Symposium: Advances in UHMWPE Biomaterials

Editorial Comment: Advances in UHMWPE Biomaterials

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It is a curious time to be involved in ultra-high molecular weight polyethylene (UHMWPE) research. On the one hand, as clinical history of first-generation highly crosslinked polyethylenes (HXLPE) now is into its second decade, there is little doubt that patients undergoing THA have benefitted from this no-longer-new technology. On the other hand, our specialty has been chastened by the largely unexpected complications associated with some metal-on-metal (MoM) hip replacement bearings, and in the wake of these

circumstances, arthroplasty surgeons have reasonably become more conservative in their bearing choices. Pricing pressures make it more difficult than ever before to introduce new innovations into orthopaedic bearing materials, especially when several well-accepted bearing choices are available.

So is innovation dead for HXLPE and related bearing materials? Hardly, judging based on the new research presented in this Symposium on Advances in Polyethylene Biomaterials. This Symposium is based on selected papers from the 6th International UHMWPE Meeting, which took place in Torino, Italy, from October 10–11, 2013. The purpose of the meeting was to bring together engineers, scientists, and clinicians from academia and industry, and present research on advances in medical grade polyethylene technology and clinical applications. The focus of the sixth meeting was on retrieval studies of HXLPE, with a special emphasis on the performance of thin acetabular liners and knee arthroplasty; developments with Vitamin E and new antioxidant technologies for polyethylene; structural composites and woven-fiber applications of medical grade polyethylene; as well as

advances in biologic aspects of polyethylene wear debris. The abstract proceedings for all of the presentations at this conference have been archived and can be accessed at www.uhmwpe.org.

As we continue to evaluate the performance of HXLPE bearings into their second decade of widespread clinical use, exciting developments have started to transition from the laboratory into surgical practice. The recent introduction of HXLPEs incorporating Vitamin E and other antioxidants is gaining increased acceptance among researchers, manufacturers, and clinicians. While 10 years ago there was little interest in blending additives into polyethylene

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Fig. 1 Steven M. Kurtz PhD

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bearings, today, two major multinational manufacturers have incorporated antioxidant polyethylene into their flagship implant designs. However, the differences in manufacturing processes, doses and types of antioxidants, and design philosophies may set us up for a situation where some of these products work better than others. Given our specialty's history, we can be excited about developments taking place in laboratories, but we need to evaluate these differences in thoughtful clinical studies, and approach these bearings with caution before adopting them into routine surgical practice.

The knee and upper extremity joints continue to be untapped topics for clinical research involving

polyethylene. Although HXLPEs are available for the knee and shoulder, with clear improvements in wear resistance in the laboratory, it is difficult to quantify their clinical benefit in joints beyond the hip. For example, in the 2014 Annual Report of the Australian registry [1], some HXLPE formulations showed improved survivorship in certain total knee replacement designs, but not others. Thus, the benefits of HXLPE in the knee, if any, are difficult to generalize. Similarly, little is known about the clinical performance of HXLPE in upper extremity joint replacements.

As new implant designs and HXLPE formulations continue to emerge, the continued importance of orthopaedic registries, working in

concert with implant retrieval programs, is more important than ever before. We encourage the orthopaedic community to continue to be engaged in polyethylene clinical research, not only in the hip, but also in the knee, shoulder, and many other anatomical locations for which polyethylene has applications. We still have much to learn.

Reference

1. Australian Orthopaedic Association. Hip and knee arthroplasty. Annual Report 2014. Available at: <https://aoanjrr.dmac.adelaide.edu.au/documents/10180/172286/Annual%20Report%202014>. Accessed November 17, 2014.