Hip resurfacing: Expectations and limitations

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Hip resurfacing: expectations and limitations

Sir—We read with interest the article by Pieter T. J. Spierings (2008) pertaining to the hip resurfacing expectations and limitations. We would like to make some comments and discuss some of the conclusions of the article:

1. For the conservative approach of the acetabular bone stock, from our experience we do not agree that more bone is removed in hip resurfacing (HRA) than in total hip arthroplasty (THA). The author does not take into account the difference in gender in the indications of both procedures. That a small survey about sales of prostheses done among the largest distributors in the Netherlands showed that there would be more excessive bone loss in resurfacing is possible, but it has been well established in all papers about HRA and THA, that the majority of patients are male in HRA (70%), female in total hip (70%) (Buergi and Walter 2007). In general the cup size in females is about 6 to 8 mm smaller than the size in male patients, which supports our point that there is not a difference between the 2 procedures even in the Netherlands.

There is also a difference in bone removal of the acetabulum in different implants because of different instrumentation, techniques and design, but this has not yet been shown to be statistically significant.

Vendittoli in a prospective, randomized study compared conservation of acetabular bone after THA and HRA of the hip (Venditolli et al. 2006). The results suggested that removal of bone on the acetabular side in HRA was comparable with that of THA, the mean or median diameters of the last reamer used or the mean size of the acetabular component (54.90 mm (44 to 64) for resurfacing arthroplasty and 54.74 mm (48 to 62) for THR, $p = 0.770$. The same results were also seen in other studies (Naal et al. 2009). Moonot showed hip resurfacing acetabular components was 2.03 mm less than that of the acetabular components in the uncemented total hip replacements ($p < 0.0001$) (Moonot et al. 2008).

We will not deny that an excessively large cup is never done in resurfacing, but this is seen as a mistake in the resurfacing technique as is also the high abduction angle in cup position.

In revision of HRA it was reported that revision of HRA may be performed successfully with a minimal increase in bone loss (Ball et al. 2007, McGrath et al. 2009). In our study based on (42) we show that the average increase in cup diameter after revision is only 1.4 mm in the hips that needed cup exchange.(De Haan et al. 2008)

2. That the range of motion is "clearly compromised" is not true. This discussion is not so simple and depends mainly on the head neck ratio we can find as well in THA where the head diameter is the most important, in HRA where the head neck ratio is important as is also the surgical technique. If a resurfacing is well done with the correct head size, all osteophytes are removed, and a correct removal of bump on the neck or conflicting bone, the same ROM as a normal hip should be seen.

The proof used in this article with a CAD model derived from CT scans, or composite femurs and pelvises can not in any way be in conflict with daily arthroplasty practice where this problem is not encountered. In some clinical studies greater improvements in hip extension and abduction moment were found in HRA, indicating typical loading of the hip, compared to THA. Shrader in his pilot study showed that HRA group achieved greater hip extension through the movement cycle compared to the THA group, which maintained reduced ($p = 0.01$) hip extension angle (Shrader et al. 2009).

That impingement problems and reduction of ROM never occurs in HRA we will not state, but this problem does not have a high incidence/prevalence.

In the literature a variety of other complications related to HRA can be found, including metallosis, raised metal ion levels, aseptic lymphocytic vasculitis associated lesions (ALVAL), pseudotumors, clicking, squeaking, and nerve palsy (Back et al. 2005, Lachiewicz 2007). Mabilleau give in this issue of Acta an overview of the literature on biological responses to metal-on metal HRA. They found an increasing number of case reports on periprosthetic soft-tissue masses and osteolysis as a response to elevated metal ion levels. (Mabilleau et al. 2008) The increased concentration of metal particles in the joint space of HRA could lead to a T lymphocyte-mediated hypersensitivity reaction (Type IV). The authors express their concerns about the risks of long-term exposure to metal ions. An increased risk of developing lymphoma in patients with chronic inflammatory disease who undergo metal-on-metal arthoplasty has recently been considered (Lidgren 2008).

The same issues can be found with metal-on-metal total hips, especially in the current era of large diameter jumbo heads. Those are rare metal-on-metal problems, not simply HR problems.

Varus placement of the femoral component leads to higher levels of stress and increases the probability of failure (Beaulé

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and Poitras 2007, Radcliffe and Taylor 2007, Lazarinis et al. 2008). Cup anteversion greater than 25% or cup abduction less than 45% can result in impingement and increased wear. The safe zone for cup and head positioning is smaller in HRA than in THA, and deviations are less forgiving.

Again, this is a big diameter MoM problem – there is clear evidence that component design is an important determinant of component wear when the implant is malpositioned, so not all HRAs will suffer from this problem to the same extent.

Stress Shielding does occur to some extent in all Hip replacements but the degree and clinical consequences are highly variable according to confounding factors including initial bone stock, vascularity, fixation and biomechanical integrity of the construct. Analysis of long-term retrieved specimens (up to 23 years) shows that this is not inevitable or clinically consequential in many well performed HRAs. Indeed, these long terms specimen often show remarkable remodelling and adaptation, even in female patients (Kordi and McMinn 2009).

Dr Spierings points out that Hing et al. "measured more than 10% thinning in 28% of his patients." which sounds alarming. However, in her paper, Dr Hing concluded that "narrowing of the femoral neck which is found with the Birmingham hip resurfacing arthroplasty is in most cases associated with no adverse clinical or radiological outcome up to a maximum of six years after the initial operation" (Hing et al. 2007).

We agree that Patients are best served with proven designs that have proven long-term outcome." With greater than 10 year follow-up in the first two HRA designs, and with excellent results in a difficult group of patients, there are proven designs of HRA available for surgeons willing to undergo the training to become specialist resurfacing surgeons.

We do also agree that easy resurfacing does not exist, even in experienced hands. Hip resurfacing arthroplasty only finds its place in high volume centres and experienced surgeons. A heart transplant is not done by a general surgeon, but only in a specialised centre.

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Sir—Thanks for the letter with comments from Drs. De Smet and Calistri in which they discuss various topics of my guest editorial.

1. More acetabular bone loss in HRA. Data obtained from Dutch distributors showed a difference of approximately 6 mm between the cup diameter of a total hip arthroplasty (THA) and a hip resurfacing arthroplasty (HRA). De Smet and Calistri claim this difference is due to a difference in sex ratio between THA and HRA. They refer to an article using data from the 2005 Australian National Joint Replacement registry. In this registry the male/female percent ratio for HRA is 44/56 and for THA 73/27. The difference in the average acetabular cup diameter between males and females is 4–5 mm (Moonot et al. 2008, Naal et al. 2009). Simple calculations then shows that the difference in sex ratio between THA and HRA accounts only for 29% × 4.5 mm = 1.3 mm diameter difference. This means that the remaining 4.7 mm or 78% of the difference in cup diameter between THA and HRA must be contributed to the surgical procedure.

Publications have shown differences between THA and HRA cup diameter. Vendittoli et al. (2006) found no difference in cup diameter. Moonot et al. (2008) found in an age and sex matched cohort no difference in cup diameter for men, and for women a 2 mm smaller cup diameter in HRA, than for uncemented THA. Naal et al. (2009) not only matched for age and sex but also for height and weight, which are associated with the cup diameter. They found that HRA required, for both men and women, a 2 mm larger acetabular component than uncemented THA. Loughead et al. (2006) found a 5 mm larger cup diameter for HRA than for THA.

Certainly surgical technique and skill plays a major role in the outcome of these studies. In the Netherlands no centers exist which are fully committed to resurfacing arthroplasty and taking into account that only 6% of all hip patients qualify for a HRA it is clear that only few surgeons will have the opportunity to gain sufficient experience. Less experienced surgeons will try to avoid notching to decrease the risk of femoral neck fracture and will probably use a larger femoral component than an experienced surgeon. Therefore it may be expected that acetabular bone loss for HRA will be higher in a nationwide survey than presented in studies of single high-volume centers.

2. Compromised range of motion. There is no doubt that the natural femoral neck diameter in HRA is larger than the prosthetic neck diameter in THA. With a given head diameter size this results in a decreased range of motion (ROM) in flexion and combined flexion-adduction- endorotation movements. I agree that in most cases the decreased ROM will not be noticed clinically and that a sufficient ROM can be achieved. In some cases however it may lead to impingement and subluxation which for a metal on metal bearing is most undesirable. Subluxation will lead to increased wear and metallosis.

3. Metal on metal. De Smet and Calistri state that many of the complications and disadvantages related to HRA are not

caused by HRA itself but are caused by the metal on metal bearing surfaces. This observation is correct. Unfortunately metal on metal is the only bearing material available for resurfacing prostheses. In many cases metal on metal is an excellent choice with a successful long-term outcome. In some cases, in particular when component positioning and range of motion are critical, metal on metal is a less good choice. Metal on metal is very unforgiving as soon as circumstances become less from optimal. Metal on metal impingement will cause excessive wear as does subluxation. Steep cup positioning will lead to rim loading and stripe wear. The combination of critical positioning, reduced ROM and metal on metal is not ideal, but metal on metal is the only choice for HRA. Any other bearing material would need a thicker acetabular cup wall thickness and therefore a larger cup diameter.

De Smet and Calistri work in a clinic fully specialized in HRA. In such a an ideal setting there is no learning curve and type of implant, instrumentation, bone preparation and cementing technique can be optimized. Their long term survival rate surely must be better than the numbers of a national register. In the 2008 Australian Registry, presenting the results of 2007, the use of HRA has decreased for the second year. Together with an increasing number of all primary hips, the percentage of resurfacing has decreased to 7%. The revison rate for this selected patient group remains high. The 1-year revision rate for HRA is 1.9% compared to 1.1% for cemented THA. The 7-year revision rate is 5.4% for HRA compared to 3.8% for cemented THA. HRA has a significantly higher revision rate compared to THA with a hazard ratio (adjusted for sex and age) of 1.4. Up to now there is no evidence that THA can improve the short-, medium- or long-term results obtained with conventional total hips.

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