UHMWPE for Arthroplasty: From Powder to Debris

Editorial Comment

A Perspective on Polyethylene

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The success of total joint arthroplasty hinges on a number of factors, including proper surgical technique, appropriate patient selection, and proven implant design. As a well-known component of implant design, ultra-high-molecular-weight polyethylene (UHMWPE) may seem like an unlikely research topic for a special symposium in *Clinical Orthopaedics and Related Research* (CORR). How could there be anything new or noteworthy to say about this common plastic? As it turns out, plenty. The papers in this symposium cover a broad range of topics related to advances in polyethylene, ranging from their clinical performance, local tissue reactions to wear debris, fracture resistance, and innovations in their formulation.

This symposium includes a selection of papers presented at the 4th International Meeting of UHMWPE for Arthroplasty, which was convened in Torino, Italy, on September 16–17, 2009. This international polyethylene meeting was organized by Prof. Luigi Costa starting in 2001 as a forum to discuss vitamin E stabilization. Since that time, the meeting has grown to include over 100 participants and talks on a broad range of topics dealing with medical-grade polyethylene. This CORR symposium represents the first time papers presented at the meeting have been organized as a collection of

peer-reviewed publications. With preparations for the 5th International UHMWPE meeting underway for September 2011 in Philadelphia, PA, the present symposium marks an important milestone in the organization of an independent and growing polyethylene research community composed of orthopaedic scientists, surgeons, materials scientists, and biomedical engineers. It is an exciting time, still, to be engaged in both basic science and clinical polyethylene research.

Two systematic reviews included with this symposium provide context for the clinical performance of first-generation highly crosslinked and thermally treated polyethylenes and the emerging field of vitamin E-stabilized polyethylene biomaterials, respectively. Polyethylene hip and knee implants containing vitamin E have been cleared by regulatory agencies in Europe, Asia, and the United States. Considering that incorporating reinforced agents and additives into polyethylene became a taboo subject after the controversial introduction of carbon fiber-filled Poly Two in the 1970s, the regulatory clearance of polyethylene containing vitamin E challenges the historical paradigm of additive-free polymer bearings for arthroplasty and has given birth to a new, clinically relevant research topic for polyethylene.

As a result, it may seem ironic today that polyethylene was considered obsolete in certain circles during the 1990s. The specter of particle-induced, inflammatory bone loss caused by polyethylene wear debris provided motivation to develop second-generation ceramic and metal bearings. These more expensive alternatives to polyethylene introduced new and unanticipated clinical failure modes, including intolerable bearing noise experienced by certain ceramic bearings and, more troubling, the adverse local tissue reactions reported for certain metal bearings. As populations age, increasing the demand for joint

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arthroplasty, the limited economic resources for health care will sharply focus technology selection by surgeons on proven value. Polyethylene remains in the spotlight for

total joint arthroplasty, in a way that was perhaps inconceivable even 5 years ago. Polyethylene, we should all realize, is here to stay.