# ANALYZING HIP MOTION – SKIN MARKER MOTION CAPTURE VS. DUAL FLUOROSCOPY AND TRACKING

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Femoroacetabular impingement, or FAI, is a disease where the femoral head and/or the acetabulum (i.e. the hip socket) are malformed. These malformations can be a bump on the femoral head, acetabular over-coverage, or a combination of both [1]. These malformations are thought to decrease the range of motion in the hip joint and cause damage to the cartilage and labrum (a fibrocartilaginous structure which surrounds the edge of the acetabulum) [1]. Surgery to correct FAI aims to restore normal range of motion by correcting the bony abnormalities. However, it is unknown how FAI alters hip articulation and joint range of motion. Previous studies have quantified gross range of motion in the hip joint using skin marker motion capture. However, skin markers are subjected to skin tissue artefact (STA) which is when the skin moves relative to the bone [2]. The Anderson lab designed a process called dual fluoroscopy (video x-ray) and model-based tracking to get around STA [1]. The focus of the project was to quantify the differences between dual fluoroscopy/tracking and skin marker motion capture. Skin markers were recorded in 3D space and the hip was imaged by the dual fluoroscopy cameras while control subjects performed a series of movements on a two-forced plate treadmill. The subject also received a CT scan of their hip joint. For skin marker data analysis, the markers were analyzed in a program called Vicon Nexus. Once the trajectories were corrected, the data was loaded into a program called Visual3D where hip joint angle and moment were calculated. For dual fluoroscopy data analysis, the CT scan was segmented to created 3D images of the pelvis and femur, and bony landmarks were identified in PostView and PreView. These images were then laid on top of the dual fluoroscopy videos frame by frame to create in-vivo hip movement. This was then uploaded into Visual3D to calculate hip joint angle and moment. The hip joint angle and hip joint moment calculations were compared between skin markers and dual fluoroscopy. After statistically analyses were run, it was determined that skin marker motion analysis provides reasonable estimation of overall hip motion for FAI patients, but dual fluoroscopy has the advantage of identifying the specific areas of bone overgrowth.

**References**

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