IN VIVO DETERMINATION OF HIP JOINT SEPARATION IN SUBJECTS HAVING VARIABLE BEARING SURFACES

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INTRODUCTION: Previous in vivo kinematic analyses of the hip joint have determined that femoral head slide from the acetabular cup occurs in metal-on-polyethylene THA, but not in metal-on-metal THA. The previous studies only analyzed subjects under non weight-bearing conditions during swing phase of gait. The present study analyzes subjects having either an alumina-on-alumina (AOA) or alumina-on-polyethylene (AOP) THA during weight-bearing, stance-phase of gait to determine if the incidence of hip joint sliding varies based on articular surface material. METHODS: Twenty subjects were analyzed in vivo using video fluoroscopy. Ten subjects had a AOA THA and ten subjects had a AOP THA. All THA subjects were implanted by the same surgeon and judged clinically successful (Harris hip scores >90.0). Each subject performed a weight-bearing gait on a treadmill and a non weight-bearing abduction/adduction leg lift while under fluoroscopic surveillance. The two-dimensional (2D) fluoroscopic videos were converted into 3D using a computer automated model-fitting technique. Each implant was analyzed at specific increments to assess the incidence of hip joint separation. RESULTS: During gait and the abduction leg lift femoral head sliding (average = 0.3 mm) was not observed in subjects having an AOA THA. Similar to our previous study pertaining to subjects having a metal-on-polyethylene THA, 6/10 subjects having an AOP THA femoral head sliding during the leg lift, while 5/10 subjects experienced it during weight-bearing gait. The maximum amount of femoral head sliding was 3.2 mm during the leg lift and 7.4 mm during weight-bearing gait. DISCUSSION: This study shows that sliding of the prosthetic femoral head in the acetabular component can occur during the weight-bearing portion of gait. It appears from our analysis that while the foot of the implanted leg remains on the ground the contra-lateral leg induces an anterior thrust that causes the acetabular cup to slide away from the femoral head. Potential effects resulting from femoral head separation could include variations in polyethylene wear rates, unknown loading conditions and questions hip stability. Multidirectional wear vectors or excessive loading may be created due to eccentric motion of the femoral head. This data may be of value in hip simulation studies to more consistently duplicate wear patterns observed in retrieved components and to assist in the understanding of the lubrication regimes and wear rates in THA designs.

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