



CASE REPORT

Osteolysis with Ceramic on Highly Cross-linked Polyethylene

Joseph Fetto, MD[§]

Abstract

A major reason for the longevity of native articular cartilage over that of materials used in arthroplasties is the former's ability to self-lubricate. The self-lubricating property of hyaline cartilage produces an extraordinarily low coefficient of friction between the joint surfaces. So long as shear stresses remain low or the architecture of the joint unchanged by trauma, native articular cartilage can provide for a lifetime of joint function, i.e. the ankle. Therefore, wear and the particulate debris created by surface wear presents a significant challenge to the arthroplasty community. [1,2] Over the past 100 years, many materials have been introduced to address this issue: ivory, wood, gold, bioglass, stainless steel, cobalt/chrome alloys, Teflon, polyethylene, ceramics, diamond. To date, although there has been significant improvement in the wear properties of bearing surfaces, no perfect surrogate for native articular cartilage has been found. Presently, ceramic on highly cross-linked polyethylene (COP) appears to be the best available option. However, although it has been demonstrated to produce less particulate debris than metal on polyethylene (MOP) articulations in the hip, it is not immune to the same osteolytic complication seen in MOP bearings.

Keywords: osteolysis; ceramic on highly cross-linked polyethylene

Case Report

R.P. is a 72 year old white female. She is 6 years S/P right THR with a MOP (chrome/cobalt on highly cross-linked polyethylene) articulation, for primary OA. Her BMI is 26. She is married, retired and engages in no regular exercise program. She had been independent in her ADL's. Over the past year, she experienced an insidious increase in right groin and buttock pain unrelated to any trauma. This was aggravated by weight bearing, stair climbing and transfer movements. Although she retained an unrestricted range of motion, sufficient to perform foot hygiene, shoes and socks, she failed to find pain relief with over the counter analgesics and NSAID's. Ultimately she became dependent on a walker in her home and a wheelchair out of doors.

The patient presented with the above complaints. Her

physical exam demonstrated a slender female in moderate discomfort with attempts to ambulate. Her internal/external rotation and ab/adduction in a seated position were unrestricted but produced groin/buttock pain at the end of range. Neuro-vascular examination of the lower extremities was unremarkable. Her x-rays demonstrated well positioned non-cemented components with asymmetrical positioning of the femoral head within the acetabular shell. There was a large osteolytic lesion in zones 1 and 2 over the right acetabulum. (Fig.1).

At surgery, after placement of a prophylactic trochanteric plate to protect the integrity of the femur, the non-cemented femoral component was found to be a well fixed.

[§] NYU Hospital for Joint Diseases
530 First Avenue, 5G, New York, NY 10016



Figure 1. Pre-operative pelvic x-ray, 6 years S/P a right non-cemented ceramic on polyethylene THA. There is a large area of pelvic osteolysis in zones 1 and 2; osteolysis is also seen in the greater trochanter and femoral zones 1 and 7. There is asymmetrical positioning of the femoral head within the acetabular shell, implying polyethylene wear.



Figure 2. Post-operatively, the patient has been permitted toe-touch-partial weight bearing with a walker. She is now two months following her revision surgery, with resolved groin/buttock discomfort and no change in position of her acetabular component.

There was osteolysis within the greater trochanter, extending circumferentially into Gruen zones 1 and 7 about the femoral component. The white caseous material was found peripherally about the posterior, superior and anterior aspects of the acetabular component, from 8 o'clock to 4 o'clock. The component appeared to be osseously integrated in the lower, medial quadrant but demonstrated a rocking motion when pressure was applied to the superior margin of the cup. After explant of the cup, a large cavitory defect was exposed measuring 2x4x3 centimeters extending into the ilium and pubis. There was no defect in the medial or posterior-inferior walls.

Fibrous tissue was gently curetted from the defect and the acetabulum reamed to accommodate a 54mm non-cemented component. Prior to implantation of the new acetabular component, the defect was filled with a mixture of ground cancellous chips and DBM paste. The acetabular preparation was completed by reverse reaming. Impaction of a flared rim cup provided modest "press-fit" fixation. This was supplemented with three 6.5mm cancellous screws. A non-hooded highly cross-linked, Vitamin E liner was gently impacted in place. With secure fixation of the acetabular component achieved, a 34mm ceramic head was fitted to the femoral component and the hip reduced without complication. (fig.2).

Conclusion

Although there has been a decrease in particulate debris production and resultant osteolysis with the introduction of COP bearing couples, wear remains an unmet challenge to hip arthroplasty.

Hopefully, promising developments in new "self-lubricating" materials which can be covalently bonded to a substrate will offer approximations of native articular cartilage, resulting in further reduction of wear and debris production.

References

1. Ohnsorge JA, Davis JD, et al. Early polyethylene wear and excessive acetabular granuloma in uncemented HA-coated THA – midterm results of a prospective study. *Hosp for Spec. Surg. J.* (2006) 2: 114-120.
2. Mueller ME. The benefits of metal-on-metal THR. *Clin Ortho Rel Res* (1995) #311: p. 54-59.