Wear Comparison of a Two Modular Hip Bearings: Mobile vs. Fixed
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INTRODUCTION:
Dual mobility hips have been in use in total hip arthroplasty since the 1970’s after being developed by Bosquet [1]. The goals of the dual mobility hip are to increase stability by decreasing the incidence of dislocation all while providing excellent wear properties.

Designs of most dual mobility hips have been of monoblock construction without screw fixation. Those that have screw fixation are through invasive flanges unlike the common screw fixation of acetabular shells in today’s modular implants. The introduction of modularity to the dual mobility concept allows its use in situations where implant fixation may be of concern. We evaluated the wear characteristics of a modular mobile bearing hip and compared it to the wear characteristics of a modular fixed bearing design.

Figure 1- Modular mobile bearing and modular fixed bearing (l to r)

METHODS:
A modular dual mobility hip (MDM, Stryker Orthopaedics, Mahwah, NJ) incorporates a CoCr femoral head (28mm diameter) into a unconstrained polyethylene insert (28mm inner diameter & 42mm outer diameter) that articulates against a metal liner (42mm inner diameter), which is mechanically secured into a cementless acetabular shell (54mm outer diameter) (Trident, Stryker Orthopaedics, Mahwah, NJ). The modular fixed bearing design consisted of a 28mm CoCr femoral head and polyethylene insert that is secured into a cementless acetabular shell (Trident, Stryker Orthopaedics, Mahwah, NJ). The polyethylene for all inserts was sequentially crosslinked and annealed [2] (X3, Stryker Orthopaedics, Mahwah, NJ).

A hip joint simulator (MTS, Eden Prairie, MN) was used for testing with the cups positioned anatomically (superior) oriented at either 50° or 65° of inclination. Testing was run at 1 Hz with cyclic Paul curve physiologic loading applied axially, at a maximum of 2450 N [3]. Samples were lubricated using Alpha Calf Fraction serum (Hyclone Labs, Logan UT) diluted to 50% with a pH-balanced 20-mMole solution of deionized water and EDTA (proein level = 20 g/l). Data was collected every 500,000 cycles, where samples were cleaned and assessed for wear gravimetrically. Samples were then placed back on the simulator with new serum for each data collection thereafter. Simulated samples were dynamically loaded soak corrected to account for any weight gain due to absorption of fluid. Weight loss data was converted to volumetric data and plotted as a function of cycle count. Linear regression and the Student’s t-test were performed on the data. Testing to volumetric data and plotted as a function of cycle count. Linear coefficients of correlation ranging from 0.94 to 0.99. Based on these results, the modular mobile bearing provides a decrease in wear rate when compared to the modular fixed bearing for both inclination angles. There was a 33% and 44% decrease in wear rate for 50° and 65° of inclination, respectively. The wear rates between the different modular constructs are statistically significant from one another at both inclination angles according to the students t-test (p<0.05).

Inclination angle does not have an effect on the wear performance of either modular construct. Student’s t-test comparing inclination angles within the same design do not indicate statistical significance for each design.

Visual observation of the modular mobile bearing polyethylene component is consistent with observations noted during previous wear tested dual mobility hip bearings [3]. Machining marks still remain on the outer diameter of the polyethylene while there is polishing and burnishing throughout the entire inner diameter of the components for both inclination angles.

Table 1- Volumetric wear and wear rates after 3 million cycles of testing

<table>
<thead>
<tr>
<th>Inclination Angle</th>
<th>Mobile</th>
<th>Fixed</th>
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<tbody>
<tr>
<td>50°</td>
<td>5.2 ± 2.1</td>
<td>8.3 ± 0.4</td>
</tr>
<tr>
<td>65°</td>
<td>4.5 ± 1.0</td>
<td>9.1 ± 1.5</td>
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Figure 2 - Wear rates after 3 million cycles of testing

Wear rates and total volume loss after 3 million cycles are reported in figure 1 and table 2. All testing groups wore linearly as a function of cycle count, with linear coefficients of correlation ranging from 0.94 to 0.99. Based on these results, the modular mobile bearing provides a

REFERENCE: