

Commentary on the medium-term results of ceramic-on-polyethylene Zweymüller-Plus total hip arthroplasty

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In their retrospective review, Li et al¹ have described the medium-term clinical and radiological results of Zweymüller-Plus total hip arthroplasty (THA) in 185 Chinese patients (207 hips). The articulation size was 28 mm, with conventional ultra-high-molecular-weight polyethylene (UHMWPE) over the acetabular side and third-generation alumina ceramics on the femoral side. Due to the number of patients lost to follow-up and other reasons, the final numbers of patients and hips available for analysis were 156 and 175, respectively. The mean duration of follow-up was 14.1 years. The series comprised both primary and revision THA cases. One should be aware of the complexity of the latter and that their results may not be directly comparable with the former. All the surgeries were performed before the year 2000, when UHMWPE was still widely used around the world.

The authors reported satisfactory clinical outcomes.¹ Two out of 175 hips were revised, making the true revision rate of 1.1%, excluding those who were lost to follow-up. Two hips were found to have excessive polyethylene wear, although the authors did not define 'excessive'. Osteolysis or radiolucent lines were detected in 4% of the femora and 1.7% of the acetabula. There are three major limitations in this study in terms of measuring polyethylene wear and survival analysis. First, the method used to measure UHMWPE liner wear in the study was imprecise, as admitted by the authors. The modern standard of measuring wear requires the use of computer software based on the concentricity of the hip ball and liner.² Second, the authors mentioned that their desired acetabular component position was $45^\circ \pm 10^\circ$ of abduction and $15^\circ \pm 10^\circ$ of anteversion. However, they did not reveal the mean postoperative angles, although malpositioning of the acetabular component is a known risk factor of excessive polyethylene wear. Third, the high number of patients lost to follow-up (13.5%) might have underestimated the revision rate and overestimated the overall survival of the prostheses.

Chiu et al³ reported the results of THA in patients below 40 years of age and found UHMWPE wear and osteolysis in 56% of the hips with 28-mm

metal on UHMWPE articulation. Of note, UHMWPE has inferior wear resistance and therefore generates wear particles that induce osteolysis and cause aseptic loosening in THA.⁴⁻⁸ Highly cross-linked polyethylene (HXLPE) was introduced for clinical use in THA in 1998, aiming to reduce wear and improve its longevity.⁹ In-vitro⁹⁻¹³ and in-vivo^{11,14-17} studies suggested that HXLPE had superior wear resistance and caused less osteolysis. Li et al¹⁸ studied the linear penetration of HXLPE in young Chinese patients with THA and found the wear rate was 0.025 mm/year.

In their meta-analysis, Kurtz et al¹⁹ also investigated the incidence of osteolysis in patients with UHMWPE liners and HXLPE liners by calculating odds ratios from individual cohort (n=8) and randomised controlled trial (n=1) studies with a minimum of 5-year follow-up. The combined and the pooled odds ratio was estimated to be 0.131 (95% confidence interval [CI], 0.064-0.268) using a random-effects model which indicates that the incidence of osteolysis was 87% lower in patients with HXLPE liners compared with patients with conventional polyethylene liners.¹⁹ Hanna et al²⁰ followed a cohort of 160 patients (179 THAs) between the ages of 45 and 65 years who received liners made of either UHMWPE (n=89) or HXLPE (n=88). The cumulative implant survival, with revision for polyethylene wear or osteolysis as an endpoint, was 86% (95% CI, 78%-94%) in the UHMWPE group and 100% in the HXLPE group at 13 years postoperatively.²⁰ Data from a United States registry also suggested that the revision rates for THAs utilising HXLPE are lower than that for non-crosslinked UHMWPE. Paxton et al²¹ found that at 7 years of follow-up, the cumulative incidence of revision was 5.4% (95% CI, 4.4%-6.7%) for metal-on-UHMWPE compared with 2.8% (95% CI, 2.6%-3.2%) for metal-on-HXLPE.

In their study, Li et al¹ did not explain in detail why their cohort showed a much lower incidence of excessive polyethylene wear or aseptic loosening compared with the literature. One possible explanation could be the age of the studied patients: more than half of their patients were older than 60

years. It is well known that 'wear is a function of use, not time'. Elderly patients are generally less physically active, and this results in less wear.

The study by Li et al¹ demonstrated good clinical and radiological outcomes with THA with ceramic on UHMWPE articulation in a Chinese population. The data, however, are of little clinical significance in today's practice as most of the THAs utilised HXLPE liner; UHMWPE liners are obsolete.

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