HHS HIP RESURFACING
2003-2008
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Hip resurfacing using metal-on-metal articulation was introduced at Hamilton Health Sciences in 2003. It was implemented to offer a long-term solution to younger, more demanding patients with advanced hip osteoarthritis. This was most commonly in association with dysplasia of the acetabulum.

DIAGNOSTIC GROUPS		
	Female	Male
Slipped epiphysis	3	3
Post Traumatic	0	2
Previous Osteotomy	2	4
Osteoarthritis	1	2
Osteonecrosis	0	1
Chondrolysis	0	1
Dysplasia	73	194

The decision to begin hip resurfacing was based on publications and personal contact with Midland Medical Technology, a company manufacturing the Birmingham Hip Resurfacing prosthesis in the UK.

Striking results were being demonstrated in younger people, 60 years or less, in whom failure would be expected in about 10 years after conventional total hip replacement. Such a statistic is unacceptable and so this group of patients was usually left to suffer until the surgeon decided they were “old enough” for a total hip replacement.

The major cause of failure of conventional metal-on-polyethylene implants is wear of the polyethylene and subsequent reaction to the fine particulate material created. This leads to local osteolysis with undermining and loosening of the implants. (1)Thus host bone is lost and renders revision complicated and eventually impossible. Ceramic implants are used to try to reduce wear debris but have their own set of complications at an unacceptable rate to warrant use in young patients. Metal-on-metal bearings had been studied by Corin Corporation following the failure of the metal-on-polyethylene hip resurfacings in the late 1970’s-1980’s. This was shown to be due to polyethylene failure and the inevitable osteolysis around the acetabular component and osteolytic femoral neck failure. It was erroneously thought to be due to femoral head avascular necrosis initially until electron microscopy demonstrated that the debris under the femoral cap was stuffed with giant

cells loaded with polyethylene micro-fragments. The giant cells were producing potent osteolysins. (2)

Studies of the initial groups of hip replacements using all metal implants, (3) prior to Sir John Charnley's introduction of polyethylene acetabular prostheses, had shown that metal debris was not always present at follow up and when not, long implant survival encountered.
It was then demonstrated that accurate critical clearances between the femoral head and acetabular implants determined the success and was bettered by increasing the carbon content of the surface layers. This reawakened the interest in preserving the femoral neck at hip arthroplasty.(4)

By 1989 Corin had produced the first Metal-on-metal hip resurfacing with Derek McMinn as the lead surgeon. He left the company to form Midland Medical Technology and produce his own version, the Birmingham, with alterations in the design and production of the acetabular implant-to-bone interface. The first of this model was implanted in 1995.
A well organized advertising campaign soon made this implant the World leader.
A further point of considerable importance is the DXA studies of the strength of the greater trochanter after hip resurfacing compared with total hip replacement. Wasting of bone is seen after total hip replacement, increase in strength after resurfacing. (5)

Thus, the Birmingham Resurfacing was chosen for The Henderson Hospital in 2003. The cost was significant compared with total hip replacement but it was only used in selected patients. The recommended upper age limits recommended by the Birmingham group was 60 for females and 65-70, depending on bone strength, for males.
The age range in the HHS group was from 35-60, one female, aged 34, seven males with an average age of 46, median 44.5 years.
None of this group of 8, implanted between April 2003 and April 2004, has needed revision and they are all still functioning at a high level with no evidence of impending failure. The Orthopaedic literature predicts that by now between 8-10% of conventional total hips would have needed revision in this age group.

BIRMINGHAM HIP RESURFACING		
	FEMALE	MALE
AGE RANGE	35	38-60
MEDIAN	35	44.5
SIZES	46/52	50/56 (3)
		50/58 (1)
		54/60 (3)

The HHS **Cormet 2000** era began in April 2004.

Twelve males and six females received Cormet 2000 hips that first year.

CORMET 2000 HIP RESURFACING		
	FEMALE	MALE
2004	6	12
2005	14	24
2006	20	51
2007	25	53
2008	14	66

Thus between 2004-2008 there were 284 Cormet 2000 hip resurfacings implanted by the author.
These have all been fully documented and followed through.
The cut-off at the end of 2008 was chosen so that there is a three year minimum follow-up period.

A preliminary analysis of clinical outcome results, including revisions has been compiled.

CORMET 2000 HIP AGE RANGE		
	FEMALE	MALE
AGE RANGE	18-65	22-75
MEDIAN	52	52
AVERAGE	48.8	52.6
SIZES ACET/FEMUR		
46/2	13	
48/3	12	
50/4	25	5
52/5	13	15
54/6	12	90
56/7	2	21
58/8	2	60

60/9	2
62/10	2

Eighteen patients required revision, one patient having two of the complications as discussed below, namely infection and femoral loosening.

There were four mechanisms of failure.
These were acetabular loosening, femoral loosening, infection and femoral neck fracture.

The high incidence of acetabular loosening (42% of failures) was associated with delamination of the plasma sprayed surface from the implant. At revision the plasma layer could be seen in the bone bed and the outer surface of the socket implant devoid of in-growth surface. This type of loosening took between 2-4 years to develop. Two occurred early and there was no readily apparent cause but must have been slight undersizing of the implant.

The loosening of the femoral head occurred after the non-cemented alternative was introduced.
The first iteration of this variety was simply spraying with hydroxylapatite (HA) and no porous surface. These failed once the HA had been resorbed by the host. So this seems to indicate a manufacturing or design fault.

One male femoral neck fracture victim had been treated for Ca. prostate with irradiation and subsequent death of the head.

One femoral loosening occurred in a female after she had developed a secondary infection in the hip. A symphysis pubis separation was treated with plating and bone grafting but became infected and spread into the hip joint. This caused loosening of the head and so is reported as both an infection and loosening.

Acetabular loosening was not associated with size, there being three at size 4 head/50mm cup, two at size 6 head/ 54 mm cup and three at size 8 head/58 mm cup.

Infections were seen in two 46 mm cups, females and one 54 mm cup, male.

The primary femoral neck fractures were in two females size 2, both from falls soon after surgery and one male who also fell within a few weeks of surgery. He was over seventy, had a satisfactory bone density study but in retrospect should not have had a resurfacing.

Females constituted 3.2% of overall complications, but 11.4% of the female resurfacings were revised. These included 3 of the 8 acetabular loosenings and 2 femoral neck fractures.

There were no femoral neck fractures in the female patients where size 4 head or greater was used.

The female neck fractures were only seen with the smallest size, 2.

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Revisions

Sex	Months to revision	Fem Neck Fracture	Fem loose	Acetab loose	Infection
F	24			X	
F	51			X	
F	2			X	
M	20			X	
M	27			X	
M	30			X	
M	24			X	
M	1.5			X	
F	56		X		
M	57		X		
M	7		X		
M	33		X		
F	45				X
M	12				X
M	1				X
F	5	X			
F	2	X			
M	1	X			
TOTAL		3	4	8	3

Acetabular loosening was associated with delamination of the plasma-sprayed coating and subsequent separation from the bone with displacement.
Femoral Loosening was not seen in cemented heads. It occurred with delamination of porous coating in non-cemented insertion.
Infection occurred in association with neck fracture in one case. A second case occurred in a young male with 9 previous hip operations. The third after open reduction of a subsequent pelvic fracture seeded the hip after becoming infected.
Neck fracture occurred in two females who fell within a short period after surgery, one on ice, one while walking two dogs through a wood. The male had pelvic irradiation for Ca. prostate.

Lessons learned

The acetabular loosening was the major cause of failure. The issue is failure of the integrity of the in-growth surface.

The size 2 femoral head is too small for safe use.

The upper limit for age of patient is not clearly defined as some older patients have done very well and returned to highly active lifestyles. Those that I allowed all had parents still alive. However it is probably wise to restrict hip resurfacing to males under 66 and to females who are very active, need size 4 or larger and are 55 or younger.

Hip resurfacing has allowed greater than 93.5% of this group to return to a very active life. They are able to out perform those with total hip replacement.

If the acetabular and femoral head prosthesis-loosening mechanism of failure is addressed by using only the Birmingham model, together with the size restrictions dictated by the results, the failure rate at HHS can reasonably be expected to reduce to approximately 1-2%.

With appropriate patient selection Hip Resurfacing is a reliable operation.

(1)Metal on Polyethylene in Hip Replacement
Bassam A. Masri, M.D., FRCSC
Associate Professor and Head,
Division of Lower Limb Reconstruction and Oncology
University of British Columbia
COA/AOC Annual meeting, 2011

(2)Clin Orthop Relat Res. 2002 Sep;(402):157-63.
Long-term survival of McKee-Farrar total hip prostheses.
Brown SR, Davies WA, DeHeer DH, Swanson AB

(3)Schmalzried TP, Jasty M, Harris WH: **Periprosthetic bone loss in total hip arthroplasty. Polyethylene wear debris and the concept of the effective joint space.**
J Bone Joint Surg Am 1992, **74**(6)**:**849-63.

(4)McKellop H, Park SH, Chiesa R, Doorn P, Lu B, Normand P, Grigoris P, Amstutz HC: **In vivo wear of three types of metal on metal hip prostheses during two decades of use.**
Clin Orthop Relat Res 1996, (329 Suppl)**:**128-40.

(5)Häkkinen et al. BMC Musculoskeletal Disorders 2011, 12:100 http://www.biomedcentral.com/1471-2474/12/100