



PATIENT INFORMATION ON BEARING SURFACES IN HIP

What is a “metal hip”?

All hip replacements are made of metal components which can be titanium or cobalt chrome. It is however important to differentiate the components (i.e.: the stem and the cup) from the bearing surface (i.e.: the material used as the head and cup liners).



Above left is an example of a cemented metal stem (hip replacement) with a metal head, which traditionally articulated with a polyethylene liner as shown on the right (metal on poly bearing). Sometimes the liners have metal shells as seen in the examples showing a ceramic liner in a metal shell with a ceramic head (ceramic on ceramic bearing) and a polyethylene liner in a metal shell with a ceramicised metal (Oxinium) head (ceramicised metal on poly bearing). Right is an example of an uncemented metal stem (hip replacement) with a ceramicised metal (Oxinium) head.

What the press are referring to when they broadly state metal hips is the bearing surface - a metal head rubbing against a metal cup liner. Below are examples of a BHR (resurfacing) left, a BHR on a stem middle and a BMHR (resurfacing) right. All have the same proven metal on metal bearing (Birmingham) which performs well.



The ASR from DePuy is another example of a metal on metal bearing which was available both as a resurfacing or on a stem as in the examples below.



Why do different metal hips have different risks of failure?

As evident in the pictures the implants are almost identical to the casual observer. It was therefore assumed by DePuy that the ASR would perform the same as the BHR. There are however several critical flaws in the ASR design which have been proven in scientific articles to have lead to it's high risk of failure. These include those shown in the table below:

Table 1. Subtended articular surface angles increase with increasing acetabular component diameter in both devices (source: manufacturers' details and independent testing^{††})

	ASR*	BHR†
Subtended articular surface angle (°)	148 to 160	158 to 166
Mean radial clearance (µm)	50	100 to 150
Wall thickness at rim (mm)	3.1	3.6/4.6
Manufacturing method of head	As cast	As cast
Manufacturing method and treatment of acetabular component	HIP/SA‡	As cast
Surface roughness (µm)	0.025	0.029
Deviation of roundness head (µm)	3.4	0.9
Deviation of roundness acetabular component (µm)	3.8	0.9
Carbon content§	High	High

* ASR, articular surface replacement

† BHR, Birmingham hip resurfacing

‡ HIP/SA, cast process and heat treatment by hot isostatic pressure/surface annealed

§ high carbon content defined as ≥ 0.20%

There is a substantial difference in the failure rate of these two implants on all of the international registries and in multiple internationally published research papers.



How do different types of hips fail?

All hips can fail for common reasons including infection, loosening and wear. Each bearing surface has other specific mechanisms of failure that are unique to it.

Metal on polyethylene bearings have slightly higher wear rates and the polyethylene debris can cause other problems. This has largely been overcome by highly cross linking the polyethylene in the manufacturing process (a technique pioneered here in South Africa). Using a ceramic or ceramicised metal head to articulate with highly cross linked poly also substantially decreases this wear rate making this a reliable, durable and well tested bearing. It is not possible however to resurface with this bearing.

Ceramic on ceramic bearings have extremely low wear rates but ceramic is brittle and can fracture with impact. This is a problem because after a ceramic fracture the small pieces will chew up any replacement bearing surface other than another ceramic one. Ceramic on ceramic bearings also have about a 5% incidence of squeaking that is unpredictable and can be annoying. It is not yet possible to resurface with ceramic on ceramic.

Metal on metal bearings can fail in 2 ways – either by friction causing metal particles to wear off and cause fluid collections and destruction in the tissue around the hip (metallosis) or by an allergic reaction to the metal in some patients leading to fluid collections and tissue destruction (ALVAL).

Metallosis occurs when wear rates are too high and this can be because the bearing is too small (less than 46mm which allows fluid film lubrication) or if the components are not well aligned and edge loading occurs. This is why it is critical that the surgeon is accurate when using metal on metal. It is also why resurfacing and metal bearings do better in men and larger patients. Metallosis has been seen in ceramic and metal on poly hips as well caused by wear at the junction of the head and stem and is therefore not unique to metal on metal bearings.

ALVAL is an extremely rare (less than 1% in the Birmingham series) and unpredictable complication when a patient is allergic to the metals themselves. This is more common in women and metal allergies to jewelry have been implicated although never definitely proven. This can occur even with perfectly orientated and sized components.

Who is the ideal patient for resurfacing and metal bearings?

A young active male and larger female patient with good strong bone and relatively normal hip anatomy (osteoarthritis) is the ideal candidate. We do consider resurfacing in older but active men with good bone stock and also in active female patients if their hips are large enough for a 46mm head.



What about small patients and females?

Birmingham has developed a ceramic head that can be used in resurfacing a hip in conjunction with their standard metal resurfacing cup. There are 2 year results available in patients and there are reduced metal levels that significantly lower the risk of metallosis and of ALVAL in the smaller and female patients. This means that the advantages of hip resurfacing will be available to a group of patients who traditionally had a higher risk of problems.

This ceramic on metal resurfacing is only available to certain surgeons worldwide as it is new technology which is being introduced in a responsible manner. These are all surgeons with vast experience in hip resurfacing. Not releasing it for general use until it is proven is a way of preventing a copy of the DePuy ASR debacle.

What about “old” patients?

Chronological age is largely irrelevant. Some patients are very active and very chronologically old. Other patients are very inactive and chronologically young. What does however happen is that bone density decreases with age at varying rates in different people. So some people over 80 are suitable for resurfacing and others under 65 are not. We do not discriminate on age. We adapt to use the prosthesis we think will fit the individual patient best.

How do we decide on a bearing for our patients?

Medicine is science and art. We use a combination of our experience and knowledge with multiple patient factors including age, size, gender, activity level, expectations and lifestyle to decide on what will work best for each individual patient in our hands. There is no one size fits all option in our practice.

