Case reports

Fracture of a ceramic acetabular insert after ceramic-on-ceramic THA—a case report

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In September 1999, a 40-year-old woman, who weighed 49 kg, underwent a left total hip arthroplasty because of osteoarthrosis. We inserted the Perfix stem implant (Kyocera, Kyoto, Japan) with an alumina head, 28 mm in diameter, via a posterolateral approach. The head was placed manually with a twisting motion and was gently impacted once with a femoral head inserter. We used a flat ABS cup (alumina-bearing surface cup, Kyocera), without a marginal lip. The ceramic liner had a polyethylene backing to prevent direct contact between the femoral neck and the ceramic liner. The acetabular liner was gently inserted without tilting. The cup abduction angle was 40 degrees, and anteversion angle 20 degrees (Figure 1). No prosthetic impingement was seen during an intraoperative impingement test. The short external rotator musculi and posterior capsule were reattached after placement of the implant, and then the posterior capsule and muscle were repaired. 2 days after surgery, the patient was permitted full weight bearing.

1.5 years after surgery, she had no complaints. The femoral head had moved slightly, as compared with the postoperative radiograph. (Figure 2). 3 months later she felt a click and squeak in the groin, but had not injured herself. Radiographs showed a fracture of the ceramic acetabular insert (Figure 3).

Figure 1.
a. Photograph of implant. The ceramic liner had a polyethylene backing to prevent direct contact between the femoral stem neck and the liner.
b. The inclination of the acetabulum was not steep immediately after the arthroplasty.

Figure 2.
a. Anteroposterior radiograph immediately after surgery.
b. Note a slight deviation of the femoral head 1.5 years later.

The stem was revised and the liner changed. The well-fixed metal shell was not removed. At surgery, we found the fracture of the insert, which had become detached from the polyethylene backing, the greatly worn polyethylene backing and the ceramic head that was discolored from contact with the metal shell (Figure 4). The postoperative course was uncomplicated. After 6 months, she had no pain, walked without aids, and had resumed normal daily activities.

Discussion

Ceramic components have been used for total hip arthroplasty with good clinical results for several years (Sedel et al. 1990, Huo et al. 1996). Ceramic-on-ceramic articulation has been assumed to cause the least amount of wear. However, the disadvantage of ceramic is its tendency to fracture due to its brittleness (Heck et al. 1995), which gave a failure rate of 22/10000 in a 5-year period. Many authors have reported a fracture of the ceramic head or of both the ceramic head and ceramic insert (Pulliam and Trousdale 1997), but few have found a fracture

Figure 3. A fracture of the ceramic acetabular insert was found 2 years after surgery.

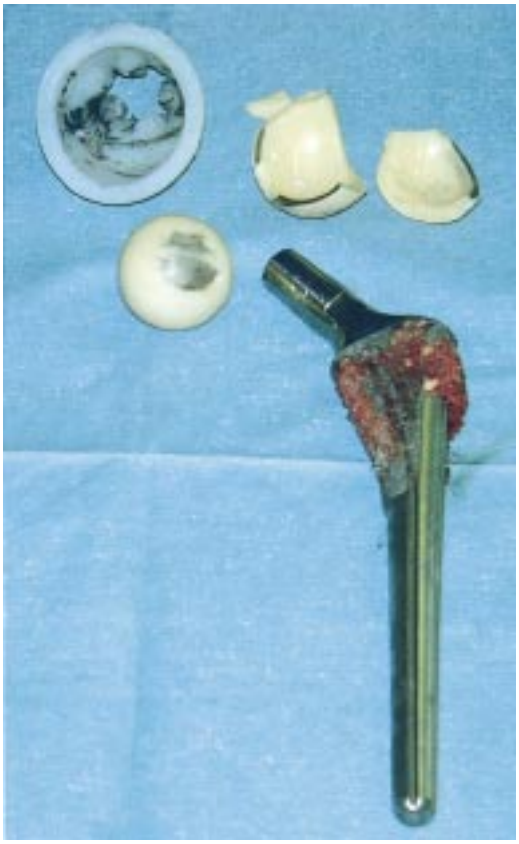

Figure 4. Retrieved implant showing fractured insert, but intact femoral head.

of the ceramic insert alone (Bergman and Young 1999).

Patient-specific risk factors contributing to ceramic component fracture include age, activities, bilateral or unilateral involvement and a history of trauma. Operation-specific factors include high cup inclination, rough insertion of the ceramic insert, impaction of the femoral head against the insert rim during reduction, and a history of dislocation. Finally, manufacturer-specific factors affecting the risk of a ceramic fracture include the quality of the ceramic and the design of the insert (Bergman and Young1999).

Our patient reported no trauma, and her activities had been housekeeping and gardening. The cup abduction angle was 40 degrees, which obviated the stress concentration observed at higher inclinations of the cup.

The average grain size of the Kyocera alumina has been 1.4 μm since 1987. The ABS cup profile o surface roughness is below 0.02 μm and its sphericity is below 2 μRa (Oonishi 1992). We found no flaws in the material from the retrieved implant.

The ABS cup has a polyethylene backing between the metal cup and the ceramic insert, which averts contact between the ceramic and metal neck. This layer may also have a shock-absorbing effect. The ceramic layer in the ABS cup, however, is only 4 mm thick, a design which increases the likelihood of a fracture.

At surgery, the edge of the broken ceramic liner was discolored, which showed that it had been in direct contact with the metal (Figure 4). This could have been secondary to fracture of the liner and dislocation, although it seems more likely that the ceramic inlay first became dislocated and then showed impingement and fracture of the liner.

As regards the locking mechanism of the socket, the metal shell has 4 hooks that hold the polyethylene backing in place. As for the ceramic liner and the polyethylene backing, mechanical taper locking at 80 °C degrees is used and the components are cooled down to obtain congruity.

The only abnormality we found at follow-up was a slight deviation of the femoral head on the radiograph. It is possible that fracture of a ceramic insert should be suspected if the femoral head is deviated on the radiograph, even if the patient has no complaints.

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