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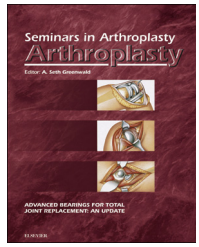

Ceramic-on-ceramic total hip arthroplasty in patients <60: A new standard

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ARTICLE INFO

Keywords:
ceramic on ceramic
ceramic-ceramic
superior hip approach
direct superior
osteolysis

ABSTRACT

Ceramic-on-ceramic bearings in total hip arthroplasty (THA) have been in use for more than 3 decades, and clinical results have been excellent in patients of all ages. While metal-on-polyethylene and ceramic-on-polyethylene bearings are the most common bearings currently used, lack of long-term studies with the most recently developed polyethylene blends leave concerns about long-term results of these technologies, particularly related to frictional torque, taper corrosion, fracture, and osteolysis. The current article describes the author's 18-year clinical experience with alumina ceramic-on-ceramic bearings in patients less than 60 years of age.

1. Introduction

Total hip arthroplasty using traditional metal-on-polyethylene bearings has proven to be reliable in the older patient population, yet concerns remain regarding the long-term outcomes of younger, higher demand patients [1,2]. Further, polyethylene technology continues to evolve, with many of the current materials having only a few years of clinical follow-up [3,4]. In addition, reports of corrosion at the taper junction between the metal head and stem have shown that these problems can lead to osteolysis, adverse tissue reaction, and revision [5]. Corrosion can be promoted by the use of large bearings and by the increased frictional torque exerted by the polyethylene [6]. Finally, potential compromise of the material properties of polyethylene remains a concern [7]. Ceramic-on-ceramic bearings have been used in total hip arthroplasty since the 1970s with routine clinical use of modern ceramics in the United States now at 20 years [8,9]. The low wear, low torque, improved wettability, and near absence of corrosion at the head–neck taper junction all are factors that make these bearings an attractive alternative to the use of polyethylene in the hip [9]. The current article reviews the author's current experience and perspective.

2. Clinical series

A prospective series of 278 hip replacements (244 patients) that underwent THA using alumina ceramic–ceramic bearings at an age of less than 60 years was evaluated. All patients underwent surgery during a 6-year period from March 1999 to March 2005. All hips were performed with uncemented titanium alloy acetabular and femoral components. The ceramic acetabular liner joined with the metal shell using a flush-mounted 18° taper design (Figs. 1 and 2). Patients treated before February 2003 participated in an FDA IDE study and contributed to the clinical basis for approval of this design of ceramic–ceramic bearings in the United States. Patients were scheduled for routine follow-up visits at least every 3 years. Attempts were made to contact all patients who had not been seen in a 3-year period. Of the 278 hips, 17 hips (16 patients) remain lost to follow-up, leaving 261 hips (228 patients; 155 hips in men and 106 hips in women) for assessment. Mean age of the patients was 46.2 years at the time of surgery (range: 17.8–59.9 years). Totally, 17% of hips had at least one previous hip surgery. Mean time following surgery was 9.75 years (range: 2–16.8 years). All patients had surgery performed with preservation of the posterior capsule and short external rotators either using the superior hip

http://dx.doi.org/10.1053/j.sart.2016.06.026
1045-4527/

Figure 1 – Photographic image of a typical ceramic THA from the time period (incremented titanium alloy with alumina ceramic (Biolox Forte; Ceramtec GMBH, Plochingen, Germany). The cup liner is flush-mounted with no elevated metal rim and is joined with an 18° taper.

approach, the transgluteal approach, or the trochanteric slide approach.

At mean 9.75-year follow-up, none of these 261 hips experienced early or late deep infection, dislocation or osteolysis. Four patients died of causes unrelated to their arthroplasty at a mean of 6.1 years, all with well-functioning constructs. Nine hips (3%) were revised: two stems and two cups failed to osseointegrate; one modular neck component sustained a modular neck fracture; and ceramic fracture occurred in one femoral head and three liners. Three of the four patients with fracture sustained severe trauma from life-threatening injuries.

3. Concerns with ceramic-on-ceramic bearings

Ceramic-on-ceramic bearings have not been widely adopted in THA despite excellent long-term clinical results [10–12]. Early concerns over cost, fracture [9,13,14], squeaking [15–17], early registry data [18], and dislocation [12], have lessened as experience with alumina ceramic has progressed, but nonetheless remain.

Cost of alumina ceramic bearings is now comparable with ceramic-on-XLPE, and actually is less than many ceramic-on-XLPE bearings with newer porous coatings. The continued problems with CoCr, including incidence of taper corrosion, wear, and pseudotumor, will reduce its future clinical use.

Fracture of ceramic-on-ceramic bearings is extremely rare [19,20], and usually associated with high-energy trauma such as a fall or motor vehicle accident. The incidence appears to be no greater with ceramic-on-ceramic than ceramic-on-XLPE, and generally involves replacing the components which potentially may have prevented bony fracture.

Patient reports of squeaking sounds after THA have been linked to β-titanium alloy stems and a metal-rimmed liner. When flush-mounted liners are used, squeaking is usually rare, but when it occurs, it is typically infrequent and temporary [15,17,21]. This appears to be a design issue rather than a bearing issue.

Concerns with ceramic-on-ceramic bearings, after reports from the Australian registry included high incidence of squeaking, revealed that the bearing designs used were

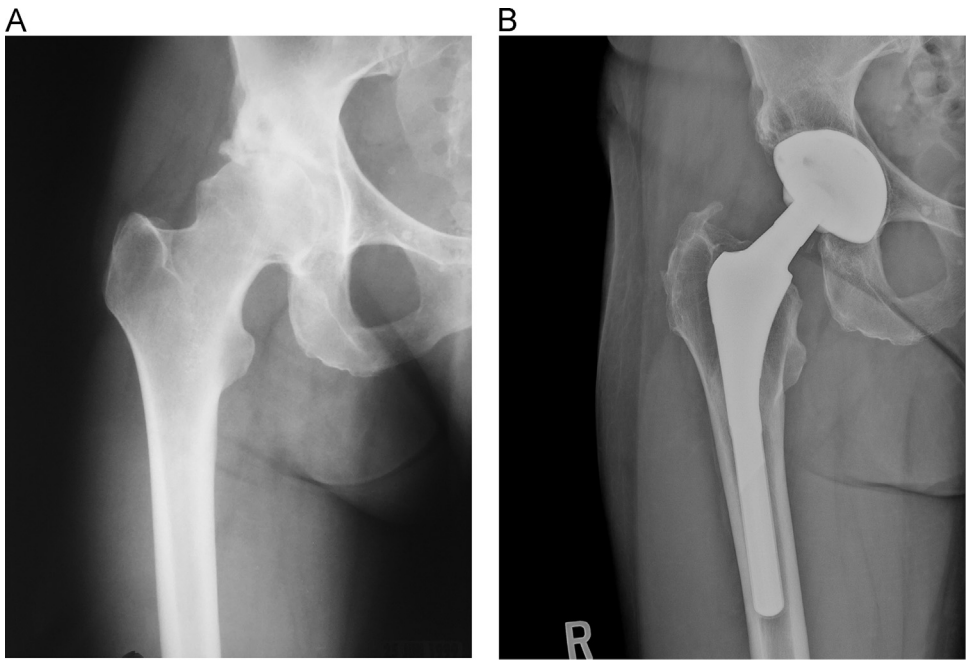

Figure 2 – (A) Preoperative AP radiograph of a 45-year-old woman taken at the time of surgery. (B) Postoperative AP radiograph taken at 16 years 4 months follow-up.