

Supplementary article data

Muscle atrophy and metal-on-metal hip implants

A serial MRI study of 74 hips

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Table 1. Summary of implants and clinical details for all cases included in the study (n = 74)

Age	Sex	Age at implant	Time a	Time b	HRA/THR	Cr ppb	Co ppb	OHS	Age	Sex	Age at implant	Time a	Time b	HRA/THR	Cr ppb	Co ppb	OHS
49	M	44	39	5	HRA	1.8	0.9	33	50	F	46	28	12	HRA	4.4	3.7	14
71	F	64	65	8	THR	7.4	44.8	42	48	M	41	59	16	THR	3.3	3.5	9
58	M	50	66	4	HRA	5.7	8.6		48	M	39	80	16	HRA	3.3	3.5	9
58	M	50	69	4	HRA	5.7	8.6		83	F	75	78	11	THR	4.4	21.7	48
57	F	49	62	17	HRA	1.4	1.1	23	74	M	63	110	9	HRA	0.6	1.1	44
59	F	49	95	5	HRA	45.4	89.7	46	47	F	36	104	11	HRA	10.2	8.1	34
59	F	47	122	5	HRA	45.4	89.7	46	47	F	36	104	11	HRA	10.2	8.1	34
75	M	67	69	4	HRA	2.6	3.2	17	64	M	57	51	29	HRA	1.5	1.7	36
55	M	51	14	7	HRA	1.7	0.2	42	61	F	51	100	15	HRA	2.8	2.5	18
62	F	55	72	5	THR	3.8	8.4	47	61	F	51	97	15	HRA	2.8	2.5	19
62	F	56	60	5	THR	3.8	8.4	47	69	M	59	106	11	HRA	4.0	3.8	41
49	M	41	79	6	THR	1.5	4.1	10	69	M	65	27	11	HRA	4.0	3.8	41
63	F	55	60	18	HRA	3.5	2.6	17	66	F	59	71	6	HRA	8.7	4.3	28
70	F	66	34	5	THR	2.9	4.6	40	42	F	36	58	8	HRA	13.4	11.5	
60	F	54	65	3	THR	7.1	4.4	12	41	M	36	42	7	HRA	1.6	1.0	41
56	F	50	25	38	HRA	10.2	10.4	40	41	M	36	42	7	HRA	1.6	1.0	41
52	F	46	6	45	THR	6.3	8.4	34	53	M	42	131	7	HRA	12.1	11.9	23
55	F	47	69	14	THR	12.3	16.9	30	53	M	43	119	7	HRA	12.1	11.9	23
55	F	47	65	14	THR	12.3	16.9	30	80	F	71	81	18	THR	24.4	71.4	35
65	F	55	108	6	HRA	1.1	1.4	41	60	F	52	76	14	THR	13.4	18.6	16
28	M	23	51	5	HRA	38.2	35.8	48	60	F	54	53	14	THR	13.4	18.6	16
60	M	51	79	10	HRA	3.5	2.6	7	48	M	39	98	4	THR	5.1	10.5	37
60	M	56	26	8	HRA	3.0	3.8	25	48	M	39	87	4	THR	5.1	10.5	37
62	M	59	21	4	HRA	0.2	1.2	24	70	F	65	37	26	THR	0.8	0.7	43
49	F	42	55	14	HRA	25.4	50.8	8	60	M	54	38	5	HRA	2.3	1.8	5
49	F	42	59	14	HRA	25.4	50.8	8	60	M	56	35	4	HRA	2.3	1.8	
69	M	60	88	6	HRA	9.7	11.2	16	41	M	32	84	12	HRA	17.8	58.0	37
61	M	49	122	12	HRA	1.2	0.8	37	41	M	32	84	12	THR	17.8	58.0	40
24	M	18	38	22	THR	1.3	0.9	27	77	F	70	68	8	THR	22.0	9.0	29
67	F	63	17	25	THR	1.8	1.5	38	59	M	52	74	9	THR	0.9	1.8	13
55	F	45	89	15	HRA	2.1	2.2	34	63	F	56	68	10	THR	12.6	27.3	20
42	F	36	62	11	HRA	1.9	1.3	18	72	M	67	55	6	THR	13.6	22.5	34
49	F	42	64	10	THR	4.1	7.1	32	70	F	64	58	8	HRA	9.7	8.3	40
62	F	54	70	14	HRA	3.5	1.4	36	59	M	52	69	11	THR	3.2	6.6	36
57	F	48	97	2	HRA	10.3	11.4	43	59	F	53	59	11	THR	10.4	16.9	39
57	F	48	97	2	HRA	10.3	11.4	43	59	F	52	67	11	THR	10.4	16.9	30
50	F	44	52	12	HRA	4.4	3.7	14	53	F	48	41	14	HRA	8.4	3.9	45

Time a = Months from surgery to first MRI
Time b = Months between MRI scans
HRA = hip resurfacing arthroplasty

THR = total hip replacement,
Cr = chromium, Co = cobalt, ppb = parts per billion,
OHS = Oxford hip score.

Table 3. Summary of muscle atrophy findings in 74 patients who underwent 2 MRI scans with a mean interval of 11 months

Muscle	A	B	p-value
Iliopsoas	0.08 (0.49)	1.42 (74)	0.2
Gluteus minimus	0.12 (0.33)	3.18 (74)	0.002
Gluteus medius anterior	0.07 (0.34)	1.69 (74)	0.1
Gluteus medius middle	0.05 (0.28)	1.65 (74)	0.1
Gluteus medius posterior	0.08 (0.28)	2.54 (74)	0.01
Gluteus medius inferior	0.10 (0.46)	2.04 (74)	0.05
Gluteus maximus	0 0	No difference	N/A

A Change (SD) in muscle atrophy between MRI 1 and 2
 B t-test comparing 2 MRI scans (df)

Table 4. Summary of soft-tissue findings in 74 patients who underwent 2 MRI scans with a mean interval of 11 months

Soft tissue abnormality	Change (SD) in mean score between MRI 1 and 2	t-test (df)	p-value
Bursal fluid	0.03 (0.23)	1.00 (74)	0.3
Tendon disruption	0.02 (0.16)	1.42 (74)	0.2
Pseudotumor presence	0.04 (0.20)	1.76 (74)	0.08
Pseudotumor frequency	0.10 (0.46)	2.04 (74)	0.05
Pseudotumor grade	0.18 (0.63)	2.41 (74)	0.02
Pseudotumor size (cm ³)	13.97 (101.87)	1.18 (74)	0.2

Table 5. Summary of clinical details for patients found to have (A) progressive atrophy of the posterior gluteus medius muscle and those with (B) complete abductor tendon disruption with associated pseudotumors

Sex	Age at implant	Months to first MRI	Cr ppb	Co ppb	OHS
A. Patients with progressive posterior gluteus medius muscle atrophy					
F	64	65	7.4	44.8	42
F	47	69	12.3	16.9	30
F	42	59	25.4	50.8	8
F	46	28	4.4	3.7	14
F	36	104	10.2	8.1	34
M	52	69	3.2	6.6	36
B. Patients with tendon disruption					
M	67	69	2.6	3.2	17
M	51	14	1.7	0.2	42
F	50	25	10.2	10.4	40
F	42	37	25.4	50.8	8
M	67	55	13.6	22.5	34
F	48	41	8.4	3.9	45

Cr = chromium, Co = cobalt, ppb = parts per billion, OHS = Oxford hip score.

Table 6. Summary of ANOVA interaction scores between muscle atrophy change and various demographic and clinical variables. Only significant p-values are shown

Soft tissue	Implant type	Age	Gender	Co	Cr	OHS
Iliopsoas	0.068	0.515	0.449	0.384	0.359	0.598
Gluteus minimus	0.058	0.024	0.433	0.127	0.099	0.738
Gluteus medius anterior	0.144	0.440	0.432	0.373	0.382	0.790
Gluteus medius middle	0.682	0.161	0.022	0.695	0.386	0.973
Gluteus medius posterior	0.528	0.953	0.175	0.329	0.369	0.922
Gluteus medius inferior	0.036	0.693	0.815	0.871	0.863	0.713
Gluteus medius whole	0.078	0.770	0.161	0.605	0.586	0.858
Gluteus maximus	^a	^a	^a	^a	^a	^a

Co = cobalt, Cr = chromium, OHS = Oxford hip score.
^a unable to be assessed as no change in underlying muscle atrophy scores.