Resurfacing Matched to Standard Total Hip Arthroplasty by Preoperative Activity Levels: A Comparison of Postoperative Outcomes

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Abstract

Background: Some studies have suggested that resurfacing patients are generally more active postoperatively than their conventional total hip arthroplasty (THA) counterparts, but controversy remains over whether this is a reflection of preferential use of resurfacing for younger and higher-activity patients. We hypothesized that, when controlling for preoperative activity levels, in addition to relevant clinical and demographic factors, resurfacing provides similar results to conventional hip arthroplasty.

Materials and Methods: The specific question asked was whether resurfacing patients had differences in postoperative activity level, clinical outcomes, or rate of revisions, as compared to a matched cohort of patients treated with conventional THA. Thirty-three patients (23 men and 10 women) who were treated with resurfacing arthroplasties were matched to a cohort of patients who underwent conventional hip arthroplasty by gender, age, body mass index (BMI), and preoperative activity level. Mean preoperative Harris hip scores and length of follow-up were similar for the two groups. Postoperative weighted activity scores, Harris hip scores, patient satisfaction scores, pain scores, and revision rates were evaluated at a mean final follow-up of 42 months (range, 25 to 68 months) for the resurfacing group and 45 months (range, 24 to 67 months) for the conventional hip group, and analyzed for differences.

Results: At final follow-up, activity levels were significantly higher in the resurfacing group, with a mean weighted activity score of 10.0 points (range, 1.0 to 27.5 points), as compared to a mean score of 5.3 points (range, 0 to 12.0 points) in the THA group. Mean Harris hip scores, patients satisfaction scores, and pain scores were similar for both groups. There were no revisions in either group.

Conclusions: The results of this study suggest that patients treated with hip resurfacing arthroplasty have a significantly higher postoperative activity level, as compared to those treated with conventional THA, when controlled for preoperative factors.

Metal-on-metal hip resurfacing has grown in popularity in recent years as a bone-preserving alternative to conventional total hip arthroplasty (THA) for the treatment of degenerative changes of the hip, especially in younger adults. The outcomes with this procedure may improve as more surgeons move beyond their learning curve with the technique, and the orthopaedic community refines its understanding of the indications.1-4

Recently, multiple studies have reported that resurfacing and conventional THA patients have similar satisfaction and clinical outcomes at short- to midterm follow-up.5-8

Some studies have noted that patients treated with hip resurfacing generally have a high postoperative activity level,9,10 with a few noting it to be superior compared to their THA counterparts.5,8,11 However, controversy remains whether this finding is a reflection of higher preoperative activity levels in patients who elect to be treated with hip resurfacing, or whether it suggests a true benefit. Although previous studies have examined directly-matched cohorts, few of these studies, if any, have matched patients specifically based on preoperative activity levels while ensuring similar preoperative hip scores and follow-up times.

We hypothesized that, when controlling for activity level,
in addition to relevant demographic factors, patients treated with resurfacing arthroplasty would have similar clinical outcomes and postoperative activity levels, when compared to conventional THA. The specific question asked was whether resurfacing patients had significant differences in postoperative weighted activity scores, clinical outcomes, or rate of revisions, compared to a matched cohort of patients treated with THA.

**Materials and Methods**

Thirty-three hips treated with primary metal-on-metal total hip resurfacing arthroplasty, between November 2002 and January 2005, were compared to a matched group of hips treated with conventional THA over the same time period. All preoperative and postoperative data were collected prospectively in a database, which was then analyzed in a retrospective manner. Full institutional review board approval was granted for the analysis of these patients.

Matching was performed by identifying patients treated with primary conventional THA at our center over the same time period as the hip resurfacing group, and who had complete preoperative and postoperative records for the parameters investigated in this study. Each patient from a group of 54 consecutive hips who underwent resurfacing was matched to a patient treated with a THA by gender (exact match), age (within 3 years), BMI (within 3 kg/m²), and activity level (within 3 points). A paired Student’s t-test was utilized to assess preoperative Harris hip scores and follow-up times to confirm that no significant differences were present between the matched groups. We were unable to identify a suitable match for 21 hips from the resurfacing group, leaving 33 hips treated with resurfacing and a matched group of 33 hips treated with THA available for analysis.

Each group consisted of 23 men and 10 women, who had a mean age of 53 years (range, 37 to 79 years) at the time of index surgery. The resurfacing group was followed for a mean of 42 months (range, 25 to 68 months), compared to a mean of 45 months (range, 24 to 67 months) for the patients treated with THA (p = 0.373). The mean BMIs and preoperative Harris hip scores were similar for both cohorts. An overview of the demographic and preoperative characteristics of the matched groups can be found in Table 1.

Activity levels for all patients were determined preoperatively and at follow-up visits using a weighted activity questionnaire. The questionnaire included a listing of activities; frequencies of activity participation per week, month, and year; the amount of time spent on each activity; and a series of patient-related questions regarding activity level, competitiveness, and satisfaction.

All surgeries were done by the senior investigator (MAM), who had performed more than 300 resurfacings prior to the procedures investigated in this report. All hip resurfacings were performed using the anterolateral approach, as described in more detail elsewhere. The Conserve® Plus prosthesis (Wright Medical Technology, Arlington, Tennessee) was used in all resurfacing patients as part of a U.S. Food and Drug Administration (FDA) investigational device exemption (IDE) clinical trial. All conventional total hip arthroplasties were performed using the Stryker Howmedica Osteonics Trident® cup and an Accolade® stem (Stryker Orthopaedics, Mahwah, New Jersey), with either ceramic or cobalt chrome alloy femoral heads articulating against a polyethylene liner.

Patients were followed postoperatively at our clinic, at approximately 3 months, 6 months, 1 year, and annually thereafter. In addition to preoperative activity levels, vari-

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**Table 1** Demographic, Preoperative, and Postoperative Data for Study Group

<table>
<thead>
<tr>
<th>Data</th>
<th>Metal-on-Metal Hip Resurfacing</th>
<th>Standard Total Hip Arthroplasty</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hips</td>
<td>33</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>23</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>53 (37-79)</td>
<td>53 (37-79)</td>
<td>0.564</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>28 (23-35)</td>
<td>29 (22-36)</td>
<td>0.126</td>
</tr>
<tr>
<td>Preoperative scores (points)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted activity score</td>
<td>2.1 (0-6.0)</td>
<td>2.3 (0-6.0)</td>
<td>0.593</td>
</tr>
<tr>
<td>Harris hip score</td>
<td>52 (28-71)</td>
<td>49 (20-69)</td>
<td>0.264</td>
</tr>
<tr>
<td>Follow-up (months)</td>
<td>42 (25-68)</td>
<td>45 (24-67)</td>
<td>0.373</td>
</tr>
<tr>
<td>Postoperative scores (points)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted activity score</td>
<td>10.0 (1.0-27.5)</td>
<td>5.3 (0-12.0)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Harris hip score</td>
<td>91 (32-100)</td>
<td>90 (50-100)</td>
<td>0.791</td>
</tr>
<tr>
<td>Satisfaction score</td>
<td>9.1 (5-10)</td>
<td>9.1 (2-10)</td>
<td>0.932</td>
</tr>
<tr>
<td>Pain score</td>
<td>1.3 (0-10)</td>
<td>1.2 (0-5)</td>
<td>0.874</td>
</tr>
<tr>
<td>Revisions</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
ous other demographic and clinical data were collected both preoperatively and at follow-up visits. This data included age, gender, BMI (calculated using height and weight measurements), prosthetic type, and months of follow-up. The pre- and postoperative clinical assessments were made using the Harris hip rating system. Patients also rated their pain level and overall satisfaction at follow-up visits, using an 11-point Likert-like satisfaction scale. Both scales ranged from 0 to 10, with 0 indicating complete absence of pain on the pain scale and total dissatisfaction on the satisfaction scale. Ten points indicated the worst possible pain on the pain scale, and complete satisfaction with the procedure on the satisfaction scale. Finally, patient records were evaluated to determine the number of revisions, if any, in each cohort.

All data collected for these patients were aggregated and analyzed using Excel spreadsheet software (Version 11, Microsoft Corporation, Redmond Washington). Statistical analyses were performed using SigmaStat software (Version 3.0, SPSS Inc., Chicago, Illinois), with the paired-t and signed rank tests used where appropriate. All statistical comparisons were conducted using 95% confidence intervals, where a p-value of less than 0.05 was considered significant.

Results

At final follow-up, the resurfacing group had a significantly higher mean weighted activity score than the THA group (p < 0.001). The resurfacing patients had a mean weighted activity score of 10.0 points (range, 1.0 to 27.5 points), while the THA patients had a mean score of 5.3 points (range, 0 to 12.0 points).

The Harris hip scores, satisfaction scores, and pain scores of the two groups were similar. The mean postoperative Harris hip score in the resurfacing group was 91 points (range, 32 to 100 points), while the mean score in the THA group was 90 points (range, 50 to 100 points). This difference was not statistically significant (p = 0.971). Satisfaction scores were similar for both groups (p = 0.932), with a mean score of 9.1 points (range, 5 to 10 points) for the resurfacing group, and 9.1 points (range, 2 to 10 points) in the THA group. Likewise, there was no significant difference in pain scores at the final follow-up (p = 0.874), with a mean score of 1.3 points (range, 0 to 10) in the resurfacing group and 1.2 points (range, 0 to 5 points) in the THA group. None of the patients in either group underwent implant revision over the study period or developed complications for which an implant revision was indicated.

Discussion

Some investigators have noted higher postoperative activity levels in patients who underwent hip resurfacing compared to patients treated with conventional THAs. This study attempted to compare the postoperative activity levels of two patient cohorts, specifically matched to control for preoperative activity levels, in addition to demographic factors. At short-term follow-up, we found that patients who underwent hip resurfacing had significantly higher activity levels compared to a matched group of patients who were treated with conventional THA. An additional finding was that both resurfacing and standard THA patients had similar clinical outcomes at the final follow-up, despite the difference in activity levels, and suggesting that the weighted score may be a more sensitive instrument for evaluating certain functional differences between arthroplasty procedures.

There have been several reports comparing resurfacing with conventional THA. Pollard and colleagues contrasted two groups of 54 hips that underwent metal-on-metal hip resurfacing or hybrid THA, matched for gender, age, BMI, and preoperative UCLA (University of California, Los Angeles) activity scores. At follow-up times of 4 to 10 years, the investigators found similar hip scores in both groups, but noted higher UCLA activity and EuroQol quality of life scores in the resurfacing group. Additionally, the investigators found revision rates of 8% in the THA group and 6% in the resurfacing patients. However, their study was limited to patients with very high preoperative activity levels (mean ULCA activity score of 9 on a 10-point scale for both groups), and did not report or control for differences in preoperative hip scores or length of follow-up. Vail and coworkers compared 57 hips treated with resurfacing to 93 hips that underwent THA. After controlling for age, gender, and difference in preoperative clinical scores, the investigators found similar Harris hip scores between the two groups, but higher UCLA activity scores and postoperative range of motion in the resurfacing group. However, the groups were not matched and had considerable differences in demographic profile and preoperative hip scores, which were controlled for using statistical methods. Additionally, they limited their analysis to a two-year follow-up for all patients. Mont and associates compared the clinical and radiographic outcomes of 54 consecutive hip resurfacings to a group of 54 conventional THAs, matched by demographic characteristics, preoperative Harris hip scores, American Society of Anesthesiologists (ASA) scores, and length of follow-up. At a mean follow-up of 40 months (range, 24 to 60 months), the investigators found similar clinical and radiographic outcomes in both groups and significantly higher postoperative activity levels in the resurfacing cohort. However, they did not control for activity level in their study and noted a significantly higher mean preoperative weighted activity score in the resurfacing group. The present study confirmed the previous findings of these reports with a similar group of patients matched by preoperative activity level.

There are several limitations to this study. First, although we attempted to evaluate a consecutive series of patients who underwent hip resurfacing, we were unable to adequately match each case to a patient treated with conventional THA. As a result, we excluded some hip resurfacing patients and were left with a non-consecutive series of patients. Nevertheless, with similar mean and range of values for all
preoperative demographic and clinical factors, as well as length of follow-up, and a statistically strong difference in postoperative activity levels with a p value of less than 0.001, we believe this report provides evidence for different outcomes in hip arthroplasty patients matched by preoperative activity levels. Second, the follow-up period of this study is relatively short, with a mean follow-up of less than 4 years for both resurfacing and THA cohorts. However, with a minimum follow-up of 2 years, we believe that the results provide relevant information for the short-term outcomes of arthroplasty patients, and await further data to confirm our findings over the medium and long-term.

Conclusions
In summary, the results of this study suggest that metal-on-metal total hip resurfacing arthroplasty may be associated with higher postoperative activity levels, as compared to THA, independent of preoperative activity level or differences in patient demographics. To the best of our knowledge, this is the first study demonstrating this finding by comparing patient cohorts that underwent hip arthroplasty, matched by preoperative activity level and demographic profile, and with similar preoperative Harris hip scores and length of follow-up. While our study supports this finding over the short-term (approximately 4 years follow-up), we await further data to confirm this finding at longer follow-up.

Disclosure Statement
Michael A. Mont, M.D., is a consultant for Stryker Orthopeics and Wright Medical Technology. None of the other authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

References