**METAL ION LEVELS IN PATIENTS WITH HIP IMPLANTS HAVING BEARINGS WITH AND WITHOUT DIFFERENTIAL HARDNESS**

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**Introduction:** Metal-on-metal (M/M) articulating surfaces are becoming increasingly popular for hip replacement surgery. The use of metal-on-metal, however, has heightened concerns about the degree and magnitude of metal particle generation and the accompanying increase in circulating metal ion concentrations (ref. 1). The purpose of the current study is to evaluate metal ion levels in serum, in patients having either of two metal-on-metal bearings, one with differential hardness and one without. Differential hardness couples consist of two mating components one of which was purposely selected to be harder than the other. Differential hardness bearing couples including such couples as dissimilar metals or metal-ceramic combinations have been shown to drastically reduce wear debris in laboratory experiments when compared to contemporary metal-on-metal couples (2,3). It is postulated that this wear reduction is the result of enhanced abrasion resistance and reduction in adhesive wear.

**Materials and Methods:** Ninety patients at 10 sites received metal-on-metal hip replacement with either an A-CLASS® BFH® stemmed total hip system (Group I) or CONSERVE® Plus resurfacing system (Group II). Both systems were manufactured by Wright Medical Technology (Arlington, TN). There were 30 patients in Group I and 60 in Group II. Group I femoral components were comprised of 3–4 parts depending on stem (Ti-6Al-4V)/neck (Ti-6Al-4V)/head (CoCr) modularity. Twenty-six cases had a modular femoral component, which is comprised of three parts: the stem, neck and head. The remaining four cases had 2-part femoral component: the stem and head. Group II femoral components were resurfacing heads (CoCr).

In both groups the femoral components articulated against identical acetabular components. Component diameter, sphericity and radial clearances were also identical in both groups. The main difference between the two bearings was the differential hardness of the femoral heads. Group I heads were manufactured to be harder than the acetabular components. Group II components had no differential.

Blood specimens were obtained pre-operatively and at 3, 6 and 12 months post-operative. Serum cobalt (SrCo) and chromium (SrCr) concentration were measured by high resolution inductively coupled plasma mass spectroscopy and/or graphite furnace Zeeman atomic absorption spectrometry pre-operatively and at each post-operative interval.

**Results:** Figures 1 and 2 are box plots showing Cr and Co in serum for the two groups. In-group comparisons revealed that in both groups the postoperative SrCr and SrCo levels were statistically higher than the pre-op levels (Friedman p<0.05). For Group II no other statistical difference was observed. In Group I SrCo levels were statistically higher at the 6-month and at 12 month post-op time periods compared to the 3 month levels. No statistical differences were seen for SrCr at the postoperative time periods. Comparing the two groups revealed that for SrCr, Group II was statistically higher at all 3 post-operative time periods compared to Group I (Fig. 1). No such difference was seen for SrCo.

**Discussion:** The preliminary results of this ongoing study demonstrate statistically significant reductions in serum chromium in patients receiving metal-on-metal bearings with differential hardness. The difference was statistically significant at all post-operative time periods. While no difference exists in SrCo up to the 12 month post-op period, additional patients with longer follow-up are needed to make definitive conclusions.

The head and neck modular junctions of the femoral component are a potential source of metal ion release in addition to the bearing surface. However in spite of this additional source of metal ion release the SrCr levels in Group I are statistically lower than those of Group II where the primary source of metal release is from the bearing surface. Bearings with differential hardness have been shown to drastically reduce wear debris as a result of enhanced abrasion resistance and reduction in adhesive wear. Although longer-term results from this study are pending, differential hardness may be a promising approach to produce lower-wear metal-on-metal bearings.

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**References:**

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