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LETTER TO THE EDITOR

Letter to the Editor

Clinical Comparison of Polyethylene Wear with Zirconia or Cobalt-Chromium Femoral Heads

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To the Editor:

We read with interest the October 2009 article by Stilling et al. [9] entitled "Clinical Comparison of Polyethylene Wear with Zirconia or Cobalt-Chromium Femoral Heads." The authors compared linear wear rates from zirconia or cobalt-chromium alloy femoral heads with gamma-irradiated but not remelted polyethylene (PE) liners, finding no difference after a minimum of 5 years in vivo.

In their discussion, Stilling et al. noted a limitation of their study was the tetragonal-to-monoclinic phase transformation associated with yttria-stabilized zirconia [1], suggesting the increased "Zr surface roughening and grain pullout provides the potential for accelerated PE wear" and thus explains the similar wear performance between yttria-stabilized zirconia and cobalt-chromium alloy femoral heads. We have observed similar phase transformation and roughening of yttria-stabilized zirconia in retrieval series [8] and in artificial aging studies [7]. However, not all zirconia degrades in vivo.

(Re: Stilling M, Nielsen KA, Søballe K, Rahbek O. Clinical comparison of polyethylene wear with zirconia or cobalt-chromium femoral heads. *Clin Orthop Relat Res.* 2009;467:2644–2650.)
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Magnesia-stabilized zirconia [2] also is available for clinical use. Although the tetragonal and monoclinic phases also are present in medical-grade magnesia-stabilized zirconia, its microstructure mainly consists of tetragonal precipitates in a cubic matrix, which tends to inhibit tetragonal-to-monoclinic phase transformation [5]. Magnesia-stabilized zirconia has proven to be stable and free from degradation and roughening in retrieval series [8] and in artificial aging studies [7]. In addition, hip wear simulator data in our laboratory comparing 28-mm femoral heads of different materials with 10-Mrad cross-linked/remelted PE revealed wrought cobalt-chromium alloy [3, 4] femoral heads produce higher gravimetric wear at 3 M cycles [6]. We continued this simulator study to 7 M cycles and found the difference in gravimetric wear between cobalt-chromium alloy and magnesia-stabilized zirconia to increase and have submitted a manuscript based on these data to a journal for review.

Finally, Stilling et al. [9] use unnecessarily broad language in their final two paragraphs, repeatedly using the abbreviation Zr to refer to all zirconia, not the unstable yttria-stabilized form examined in their study. For example, the statement that "Zr femoral heads were withdrawn from the commercial market in 2001 owing to incidents of head fracture" is not entirely accurate, because only certain batches of yttria-stabilized zirconia manufactured by Saint Gobain Desmarquest (Evreux, France) were recalled. Magnesia-stabilized zirconia was not affected by the recall, and no cases of magnesia-stabilized zirconia fracture have been reported.

Although yttria-stabilized zirconia is susceptible to low-temperature degradation and has all but completely disappeared from the market, magnesia-stabilized zirconia has proven to be stable and safe in clinical use. Our hip simulator data suggest the use of magnesia-stabilized zirconia femoral heads will lead to a reduction in wear in vivo compared with cobalt-chromium alloy heads, even with cross-linked acetabular liners.

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