



# ADEPT<sup>®</sup> Hip Resurfacing System

Clinical Rationale

Delivering Results  
Through Performance

Forever **Active**

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## 1 Introduction

Hip resurfacing is recommended as **'one option for people with advanced hip disease who would otherwise receive and are likely to outlive a conventional primary total hip replacement'** – The National Institute for Health and Care Excellence (NICE) guidance for metal-on-metal (MoM)<sup>1</sup>.

In its guide to **good practice in primary hip replacement**, the British Orthopaedic Association (BOA) states that **metal-on-metal resurfacing implants remain an acceptable option for well-selected patients**<sup>2</sup>.

The ADEPT® Hip Resurfacing System evolved from successful very-low-wear MoM bearing THR devices that lasted 35 years+ and following successful implementation of modern-day hip resurfacing.

With more than **17 years of supporting clinical data**, the evidence demonstrates that **the ADEPT® Hip Resurfacing is the best treatment option for many patients**.

## 2 Development of Modern-Day Hip Resurfacing

Modern-day hip resurfacing is **based on observations** of patients with large diameter metal-on-metal (MoM) total hip prostheses such as the McKee-Farrar and the Ring Hip (Figure 1), who retained functioning hips with **very little wear for more than 30 years** after their operation<sup>3</sup>.

Finsbury (now MatOrtho®) was involved in the development of the Birmingham Hip Resurfacing (BHR), which was based on study of the successful devices and the application of modern manufacturing techniques. Since its first use in 1997, thousands of successful hip resurfacing procedures have been performed around the world.



Figure 1 Historical MoM prosthesis: the Ring Hip implanted 1964–1979.

**The ADEPT® Hip Resurfacing System was developed using the knowledge gained** by direct involvement in the BHR and the extensive research of historical MoM devices, and as the original manufacturer of the BHR<sup>3</sup>, manufacturing over 200,000 BHR devices. The ADEPT® Hip Resurfacing was first used in 2004.

**The ADEPT® introduced a small number of advancements** including consistent angle of coverage for all implant sizes, smaller increments between sizes and advanced instrumentation for its reliable implantation.



Figure 2 The ADEPT® Hip Resurfacing and *in situ*.

### 3 Benefits of Hip Resurfacing

The benefits of hip resurfacing include:

- a viable treatment for younger, more active patients,
- early intervention,
- bone conserving procedure,
- more reliably restored native hip joint biomechanics<sup>4</sup>,
- lower infection rates<sup>5</sup>,
- lower incidence of dislocation<sup>4</sup>,
- improvements in activity levels and hip scores, particularly in younger patients<sup>4,6</sup>, and
- ease of femoral revision.

**Surgeons allow their hip resurfacing patients to return to a wider variety of sport and leisure activities without restriction than with a total hip replacement (THR).**

Resurfacing of the femoral head allows for better restoration of the anatomy<sup>4,7</sup> and may be more natural under stressed gait conditions such as high walking speeds, push-off forces and hill walking when compared to conventional THR<sup>8,9</sup>. Expert surgeons allow their hip resurfacing patients to return to a wider variety of sport and leisure activities without restriction as compared to total hip replacement, and return to activity is commonly much earlier in the postoperative recovery phase<sup>4, 10,11</sup>. Patients report a high level of activity including running<sup>4,6, 8,13,13</sup> and these levels of activity may be maintained into the second decade after primary surgery<sup>13,14,15,16</sup>.

**Hip resurfacing significantly reduces the risk of dislocation as compared to total hip replacement.**

Hip resurfacing allows the safe use of large-diameter head components, which offers an immediate advantage for the patient in terms of stability, and significantly reduces the risk of dislocation that is associated with THR<sup>4</sup>. In the UK National Joint Registry (NJR) the incidence rate of revision for dislocation within the first postoperative year is estimated at 2.5 to 4.5 times less for hip resurfacing than for THR and remains low at later time points<sup>5</sup>.

**Hip resurfacing is more conservative than THR and has a lower risk of postoperative infection.**

Hip resurfacing is a more conservative procedure than THR, with no requirement to ream deep into the femoral shaft, which may reduce exposure to bacteria. The UK NJR shows that a hip resurfacing procedure is 1.3 to 1.9 times less likely to be revised within one year for infection than a THR<sup>5</sup>. The benefits of reducing the risk of infection are far-reaching: revision for infection is associated with twice the costs and length of stay in hospital as compared to revision for aseptic causes<sup>17</sup>, and is associated with a higher level of complication, reoperation and morbidity<sup>17</sup>. Hip resurfacing also has a lower risk of mortality when compared to THR<sup>18,19</sup>.

**Revision of a hip resurfacing is similar to performing a primary THR.**

Revision following a conventional THR is invariably more challenging, more expensive and takes longer than the primary procedure, despite the many specialist techniques to address the problems at revision surgery. Retention of the femoral neck and an uncompromised femoral shaft means that revising a hip resurfacing is essentially conversion to a primary total hip replacement, with similar technology, expense and potentially the same postoperative recovery to a conventional primary THR.

This is more appealing to younger patients who are more likely to require a repeat surgery in their lifetime.

**Patients receiving a hip resurfacing device have a lower risk of mortality compared to THR.**

Resurfacing devices are used more commonly in younger, more active patients and there are numerous confounding risks for mortality rates; nevertheless, there is a growing body of evidence supporting the observation that mortality rates are lower for hip resurfacing when compared to THR.

The Australian Joint Registry reported in 2019<sup>20</sup> that hip resurfacing patients have 1.5 times and 1.8 times higher rates of survival beyond 15 and 18 years respectively compared to THR patients after adjusting for age and gender (Figure 3). Published studies also describe lower mortality rates in the long term when a hip resurfacing implant is used, especially in male patients under 55 years of age at surgery<sup>21,22,23</sup>.

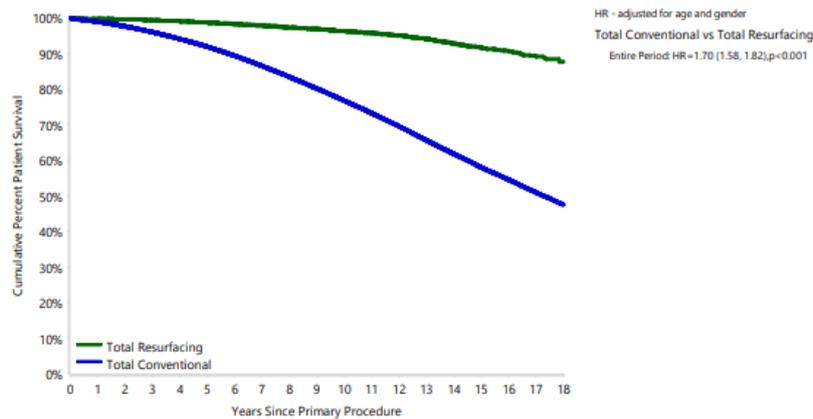


Figure 3 Cumulative percent survival of patients receiving hip resurfacing or THR<sup>20</sup>

**4 Long-term Outcomes of Hip Replacement**

Although THR is a highly successful procedure in many patients, younger patients are more likely to require revision surgery in the early years after their primary surgery than older patients (Figures 4-5). The rate of revisions beyond 10 years also increases in younger patient groups (the graphs become steeper), illustrating the number of younger patients who will face a more complex and expensive revision operation in their lifetime.

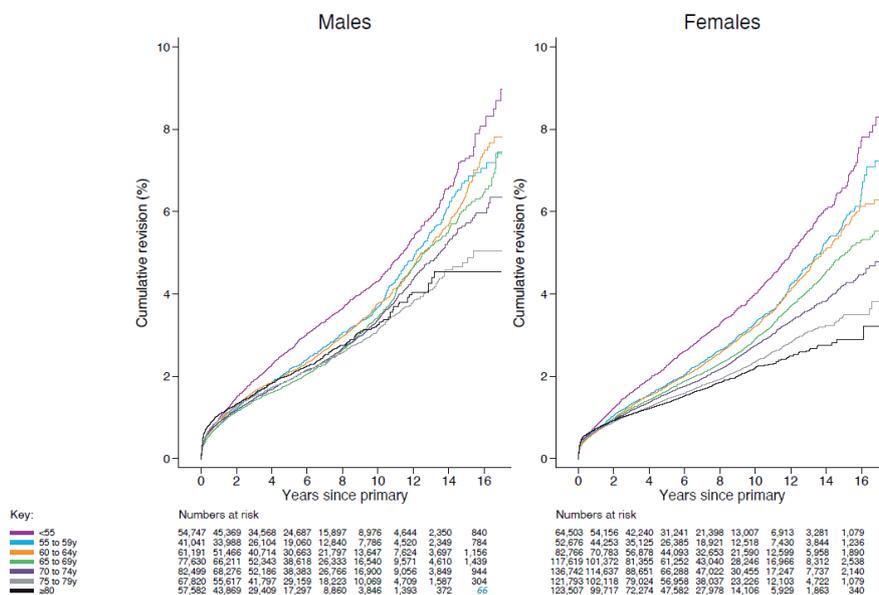


Figure 4 NJR Kaplan-Meier estimates of cumulative revision of all hip replacements, excluding MoM THR and resurfacings<sup>5</sup>. Note the increasing rate of revisions (upward curve) for younger patients beyond 10 years.

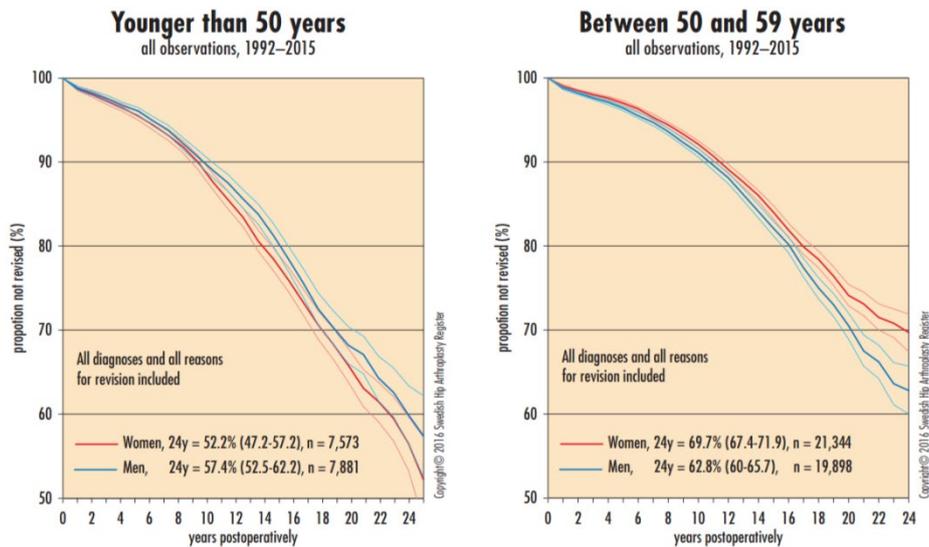


Figure 5 Swedish registry survivorship of total hip replacements for younger patients: 30-50% of patients will have required revision surgery within 25 years of their primary operation<sup>24</sup>.

Registry data does differ for individual devices and bearing options; however, a distinct overall trend is evident in younger males for whom hip resurfacing is most often prescribed (80.6% of the AOANJRR-recorded hip resurfacing patients were male with average age 53.4 years, SD: 9.1)<sup>19</sup>. An independent post-market surveillance report on ADEPT® Hip Resurfacing<sup>25</sup> found that male patients under the age of 50 with indication osteoarthritis have a lower risk of revision than any THR bearing type: 0.9% (0.0, 1.9) at 10.5 years. **Not only have these patients benefitted from the return to activity offered by hip resurfacing, but they have also become less likely to have required a revision surgery than similarly aged THR patients overall.**

**Young, male hip resurfacing patients are less likely to require revision surgery than similarly aged THR patients.**

## 5 Hip Resurfacing and the ADEPT®: Factors Influencing Survival

Appropriate device design is an essential factor for the performance of a hip resurfacing device. Different metallurgy, clearance, geometry and fixation are proven to affect clinical outcome and, consequently, results have differed greatly between devices (Figure 6a).

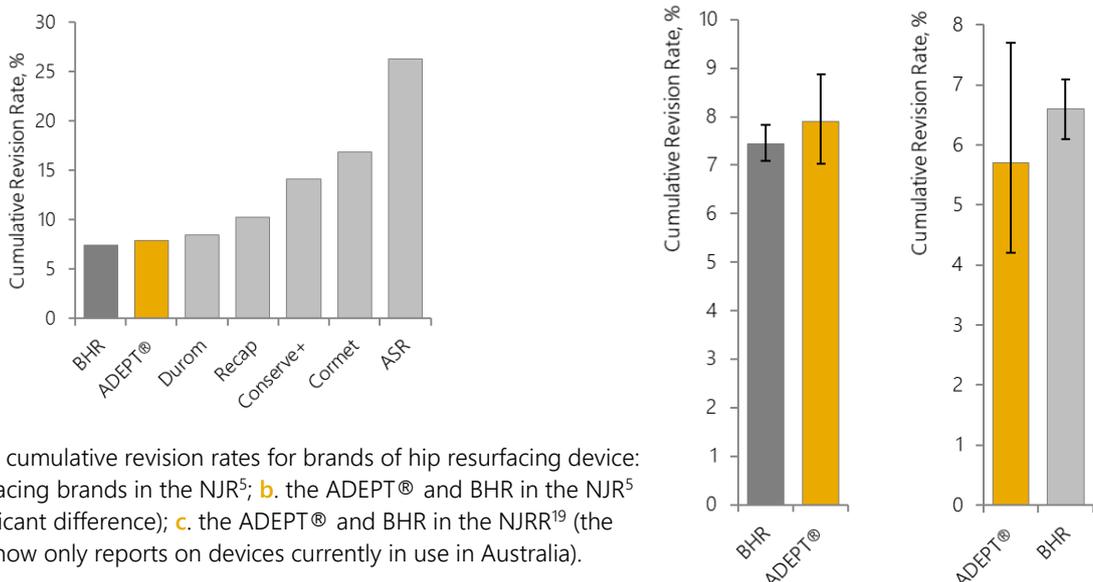


Figure 6 10-year cumulative revision rates for brands of hip resurfacing device: **a.** all resurfacing brands in the NJR<sup>5</sup>; **b.** the ADEPT® and BHR in the NJR<sup>5</sup> (no significant difference); **c.** the ADEPT® and BHR in the NJRR<sup>19</sup> (the NJRR now only reports on devices currently in use in Australia).

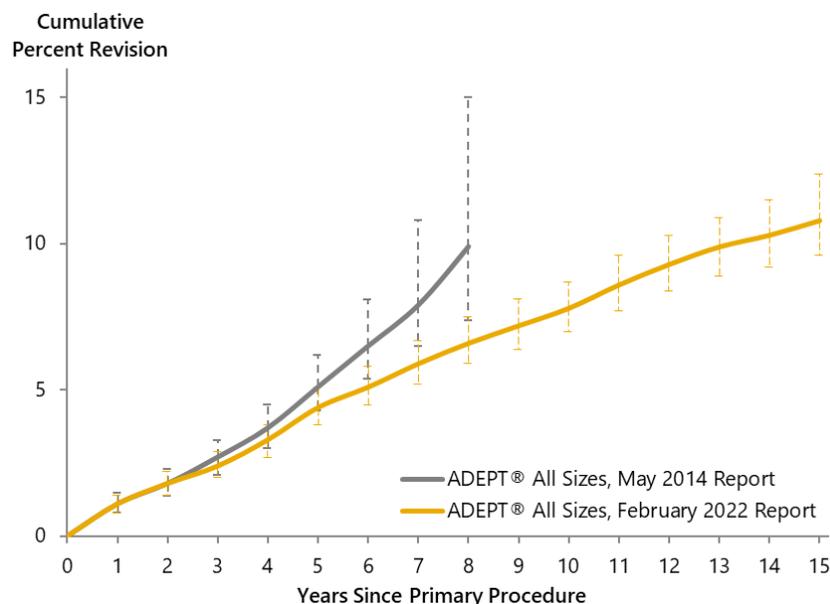
Of the devices shown in Figure 6a, only the ADEPT® and BHR are the original ‘modern-day’ hip resurfacing implants with the same clearance, metallurgy, geometry and fixation based on analysis of the successful early MoM devices and both manufactured by Finsbury (now MatOrtho®; BHR manufactured from start until 2009). Now only the ADEPT® is provided by the original manufacturers (MatOrtho®).

**Success of MoM hip resurfacing is brand specific.**

The early clinical success of the concept led to the release of several other devices into the market. Most are no longer available due to poor design and manufacturing tolerances, rapid release to the market without adequate training to surgeons and overall poor clinical outcomes<sup>5,19</sup>. Therefore, revision rates vary widely by brand, with the best performing devices (ADEPT® and BHR) having 10 years cumulative revision <8% and the worst performing brand >29%.

National registry data (Figure 6a) includes all time use of resurfacing, which includes the smallest head sizes now withdrawn from all brand ranges (due to poorer performance than larger head sizes). The data also captures the wider patient selection indicated in early use of hip resurfacing (which were initially offered to all-comers similar to a THR population) and the acknowledged learning curve<sup>27,28</sup> related to the introduction of the hip resurfacing concept (which is a fundamentally different technology to THR). Therefore, national joint registry data represents a ‘worst’ case in terms of survival analysis of hip resurfacing devices. Nonetheless, ADEPT® cumulative revision rate ranges from 2.3% to 11.1% at 10 years, which is comparable to the range recorded for total hip (2.42% to 12.6% at 10 years)<sup>5,19,25,29</sup>. Closer representation of current use includes revision rates of 2.3% for individual surgeon males only<sup>43</sup> to 9.6% for all-time NJR use of the current size range<sup>31</sup> at 15 years post-operation.

Probability estimations for survivorship of ADEPT® Hip Resurfacing are improving over time as the cohorts of patients on whom the estimations are based mature – the more patients with hips ‘at risk’ at longer time periods, the more accurate the estimation becomes. Figure 7 shows the difference in estimated probability of survivorship in May 2014, based on a starting cohort of over 3,000 patients recorded in the NJR from 2004 onwards<sup>29</sup>, compared to the estimated probability of survivorship in February 2022<sup>30</sup>. The difference is simply that in early estimates few patients had reached >5 years post operation.



**Figure 7** Cumulative percent revision rate of the ADEPT®, including all bearing sizes 38-58mm, males and females, for essentially the same patient cohort, reported in May 2014 (3,221 patients from 2004 to December 2013)<sup>29</sup> and February 2022 (3,949 hips from 2004 to December 2021)<sup>30</sup>.

When first used, the ADEPT® Hip Resurfacing was available with femoral head diameters 38mm to 58mm. In 2013, the available data indicated that the revision rates for smaller head sizes (<46mm) were trending above 1% per year. Based on this data MatOrtho® voluntarily withdrew the smaller bearings (38-44mm) from the market.

National Registry data does not accurately reflect current use of ADEPT®: registry data presents revision rates for all-time use, including all sizes, both genders, with the initial wider patient selection criteria, and learning curve for many surgeons. However, a review of clinical outcomes for the last 10 years only (46-58mm heads) demonstrates a more relevant cumulative revision rate, which is 4.5% (95% CI 3.3 to 6.0) at 10 years<sup>31</sup>. This rate is statistically equivalent to cemented and cementless THRs in younger age groups<sup>5</sup>.

**For all ADEPT® implanted within the last 10 years (46-58mm head sizes), the 10-year revision rate is 4.5% (95% CI 3.3 to 6.0).**

Based on the growing evidence for its success in well-selected patients and the ongoing support for the concept from the device manufacturer, use of the ADEPT® has grown in recent years<sup>32</sup>. This is evident in the NJR<sup>5</sup> and NJRR<sup>19</sup>. The ADEPT® Hip Resurfacing is now the most-used resurfacing device in Australia, accounting for over 56% of all hip resurfacings in the last reported year<sup>19</sup>.

## 6 PROMs Data

The mean postoperative hip score for hip resurfacing is reported to be in the 'excellent' category in numerous published studies<sup>4,6,33,34,35</sup>.

Based on up-to-date systematic review of peer-reviewed literature published in 2019, MoM hip resurfacing is associated with superior outcomes when compared to THR<sup>4</sup>. The review includes findings such as decreased thigh pain<sup>6</sup>, less limp with walking<sup>6</sup>, improved function<sup>14</sup>, superior UCLA activity scores<sup>36, 37</sup>, quality of life<sup>36,37</sup> and return to manual labour work<sup>36</sup>, moderate/heavy activity<sup>37</sup>, sport<sup>36</sup> and long distance walking and running<sup>6</sup>.

The ADEPT® Hip Resurfacing System in particular has excellent results in well-selected patients<sup>38</sup>:

- Oxford scores for hip resurfacing patients were high compared to total hip replacement patients,
- WOMAC scores indicated excellent function,
- the UCLA Activity Scale showed that patients were regularly participating in moderate activity, with 10% regularly participating in high impact sports,
- metal ion levels just 14% (cobalt) and 19% (chromium) of the limit used for the ASR recall and published guidelines by the MHRA (cobalt 119 nmol/L, chromium 135 nmol/L),
- no failures associated with wear or increased metal ions in the resurfacing group.

Patient reported outcomes recorded by the NJR, including the Oxford Hip Score and EQ-5D are higher for ADEPT® Hip Resurfacing than THR, however not statistically different when the NJR case-mix adjustment is applied<sup>31</sup>.

In other words, in terms of health gain and patient satisfaction following a hip operation, hip resurfacing is as equally valuable an operation as total hip replacement, which is considered to be one of the most successful and cost-effective interventions in medicine.

**Patient satisfaction for the ADEPT® Hip Resurfacing is over 95%.**

When asked "Overall, how are your problems now, compared to before your operation?" **96% of ADEPT® Hip Resurfacing patients respond that their problems are better**, and when asked "How would you describe the results of your operation?" **95% of patients respond 'good', 'very good' or 'excellent'**<sup>31</sup>.

## 7 Orthopaedic Data Evaluation Panel (ODEP)

The Orthopaedic Data Evaluation Panel (ODEP) was set up to monitor the NICE guidance on primary hip implants in 2002 and hip resurfacing in 2004. The Panel provides on-going assessment of hip implants to benchmark both hip femoral stems and hip acetabular cups against the NICE guidance, providing a benchmark rating for implant survivorship and data submission quality.

The current range of ADEPT® Hip Resurfacing implants has been awarded an ODEP 13A rating (Figure 8) based on the panel's independent review of the survivorship associated with the device and on the quality of data supporting the device<sup>39</sup>.



Figure 8 ODEP rating for the ADEPT® Hip Resurfacing<sup>39</sup>.

Further information is available on ODEP criteria and use of the ratings by hospitals on the ODEP website<sup>40</sup>.

## 8 Summary

Metal-on-metal (MoM) bearing hip replacement has the longest clinical history of any bearing couple in use today<sup>41</sup>. Although hip resurfacing was first attempted in 1948 and later in the 1970s with metal on poly bearings<sup>42</sup>, it was not until the 1990s that the availability of long-term data on the early MoM THR devices and the highly specialised manufacturing techniques developed by Finsbury (now MatOrtho®) enabled a revival of the resurfacing concept<sup>3</sup>.

The ADEPT® Hip Resurfacing was based on experience gained from analysis of successful historical MoM devices and development and manufacture of the most successful modern day hip resurfacing devices. It has been shown to meet the demands of patients who, due to their relatively younger age or increased activity level, are likely to outlive or outperform a traditional total hip replacement.

As the available data matures, fewer patients are requiring revision surgery than was previously expected. The ADEPT® Hip Resurfacing meets both the current NICE guidelines and ODEP 13A rating criteria with a revision rate of 4.5% (95% CI 3.3-6.0) at 10 years after the operation.

With changing demographics and patients expecting more from their procedure, the ability to return to a normal active lifestyle is as important as revision data and many young and active people continue to benefit from their hip resurfacing.

- The ADEPT® Hip Resurfacing is available for younger and more active patients who require it.
- Hip resurfacing patients are free to return to work and active lifestyles<sup>4,10,11</sup> without compromised function and with all options maintained for further treatment if required.
- Survivorship for well-selected patients receiving ADEPT® is in line with THR<sup>5,19,29,32,43</sup>, the device is awarded an ODEP 13A rating<sup>39</sup> and meets NICE guidelines.
- Clinical data for the ADEPT® demonstrates good outcomes and, when used in well-selected patients, revision surgery is less likely than it is for young, active patients who receive a THR<sup>19</sup>.
- Hip resurfacing patients live longer.

## 9 Key Literature

### Mid-Term Review of ADEPT Metal-On-Metal Hip Mid-Term Review of ADEPT Metal-On-Metal Hip Prosthesis. Functional, Radiological and Metal Ion Analysis.

Plant JGA, Prosser GH, Burston BJ, Edmondston SJ, Yates PJ. Open Journal of Orthopedics. 2014; 4: 38-43.

#### Abstract

**Background:** There is much interest regarding metal-on-metal implants in medical and general media. Much of this has been regarding failure of specific implant systems and metal ion toxicity. We present our early mid-term experience of the ADEPT metal-on-metal system which has both modular and non-modular hip options.

**Methods:** Functional assessment, blood metal ion quantification, and radiographic analysis were performed for the modular and non-modular ADEPT variants. Fifty implants were implanted with a mean follow up time of 28 months. Unpaired t-tests were used to compare modular and resurfacing groups, standardised hip scores were used to compare function to conventional total hip arthroplasty.

**Results:** Metal ion levels were significantly higher in modular prostheses compared to resurfacing implants, but not at "harmful" levels (as determined by a previous metal-on-metal implant recall). Functional outcomes were excellent and revision rates were lower than expected.

**Conclusions:** At our institution we have good outcomes with the ADEPT hip prosthesis. Though patient selection and implant position are crucial, poor performance of metal-on-metal hip replacements is implant specific.

### Metal-On-Metal hip resurfacing arthroplasty provides excellent long-term survivorship and function in patients with a good-sized femoral head. Results of a single, non-designer surgeon's cohort.

Gani MH, Zahoor U, Hanna SA, Scott G. Bone & Joint Open. 2022; 3(1): 68-76.

#### Abstract

**Aims:** To establish the survivorship, function, and metal ion levels in an unselected series of metal-on-metal hip resurfacing arthroplasties (HRAs) performed by a non-designer surgeon.

**Methods:** We reviewed 105 consecutive HRAs in 83 patients, performed by a single surgeon, at a mean follow-up of 14.9 years (9.3 to 19.1). The cohort included 45 male and 38 female patients, with a mean age of 49.5 years (SD 12.5).

**Results:** At the time of review 13 patients with 15 hips had died from causes unrelated to the hip operation, and 14 hips had undergone revision surgery, giving an overall survival rate of rate of 86.7% (95% confidence interval (CI) 84.2 to 89.1). The survival rate in men was 97.7% (95% CI 96.3 to 98.9) and in women was 73.4% (95% CI 70.6 to 75.1). The median head size of the failed group was 42 mm (interquartile range (IQR) 42 to 44), and in the surviving group was 50 mm (IQR 46 to 50). In all, 13 of the 14 revised hips had a femoral component measuring  $\leq$  46 mm. The mean blood levels of cobalt and chromium ions were 26.6 nmol/l (SD 24.5) and 30.6 nmol/l (SD 15.3), respectively. No metal ion levels exceeded the safe limit. The mean Oxford Hip Score was 41.5 (SD 8.9) and Harris Hip Score was 89.9 (14.8). In the surviving group, four patients had radiolucent lines around the stem of the femoral component, and one had lysis around the acetabular component; eight hips demonstrated heterotopic ossification.

**Conclusion:** Our results confirm the existing understanding that HRA provides good long-term survival and function in patients with adequate-sized femoral heads. This is evidenced by a 97.7% survival rate among men (larger heads) in our series at a mean follow-up of 14.9 years. Failure is closely related to head sizes  $\leq$ 46mm.

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## 11 Notes

Notes



CE 1434 TGA Health Safety Regulation  
ARTG209647  
ARTG209655

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