

Metal-on-Metal Surface Replacement: A Triumph of Hope Over Reason: Affirms

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abstract

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Metal-on-metal hip resurfacing offers some potential for total hip arthroplasty (THA) in the young patient. However, short- and intermediate-term results of the currently available implants have failed to demonstrate advantage over conventional THA. The risks of femoral neck fracture or avascular necrosis have been disappointing early limitations of the procedure. The Australian Joint Registry reports a 5-year revision rate of all hip resurfacings of 3.8%, compared with conventional THAs at 2.8%, and a 9-year cumulative revision rate of 7.2% for hip resurfacings. Recent reports of femoral neck erosion and pseudotumors associated with resurfacing have raised concern about the survivorship of the procedure in some patients. Recently, the British Medicines and Healthcare Product Regulatory Agency issued an alert over adverse reactions associated with metal-on-metal THAs, with particular concern expressed about hip resurfacings.

Acetabular bone stock may not be conserved when large-diameter femoral head components are used, depending on the surgical technique and implant design. In hip resurfacing, the minimum diameter femoral component avoids notching of the femoral neck; thus, larger diameter acetabular components may be necessary to accommodate the femoral component. Hip resurfacing is contraindicated in cases of avascular necrosis of the femoral head, especially with cysts >1 cm in diameter, with severe slipped capital femoral epiphysis, and in some posttraumatic arthroses; furthermore, the biomechanics of the resurfaced hip appear to be less reliably restored than with conventional THA. The hypothesis that resurfacing is a more conservative procedure than conventional THA remains unproven at this time. Given the documented intermediate failure rates of resurfacing, metal-on-polyethylene is the more successful implant choice.

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Surface replacement arthroplasty of the hip has been driven largely by Internet-based marketing of unfounded claims.¹ A critical examination of the data for surface replacement arthroplasty, particularly when compared to data from conventional cementless metal-on-polyethylene total hip arthroplasty (THA), suggests that the purported advantages of surface replacement arthroplasty remain unconfirmed. Surface replacement arthroplasty should be regarded as an evolution in THA that awaits confirmation with longer-term follow-up data.

BIOMECHANICAL AND DESIGN ISSUES: LIMITATIONS UNIQUE TO SURFACE REPLACEMENT ARTHROPLASTY

Surface replacement arthroplasty can maintain hip offset but is unable to increase offset or adjust limb length.² This represents an inherent limitation to surface replacement arthroplasty, as the pathoanatomy of many cases of degenerative hip disease are associated with shortening of the extremity or loss of offset. Small femoral heads as occur in small-statured patients or women with small acetabula are associated with a higher risk of femoral neck fracture and impingement, and thus constitute a relative contraindication to surface replacement arthroplasty.³

Range of motion (ROM) following surface replacement arthroplasty is less than that of conventional large-ball THA, due to impingement of the native femoral neck against the prosthetic or natural acetabulum.⁴ However, a study of the clinical ROM comparing the results of surface replacement arthroplasty vs conventional THA showed no difference among 35 patients who had undergone bilateral prosthetic arthroplasty with a surface replacement arthroplasty on 1 side and THA on the contralateral hip.⁵

PATIENT SELECTION ISSUES LIMIT THE INDICATIONS FOR SURFACE REPLACEMENT ARTHROPLASTY

Patient selection for surface replacement arthroplasty can have a significant

effect on outcome. Age, sex, bone stock, obesity, and preoperative proximal femoral deformity are relative contraindications to surface replacement arthroplasty as opposed to conventional THA. The patient with the lowest risk of early failure following surface replacement arthroplasty appears to be a man younger than 55 years, with no significant proximal femoral deformity.^{6,7} Obesity was not a factor in failure in 1 report.⁸ However, other studies report female sex and obesity to significantly increase the risk of early failure.⁹ One study based on preoperative templating of potential surface replacement arthroplasty candidates found only 50% of the study population was appropriate due to limiting factors such as femoral head deformity, large infarcts, or femoral head cysts.¹⁰ However, it appears that surface replacement arthroplasty performed by a highly experienced surgeon may not be as limited with regard to patient selection.¹¹

Deformity of the proximal femur such as occurs following Perthes disease or slipped capital epiphyses make preparation of the femoral head extremely difficult in surface replacement arthroplasty due to the possibility of notching of the femoral neck. Computer navigation has been suggested as a possible aid in femoral preparation for surface replacement arthroplasty, although this adds an additional layer of complexity and cost to the procedure.^{12,13}

COMPLICATIONS OF SURFACE REPLACEMENT ARTHROPLASTY: MORE COMMON THAN AND DIFFERENT FROM THA

The most common cause of early failure of surface replacement arthroplasty is femoral neck fracture.¹⁴ The short-term results of surface replacement arthroplasty in national joint registries is consistently worse than that of conventional THA. For instance, the Australian Joint Registry reports in its 2010 report that at 9 years, the cumulative percent revision is 7.2% for resurfacing THA compared to

5.4% for conventional THA.¹⁵ Interestingly, this report further indicates worse outcomes for sockets <50 mm for both men and women at 7- to 9-year follow-up, and worse results in patients older than 65 years, indicating additional relative contraindications for the use of this design in these groups of patients.

Recent reports have described the formation of pseudotumors around the hip of patients receiving surface replacement arthroplasty.^{16,17} Pseudotumors appear to represent a T-cell-mediated inflammatory and necrotic reaction to nano-sized metal debris and are associated with pain, swelling, femoral neuropathy, and potentially extensive tissue destruction.¹⁸ It appears based on these reports that this phenomenon is more common among women. Revision of patients forming pseudotumors has been reported to have a far less optimal outcome than revision of mechanical failures of surface replacement arthroplasty not associated with pseudotumors.

CLINICAL RESULTS OF SURFACE REPLACEMENT ARTHROPLASTY ARE NOT SUPERIOR TO THA

Two prospective, randomized studies exist comparing the results of surface replacement arthroplasty with THA.^{19,20} Importantly, neither of these studies demonstrates any improvement in outcome for surface replacement arthroplasty when compared with large-ball metal-on-metal THA. Some clinical series claim improved function after surface replacement arthroplasty when retrospectively compared with the outcome of THA. However, a recent study indicates that bias of selection for surface replacement arthroplasty probably influences these conclusions.²¹ A recent meta-analysis comparing the outcomes of surface replacement arthroplasty vs THA found that at 3.9 years after follow-up, the failure rate for cementless stems in young patients was 1.3%, compared with 2.6% failure of the femoral component in surface replacement arthroplasty.²²

CONCLUSION

The critical and unanswered question remains as to the long-term results of surface replacement arthroplasty compared with big-ball THA. These data will not be available for at least another 10 years. However, early to intermediate data clearly demonstrate the results of surface replacement arthroplasty to be inferior to those of conventional metal-on-polyethylene THA. The procedure should be limited to specialized centers and surgeons who have both the clinical experience in surface replacement arthroplasty technique and the commitment to continued monitoring and reporting of results. Surface replacement arthroplasty is not the gold standard for hip reconstruction based on this review of the existing data. 

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