Ceramic Head Fracture in Ceramic-on-Polyethylene Total Hip Arthroplasty

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INTRODUCTION

Revision rates of total hip arthroplasty have decreased after introducing total hip arthroplasty (THA) using ceramic component, since ceramic components could reduce components wear and osteolysis. The fracture of a ceramic component is a rare but potentially serious event. Thus, ceramic on polyethylene articulation is gradually spotlighted to reduce ceramic component fracture. There are a few recent reports of ceramic head fracture with polyethylene liner. Herein, we describe a case of a ceramic head component fracture with polyethylene liner. The fractured ceramic head was 28 mm short neck with conventional polyethylene liner. We treated the patient by total revision arthroplasty using 4th generation ceramic on ceramic components.

Key Words: Ceramic head fracture, ceramic-on-polyethylene, total hip arthroplasty, revision arthroplasty

CASE REPORT

A 72-year-old woman underwent THA for idiopathic osteonecrosis of left femoral...
A ceramic head fracture in a ceramic-on-polyethylene total hip arthroplasty (THA) was encountered in a patient with osteolysis. The ceramic head that was loosened because of osteolysis was removed, and massive irrigation and extensive synovectomy were done to remove microscopic ceramic fragments.

For revision, a new cementless acetabular cup (Delta-PF Cup, Lima, Udine, Italy), full-coated modular cementless stem (Revision hip uncemented stem-Lima, Udine, Italy) were used. And, the 4th generation ceramic liner (Neutral liner, 36 mm I.D., Biolox Delta, CeramTec, Plochingen, Germany) was implanted for revision surgery.

Revision operation was done. Posterolateral approach was used, similar to previous operation. After capsulectomy thorough posterolateral approach, various sizes of ceramic particles were observed. Intraoperatively, ceramic fragments were meticulously removed, and extensive capsulectomy was performed. Inner surface of polyethylene liner and metal neck taper junction of the femoral components were severely scratched to retain (Fig. 2). There were concerns about refracture of ceramic head and galvanic corrosion of metal head because of the scratched femoral neck. Thus, femoral stem was removed. In addition, the acetabular cup that was loosened because of osteolysis was also removed. After the removal of all components, massive irrigation and extensive synovectomy were done to remove microscopic ceramic fragments.

For revision, new cementless acetabular cup (Delta-PF Cup, Lima, Udine, Italy), full-coated modular cementless stem (Revision hip uncemented stem-Lima, Udine, Italy) were used. And, the 4th generation ceramic liner (Neutral liner, 36 mm I.D., Biolox Delta, CeramTec, Plochingen, Germany) was implanted for revision surgery. Full-coated modular cementless stem (Revision hip uncemented stem-diameter 16 mm, length 140 mm, Neck with screw-height 60 mm, Lima, Udine, Italy) was inserted with allogenic bone graft around proximal femur. Finally, the 4th genera-
rate of ceramic head in ceramic-on-ceramic articulation has been shown to range from 0.004% to 0.05%. It is very rare but catastrophic event which requires revision operation. To our best knowledge, there are only a few reports on ceramic head fracture in ceramic-on-polyethylene THA.

Revision arthroplasty should be performed, because a fractured ceramic component carries a high risk of failure. The ceramic fragments are harder than metal. Microscopically small ceramic particles are easy to remain and can lead to third-body wear of replaced new components in spite of meticulous removal of ceramic fragment after revision THA. Thus, new ceramic-on-ceramic articulation should be considered as one of the possible bearing options in revision THA. In the present case, the former acetabular cup was not stable due to acetabular osteolysis. Furthermore, metal taper of the femoral component was badly scratched. Thus, all components were revised using 4th generation ceramic composition.

The fractured ceramic head was 28 mm short-neck taper in this patient. Callaway, et al. reported four cases of ceramic head fracture with polyethylene liner in 1995. The diameter of femoral component was 28 mm and the neck length was short in all instances. Koo, et al. also reported that the rate of ceramic head fracture associated with a 28 mm short-neck modular alumina femoral head was 1.4% (5 of 359). The stress at the taper-bore interface is decreased with a 28 mm short-neck femoral head. Thus, 28 mm short-neck ceramic heads also might be at a risk of fracture. The fatigue fracture in ceramic head with vulnerable design as well as obesity and squatting position during daily activity could be responsible in this patient.

In the present case, we were able to solve the ceramic head fracture with polyethylene liner by performing total revision arthroplasty. Our finding suggests that ceramic head fracture could occur not only in ceramic-on-ceramic articulation, but also in ceramic-on-polyethylene articulation, especially in not-contemporary ceramic materials with vulnerable design of 28 mm short-neck ceramic head. We recommend that surgeons should not implant 28 mm short-neck ceramic femoral head regardless of the composition of acetabular liner.

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