SEMEN PARAMETERS IN YOUNG PATIENTS WITH METAL-ON-METAL TOTAL HIP REPLACEMENT

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INTRODUCTION
Numerous factors influence male fertility. It is for example well known that exposure to heavy metals such as lead, copper, mercury, nickel, and cadmium may lead to significant alterations in human sperm morphology and motility [1]. Several studies have shown elevated levels of cobalt (Co) and chromium (Cr) ions in the blood of patients with metal-on-metal (MM) total hip arthroplasty (THA). These ions can generate reactive oxygen species (ROS) leading to an oxidative stress. Spermatozoa are particularly sensitive to ROS because they lack cytoplasmic defences [2]. More specifically, the sperm plasma membrane contains lipids in the form of polyunsaturated fatty acids that are vulnerable to attack by ROS, leading to the formation of lipid peroxides [3]. However, the relationships between elevated levels of Co and Cr ions in young patients with MM THA and sperm function are not known. The objective of the present study was to determine the concentration of Co and Cr in the semen of young patients with MM prosthesis and to determine if the presence of these metal ions influence sperm parameters.

MATERIALS AND METHODS
Semen was collected form 10 patients between 41 and 49 years old (mean=45.9±3.0 years) by masturbation after 2-3 days of abstinence. The time of implantation varied from 1 to 9 years (mean=5.1±3.9 years). Samples were collected in a sterile container and examined within 1h after ejaculation for morphology, motility, and number of sperm cells following standard criteria [4]. All patients were doing well at their follow-up visits (Harris Hip Score=94±4; UCLA activity a score=7±1) and no sign of osteolysis was observed on X-rays.

Co and Cr concentrations were measured in both the seminal plasma and in the blood of patients by inductively coupled plasma-mass spectroscopy (ICP-MS) [5]. Peroxide concentrations were measured in both the seminal plasma and the blood of patients by the Biomedica OxyStat assay to quantify damage to lipids.

RESULTS
Results showed that the levels of Co in the seminal plasma and the blood of the patients were not statistically different (Fig. 1). However, the level of Cr was significantly lower in the seminal plasma than in the blood of the patients (Fig. 1). Results also showed that the level of peroxides was lower in the seminal plasma than in the blood plasma of these patients (Fig. 2).

DISCUSSION AND CONCLUSION
The presence of Co and Cr ions in the blood of men in age of fathering a child and having MM prosthesis raised concerns about the quality of semen in these patients. Results of the present study strongly suggest that both Co and Cr ions crossover to the semen but that their concentrations were too low to significantly affect sperm parameters of young patients with MM prosthesis.

Semen analysis is the basic investigation in the exploration of male infertility. However, the methods used to identify potential normal and fertile semen samples are still contradictory and not exactly defined [6]. Studies showed for example that only "total numbers of sperm with progressive mobility are significantly different in the fertile than in sub-fertile men [7], while others suggested that the cut-off value of a fertile population was a sperm concentration of 14x10^6/ml and a total count of 29.6x10^6 [8] or a sperm morphology of 30% [9]. Taken together, these studies also suggest that the cut-off values for normality are substantially lower than those proposed by the WHO manuals and that there is a large and overlapping distribution in the fertile and subfertile populations. Importantly, and as observed in the present study, no participants of the fertile populations fulfilled all criteria for sperm parameters.

In conclusion, results suggest that Co and Cr ions generated from MM prosthesis have no significant effect on the sperm parameters of young patients in the age of fathering a child. Further longitudinal studies are however necessary to conclusively determine the effect of metal ions from MM prosthesis on sperm parameters.

REFERENCES