Introduction

There still remains concern over the long-term biocompatibility of metal-on-metal (MOM) hip prostheses due to systemic ion release [1]. Patients at greatest risk are the highly active males. However, there have been few in vitro models created to simulate these high-risk active patients.

Laboratory MOM studies with more ‘severe’ gait, such as intermittent loading, micro-separation etc., have all created higher wear, with most studies reporting similar maximum wear rate of ~2.0 mm/Mc for 28mm Co-Cr bearings [2-5], (Table 1). However, this wear increase still does not explain the large variations in wear seen clinically [7].

Bowsher et al introduced fast-jogging cycles to model ‘severe’ gait conditions [8,9]. This model represented the most severe published hip simulator-testing regime, creating 2–4-fold greater wear compared to other studies using (smooth) undamaged bearings, (Table 1).

While wear rates are important, changes in wear particle sizes may also be critical [1]. To date, the factors that influence the size range of wear particles from MOM hip bearings are not well understood. Therefore, the aim of this wear study was to test the hypothesis that ‘severe’ gait conditions will greatly increase the size of Co-Cr-Mo wear particles, thereby causing a sizable increase in wear particle surface area.

Materials and Methods

Four 40mm MOM bearings were investigated (east high carbon 0.3 % wt Co-Cr-Mo HIPed/solution annealed) (Corin Medical, Cirencester, UK), (Table 2). The cups were inclined physiologically at 35 ° to the horizontal in an or bital hip joint simulator (MTS Systems, USA). The lubricant was 25% newborn calf serum, 17 mg/ml protein content (500 ml, heated to 37 °C).

Discussion and Conclusions

This is the first study to show that the degree of patient gait can affect Co-Cr-Mo wear particle sizes in modern MOM hip bearings. Simulated fast-jogging created a 3-fold increase in the number of larger elongated (needle) wear particles compared to normal walking, and generating a 20-fold increase in total wear particle surface area per year of use compared to normal walking. Therefore our hypothesis was proved.

This result suggests that errors may be made in calculating the possible biological reactions for high-risk patients if only considering normal walking models. The clinical significance of this result suggests that highly active MOM patients will exhibit greater ion release.

Acknowledgements

This research was supported by Corin Medical UK

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Poster No: 0285