

Appendix 1 Clinical details of the 39 revised metal-on-metal total hip replacements								
Revision number	Age / sex	Time to revision	Cup size	Primary indication	Revision indication	Revision bearing	Operative time	Outcome after revision
1	78 M	0.01 yrs	52mm	OA	Dislocation	MoM	60 mins	Died after 3.2 yrs
2	32 F	0.02 yrs	50mm	DDH	Dislocation	MoM	67 mins	4.9 yrs no complications
3	56 F	0.69 yrs	52mm	OA	Recurrent dislocation	MoP	40 mins	0.1 yrs re-revised for dislocation (liner exchange)
4*	49 F	1.00 yrs	54mm	OA	Aseptic loosening (femur)	OxP	185 mins	4.3 yrs no complications
5	59 F	1.05 yrs	52mm	OA	Stem subsidence with LLD	MoM	109 mins	0.1 yrs re-revised for periprosthetic stem fracture; subsequent evacuation of haematoma 2 wks later
6	58 F	1.25 yrs	54mm	OA	Aseptic loosening (cup)	MoM	60 mins	0.2 yrs re-revision for aseptic cup loosening
7* [†]	67 M	1.37 yrs	56mm	OA	Deep infection	1st stage [‡]	103 mins	4.0 yrs no complications
8	78 M	1.69 yrs	54mm	OA	ARMD	MoP	80 mins	2.1 yrs no complications
9*	66 M	1.81 yrs	60mm	OA	Aseptic loosening (femur)	MoP	305 mins	2.2 yrs stem lucency but not re-revised
10	71 F	1.86 yrs	52mm	OA	LLD	MoM	97 mins	4.1 yrs re-revised for aseptic femoral loosening
11*	70 F	1.96 yrs	52mm	OA	Deep infection	MoP	124 mins	3.6 yrs no complications
12	46 F	1.97 yrs	50mm	OA	Unexplained pain	CoP	60 mins	1.0 yrs no complications
13*	48 F	2.00 yrs	52mm	AVN	Deep infection	MoM	90 mins	6.8 yrs no complications
14*	63 F	2.03 yrs	52mm	OA	Recurrent dislocation	CoP	48 mins	3.3 yrs no complications
15	73 F	2.25 yrs	52mm	OA	LLD	MoP	65 mins	3.6 yrs no complications
16	59 F	2.29 yrs	50mm	SUFE	ARMD	CoP	81 mins	1.4 yrs no complications
17	63 F	2.97 yrs	52mm	OA	Aseptic loosening (femur)	MoP	106 mins	2.3 yrs no complications
18*	63 F	3.53 yrs	50mm	OA	Periprosthetic stem fracture	MoP	128 mins	1.1 yrs no complications
19	70 F	3.66 yrs	52mm	OA	ARMD	CoP	60 mins	1.8 yrs no complications
20* [†]	68 M	3.66 yrs	58mm	OA	Deep infection	1st stage [‡]	114 mins	3.1 yrs no complications
21	58 F	3.69 yrs	50mm	OA	ARMD	CoP	66 mins	1.5 yrs no complications
22*	68 F	4.01 yrs	52mm	DDH	Deep infection	1st stage [‡]	81 mins	1.4 yrs no complications
23	69 M	4.06 yrs	54mm	OA	Aseptic loosening (femur)	MoP	259 mins	0.9 yrs no complications
24*	60 F	4.08 yrs	52mm	OA	Aseptic loosening (femur)	MoP	117 mins	4.1 yrs no complications
25	67 F	4.20 yrs	52mm	OA	ARMD	CoP	81 mins	1.3 yrs no complications
26	73 F	4.22 yrs	52mm	OA	ARMD	MoP	183 mins	1.0 yrs lucency around acetabular component but not revised
27	60 F	4.24 yrs	52mm	OA	ARMD	CoP	92 mins	0.9 yrs no complications
28*	61 F	4.43 yrs	52mm	OA	ARMD	CoP	90 mins	0.6 yrs no complications
29*	62 M	4.51 yrs	58mm	OA	ARMD	CoP	103 mins	0.7 yrs no complications
30*	72 F	4.83 yrs	52mm	OA	Aseptic loosening (cup)	MoP	106 mins	0.5 yrs no complications

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Appendix 1 Clinical details of the 39 revised metal-on-metal total hip replacements (Continued)

31	70 M	5.01 yrs	54mm	AVN	ARMD	CoP	62 mins	0.3 yrs no complications
32*	72 F	5.23 yrs	54mm	OA	ARMD	OxP	118 mins	1.4 yrs no complications
33	65 F	5.32 yrs	52mm	OA	Aseptic loosening (femur)	MoP	127 mins	1.5 yrs no complications
34*	69 F	5.84 yrs	52mm	OA	ARMD	CoP	46 mins	0.5 yrs no complications
35*	69 F	6.06 yrs	52mm	OA	ARMD	CoP	65 mins	0.2 yrs no complications
36*	63 F	6.28 yrs	54mm	OA	ARMD	CoP	85 mins	0.1 yrs no complications
37*	67 F	7.33 yrs	52mm	OA	ARMD	CoP	110 mins	0.2 yrs no complications
38*	46 M	8.13 yrs	56mm	OA	ARMD	MoP	206 mins	0.1 yrs no complications
39	78 F	8.26 yrs	52mm	OA	ARMD	CoP	75 mins	0.1 yrs no complications

ARMD = adverse reaction to metal debris; AVN = avascular necrosis; CoP = ceramic-on-polyethylene; DDH = developmental dysplasia of the hip; F = female; LLD = leg length discrepancy; M = male; MoM = metal-on-metal; MoP = metal-on-polyethylene; OA = osteoarthritis; OxP = Oxinium-on-polyethylene; SUFE = slipped upper femoral epiphysis

*Bilateral MoM bearing (total hip replacement or hip resurfacing)

† Revision 7 and 20 was the same patient requiring bilateral MoM revision hip arthroplasty.

‡All first stage revisions performed for deep infection underwent successful second stage revision total hip arthroplasty using a MoP bearing.

Appendix 2 Details of the 17 patients undergoing revision for adverse reaction to metal debris. Revision numbers correspond to those in Appendix 1

Revision number	Initial cup inclination	Blood metal ion levels before revision	Imaging	Revision performed	ARMD intraoperative findings	Histopathology
8	49.0°	Not performed	Ultrasonography + CT large joint effusion	Head, cup and liner	Milky effusion; granulomatous infiltration; cup over anteverted	ARMD
16	55.5°	Co 1,093nmol/l Cr 699nmol/l	Ultrasonography normal	Head, cup and liner	Metallosis; cup with excessive inclination and anteversion	ARMD with prominent perivascular lymphocytic infiltrate
19	39.7°	Not performed	Ultrasonography small effusion X-ray proximal femoral osteolysis	Head and liner	Milky effusion; granulomatous infiltration; cup over anteverted	ALVAL
21	39.9°	Co 165nmol/l Cr 129nmol/l	Ultrasonography effusion	Head and liner	Necrotic tissue in trochanteric bursa; free light brown watery fluid	ALVAL
25	42.4°	Co 30nmol/l Cr 25nmol/l	Ultrasonography effusion	Head and liner	Thickened trochanteric bursa with fluid content; thickened capsule with watery effusion	ARMD with lymphocytic infiltrate
26	40.1°	Co 146nmol/l Cr 54nmol/l	X-ray acetabular osteolysis with medial migration of socket MRI two large effusions	Stemmed acetabular component and long femoral stem	Abductor detachment; pelvic discontinuity; significant osteolysis of femur	ARMD
27	49.6°	Co 93nmol/l Cr 20nmol/l	Ultrasonography effusion	Head, cup and liner	15ml black stained fluid; metallosis; cup open and in 30° of anteversion	ARMD

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Appendix 2 Details of the 17 patients undergoing revision for adverse reaction to metal debris. Revision numbers correspond to those in Appendix 1 (Continued)

28*	37.5°	Co 443nmol/l Cr 313nmol/l	Ultrasonography + MRI small effusion	Head and liner	Metallosis of abductors and trochanteric bursa	ARMD
29*	45.5°	Co 12nmol/l Cr 27nmol/l	Ultrasonography effusion	Stem, head and liner	Extensive inflammatory haemorrhagic tissues; proximal femoral osteol- ysis exposing upper 3/4 of stem; osteolysis around cup	ARMD
31	45.7°	Co 65nmol/l Cr 11nmol/l	CT and MRI moderate effusion	Head and liner	100ml thick white fluid / metal debris; hip dislo- cating easily; anterior scar tissue	ARMD
32*	44.5°	Co 31nmol/l Cr 23nmol/l	Ultrasonography normal	Stem, head, cup and liner	Metallosis; neutral cup; well fixed but proud stem	ARMD
34*	38.5°	Co 174nmol/l Cr 25nmol/l	MRI effusions	Head and liner	Mild effusion; necrotic tissue in capsule; trunnion corrosion	ARMD
35*	43.2°	Co 151nmol/l Cr 44nmol/l	Ultrasonography + MRI small effusion	Head and liner	20ml black stained metal debris fluid; trunnion stained black	ARMD
36*	46.3°	Co 147nmol/l Cr 184nmol/l	Ultrasonography + MRI moderate effusion	Head and liner	Breakdown of previous repair with black/grey fluid communicating with joint; metallosis	ARMD
37*	46.6°	Co 263nmol/l Cr 194nmol/l	Ultrasonography normal	Head and liner	Metallosis; well fixed components	ARMD
38*	51.7°	Co 1,061nmol/l Cr 716nmol/l	X-ray femoral osteolysis Ultrasonography large effusion	Long modular femoral stem and cup	Large green/brown fluid collection; extensive metallosis; cup open and anteverted	ARMD
39	49.3°	Co 232nmol/l Cr 155nmol/l	MRI normal	Head and liner	Metallosis	ARMD

ALVAL = aseptic lymphocytic vasculitis associated lesion; ARMD = adverse reaction to metal debris; Co = cobalt; Cr = chromium;
CT = computed tomography; MRI = magnetic resonance imaging
*Bilateral metal-on-metal bearing (total hip replacement or hip resurfacing)