INTRODUCTION
Hip simulator studies on metal-on-metal (MoM) bearings in total hip replacements (THRs) under standard gait cycle conditions have demonstrated low wear rates [1-3] and reduction in wear with increasing head diameter size [2,3]. Clinical and retrieval studies of MoM bearings, especially surface replacements (SR), have associated increased wear and elevated patient ion levels with steep cup inclination angles [4,5]. Steep cup inclination angles and elevated patient ion levels with steep cup inclination angles [4,5]. Studies on MoM bearings have shown this to increase the wear rate of MoM bearings [6,7], however not to the levels measured on retrievals. Microseparation and edge loading conditions have replicated clinically relevant wear rates and wear mechanisms in ceramic-on-ceramic bearings [8] and elevated the wear rates of MoM SR bearings to levels similar to those seen in retrievals [7].

The aim of this study was to assess the wear of two different size metal-on-metal bearings under steep cup inclination angles and microseparation and edge loading conditions.

MATERIALS AND METHODS
The six-station Physiological Anatomical Hip Joint Simulator was used in this study. High carbon cobalt chrome alloys (CoCrMo) MoM bearings for THRs were used. Two hip simulator tests were performed: one using 28mm diameter size bearings and the other using 36mm diameter size bearings. For each test, three liners were mounted to provide a clinical angle of 45°, and three liners were mounted to provide a clinical angle of 65°.

The first test using a 28mm size bearings ran for a total of 6 million cycles. The first three million cycles were under standard gait conditions; flexion/extension of ±15°/±50°, internal/external rotation of ±10° and a twin peak Paul load with a maximum load of 3kN and in vivo phase load of 0.3kN. Microseparation was achieved by applying a lateral movement to the acetabular cup and the femoral head in MoM THR particularly in small bearings. The wear rate obtained in this study under combined cup inclination angle and microseparation were half of that obtained when SR MoM bearings were tested under similar adverse conditions [7]. This may be related to the difference in acetabular cup design. There was no significant difference in the wear rates between the two cup inclination angle under microseparation conditions indicating the dominant effect of microseparation and edge loading over steep cup inclination angle. However, in vivo, steep cup inclination angle could facilitate microseparation and edge loading conditions.

CONCLUSION
This study shows the importance of accurate surgical positioning of the acetabular cup and the femoral head in MoM THR particularly in smaller size bearings. Microseparation and edge loading increased the wear rate of MoM THR under all conditions and sizes and this effect was more dominant to that of head rim contact due to increased cup inclination angle. Surgical positioning of the head, restoration of offset and cup centre, (factors which effect joint laxity and microseparation) are important determinants of wear in metal-on-metal bearings.

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