Does a Prior Hip Arthroscopy Affect Clinical Outcomes in Metal-on-Metal Hip Resurfacing Arthroplasty?

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Abstract

The effect of a prior hip arthroscopy on the outcome of a subsequent metal-on-metal hip resurfacing arthroplasty (HRA) has not been studied. Forty-three patients received an HRA after a prior hip arthroscopy (arthroscopy cohort). A 1:2 matching analysis was performed to formulate a control cohort of 86 patients. Range of motion, Harris Hip Score, University of California at Los Angeles activity score, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score, and Short Form-12 scores were assessed at 6 weeks, 3 months, 6 months, 1 year, and most recent follow-up visits. At 6-week follow-up, the arthroscopy cohort showed a decreased WOMAC score compared with the control cohort (72.9 [SD, 15.5] vs 80.5 [SD, 11.8], respectively; $P = .05$). However, no significant difference was appreciated between the 2 cohorts for any of the clinical indices measured after 6 weeks postoperatively. This study shows that a prior hip arthroscopy does not appear to affect the short-term, clinical outcomes of a metal-on-metal HRA.

Metal-on-metal hip resurfacing arthroplasty (HRA) remains an alternative to total hip arthroplasty (THA) in appropriately selected, younger, active adults with degenerative hip disease.[1-4] While concerns remain regarding the potential for adverse local tissue reactions from wear of the metal-on-metal bearing surface,[5-8] 10-year data from the Australian Orthopaedic Association National Joint Replacement Registry Annual Report[9] showed a revision rate of only 6.3% when the Birmingham Hip Resurfacing (BHR) System was used (Smith & Nephew Inc, Memphis, Tennessee). In addition, in an independent review of 230 consecutive BHRs at a mean follow-up of 10.4 years, Coulter and colleagues[10] showed encouraging clinical results, with a mean Oxford Hip Score of 45.0 and a mean University of California at Los Angeles (UCLA) activity score of 7.4.

Similar to the prior increase in popularity of HRA, hip arthroscopy has also become much more commonplace, and its indications continue to evolve.[11] Hip arthroscopy has been used in the native hip joint to manage femoroacetabular impingement, labral tears, and iliopsoas tendinopathy, among other conditions.[12] In addition, the use of hip arthroscopy has not been limited to the native hip but also has increased as a diagnostic and therapeutic procedure after hip arthroplasties. Bajwa and Villar[12] found hip arthroscopy to be diagnostic in 23 of 24 patients who underwent the procedure after a hip arthroplasty, concluding that arthroscopy is a useful adjunct in the diagnosis of symptomatic arthroplasties.

Therefore, hip arthroscopy has been shown to be an effective modality to treat pathology in both the native hip and after hip arthroplasties. However, the effect of a prior hip arthroscopy on the outcome of a subsequent metal-on-metal HRA has not been determined. Piedade and colleagues[13] showed a prior knee arthroscopy to increase the risk of postoperative complications and subsequent revision after total knee arthroplasty. Complications included reflex sympathetic dystrophy, undiagnosed pain, infection, stiffness, and component loosening. A prior osteochondroplasty at the femoral head-neck junction could increase the risk of femoral neck fracture after a subsequent HRA. Thus, the purpose of this study was to evaluate the clinical outcomes of a series of patients who received an HRA after a prior hip arthroscopy and to compare these results with a cohort of patients who received an HRA with no prior hip surgeries. Our hypothesis is that a prior hip arthroscopy will lead to inferior outcomes in patients undergoing HRA.

Materials and Methods

This study is a retrospective, case-control study using a 1:2 matching analysis. Dr. Su performed all HRAs, which were enrolled in an institutional review board–approved arthroplasty registry. All HRAs were performed using the BHR System.

The surgical technique for hip resurfacing arthroplasty has been described.[1] All procedures were performed via a posterior approach with the patient in the lateral decubitus position. All

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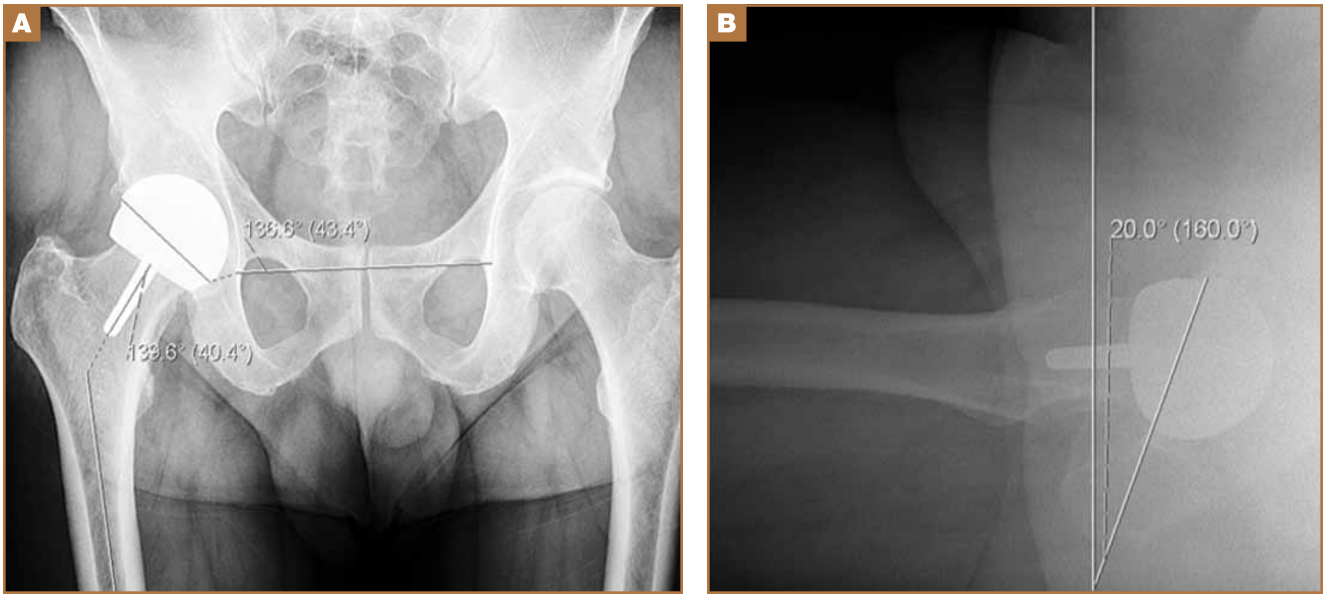

Figure. Anteroposterior and cross-table lateral radiographs showing the technique for measuring (A) acetabular anteversion and femoral stem-shaft angle and (B) acetabular anteversion.

patients received a hybrid metal-on-metal hip resurfacing, with an uncemented acetabular component and cemented femoral component. Intraoperative anesthesia for all patients was performed via a combined spinal-epidural anesthetic, and an epidural patient-controlled analgesic was used for the first day postoperatively, followed by a transition to oral analgesics. The sizes of the acetabular and femoral components were recorded for each hip resurfacing. Postoperatively, intermittent pneumatic compression devices were placed upon arrival in the recovery room, and active ankle flexion and extension exercises were initiated immediately after the patient's neurologic function returned.[14] Aspirin was used for chemical deep venous thrombosis prophylaxis in all patients postoperatively for a period of 6 weeks. Full weight-bearing, with the use of crutches for assistance with balance, was permitted immediately. Crutches were used for a period of 3 weeks prior to being discontinued.

From a database of 1357 HRAs (all BHR implants) performed between June 2006 and June 2012, 51 patients were identified who received an HRA after a prior hip arthroscopy.

Table 1. **Procedures in Hip Arthroscopy Cohort**

Arthroscopic Procedure	No. of Patients
Labral débridement only	15
Osteochondroplasty and labral débridement	12
Osteochondroplasty and labral repair	10
Labral débridement and microfracture	2
Unknown	4

Eight patients were excluded because they did not possess adequate clinical documentation or were lost to follow-up. In the remaining 43 patients, there were 32 men and 11 women (21 right hips, 22 left hips), which formed the arthroscopy cohort. Two patients had a history of multiple hip arthroscopies (1 patient with 2 prior procedures, 1 patient with 3 prior procedures). The mean (SD) time from the most recent hip arthroscopy to the HRA was 2.5 (2.5) years. **Table 1** presents a summary of the hip arthroscopy procedures (including only the most recent hip arthroscopy procedure in those with multiple arthroscopies).

Patient demographic variables (age, body mass index [BMI]) were recorded preoperatively, along with the Harris Hip Score (HHS),[15] UCLA activity score,[16] Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score,[17] and preoperative hip range of motion (flexion, extension, abduction, adduction, internal rotation, and external rotation). The same clinical indices were assessed postoperatively along with the Short Form-12 (SF-12) Health Survey Score,[18] at the 6-week, 3-month, 6-month, 1-year, and most recent follow-up visits.

Radiographic assessment consisted of a low anteroposterior (AP) pelvic radiograph (with the radiographic beam centered on the pubic symphysis) and a cross-table lateral radiograph obtained at the most recent follow-up visit. Both the acetabular component abduction relative to the inter-teardrop line, and the angle between the femoral stem and the anatomic axis of the femoral shaft (stem-shaft angle) were measured on AP radiographs.[19,20] Acetabular component anteversion was measured on the cross-table lateral radiographs as the angle between the projected long axis of the acetabular opening and a line drawn perpendicular to the long axis plane of the body (**Figures A, B**).[21]

The same registry database was used to identify patients who received an HRA without a prior history of arthroscopy or hip surgery. A 1:2 matching analysis for those patients with a prior hip arthroscopy to those without a prior hip arthroscopy was performed to formulate a control group (control cohort) of 86 patients. Each patient in the arthroscopy cohort was matched with 2 patients in the control cohort based on the following parameters: age (± 6 years), sex (same), BMI (± 4 kg/m^2), femoral head size (± 4 mm), and preoperative HHS and WOMAC scores (± 7 points). In the event an arthroscopy patient matched to 2 or more control patients, the patients who minimized the least squared error among the matching variables were selected.

Statistical Analysis

All data were collected and analyzed using Microsoft Excel software (Microsoft Corporation, Redmond, Washington). Statistical comparisons between the 2 cohorts regarding demographic variables, clinical outcomes, and radiographic alignment were performed using an unpaired, Student 2-tailed *t* test, with statistical significance set at $P \le .05$.

Results

A comparison of the results of the 1:2 matching analysis between the arthroscopy and control cohorts is presented in **Table 2**. There was no significant difference in the preoperative age, BMI, femoral head size, HHS, or WOMAC score between the 2 cohorts. However, the control cohort did show a more severe, preoperative flexion contracture (as expressed by a decreased amount of extension) and a decreased amount of preoperative abduction (**Table 3**). The preoperative UCLA activity score was also decreased in the control cohort, but this was not statistically significant.

The mean (SD) follow-up was 2.0 (1.0) years in the arthroscopy cohort and 2.1 (1.1) years in the control cohort. There was no significant difference in radiographic alignment between the 2 cohorts. The stem-shaft angle was 139.3° (SD, 5.4°) in the arthroscopy cohort (vs 138.3° [SD, 5.5°] in the control cohort; $P = .3$), the acetabular abduction was 43.9° (SD, 5.8°) in the arthroscopy cohort (vs 42.9° [SD, 6.1°] in the control cohort; $P = .4$), and the acetabular anteversion was 21.1° (SD, 7.5°) in the arthroscopy cohort (vs 20.8° [SD, 7.1°] in the control cohort; $P = .8$).

At 6-week follow-up, the arthroscopy cohort showed a significantly decreased WOMAC score

Table 2. Results of Preoperative 1:2 Matching Between Arthroscopy and Control Cohorts

	Arthroscopy Cohort		Control Cohort		
Matching Criteria	Mean	SD	Mean	SD	*P*
Age, y	45.6	7.5	46.2	7.1	.6
BMI, kg/m^2	25.6	3.3	25.6	3.5	.9
Femoral head size, mm	49.5	3.3	49.7	3.3	.7
Preoperative HHS	62.6	10.7	62.4	9.3	.9
Preoperative WOMAC score	56.4	18.8	53.6	17.8	.4

Abbreviations: BMI, body mass index; HHS, Harris Hip Score; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

Table 3. Preoperative Range of Motion and UCLA Scores Between the 2 Cohorts[a]

	Arthroscopy Cohort		Control Cohort		
Preoperative Variable	Mean	SD	Mean	SD	*P*
Range of motion, °					
Flexion	100.8	13.1	96.9	15.8	.2
Extension	-2.3	7.7	-5.8	8.2	.05[b]
Abduction	35.6	7.3	30.9	9.4	.01[b]
Adduction	9.2	7.8	6.9	9.0	.2
Internal rotation	3.2	10.6	0.2	13.0	.2
External rotation	31.2	12.9	31.2	10.1	1
UCLA score	7.3	2.6	6.4	2.2	.06

[a]The control cohort showed a greater preoperative flexion contracture (as expressed by a decreased amount of extension) and a decreased amount of preoperative abduction
[b]Statistically significant
Abbreviation: UCLA, University of California at Los Angeles activity score.

Table 4. Results of Clinical Indices at 6-Week Follow-up Between the 2 Cohorts[a]

	Arthroscopy Cohort		Control Cohort		
6-Week Follow-up	Mean	SD	Mean	SD	*P*
HHS	84.1	12.3	85.4	15.0	.7
SF-12 score, physical component	37.7	10.7	38.6	7.3	.7
SF-12 score, mental component	52.2	9.3	56.5	7.8	.06
WOMAC score	72.9	15.5	80.5	11.8	.05[b]
UCLA score	4.7	1.7	5.2	2.3	.4
Range of Motion, °					
Flexion	99.5	11.1	97.5	12.8	.4
Extension	-4.0	6.6	-3.0	4.3	.4
Abduction	36.9	5.3	35.8	6.8	.4
Adduction	11.3	6.7	11.6	7.8	.8
Internal rotation	10.5	7.3	10.2	8.0	.9
External rotation	33.1	9.1	33.3	7.8	.9

[a]The arthroscopy cohort showed a significantly decreased WOMAC score vs the control cohort.
[b]Statistically significant
Abbreviations: HHS, Harris Hip Score; SF-12, Short Form-12 Health Survey Score; UCLA, University of California at Los Angeles activity score; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

Table 5. **Results of Clinical Indices at 3-Month Follow-up Between the 2 Cohorts[a]**

	Arthroscopy Cohort		Control Cohort		
3-Month Follow-up	**Mean**	**SD**	**Mean**	**SD**	***P***
HHS	96.9	3.5	95.5	6.6	.4
SF-12 score, physical component	50.5	9.4	47.4	10.1	.3
SF-12 score, mental component	56.3	5.1	57.4	5.5	.5
WOMAC score	88.7	10.2	89.5	9.8	.8
UCLA score	6.2	1.4	6.4	1.4	.9
Range of Motion, °					
Flexion	111	10.3	110	10.0	.7
Extension	-2.9	6.6	-3.5	3.4	.4
Abduction	42.2	5.2	40.9	4.7	.5
Adduction	14.7	5.3	15.1	5.6	.5
Internal rotation	13.9	7.0	14.5	6.7	.4
External rotation	40.3	7.4	37.8	7.9	.5

[a]No statistically significant difference was seen between the 2 cohorts for any of the clinical measures.
Abbreviations: HHS, Harris Hip Score; SF-12, Short Form-12 Health Survey Score; UCLA, University of California at Los Angeles activity score; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

Table 6. **Results of Clinical Indices at 6-Month Follow-up Between the 2 Cohorts[a]**

	Arthroscopy Cohort		Control Cohort		
6-Month Follow-up	**Mean**	**SD**	**Mean**	**SD**	***P***
HHS	98.3	1.9	97.7	3.4	.7
SF-12 score, physical component	52.4	11.1	50.3	8.9	.6
SF-12 score, mental component	55.4	10.0	54.1	8.1	.6
WOMAC score	93.4	2.4	91.1	7.7	.3
UCLA score	7.8	1.9	7.0	2.1	.5
Range of Motion, °					
Flexion	114	9.8	112.2	12.3	.7
Extension	-2.5	5.0	-3.3	5.2	.8
Abduction	43.3	6.1	44.4	6.8	.7
Adduction	15.8	9.2	15.3	6.2	.9
Internal rotation	19.3	14.0	14.4	7.7	.3
External rotation	41.4	8.0	37.9	6.6	.3

[a]No statistically significant difference was seen between the 2 cohorts for any of the clinical measures.
Abbreviations: HHS, Harris Hip Score; SF-12, Short Form-12 Health Survey Score; UCLA, University of California at Los Angeles activity score; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

compared with the control cohort (72.9 [SD, 15.5] vs 80.5 [SD, 11.8], respectively; P = .05). In addition, there was a trend towards a decreased SF-12 mental component score in the arthroscopy cohort (52.2 [SD, 9.3] vs 56.5 [SD, 7.8] in the control cohort; P = .06). However, none of the remaining clinical indices showed a significant difference between the 2 cohorts, and there was no difference in range of motion between the 2 cohorts at the 6-week follow-up visit (**Table 4**).

In addition, at 3-month follow-up, no statistically significant differences were seen between the 2 cohorts for any of the clinical indices or range of motion values. Both groups continued to improve rapidly, with HHS of 96.9 (SD, 3.5) in the arthroscopy cohort and 95.5 (SD, 6.6) in the control cohort, and WOMAC scores of 88.7 (SD, 10.2) and 89.5 (SD, 9.8), respectively (**Table 5**). Similarly, at the 6-month and 1-year follow-up intervals, the 2 cohorts showed continued improvement in their clinical measures, with no statistically significant differences between the 2 cohorts (**Tables 6, 7**).

At the most recent follow-up visit, more than 1 year after surgery, the HHS was 99.5 (SD, 1.3) in the arthroscopy cohort and 99.2 (SD, 9.7) in the control cohort (P = .9), and the WOMAC score was 93.5 (SD, 11.3) and 92.4 (SD, 12.2), respectively (P = .8). No significant perioperative complications were seen in the arthroscopy cohort. In the arthroscopy cohort, 1 patient was diagnosed with a deep venous thrombosis 2 weeks after the procedure and was placed on low-molecular-weight heparin and coumadin for treatment. A second patient in the arthroscopy cohort had continued serosanguinous drainage for 4 days postoperatively, which resolved with continued compressive dressings. To date, no patients in the arthroscopy or control cohorts have required a second operation or revision of their components.

Discussion

Given the increasing prevalence of hip arthroscopies to treat multiple disorders of the native joint, it is important to assess the potential consequences of these procedures on future arthroplasties. Piedade and colleagues,[13] in a retrospective review of 1474 primary total knee arthroplasties, showed a prior bony procedure (high tibial osteotomy, tibial plateau fracture, patellar realignment) to be predictive of decreased range of motion postoperatively. In addition, a prior knee arthroscopy was associated with a higher rate of postoperative complications, with 30% of the complications

Table 7. **Results of Clinical Indices at 1-Year Follow-up Between the 2 Cohorts**[a]

	Arthroscopy Cohort		Control Cohort		
1-Year Follow-up	**Mean**	**SD**	**Mean**	**SD**	***P***
HHS	97.7	3.5	98.5	1.6	.3
SF-12 score, physical component	53.2	6.7	54.1	5.4	.7
SF-12 score, mental component	56.0	6.9	54.2	8.3	.5
WOMAC score	95.2	9.9	95.0	8.7	.9
UCLA score	8.7	1.4	8.4	1.3	.6
Range of Motion, °					
Flexion	121	8.8	117	9.5	.2
Extension	-0.4	2.5	-0.8	2.4	.6
Abduction	43.1	6.3	42.7	4.9	.8
Adduction	15.3	5.9	16.5	6.3	.5
Internal rotation	16.9	8.3	17.5	6.9	.8
External rotation	38.8	9.4	41.5	5.2	.2

[a]No statistically significant difference was seen between the 2 cohorts for any of the clinical measures.
Abbreviations: HHS, Harris Hip Score; SF-12, Short Form-12 Health Survey Score; UCLA, University of California at Los Angeles activity score; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

requiring a reoperation, and 8.3% of the complications requiring a revision total knee arthroplasty. Kaplan-Meier survival curves showed a survival rate of only 86.8% in those patients with a prior knee arthroscopy (vs 98.1% in those without a prior knee surgery).[22] Therefore, the purpose of this study was to evaluate the clinical outcomes of a series of patients who received an HRA after a prior hip arthroscopy. After the initial 6-week follow-up visit, no significant difference was seen in the functional outcomes between those patients with or without a history of prior hip arthroscopy who received an HRA.

After analysis of patient outcomes using multiple clinical measurement tools, at 6-week, 3-month, 6-month, 1-year, and most recent follow-up intervals, the only significant difference between the 2 cohorts was the WOMAC score at 6-week follow-up. Interestingly, there was no significant difference seen in the other clinical assessments, including the SF-12 score, HHS, range of motion, or UCLA activity score (although this did trend towards significance). This can be explained by the difference in both the mode of administration and various metrics assessed by these instruments. In comparison to the HHS evaluation, the patient completes the WOMAC (rather than the clinician) and also provides a more detailed assessment of symptoms, pain, stiffness, and activities of daily living.[17] Therefore, this study suggests that patients with a prior hip arthroscopy may require more time to return to their activities of daily living after an HRA. However, whether the statistically significant difference between the 2 scores translates into a clinically significant difference can be questioned.

The clinical outcomes of this series of patients were excellent at the short-term follow-up, and both groups achieved clinical results comparable to prior reported results of HRA.[1,10,23,24] However, despite these results, there are several limitations to this study. First, longer-term follow-up is required to determine if any significant differences (such as aseptic loosening, infection, and prosthesis survival) are associated with a prior hip arthroscopy. In addition, this study included a relatively small cohort of patients who had a prior hip arthroscopy. However, a relatively large, single-surgeon database of 1357 HRAs was reviewed, with only 51 cases being reported (3.7%). With the increasing popularity of hip arthroscopy, the number of patients presenting for HRA will likely continue to increase. However, despite these limitations, this study shows that a prior hip arthroscopy does not appear to affect the short-term, clinical outcomes of a metal-on-metal HRA.

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