Use of an Alumina Ceramic-on-Alumina Ceramic Bearing Surface in THA in a 13 Year Old with JIA
A Single Case Study

William N. Capello, M.D., and Judy R. Feinberg, Ph.D.

Abstract

Total hip arthroplasty (THA) has been shown to be highly effective in ameliorating pain and increasing function in adults with end stage arthritis of the hip. Early studies of cemented THA in children with advanced hip disease reported poor results, but, more recently, results of cementless THA show greatly improved outcomes. More recently, concerns related to THA in children have focused on wear of the bearing surfaces, which may result in periprosthetic bone loss and eventual loosening of the prosthetic components. This case report describes the use of an alumina ceramic-on-alumina ceramic bearing surface in THA in a 13-year-old female with bilateral end-stage arthritis of the hips. At 7 and 8 years post-THA, the patient has no pain, no limp, and is able to walk long distances without difficulty. Radiographs show no signs of implant loosening, osteolysis, or wear of the bearing surface.

Juvenile idiopathic arthritis (JIA) is not a single disease, but a group of diseases with one common factor, chronic joint inflammation, and, by definition, begins before the age of 16. JIA can present in any of several ways: as a systemic disease, oligoarthritis, or polyarthritis (rheumatoid factor positive or negative). Less than 20% of children present with the systemic type of disease, and about one-third have the polyarticular form of the disease, which is most similar to adult-onset RA and most often involves the smaller joints of the hands and feet. About one-half of children with JIA have the pauciarticular form of the disease, in which the larger joints are more likely involved. The pauciarticular form of JIA often begins in early childhood, and, while it may be a mild condition that causes few long-term problems in some children, in others, the disease can persist and cause significant joint damage.

Arthritis of the hip joint in children with JIA can result in activity-limiting pain and loss of function, and can be devastating to their mobility as well as to their psychosocial development. Besides requiring a total hip arthroplasty (THA) at a very young age, these children present many additional challenges to the arthroplasty surgeon, including small and abnormal hip and pelvic anatomy, poor bone quality, and significant joint contractures. In addition, multiple joint involvement limits rehabilitation efforts. Nonetheless, children who do not respond to conservative treatment become candidates for surgery and can benefit greatly from THA. The goal of hip replacement in this special population is the same as it is for any patient undergoing hip replacement, that is, to provide the patient with a construct that will last long-term and will provide the patient with a relatively pain-free and functional outcome.

A number of studies have shown varying results of THA in JIA. Early studies of cemented stems reported high failure rates, and more recent studies of cementless fixation report improved long-term outcomes. Yet even with reports of no aseptic loosening at 10 or 15 years post-implantation, wear of the bearing surface remains a serious threat to not only the long-term stability of the implant but to bone loss should revision arthroplasty be needed. This single case study reports on the use of an alumina ceramic-on-alumina ceramic bearing surface in bilateral THA in a 13-year-old female with JIA, now with 7 and 8 years follow-up, respectively.

Case Study

The female patient was first diagnosed with the systemic type of JIA at 5 years of age. Over time, she has developed...
significantly joint involvement of her shoulders, hips, knees, and ankles. Her medical management thus has included NSAIDs, methotrexate, and prednisone, and she is currently on Remicade® intravenous therapy (infliximab, Centocor Inc., Malvern, Pennsylvania).

In December, 1998, the patient underwent arthroscopy, with synovectomy and debridement of the right hip, achieving only temporary pain relief. She was subsequently evaluated for THA. At the time of evaluation, the patient was 12 years old and essentially wheelchair-bound outside of her home, primarily due to right hip pain. Within the home, she was able to ambulate somewhat by using a walker. Her preoperative radiographs (Fig. 1) showed destruction of the hip joint sufficient to warrant THA. At the time of her evaluation, the multicenter study of the efficacy of alumina ceramic-on-alumina ceramic bearings was underway, and it was thought that this patient might benefit from the use of the bearing surface over the standard metal-on-polyethylene. Since the patient was a minor, not only was informed consent required of her parents as well as her, a humanitarian exemption was petitioned for and granted to allow her inclusion in the study.

A right THA, using Secur-fit™ hydroxyapatite (HA)-coated femoral and acetabular components, with an alumina ceramic-on-alumina ceramic bearing system (ABC®) (Stryker Orthopaedics, Mahwah, New Jersey), was performed in June 1999. Her postoperative course was unremarkable, and the patient was discharged to her home for continued physical therapy. She was able to ambulate post-THA; however, within a short period of time, her left hip worsened to the point that she was, again, in need of crutches or a wheelchair for mobility. The patient’s parents were very pleased with the results of the right THA and requested that a similar procedure be performed on the left hip. Once again, a humanitarian exemption was petitioned for and granted. In May 2000, the patient underwent a left THA, this time with an Omnitfit® HA-coated stem and a Trident® cup (Stryker Orthopaedics, Mahwah, New Jersey).

This patient was seen most recently in June 2007, 7 and 8 years post-THA on the left and right hips, respectively. She is now 20 years old and attending college, majoring in elementary education. She has no pain in either hip and walks long distances without difficulty and without a limp. Her radiographs show no signs of loosening, lysis, or wear (Fig. 2). The patient’s only complaint relative to her hips was that, on occasion, she hears an ill-defined noise. She attempted to reproduce the noise in the clinic by standing upright and swaying her hips but was unable to do so. She stated that she is not bothered by the noise, only reporting it as an event that happens on occasion.

Discussion

Recent advances in pharmacologic management of JIA have resulted in a greatly improved prognosis for these children. However, unfortunately, some children do develop advanced arthritis of the hip, and that small minority of children with JIA may benefit greatly, both physically and psychologically, from THA. This single case study reports on the use of an alumina ceramic-on-alumina ceramic bearing surface in bilateral THA in a 13 year old with JIA. At the time of implantation, this bearing surface was still pending FDA (U.S. Food and Drug Administration, Rockville, Maryland) approval, and has since been approved for use. This bearing surface was used in this individual, because it was felt that the reduced wear associated with such bearing surfaces would be advantageous in such a young individual.

Because the implants used in this patient have been shown to produce excellent results at 15-year follow-up, the aim with this patient was to provide her with not only long-term stability of her implants but also to minimize...
wear debris, which can lead to osteolysis and implant loosening. Advantages of alumina ceramic include its hardness and scratch resistance; improved lubrication that creates a low coefficient of friction, resulting in excellent resistance to wear; and particulate debris that is less bioreactive than either polyethylene or metal debris.12-14

As part of a larger, multicenter study, this patient’s results are typical of the larger study group with no stems and one cup, revised secondary to aseptic loosening at 3- to 5-year follow-up in 431 hips implanted with the ceramic bearing system. Albeit short-term results, only two hips show scalloping in zones one or seven, with no cases of osteolysis at 3 to 5 years.15

Interestingly, this patient reports an occasional noise in her right hip, which she cannot describe with any clarity, nor could she reproduce the noise in the clinic setting (Capello grade 1) (Table 1).16 There have been reports of noise with ceramic bearing surfaces, some of which have been bothersome enough to require revision.17 The noise, in this case, was not considered bothersome by the patient and, as such, is simply being documented with no plan for intervention at this time.

In summary, this case study reports on the use of an alumina ceramic-on-alumina ceramic bearing surface in bilateral THA in a very young female patient, with the clinical aim of providing her with the best technology available to promote long-term implant stability and preservation of bone. At 7 and 8 years, the implants remain stable and without evidence of osteolysis or wear. However, the patient is still a very young 20 year old and, therefore, most likely will require revision surgery at some time, regardless.

Disclosure Statement
William N. Capello, M.D., is a paid consultant to and receives royalties from Stryker Corporation, Mahwah, New Jersey. Judy R. Feinberg, Ph.D., has no financial or proprietary interest in the subject matter or materials discussed.

Table 1 Capello Noise Grading Scale for Ceramic Bearings in Total Hip Arthroplasty

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Occurs only rarely or occasionally (less than one time per month) and is not reproducible</td>
</tr>
<tr>
<td>II</td>
<td>Occurs occasionally less than one time per week and is reproducible</td>
</tr>
<tr>
<td>III</td>
<td>Occurs frequently (greater than one time per week) and is reproducible</td>
</tr>
<tr>
<td>IV</td>
<td>Occurs with every step or position change</td>
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References