Comparison of Functional Results of Hip Resurfacing and Total Hip Replacement: A Review of the Literature

Andrew J. Shimmin, MBBS, FAorthA, FRACS*,
Jon V. Baré, MBBS, FAorthA, FRACS

KEYWORDS

• Total hip • Replacement • Resurfacing • Arthroplasty
• Function

Total hip arthroplasty (THA) has long been considered the treatment of choice for osteoarthritis of the hip in older patients. This procedure results in consistently good outcomes in function and risk for revision in this patient demographic. However, the same procedure performed in young, active patients results in an increased rate of revision and less favorable outcome of those revision proceedures.[1–4]

Modern metal-on-metal hip resurfacing arthroplasty (HRA), despite having a higher overall rate of revision[1,5] and less evidence-based literature supporting its use in all demographics, is perceived by patients as being a safer, more effective treatment that results in a greater range of motion than THA.[6] In the literature, HRA is often described as an appropriate treatment of hip osteoarthritis in young, active patients.[7–9] In Australia, 50% of HRA is performed in patients who are less than 55 years of age.[1]

The active lifestyle of younger patients places additional stresses on hip prostheses for a prolonged period of time that are not encountered in older patients. Furthermore, young active patients are less tolerant of compromised function and, therefore, selection of an appropriate prosthesis that provides good functionality and durability is critical in these patients.[2] Data that compare the functional results of HRA and THA across different patient demographics and activity levels give surgeons the ability to make adequately informed, patient-based decisions regarding prosthesis selection.

We have examined the literature to prepare a review of published studies that compare the functional results of THA and HRA. Specific outcomes such as range of motion, activity level, groin pain, patient satisfaction, and restoration of normal hip anatomy and gait are addressed separately.

METHODS

The authors systematically reviewed the literature on hip resurfacing outcomes using the PubMed bibliographic database. An initial search was performed to identify all articles that might be relevant to the review by collecting all entries with the keywords “hip resurfacing,” “resurfacing

The authors have nothing to disclose.
Melbourne Orthopaedic Group, 33 The Avenue, Windsor, Victoria 3181, Australia
* Corresponding author.
E-mail address: ashimmin@optusnet.com.au

Orthop Clin N Am 42 (2011) 143–151
doi:10.1016/j.ocl.2010.12.007

arthroplasty," "hip resurfacing versus total hip" and "functional outcome hip resurfacing." The initial keyword search yielded 713 articles. The abstracts of these articles were searched to determine whether they were suitable for inclusion in this review. In examining the references generated by this process, articles were selected that discussed the functional outcome of HRA compared with the functional outcome of conventional total hip replacement, with preference given to studies in which patients were matched for age, gender, and preoperative function. Of the 713 articles found using the keyword search, 46 articles were selected for further evaluation. No preference was given to articles in which a specific femoral head size was used for either HRA or conventional THA. Review articles and the bibliographies of each reference were also searched to find additional articles that appeared relevant.

RESULTS

Range of Motion

Range of motion (ROM) is particularly important for younger patients who wish to return to a highly active lifestyle following joint replacement. Limited ROM may be a consequence of impingement, which may cause subluxation and hence high levels of wear and early failure.[10]

In vitro studies including both cadaver and computer simulation studies consistently show that HRA results in reduced ROM when compared with conventional THA. Bengs and colleagues[11] evaluated 3 contemporary hip resurfacing systems and compared 20 different movements (10 with zero femoral anteversion, and 10 with 20 degrees femoral anteversion) with those of 5 conventional hip replacement systems. Overall, the hip resurfacing systems resulted in less ROM than the conventional THA systems, with the conventional THA having significantly more ROM in 12 of the 20 movements tested. The summed mean arcs of motion in the sagittal, coronal, and axial planes for the HRA group were 135, 78, and 115 degrees, compared with 174, 87, and 150 degrees for the zero anteversion group, and 158, 90, and 147 degrees for the groups with 20 degrees of anteversion. These findings are consistent with those of Kluess and colleagues,[10] who showed that ROM for 8 designs of hip resurfacing prosthesis tested in 3 different leg positions were on average 31 to 48 degrees less than for conventional hip replacements using a 32-mm head diameter. In both studies, neck-on-cup impingement was the cause of the observed reduction in ROM. Incavo and colleagues[12] attempted to eliminate all patient-related variables by using a combination cadaver/computer simulation. The investigators found that, with controlled patient variables, THA was able to restore normal ROM more effectively than HRA. Surface replacement showed minor deficits in extension and significant reductions in flexion and internal rotation at 90° compared with the natural hip. The investigators concluded that decreased ROM for the HRA group was attributed to a smaller head-neck ratio or head-neck offset at points of impingement.

The translation of the results from these in vitro studies to the clinical situation is limited because they do not accurately mimic the complex nature of the in vivo implanted hip. Differences may be expected because of variation in hip anatomy and musculotendinous attachments, as well as subtle differences in surgical approach. Furthermore, fear of instability for hips treated with THA and the benefits of complete capsular release in HRA that overcomes preoperative soft tissue contracture may also cause discrepancies between the results of in vitro and in vivo studies.

Clinical studies report that the ROM for THA and HRA is similar or even better for HRA (**Table 1**). Vail and colleagues,[13] in a study of 52 patients (57 hips) with resurfacing and 84 patients (93 hips) with cementless THAs, found that, after controlling for age, gender, and preoperative differences, the resurfacing group had significantly higher ROM scores than did the cementless THA group after a mean follow-up of 3 years. However, Lavigne and colleagues,[14] in a single-blind randomized study using digital photography of hip motion, failed to find a difference between patients assigned to the HRA group and the THA group at 1-year follow-up. In this study, patient demographics and preoperative ROM were similar. Le Duff and colleagues[15] also found no difference in ROM between patients treated bilaterally, with an HRA on one side and a conventional THA in the contralateral limb to control patient variability. The investigators reported that the ROM for both implant types was consistent with the ROM seen in normal, undiseased hips. It is possible that, although THA can result in significantly greater ROM in the laboratory setting, this increased ROM is unable to be achieved in patients with normal to average flexibility, thereby resulting in a similar clinical ROM for THA and HRA.

In summary, although the geometry of hip resurfacing components may limit their ROM in the laboratory setting, clinically patients may expect to achieve equivalent, if not better, ROM following HRA. If patients do experience a decreased ROM as a consequence of impingement, then subluxation and edge loading may occur, which can lead to a higher wear rate and early failure.