Conventional total hip replacement vs. resurfacing total hip replacement: what’s best for my patient

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Hip resurfacing arthroplasty has increased in popularity as a viable treatment option for young, active patients with osteoarthritis that find in this procedure the real option to return to their old habits of life. Early literature show that resurfacing hip arthroplasty patients had kinematics and kinetics (abduction moments, extension moments, and walking velocities) that approached normal values for patients without hip osteoarthritis. Many of the technical problems that affected resurfacing implants have been identified and resolved, with improved engineering and manufacturing techniques. At the present time, failure for THR for all diagnoses in patients younger than fifty years old, as reported by the Swedish Arthroplasty Registry, was associated with a ten-year survival rate of 85%. In contrast, HRA failure for any reason is rare and the ten-year survival rate from the best cohort were 95.5%–96.1%. We agree that hip resurfacing arthroplasty only finds its place in high volume centres and experienced surgeons. We need further clarification by well planned prospective studies and evaluation of longer-term outcomes.

Key words: Arthroplasty, replacement, hip - Osteoarthritis - Recovery of function.

Metal on metal hip resurfacing arthroplasty (HRA) has gained popularity as a viable treatment option for young, active patients with osteoarthritis of the hip, and high functional expectations. This procedure is more technically demanding than routine total hip replacement arthroplasty (THA), particularly for surgeons new to the procedure: only high volume hip surgeons who received training specifically in this technique should perform it. The learning curve is known to be longer than in other hip procedures, it is expected to be more than 50 surgeries. The correct placement of both the acetabular and femoral components is critical for the optimal functioning of the metal-on-metal bearing. The controversy regarding the superiority of either resurfacing arthroplasty or conventional THR remains unsolved. There are several purported advantages of resurfacing over standard THR: Resurfacing is bone conserving on the femoral side, has lower dislocation rates, produces a more normal gait pattern, a quicker recovery and shorter hospital stay, increased activity levels and easier revision. It is interesting and important for the orthopaedic surgeon to know how and why to make the decision to choose the procedure for their patients between total hip arthroplasty and hip resurfacing arthroplasty.
Materials and methods

The authors systematically reviewed the literature found on the Medline and EMBASE bibliographic databases that were related to hip resurfacing and the comparison between THA and HRA. The search parameters used to identify relevant articles were "hip resurfacing and surface replacement" and "total hip replacement" and "total hip arthroplasty". Bibliographies of review articles were then analyzed for any additional relevant studies. We specifically analyzed articles that compared resurfacing to standard THA. We also looked for articles that described difference of these devices.

Results

There are limitations to the present analysis that include the level of evidence of the studies reviewed, as there were few randomized, prospective trials. We identified the items that had more controversies in the early literature and we try to discuss these by comparing data from the best articles and our own experience. We found controversies in bone removal with the two procedures, what to do in case of revision, range of motion, wear properties and consequent reactions, stress shielding and dislocation rate. The higher activity level in HRA remains today a "hot topic", but any difference between HRA and THA must consider if the THA has a 28 mm articulation or larger head size.

Bone removal between HRA and THA has been discussed in a lot of papers from, in vivo as well as in cadavers, and sawbones. Bone removal is always more conservative on the femoral side, and now with new instruments, a better understanding and low profile designs, also the resurfacing acetabular procedure can be even more conservative than in THA.

It is also well established in all papers about HRA and THA that the majority of patients are male in HRA (70%), female in total hip (70%). 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 two procedures. Venditelli in a prospective, randomized study compared conservation of acetabular bone after THA and HRA of the hip. The results suggested that removal of bone on the acetabular side in HRA was comparable with that of THA, the mean or median diameter of the last reamer used or the mean size of the acetabular component (54.90 mm, range 44 to 64), for resurfacing arthroplasty and 54.74 mm (48 to 62) for THA, P=0.770. The same results were also seen in other studies. Monnot showed that hip resurfacing acetabular components were 2.03 mm less than that of the acetabular components in the uncemented total hip replacements (P<0.0001). 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 might be performed successfully with a minimal increase in bone loss. In our study based on revisions of 42 HRA's we show that the average increase in cup diameter after revision is only 1.4 mm in the hips that needed cup exchange.

The discussion about better range of motion in THA than HRA, 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 the bump on the neck or conflicting bone, the same ROM as a normal hip should be achieved. 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. Shadrer in his pilot study showed that the HRA group achieved greater hip extension through the movement cycle compared to the THA group, which maintained reduced (P=0.01) hip extension angle. We cannot say that impingement problems and reduction of ROM never occur in HRA, but this problem does not have a high incidence/prevalence.
A variety of other complications related to HRA can be found in the literature, including metallosis, raised metal ion levels, aseptic lymphocytic vasculitis associated lesions (ALVAL), pseudotumors, clicking, squeaking, and nerve palsy. Mabileau in his overview of the literature on biological responses to metal-on-metal HRA found an increasing number of case reports on periprosthetic soft-tissue masses and osteolysis as a response to elevated metal ion levels. 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 arthroplasty has recently been considered. The same issues can be found with metal-on-metal total hips, especially in the current era of large diameter jumbo heads. These are rare metal-on-metal problems, not simply HRA problems.

Varus placement of the femoral component leads to higher levels of stress on the femoral neck and increases the probability of failure. 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. 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 HRA's will suffer from this problem to the same extent. Langton et al. have emphasized that the importance of the location of the articular contact patch in the standing position of the patient is crucial in the development of high wear states. The closer this patch lies to the rim of the acetabular component, the greater the chance of increased blood metal ion levels.

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 HRA's. Indeed, these long-term specimens often show remarkable remodeling and adaptation, even in female patients.

Lower Dislocation Rates: in comparison to standard THA, dislocation is a rare complication after hip resurfacing. With conventional arthroplasties, the dislocation rate ranges from 2% to 5%. In the international literature, the dislocation rate with resurfacing has been 0.21%. The senior author (De Smet) had a total of 5 dislocations in the first 900 cases, only 2 normal daily dislocations for technical reasons. There were no subsequent dislocations in the following 2300 cases.

Conclusions

Metal-on-metal hip resurfacing has recently been advocated as an alternative to modern uncemented diaphyseal total hip components in young patients. At the present time, failure for THA for all diagnoses in patients younger than 50 years of age, as reported by the Swedish Arthroplasty Registry, was associated with a ten-year survival rate of 85%. In contrast HRA failure for any reason is rare and the ten-year survival rate from the best cohort were 95.5-96.1%. More interestingly still, if we are going to evaluate the survival rate in males with osteoarthritis younger than 55 years old, the Kaplan-Meier survivorship curves show a survivorship rate of 99.4%. The reasons could lie with the bigger size of the prosthesis i.e., increasing femoral head diameters to improve fluid-film thickness and to reduce frictional forces on the articulating surfaces and thus reduce wear. Larger acetabular components also may resist deformation and thereby maintain clearance and prevent jamming and wear. We do agree hip resurfacing arthroplasty only finds its place in high volume centres and experienced surgeons. We need further clarification by well-planned prospective studies and evaluation of longer-term outcomes.
Riassunto

Protesi totali di anca convenzionali vs. protesi totali di anca di superficie: che cosa è meglio per il paziente

L'artroplastica di anca di superficie è sempre più popolare essendo una valida opzione di trattamento nei pazienti giovani, affetti da osteoartrite, che grazie a questa procedura possono realmente tornare alle proprie abitudini di vita. I dati pubblicati fino alla fine del XX secolo dimostrano che i pazienti sottoposti ad artroplastica di anca di superficie presentano parametri di drenaggio statico e di drenaggio dinamico (momenti di abduzione, movimenti di estensione, e velocità di camminata) che sono molto simili ai normali valori nei pazienti non affetti da osteoartite. Numerosi problemi tecnici che riguardano gli impianti di superficie sono stati superati con il passare del tempo grazie a iniziative tecniche di ingegneria e di fabbricazione. Al momento attuale l'insuccesso della THA per le diagnosi in pazienti di età inferiore a cinquant'anni, come riportato dallo Swedish Arthroplasty Register, era associato con un tasso di sopravvivenza a dieci anni dell'88%. Al contrario, l'insuccesso della THA con qualsiasi regione è raro e il tasso di sopravvivenza a dieci anni nelle migliori serie è del 95,3% - 96,1%. Secondo la nostra opinione, l'artroplastica di anca di superficie trova il suo spazio di applicazione soltanto in centri ad alta volume e con chirurghi esperti. Ulteriori studi prospettici e la valutazione dei risultati a più lungo termine sono necessari per chiarire ulteriormente il panorama.

Parole chiave: Artroplastica d'ancia - Osteoartiite - Recupero delle funzioni.

References