Ceramic-on-Ceramic Hip Arthroplasty in Young Patients: 12-year Median Follow-Up of Patients Aged 55 Years or Younger

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Introduction

Total hip arthroplasty (THA) in young patients is controversial. Many of these patients develop arthritis secondary to avascular necrosis (AVN) of the hip, post-traumatic arthritis, developmental dysplasia of the hip (DDH), or history of slipped capital femoral epiphysis (SCFE). When non-operative management fails, THA may provide the young active patient with the best chance for pain relief and restoration of function. A major concern for the patient and surgeon is the risk for revision surgery. Historically, THA for cases of osteonecrosis proved to be challenging due to poor implant survivorship with an average revision rate of 40% at mid-term followup.[1,2] With newer techniques and advancements in prosthetic design, such as third generation ceramic-on-ceramic (CoC) components, THA in patients treated for osteonecrosis has demonstrated promising results at mid and long-term follow-up with revision rates ranging from 0% to 1%.[3-5] The purpose of this study is to evaluate the clinical and functional outcomes at long-term follow-up from THA with modern CoC bearings in young, active patients.

Methods

This is a single-surgeon, single-institution retrospective review of cases of a fellowship-trained arthroplasty surgeon at an academic center between years 2003 and 2010. All operations were performed by the senior investigator (C.L.N.) via a posterolateral approach with posterior soft-tissue repair. Stryker (Mahwah, NJ) or DePuy (Warsaw, IN) ceramic-on ceramic bearings were implanted in all patients. In the immediate postoperative period all patients were made weight-bearing as tolerated. Representative pre- and post-op images of bilateral CoC hip replacements are shown in figures 1 and 2.

Revision surgery for any reason was the primary study endpoint. Patient-centered clinical and functional scores were secondary endpoints. Preoperative and postoperative Western Ontario and McMaster University Arthritis Index (WOMAC) and University of California at Los Angeles Activity scores (UCLA) were collected via telephone survey. A questionnaire of squeaking described by Lee and coworkers was included.[6] This questionnaire assesses several squeaking issues: presence, nature, time of onset, frequency,

Figure 1. Representative preoperative image of a patient from our sample with bilateral dysplastic hips.

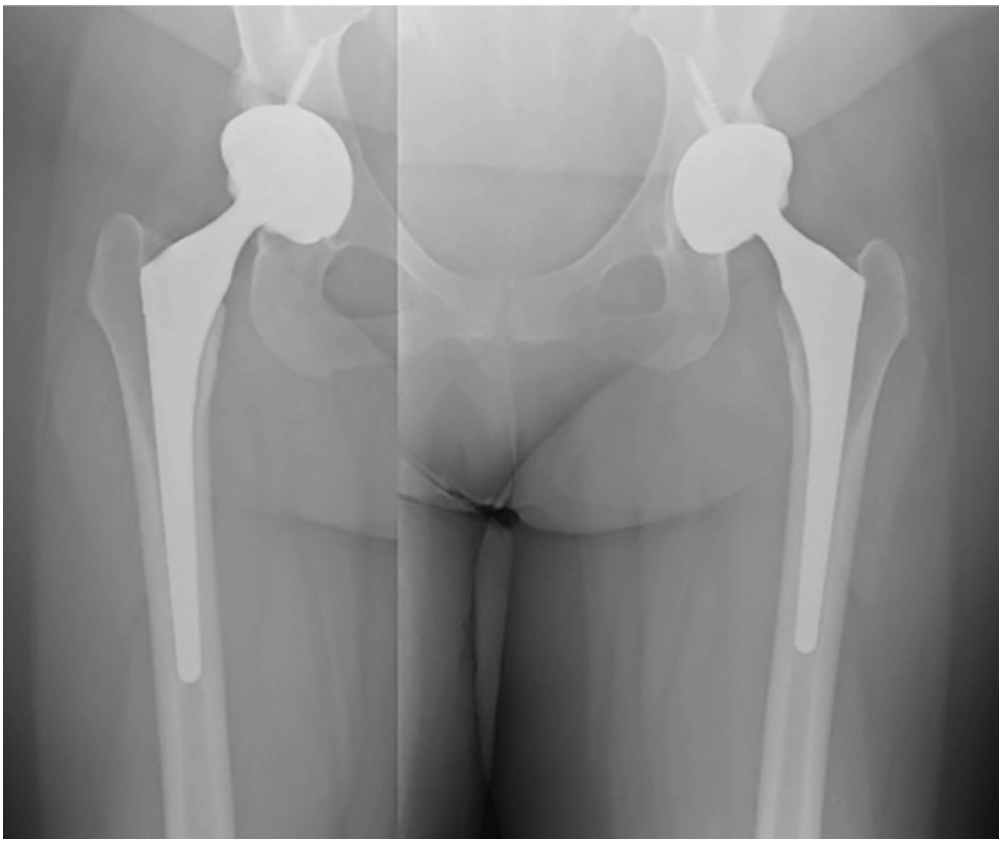

Figure 2. Postoperative radiographs of the patient shown in figure 1, status post bilateral ceramic-on-ceramic hip replacements

associated activities, awareness by other people, intensity over time, associated pain, and how the noise affects the quality of life. Institutional review board approval was obtained prior to data collection. All postoperative complications were recorded.

Demographic data was analyzed descriptively. Student's t-tests were used to determine significance between preoperative and postoperative WOMAC and UCLA scores. A p-value of less than 0.05 was considered significant. All data were tabulated with SPSS software (Version 15.0; SPSS Inc, Chicago, IL).

Results

In this cohort of 108 hips the median age at time of THA was 39 (range 14-55) and the median interval of follow-up was 12.4 years (range 9-16). Forty-two percent had a diagnosis of AVN, 12% had post-traumatic osteoarthritis, 8% had a history of DDH, and 5% had a history of SCFE. Average preoperative BMI was 27 (range 19-40). WOMAC scores (1-100 scale) increased from preoperative mean of 39.1 (range 6.3-78.9) to postoperative mean 84.6 (range 23.1-100) at latest follow-up ($p < 0.05$). WOMAC scores improved on average 46.1 points. UCLA scores (1-10 scale) improved from a preoperative mean of 3.1 (range 1-10) to postoperative 7.2 (range 2-10) at latest follow-up ($p < 0.05$). UCLA scores improved on average 4.2 points. Forty percent of patients were highly active with UCLA scores between 8 and 10.

There were no dislocations, deep infections, or ceramic component failures. At 12.5 years median follow-up, 4 patients had undergone revision surgery. One patient underwent early revision for femoral component loosening, one underwent revision for chronic pain at another institution, one hip was revised for instability at 5 years post-op, and one was revised for traumatic fracture at 10 years postoperatively. Six patients noted some squeaking sounds from the hip. The mean time of onset of squeaking was 9 years postoperatively (range 1-12). None of these patients reported that the squeaking had any effect on self-reported quality of life.

Many patients have regained previous high-level functionality. Two patients have resumed long distance running, including marathons. Another patient is a division one collegiate volleyball player, and several others have resumed occupations involving manual labor such as construction.

Discussion

With the advancements in surgical technique, implant designs, and improved instrumentation, THA has been consistently successful treatment for advanced hip arthritis. Younger and more active patients have been enjoying the benefits of THA, and literature supporting its use in this patient population has been growing.[7-10] A recent literature review reports a 97% implant survival rate for patients treated with THA for the most common risk factors and diagnoses of osteonecrosis since 1990.[11] At long-term follow-up Nich and colleagues report on 52 consecutive hips treated with CoC bearings and found no cases of osteolysis, even at maximum 24 years post-THA.[12] The choice to implant CoC bearings in this population is based on characteristics of low clinical

wear, low rates of osteolysis, and the continuing success of third generation ceramic technology, particularly in the young and active patient population.[13-17] Our findings support the idea that THA with CoC bearings affords high activity level with excellent clinical outcomes and component longevity in young, active patients.

In 2006, Seyler and associates produced a prospective, randomized, multicenter study of patients with osteonecrosis treated with third generation CoC components. Of the 79 hips assessed at an average of 4.2 years postoperatively, they reported a 95.5% implant survival rate (confidence interval 86.5% to 98.6%).[18] They had three revisions in the CoC osteonecrosis cohort, a revision rate of 3.8% and this is similar to our revision rate.[18] One of their revisions was for pain, another for a femur fracture, and a third for recurrent dislocations.[18] In comparison to our current study, we similarly had a patient who was revised at an outside institution exclusively for pain. Most importantly, revisions did not occur in either study due to osteolysis and subsequent loosening.

Populations of young patients engage in more strenuous physical activity when compared to aging populations.[19] Despite cautioning patients regarding activity modifications post-THA, several patients in this cohort have resumed previous strenuous activity without any complications as of this publication, including marathon running, division one collegiate volleyball, and manual labor. One of the female marathon athletes qualified for and ran in the Boston Marathon. While this mid-term study in no way supports impact activity following THA, patients today have high expectations with regard to activity, and a longer-term follow-up of these patients may help us understand whether these high activity goals will lead to high failure rates. This is particularly important as we continue to investigate the role of alternatives to THA such as hip resurfacing and joint preservation procedures.

Conclusion

Our study has several limitations. Some limitations include our retrospective design and lack of control groups. Furthermore, the use of phone surveys utilizing WOMAC and UCLA questionnaires have inherent variability due to patient subjectivity and researcher questioning. Despite these, all efforts were made to control variability by using one telephone interviewer and a standard set of survey questions. There are also challenges in assessing the activity levels of young and very active patients who may encounter a ceiling effect on UCLA survey. Alternatively, patients with multiple comorbidities or prior poly-trauma patients may have clinical or functional limitations that are not related to their THA.

Despite these limitations, this study shows that at long-term follow-up young patients who underwent total hip arthroplasty with ceramic-on-ceramic bearing surfaces had high activity levels with excellent clinical outcomes and component longevity. The strengths of this study include a consecutive series from a single surgeon and institution, as well as the use of modern third generation CoC components in all patients. Surgeons should feel comfortably treating young patients suffering from advanced hip arthritis with THA if necessary, and this study shows that ceramic components in young active patients can provide long-term success with low risk of revision.

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