well-fixed and in a satisfactory position with no surface damage, the metal head can be exchanged for polyethylene ADM/MDM bearings with retention of the acetabular prosthesis. This presents significant benefits, with a shorter procedure and a lower risk of complications.

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Take home message

- In selected patients with Birmingham metal-on-metal hips, where the acetabular component is well-fixed and in a satisfactory position with no surface damage, the metal head can be exchanged for polyethylene anatomical or modular dual-mobility bearings with retention of the acetabular prosthesis.
- Our study shows significant benefits through a less invasive procedure, with a shorter operating time, reduced blood loss, shorter length of stay, improved postoperative weight-bearing, and a lower risk of complications.

Introduction

In the past, during a time of smaller head sizes and cross-linked polyethylene prone to wear, debris formation, and osteolysis, metal-on-metal total or resurfacing hip arthroplasty offered an attractive solution. Larger head sizes, durable metal-on-metal (MoM) bearings with lower volumetric wear rates, and preservation of femoral bone lend themselves towards young, high-demand individuals with osteoarthritis.

Over one million MoM bearings have been implanted worldwide. However, after their introduction, registry data highlighted unacceptable early failure rates, and a number of implants underwent recall.[1,2] Mechanically induced corrosion can release cobalt and chromium ions, leading to elevated serum metal ions and a local inflammatory response (adverse reaction to metal debris (ARMD)). The effects on surrounding soft-tissues can further compromise the outcomes of future revision surgery.[3] Large registry studies have reported the prostheses at risk and factors for failure,[4,5] which now reflect the narrow indications for implantation, implant sizes, and patient demographics. The Medicines and Healthcare products Regulatory Agency (MHRA) alert also reflects the updated knowledge in the 2017 follow-up guidelines.[6]

One of the most used MoM implants in the UK was the Birmingham hip system (Smith and Nephew, UK). This can be used as a hip resurfacing, or as a total hip arthroplasty (THA) using a femoral stem and large-diameter MoM bearings. Removal of well-fixed acetabular components lead to excessive and undesirable bone loss, which can be difficult to reconstruct. The size and diametral clearance of Anatomical Dual-mobility (ADM) and Modular Dual-mobility (MDM) (Stryker, USA) highly cross-linked polyethylene (X3) bearings match those of the Birmingham Hip components, and so can fit within an existing, retained acetabular component. This presents the opportunity for revision of the hip without the need for removal of the acetabular component if it is well fixed and appropriately positioned. The X3 highly cross-linked polyethylene bearing of the ADM and MDM systems are identical in design and material, and made by the same manufacturer (Stryker). The MDM range is designed to fit within the modular liner of the Trident acetabular component system, and is available from 36 mm to 58 mm outer diameter in either 2 mm or 4 mm increments. Due to variations in size in the range to fit the inner liner, there is no polyethylene bearing of 40 mm, 44 mm, 50 mm, or 56 mm outer diameter in the range. The ADM range is designed to fit the ADM monobloc cup system and is available in each 2 mm increment from 40 mm to 58 mm outer diameter. There are, however, no 36 mm or 38 mm options in the range, unlike with MDM. By using the combined range of both dual-mobility designs, available from the same manufacturer, it is possible to achieve a range of polyethylene DM head sizes from 36 mm to 58 mm outer diameter inclusive in 2 mm increments.

Outcomes of revision surgery in MoM prostheses have improved with time, as surveillance and thresholds for revision have improved. However, complications still remain higher in revision of MoM hip arthroplasties than in revisions for other causes.[7] Modular implant retention represents a less invasive procedure. Dual-mobility components have previously been shown to reduce the risk of dislocation in revision surgery for other causes.[8]

This study reports on our experience using polyethylene MDM/ADM bearings to revise Birmingham MoM resurfacings and THAs while retaining the acetabular component, and the results of those patients who did undergo revision of the acetabular component. We report mid-term outcomes in both groups.

Methods

Patients who had undergone revision of a Birmingham MoM THA or resurfacing were identified across two hospitals, which are within separate healthcare trusts in the UK. Patients undergoing revision procedures for infection were excluded. All reviews were conducted according to routine follow-up protocols, and so specific ethical approval was not required.

In Hospital 1, five surgeons performed 78 revision procedures of Birmingham MoM hips in 72 patients between February 2014 and October 2020. In Hospital 2, five surgeons performed 16 procedures in 16 patients between August 2012 and October 2020. The Birmingham component was retained and a dual-mobility head was used (DM) in 45 procedures in Hospital 1, and eight in Hospital 2. An ADM polyethylene head was used in 20 (37.8%) patients and a MDM head in 17 (32.1%). In 16 (30.2%) patients who received their surgery early during the study period, a custom-made polar head (POLARCUP XLPE insert, Smith & Nephew, UK) was used. In all other cases the acetabulum was revised, with removal of the existing Birmingham acetabular component and insertion of a new prosthesis (AR).

Patient characteristics and details of previous surgery by hospital and by revision type are shown in Tables I and II.

Indications for surgery were most frequently related to ARMD including pain, rising serum metal ions, and increasing size of associated collections. The exception to this in the DM group was one patient (1.9%) who underwent revision for a loose femoral side resurfacing component. In the AR group, one (2.4%) patient underwent revision for metastatic disease in the femur, two (4.9%) patients underwent revision for fractures around the femoral prosthesis, four (9.8%) underwent revision for loosening of the femoral component, and two (4.9%) patients underwent revision for loosening of the acetabular component.

MRI was performed preoperatively in 87 patients. Periarticular collections were identified in 73 patients. Further details are provided in Table II.

Preoperative and postoperative radiographs were reviewed, and cup inclination[9] and leg lengths[10] were measured using MDesk software (RSA Biomedical, Sweden) in Hospital 1 and Insight PACS (Insignia Medical Systems, UK) software in Hospital 2. Radiological parameters and serum metal ions are shown in Table III. Postoperative metal ions

Table I. Baseline characteristics of 94 patients undergoing revision of a Birmingham metal-on-metal resurfacing or total hip arthroplasty by hospital.

Characteristic	Hospital 1	Hospital 2	Overall	p-value
N	78	16	94	
Mean age, yrs (range)	66.1 (33 to 87)	62.8 (36 to 85)	65.5 (33 to 87)	0.397*
Male:Female, n	37:41	6:10	43:51	0.467†
Mean time from last procedure, mths (range)	123.4 (59 to 179)	159.8 (60 to 277)	129.9 (59 to 277)	0.036*‡
Primary implant type, n (%)				
Birmingham Resurfacing	15 (19.2)	14 (87.5)	29 (30.9)	
Synergy (Smith & Nephew)/Birmingham THA	62 (79.5)	0 (0)	62 (66.0)	
SL Plus (Smith & Nephew) Stem/Birmingham THA	0 (0)	2 (12.5)	2 (2.1)	
CPCS Stem (Smith & Nephew)/Birmingham THA	1 (1.3)	0 (0)	1 (1.1)	
Cup retention and dual-mobility, n (%)	45 (57.7)	8 (50.0)	53 (56.4)	0.572†
Acetabular revision, n (%)	33 (42.3)	8 (50.0)	41 (43.6)	

*Independent-samples *t*-test.
†Chi-squared test.
‡Significant at 5% level, no adjustment for multiple testing.
THA, total hip arthroplasty.

Table II. Baseline characteristics of 94 patients undergoing revision of a Birmingham metal-on-metal resurfacing or total hip arthroplasty by procedure type.

Characteristic	Cup retention and dual-mobility	Acetabular revision	Overall	p-value
N	53	41	94	
Mean age, yrs (range)	68.3 (36 to 87)	62.0 (33 to 75)	65.5 (33 to 87)	< 0.001*†
Male:Female, n	27:26	14:27	41:53	0.047*‡
Mean time from last procedure, mths (range)	143.7 (75 to 277)	113.0 (59 to 191)	129.9 (59 to 277)	< 0.001*†
Primary implant type, n (%)				
Birmingham Resurfacing	11 (20.8)	18 (43.9)	29 (38.9)	
Synergy (Smith & Nephew)/Birmingham THA	40 (75.5)	22 (53.7)	62 (66.0)	
SL Plus (Smith & Nephew) Stem/Birmingham THA	1 (1.9)	1 (2.4)	2 (2.1)	
CPCS Stem (Smith & Nephew)/Birmingham THA	1 (1.9)	0 (0)	1 (1.1)	
Preoperative MRI, n (%)	49 (92.5)	37 (90.2)	86 (91.5)	
Collection on MRI, n (%)	45 (91.8)	26 (70.3)	71 (82.6)	0.009*‡
Mean maximum diameter of collection, cm (range)	6.5 (1.5 to 14.0)	5.9 (1.0 to 12.0)	6.3 (1.0 to 14.0)	0.455†

*Significant at 5% level, no adjustment for multiple testing.
†Mann-Whitney U test.
‡Chi-squared test.
THA, total hip arthroplasty.

were available in 49 patients at a minimum of three months, at a mean of 43.3 months (3.6 to 96.4) from surgery.

Patients were routinely followed up after surgery at six weeks, approximately six months, one year, two years, and five years, with clinical and radiological review and monitoring of serum metal ions.

The review of routinely collected health records for this study did not require ethical approval or patient consent, but the study received all necessary approvals from local information governance teams.

Operative technique

Orthogonal radiographs were assessed preoperatively to assess both component position and integration of the acetabulum with assessment of any lucent lines or bone loss at the implant-bone interface, and comparison to previous radiographs. Acetabular component position and fixation were further assessed intraoperatively by direct visualization for any evidence of loosening or compromise of the implant-bone interface, ensuring the acetabular component was well fixed with no movement on intraoperative loading. The

Table III. Preoperative and postoperative metal ions, radiological cup inclination, and leg length discrepancy by procedure type.

Variable	Cup retention and dual-mobility	Acetabular revision	Overall	p-value*
Median preoperative chromium, nmol/L (range)	45.1 (7.7 to 2,430.0)	52.0 (15.0 to 1,117.3)	56.0 (7.7 to 2,430.0)	0.409
Median postoperative chromium, nmol/L (range)	18.5 (0 to 443.0)	11.8 (6.0 to 97.3)	16.4 (0 to 443.0)	0.242
Median preoperative cobalt, nmol/L (range)	172.1 (16.0 to 3,067.0)	127.0 (5.0 to 2,000.0)	153.9 (5.0 to 3,067.0)	0.035†
Median postoperative cobalt, nmol/L (range)	12.7 (0 to 838.6)	11.2 (6.4 to 189.9)	11.8 (0 to 838.6)	0.608
Median preoperative cup inclination, ° (range)	44.0 (23.2 to 60.0)	47.0 (34.0 to 61.0)‡	44.0 (23.2 to 61.0)	0.017†
Median postoperative cup inclination, ° (range)	N/A	46.0 (34.0 to 56.0)	N/A	
Mean preoperative leg-length discrepancy, mm (range)	1.7 (-10.0 to 16.0)	-0.8 (-12.0 to 14.0)	-0.6 (-12.0 to 16.0)	0.039†
Mean postoperative leg-length discrepancy, mm (range)	2.4 (-8.0 to 14.0)	0.6 (-12.0 to 14.0)	1.6 (-12.0 to 14.0)	0.169
Mean change in leg-length, mm (range)	0.4 (-5.0 to 7.0)	1.4 (-5.0 to 12.0)	0.9 (-5.0 to 12.0)	0.625

*Mann-Whitney U test.
†Significant at 5% level, no adjustment for multiple testing.
‡One extreme outlier excluded where cup had spun out (inclination of 110°).
N/A, not applicable.

Table IV. Operating time, preoperative and postoperative haemoglobin, length of stay, and postoperative weightbearing status by procedure type.

Variable	Cup retention and dual-mobility	Acetabular revision	Overall	p-value
Mean operating time, mins (range)	68.4 (25.0 to 210.0)	101.5 (60.0 to 192.0)	82.2 (25.0 to 210.0)	< 0.001*
Mean preoperative haemoglobin, g/L (range)	137.6 (120.0 to 176.0)	137.5 (111.0 to 171.0)	137.5 (111.0 to 176.0)	0.693†
Mean postoperative haemoglobin, g/L (range)	120.4 (82.0 to 156.0)	109.7 (83.0 to 143.0)	115.8 (82.0 to 156.0)	< 0.001*‡
Mean drop in haemoglobin, g/L (range)	17.2 (1.0 to 54.0)	27.8 (11.0 to 44.0)	21.8 (1.0 to 54.0)	< 0.001*‡
Mean length of stay, days (range)	1.8 (0 to 7)	3.2 (1 to 18)	2.4 (0 to 18)	< 0.001*
Number of patients allowed to fully weightbear immediately postoperatively, n (%)	53 (100.0)	28 (68.3)	81 (86.2)	< 0.001*§

*Significant at 5% level, no adjustment for multiple testing.
†Mann-Whitney U test.
‡Independent-samples *t*-test.
§Chi-squared test.

acetabular component was also inspected for macroscopic surface damage. Acetabular component retention and the use of a dual-mobility polyethylene head was only considered if the acetabular component position was satisfactory in terms of both inclination and anteversion, and it was well fixed, with no macroscopic surface damage. A suggested pathway for the decision-making process is shown in Figure 1.

The inner diameter of the acetabular component was established from previous operative documentation where possible but was also always measured intraoperatively using the extracted femoral head for confirmation of sizes. When revising a MoM THA, the femoral stem was retained if this was in a satisfactory position, with no evidence of significant trunnionosis, and was well fixed with no signs of loosening on both radiological and intraoperative assessment. The inner head of the dual-mobility construct varied, depending on compatibility with the retained or new femoral stem. Ceramic (Stryker or BIOLOX delta; Ceramtec, Germany) or stainless steel heads (Stryker) were used, to avoid re-insertion of additional cobalt chrome. When revising a Birmingham hip resurfacing, the femoral neck was cut and a cemented Exeter V40 stem was used.

Where the acetabular component was revised, it was extracted while trying to preserve bone stock using the individual surgeon's preferred extraction technique. Decisions on implant type and the use of additional reconstruction

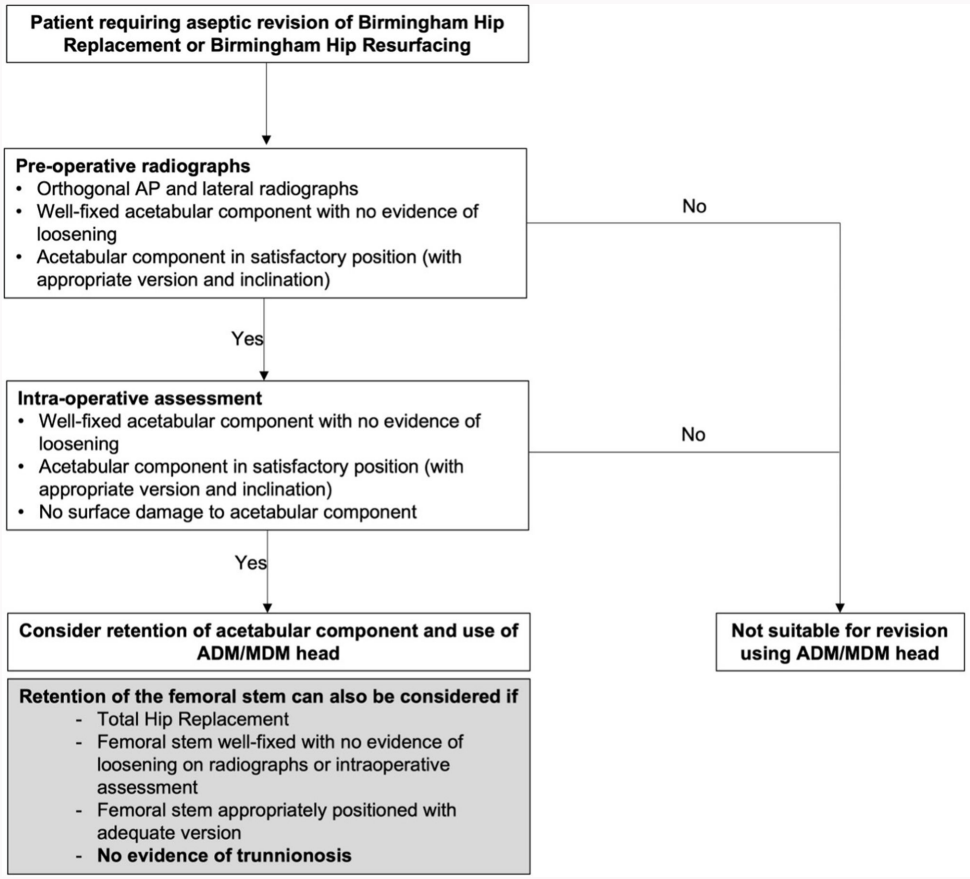

Fig. 1
Flowchart showing a suggested pathway for the decision-making process when considering retention of the acetabular component and use of anatomical dual-mobility (ADM)/modular dual-mobility (MDM) components in revision of a Birmingham metal-on-metal total hip arthroplasty or hip resurfacing. AP, anteroposterior.

augments were made on an individual patient basis after both preoperative radiological assessment and intraoperative assessment.

All patients with dual-mobility and acetabular component retention were allowed to fully weightbear. In patients who underwent revision of the acetabular component, weightbearing status was decided by the surgeon according to the fixation method and the implants used.

Statistical analysis

Survival analysis was performed using the Kaplan-Meier method[11] and survival curves produced at five years (with 30 patients remaining at risk, more than the required minimum of 10%), as described by Lettin et al,[12] with censoring at the time of last clinic visit or death. The primary endpoint for survival analysis for treatment failure was the time of further revision surgery. A 'worst case' curve was also constructed where the case lost to follow-up was included as a failure.[13] Survival estimates are reported with 95% confidence intervals, and comparisons between cup group were made using the log-rank test. Scores are reported as means and ranges. Comparisons between hospitals and cup group were made using the chi-squared test, independent-samples *t*-test, analysis of variance (ANOVA), or Mann-Whitney U test, as appropriate. Changes in serum metal ions were compared using the Wilcoxon signed-rank test for non-parametric paired data. Statistical analysis was performed using SPSS version 28 (IBM, USA). The significance level was set at 5%.

Results

Two patients in the AR group died before their two-year review, for reasons unrelated to the surgery. Two further patients died after their two-year review, and are therefore included in the analysis. One patient was unable to be contacted after 22 months and is classed as lost to follow-up for the purposes of this study. For the surviving patients, mean follow-up in Hospital 1 was 4.5 years (2.1 to 8.5) and in Hospital 2 was 5.3 years (2.3 to 7.5). Overall mean follow-up was 4.6 years (2.1 to 8.5).

Operating time, preoperative and postoperative haemoglobin, length of stay, and postoperative weightbearing status are shown in Table IV. Mean operating time, length of stay, and change in haemoglobin after surgery were significantly lower in the DM group compared to the AR group.

Serum metal ions, acetabular inclination and leg length changes are shown in Table III. There was a significant reduction in serum metal ions postoperatively in both groups ($p < 0.001$), although there was no difference between groups for this reduction ($p = 0.674$ (cobalt); $p = 0.186$ (chromium)).

Of the 53 DM procedures, two patients (3.8%) underwent further procedures. One (1.9%) underwent an exchange of the dual-mobility head, following intraprosthetic dislocation of the dual-mobility construct. Acetabular

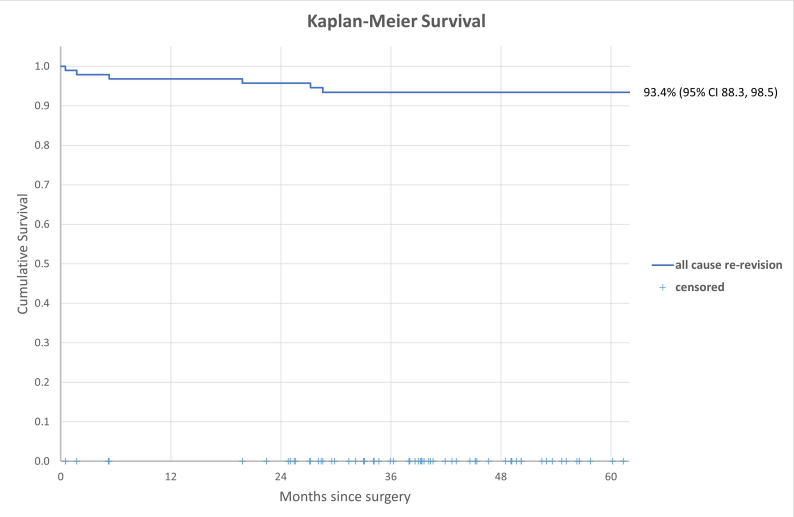

Fig. 2
Overall Kaplan-Meier survival curve. CI, confidence interval.

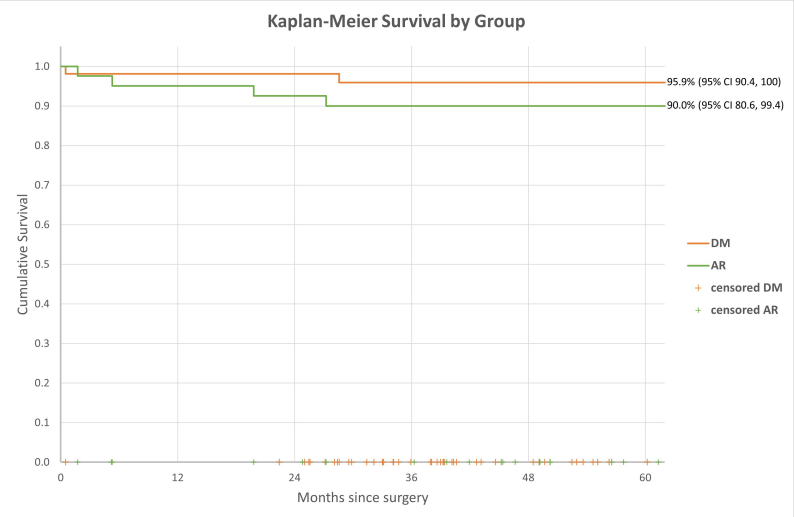

Fig. 3
Kaplan-Meier survival curve by group. AR, acetabulum revised; CI, confidence interval; DM, dual-mobility.

component inclination was 44°, and leg length change was -1 mm after the first revision using a 54 mm custom polar cup with a 28 mm ceramic head. One (1.9%) patient underwent debridement, washout, and exchange of the ADM dual-mobility head for infection. Additionally, one (1.9%) patient developed an infected fluid collection in the region of iliopsoas and underwent radiological percutaneous drainage of this 26 months after the first revision procedure. Following this, the patient continued to receive long-term antibiotic suppression but did not require any revision procedure. One (1.9%) patient sustained a periprosthetic femur fracture in the trochanteric region following a fall, which was managed conservatively.

Of the 41 AR procedures, four (9.8%) underwent further procedures. Two patients underwent re-revision for loosening of the acetabular component: one at 27 months after the first revision procedure, and one for early loosening two months after the first revision procedure. The femoral stem was not revised in either patient. Two patients underwent revision following recurrent dislocations: one underwent re-revision five months after the first revision procedure, with a change of the acetabular liner and revision of the femoral stem, and one underwent re-revision 20 months after the first revision procedure, with a change of the femoral head only. In both patients an Exeter V40 stem and Trident acetabular component (Stryker) was used for the original MoM revision, with 28 mm and 32 mm stainless steel heads, respectively. No other patients had dislocations.

Overall Kaplan-Meier survival with re-revision as the endpoint was 93.4% (95% CI 88.3 to 98.5%) at 60 months with 30 cases remaining at risk. There was no significant difference in Kaplan-Meier survival ($p = 0.248$, log-rank test) between groups. Survival rates, including a worst-case curve (where the case lost to follow-up is classed as a failure) are shown in Table V, Figure 2, and Figure 3.

Table V. Kaplan-Meier survival rates at five years.

Survival	DM (n = 53)	AR (n = 41)	Overall (n = 94)	p-value*
K-M survival all cause re-revision (95% CI)	95.9% (90.4% to 100%)	90.0% (80.6% to 99.4%)	93.4% (88.3% to 98.5%)	0.248
Number of events (revisions)	2	4	6	
Number remaining at risk	7	23	30	
Worst-case survival (95% CI)	94.1% (87.6% to 100%)	90.0% (80.6% to 99.4%)	92.3% (86.8% to 97.8%)	0.452
Number of events (revisions/lost)	3	4	7	
Number remaining at risk	7	23	30	

*Log-rank test.
AR, acetabulum revised; CI, confidence interval; DM, dual-mobility; K-M, Kaplan-Meier.

Discussion

We report on the success of revising Birmingham MoM THAs and resurfacings using dual-mobility implants with retention of the acetabular component in 53 patients, with a re-revision rate of 3.8%. This compares to a re-revision rate of 9.8% in 41 patients who underwent revision of the acetabular component.

Exchange of the metal head for dual-mobility bearings and retention of the acetabular component offers several advantages compared to revision of the acetabular components. Operating time was significantly lower in hips revised with DM and component retention by a mean of 33 minutes (68.4 vs 101.5 minutes). The procedure is less extensive, without the need to revise the acetabulum, and results in less blood loss, as reflected by the mean postoperative drop in haemoglobin levels of 16.6 g/L compared to 27.8 g/L in the patients undergoing revision of the acetabular component. Additionally, all patients were allowed to fully weightbear after surgery, compared to only 68.3% (n = 28) of patients in the AR group where there may be bone loss and the need for additional augmentation or reconstruction. We have also seen differences in recovery and early mobilization with the use of DM compared to AR. Length of stay was significantly lower in the DM group, and one patient in the DM group even received their revision surgery as a day-case procedure.

High dislocation and re-revision rates have previously been reported following revision surgery for ARMD.[14] A review of 2,535 MoM hip arthroplasties in the National Joint Registry found a re-revision rate of 7.6% at five years.[7] In our study, there was only one (1.9%) revision for dislocation in the DM group. There were no other dislocations in the DM group. One further patient (1.9%) underwent debridement, washout, and exchange of the modular components for infection, and one patient (1.9%) developed an infected fluid collection managed with drainage and suppressive antibiotics. The risk of infection is recognized to be higher after revision of MoM hip arthroplasties compared to other bearing surfaces.[15] The presence of pseudotumour with significant necrosis or large collections may further increase the risk, and we note the higher incidence of collections on MRI in the DM group in this study. Recent data from the National Joint Registry have shown higher rates of revision for infection in dual-mobility implants, particularly with the use of metal-on-polyethylene-on-metal bearings.[16] Both of the infections in this cohort used stainless steel inner heads.

Overall, the re-revision rate was lower in the DM group than in the AR group, although this difference was not statistically significant.

We acknowledge that there may be some limitations in a direct comparison between the two groups in our series, as patients were carefully selected for revision using dual-mobility components. Therefore, many patients in the AR group would not be eligible for retention of acetabular component for reasons such as component position, which is reflected by the higher mean inclination angle (Table III), and evidence of acetabular loosening preoperatively in two patients. Unfortunately, due to the retrospective nature of this study we did not consistently have reproducible and comparable details of the extent of bone loss following removal of the acetabular component, or complexity of the revision surgery in the AR group.

In the DM group, 91.8% (n = 45) of patients had a collection on preoperative MRI compared to 70.3% (n = 26) of patients in the AR group, which likely reflects the number of patients in the AR group undergoing surgery for indications other than ARMD. Similarly, preoperative serum metal ion levels were higher in the DM group (Table III). In both groups, there was a significant reduction in serum metal ion levels after the revision surgery. The mean time from the original procedure was significantly higher in patients in the DM group. Again, this may be associated with the time in which ARMD develops before operative intervention is required, compared to other indications for revision arising earlier in the AR group.

A greater proportion of patients in the AR group had a hip resurfacing at 43.9% (n = 18), compared to only 20.8% (n = 11) of patients in the DM group. This may be due to surgeons opting to revise the acetabulum and use traditional THA components in resurfacing cases where it is already necessary to revise the femoral component, compared to the opportunity to only exchange the bearings if a THA stem is already in situ.

Despite differences between the two groups, these results demonstrate that the use of dual-mobility bearings and retention of the acetabular component in selected patients has a low overall complication rate. This is set in the context of the high complication profile of revision surgery for ARMD

reported previously in the literature,[14] and that seen in the AR group in this study.

There were also differences between the two centres in the primary implant type; in Hospital 2, 87.5% (n = 14) had a hip resurfacing, compared to only 19.2% (n = 15) in Hospital 1. This reflects differences in historical practice and/or referral patterns between the centres. Both centres have seen success after independently adopting the practice of retaining the acetabular component and using dual-mobility bearings, confirming its generalizability, and applicability to revision of both resurfacings and THAs.

Previous literature on the use of dual-mobility components in revision of MoM THAs and resurfacings is limited, as noted in the 2020 systematic review by Affatato et al.[17] They reported an overall complication rate of 10.7%, including an intraprosthetic dislocation rate of 4.6% and true dislocation of 3.1%. One of the larger included studies by Plummer et al[18] reported the results of 25 patients with well-fixed MoM THAs and resurfacings with femoral side only revision and dual-mobility articulation.[18] One (4.0%) patient had a dislocation, where notably the acetabular inclination was 67°. Another included study by Blevins et al[19] found a dislocation rate of 7.4% in 27 patients undergoing MoM hip revision with retention of the acetabular component and use of dual-mobility implants.[19]

In 2020, Klemt et al[20] observed no dislocations in 42 MoM hips revised using dual-mobility implants in patients with abductor muscle insufficiency. Colacchio et al[21] reported a revision rate of 6.9% in 29 MoM hip arthroplasties revised to dual-mobility without acetabular revision, compared to 16.0% in 114 hip revisions with acetabular revision. In 2022, Salmons et al[22] reported on revision of 52 MoM with favourable outcomes in 11 cases where the acetabulum was retained.

To our knowledge, this study is the largest series using the technique of acetabular retention and dual-mobility bearings. Combining data from two centres has increased the size of the cohort. We have also described our approach to the use of this technique. While other studies have used other dual-mobility implants, it is important to note that our results in this report are only from revision of Birmingham THAs and resurfacings, using primarily ADM/MDM components. A minority of patients in the DM group received a custom-made polar head early in the study period; however, these have now been superseded by the readily available and more cost-effective ADM and MDM components.

Minimum follow-up in this study was two years, although the majority of patients were followed up for far longer, with a mean follow-up of 4.6 years and maximum of 8.5 years. The aim of this study is to describe our approach to the use of dual-mobility components in revision of Birmingham MoM hips, and report on early and mid-term complications. A number of systematic reviews have shown excellent results in dual-mobility in revision hip arthroplasties, with low rates of re-revision, dislocation, aseptic loosening, and infection.[8,23,24] Future research should focus on the long-term outcomes of dual-mobility implant revision surgery of MoM hip arthroplasties. We intend to present outcomes of our series at subsequent follow-up timepoints in due course.

In summary, our results demonstrate that in selected patients with Birmingham MoM hip arthroplasties or resurfacings where the acetabular component is well fixed, is in a satisfactory position, and there is no macroscopic surface damage, the metal head can be exchanged for highly cross-linked polyethylene dual-mobility bearings with a low risk of complications. This presents significant benefits through a less invasive procedure with reduced operating time, blood loss, length of stay, and improved postoperative weightbearing.

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Data sharing

The datasets generated and analyzed in the current study are not publicly available due to data protection regulations. Access to data is limited to the researchers who have obtained permission for data processing. Further inquiries can be made to the corresponding author.

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Ethical review statement

This review was performed as part of ongoing routine review of patients, and so is exempt from IRB approval.

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