INTRODUCTION:
Cobalt and chromium ion levels in serum or blood from patients with metal-on-metal hips have been used to monitor the clinical performance of the bearings [1]. It has been shown that ion levels are affected by implant design, size and surgical placement and that patients with adverse soft tissue reactions often have elevated or outlier levels of metal ions [2]. The main aim of the study was to measure metal levels over time in a group of young active patients who were likely to pursue a high and sustained level of postoperative activity long term. We describe the long-term ion levels in a group of patients with one type of hip resurfacing arthroplasty studied prospectively and now out to 10 years.

MATERIALS AND METHODS:
This study was approved by our institutional review board, and all subjects consented to participating in the study which began in 1999. Only patients without known exposure to cobalt or chromium, no metal implants elsewhere in their bodies and without any history of kidney disease were enrolled. The patients were implanted with the Conserve++ (Wright Medical Technology Inc, Arlington TN, USA). The monoblock acetabular component has sintered CoCr (F75) beads on the outer surface. The internal coverage arc of this component is approx 170 across all sizes.

There were 39 males and 11 females with an average age at implantation of 49 years. The components were smaller in the female patients (38-46mm) while the male patients’ components ranged from 40 – 60mm. Acetabular and femoral component positions were assessed from radiographs using EBRA software. Serum samples were collected pre-operatively and at 3-6 months and yearly thereafter when patients reported for annual follow-up visits. Standard physical and radiographic examination techniques and the UCLA score were used to assess clinical performance and satisfaction.

Serum was assayed for Co (SCo) and Cr (SCr) concentrations using Zeeman 5100 graphite furnace atomic absorption spectrophotometry. The detection limits in serum were 0.03 ng/ml (ppb) for Cr and 0.3 ppb for Co. Non-parametric and descriptive statistical tests were applied to examine trends in metal levels over time and the factors that affected them.

RESULTS:
Metal levels typically increased within the first year then decreased and stabilized. The average CoS at 1, 5 and 10 yrs was 1.23, 1.04 and 0.99 ppb respectively for CrS the results were 1.94, 1.96 and 1.35 ppb respectively but only 4 patients provided 10 year data so far. Fourteen patients had three or more measurements where CoS was less than 1 ppb, including 3 of the 4 patients at 10 years. Generally, chromium levels in serum were slightly higher at all time points than cobalt in serum.

Although cup abduction ranged from 30 to 62 degrees, and the group included 11 women with component diameters less than 50mm, none of the clinical or implant factors including female gender, component diameter or position were found to be strongly correlated with serum metal levels. One patient with very high metal levels and an antverted socket eventually developed an asymptomatic fluid filled mass; a second patient with outlier levels was revised for femoral and acetabular loosening.

DISCUSSION:
At the time that the study was started, there were only a small number of reports of the metal levels in metal-on-metal total hip replacements and the factors controlling wear and metal levels were unclear. There is a growing understanding of the complex interaction between implant and patient factors influencing circulating ion levels. All patients experienced an initial elevation following implantation as expected. The sustained downward trend in metal levels with time is in agreement with several other ion studies where multiple data points were obtained [3, 4]. Elevated ion levels have been reported in patients with small sized components especially with implant designs that had a small arc of coverage and when the implants were malpositioned [1]. Although the current study had a smaller number of patients, the same patients were followed over time, up to 10 years. The levels in this group of patients were often comparable to the 1ppb level suggested to represent well-functioning metal-on-metal total hip bearings [5]. In this group of patients, component size and position had little effect on metal levels.

Figure 1 showing average Co and Cr levels (ppb or ug/L) over time.

References
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2. Langton DJ et al. JBJS Br 92:38, 2010

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