DOES NECK/LINER IMPINGEMENT INCREASE THE WEAR OF UHMWPE LINERS?

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INTRODUCTION
Surface damage of acetabular inserts secondary to liner/neck impingement is commonly observed during revision of total hip prostheses. Although rim impingement can be catastrophic in hard-on-hard bearings, it has often been regarded as an incidental finding in metal-on-plastic articulations. In this study we explore the hypotheses that repetitive impingement increases wear of UHMWPE inserts at both 1. the articular surface, and 2. the backside surface, through increased shell/liner micromotion

METHODS
113 acetabular components were retrieved during revision total hip arthroplasty after an average time of 84 months in situ (range 2 to 192 months). The retrieved components consisted of 25 different designs, primarily from 5 manufacturers: Zimmer, JMP, Howmedica, Depuy and Biomet. The dominant reasons for revision include infection, loosening, dislocation and wear.

Each acetabular liner was examined with incident light and inspected for presence, location, and severity of damage secondary to impingement caused by the femoral neck. The severity of neck/liner impingement damage was quantified on a 4-point grading system based on the radial width, X, and the radial span, A, of the impingement scar. grade 0: no visible damage, grade 1: X<4mm and A<90°, grade 2: X>4mm or A>90°, and grade 3: loss of material severe.

The backside of each UHMWPE liner was stained with India ink and examined by stereomicroscopy for backside wear. Damage to the backside was classified as burnishing, pitting, plastic deformation, or scratching according to its morphology, and graded on a similar 4-point scale of severity dependent on the degree of damage as well as the surface area affected.

Wear of the articular surface was quantified by measuring the depth of penetration of the femoral head into the bearing surface. The neck diameter of the femoral component was measured at the predicted site of impingement and implant head-to-neck ratio was calculated.

RESULTS
Of the 113 of acetabular liners examined, 68 (60%) showed evidence of prosthetic impingement, with moderate or severe damage to the rim in 32% (36/113) of components. Significant damage to the back surface was present in 29% (28/96). Significant backside wear (graded as moderate or severe) primarily for burnishing, pitting and scratching was strongly associated with significant prosthetic impingement (p<.0001). Moderate or greater backside wear was found in 60% (18/30) of liners exhibiting significant impingement damage, vs. 15% (10/66) of liners without impingement (Figure 2).

There was also a strong association between articular wear with prosthetic impingement. In liners with moderate or severe impingement damage, the average wear rate of the articular surface was 0.486mm/yr, compared to 0.177mm/yr for liners with mild or no impingement damage (p=.0156). Whereas the depth of head penetration into the UHMWPE liner increased with time in situ (p=.0004), there was no correlation between impingement damage, or backside wear and time in service (p=.3608 and p=.2383, respectively).

DISCUSSION
Repetitive impingement frequently occurs after THR and leads to a multitude of adverse events, including motion between the liner and the acetabular shell leading to backside wear, and accelerated wear of the articular surface. Our results suggest that impingement between the acetabular liner and the femoral neck should be prevented whenever possible to increase the longevity of total hip replacements.

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