

## Appendix 1

MR imaging was conducted with participants supine and feet held together in neutral rotation with a tie. A 12 lead cardiac coil (Siemens, Erlangen, Germany) was placed over the anterior pelvis when imaging the hips. An axial fast spoiled gradient echo fat saturated 3D sequence from the anterior superior iliac spine to the lesser trochanters was used to assess hip morphology (Field of view 34cm, echo time (TE) 2.7ms, relaxation time (TR) 7.9ms, slice thickness 2mm, flip angle 0). Additionally coronal and sagittal proton dense fat saturated (TE 44.4, TR 2000, slice thickness 3mm) sequences of each hip were used to assess for intra articular pathology. In order to assess femoral neck antetorsion the axis of the femoral condyles was determined using a localiser sequence (TE 1.3, TR 4.9, slice thickness 3mm).