indicating the coverage of the acetabulum became larger in elderly population.

Discussion: This study revealed that the frequency of FAI related radiographic features in non-asymptomatic Japanese population. We found that the coverage of acetabulum is larger in male population than female population. In addition, it is larger in elderly population compared to younger population, indicating that degenerative change such as osteophyte formation might affect to this result. Since this study is CT-based assessment of hip morphology, the result is much more reliable than X-ray-based studies that can be affected by the photographing position and the variety of pelvic tilt. We defined the cut-off line based on the previous reports from western countries. Based on these cut-off values, 37% of the participants showed at least 1 abnormal value and 10.1% of them showed more than 2 abnormal values. On the other hand, Chakraverty et al. has reported that 66% of the asymptomatic Caucasian population showed at least 1 abnormal value and 22% of the same population showed more than 2 abnormal values. These rates are much higher than our results from Japanese asymptomatic population. Although the evaluation is based on radiographs, Laborie et al. investigated 2081 healthy subject and reported that the majority of the subjects showed characteristic feature of the FAI. Because the age distribution or evaluation item was deferent, it can not make an easy comparison with our results, our result suggested FAI might not contribute to primary hip OA in Japanese population.

528
FOOT MORPHOLOGY IN OSTEOARTHRITIS AND HALLUX VALGUS

N. Milliken †, H.B. Menz ‡, E. Roddy §, G. Peat §, R.M. Aspden †, M. Marshall §, J.S. Gregory †. †*Univ. of Aberdeen, Aberdeen, United Kingdom;* ‡*La Trobe Univ., Melbourne, Australia;* §*Keele Univ., Keele, United Kingdom*

Purpose: The purpose of this study was to develop statistical shape models from foot radiographs to quantify foot morphology in people with foot osteoarthritis and hallux valgus (HV). The foot is one of the least studied musculoskeletal structures, even though foot pain is a common complaint. Osteoarthritis (OA) and hallux valgus (HV) are two of the most prevalent conditions affecting the foot with morphological changes in skeletal structure observed in both disorders. Structural analysis of these conditions is generally performed using semi-quantitative visual assessment of radiographs. Active shape modelling (ASM), which has been effective for quantifying the effect of osteoarthritis in the hip and knee, may be a useful tool for observing and quantifying changes in foot structure that occur with OA and HV.

Methods: Weight-bearing dorsal-plantar (DP) and lateral radiographs were collected from participants in the Clinical Assessment Study of the Foot (CASF), a population-based cohort of adults aged ≥50years who reported foot pain in the previous year. The presence of OA was determined in the right foot using a validated radiographic atlas and was defined as scoring ≥2 for either osteophytes or joint space narrowing in the 1st metatarsophalangeal, 1st and 2nd cuneometatarsal, navicular-first cuneiform or talonavicular joints on either view. HV in the right foot was determined from a validated self-reported line-drawing instrument. Individuals with OA and HV were age- and sex-matched to controls who were free of both OA and HV. Two ASMs were made from the DP radiographs: (i) a whole foot view (113-points) and (ii) a first ray view modelling the three bones of the first ray (45-points). Points were placed on images to outline the bones and principal components analysis of the point coordinates, generated modes of variation to quantify the shape. One-way ANOVAs were used on the first 5 modes of variation in each ASM to test for differences between the three groups. Pearson's correlations assessed the association between mode scores and age and BMI (Sigmaplot V12).

Results: 114 age- and sex-matched participants split equally between three groups: OA, HV and controls (61% females, aged 52-86 years(mean age 67)). Whole foot modes 1 (P0.0001) whilst low Mode 5 scores were associated with OA ($P = 0.03$, [Fig. 1(D)]. Age was negatively correlated with modes 3 and 4, whilst BMI was positively correlated with modes 2 and 3 ($P < 0.05$).

Conclusions: Changes in foot shape are quantifiable using ASM and variation due to HV or OA are separable. Whole foot models in the DP view may be more useful for HV due to the large deviations and to examine the widespread impact of first hallux deviation of the morphology in the rest of the foot. However, more focused smaller models, such as the first ray model may be more suitable for studying OA. This model may be useful for quantification of changes in future longitudinal studies of foot radiographs.

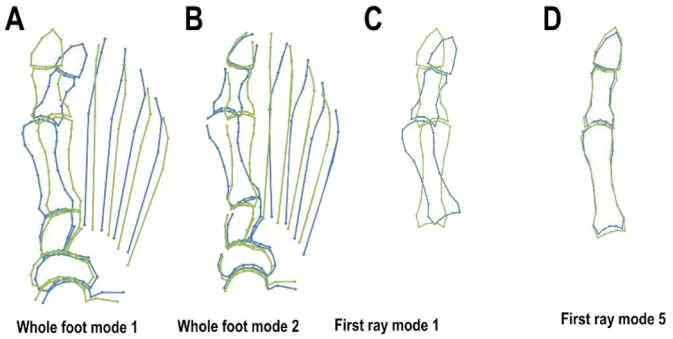

Fig. 1. Foot modes showing significant differences between the HV, OA and control groups identified by the whole-foot (A and B) and first ray (C and D) models. In each case high scores (blue lines indicate + 2 st. dev. from the mean shape) were associated with HV whilst low scores (green lines indicate − 2 st. dev.) were more likely to be associated with OA.

529
COMPARISON OF THREE KNEE POSITIONING PROTOCOLS FOR MEASURING KNEE MORPHOLOGY USING DUAL ENERGY X-RAY ABSORPTIOMETRY.

T.W. Walshaw †, K.A. Beattie ‡, J.S. Gregory †, R.J. Barr †. †*Univ. of Aberdeen, Aberdeen, United Kingdom;* ‡*McMaster Univ., Hamilton, ON, Canada*

Purpose: Statistical Shape Modelling (SSM) has the potential to reliably measure changes in OA. SSM can be applied to both DXA and radiographic images. DXA has some advantages since it can measure bone mineral density (BMD) and has a very low radiation dose, however, weight bearing imaging is not possible in DXA. Previous studies investigating knee positioning for DXA have focussed on BMD precision; to optimise knee positioning in DXA for use with shape modelling studies we tested 3 positioning protocols. For ultimate success, this must combine the needs of the patient, radiographer and the researcher, so questions about comfort and ease of use were assessed alongside measures of precision and image appearance. The purpose of this study was to compare 3 positioning protocols (neutral, wedge and full-leg) for measuring knee morphology from Dual Energy X-ray Absorptiometry (DXA) images.

Methods: 30 volunteers with no history of knee injury or severe knee pain were recruited. IDXA Scans (GE LUNAR) were performed twice on each subject, at least 1 day apart using 3 protocols 1) Legs in full extension, without any device, similar to a routine supine knee radiograph (neutral). 2) A full-leg-length positioner (full-leg). 3) A cushioned (GE Lunar) knee support, (wedge). Images were ranked for visual appearance of rotation, cruciate processes, joint space, interference (clearest image of bony structure) and flexion. An 85point SSM knee model was applied to all right knee images from both time points (180 images). Questionnaires about comfort and ease of positioning were completed by both the volunteers and the radiographers. The ISCD Least Significant Change (LSC) for 30 people was applied to measure precision of mode scores. Volunteer data were investigated using descriptive statistics and image rankings using Kruskal–Wallis tests.

Results: All visits were completed within 15 days (mean 4.6). Volunteers were 23–64 years old (mean 44), 150–184 cm tall (mean 165 cm) and 49.5–98.5 Kg in weight (mean 70.9 Kg), 80% were female. The first five SSM modes were analysed. The neutral protocol ranked highest overall (3/5 1st ranks) and the wedge worst (3/5 2nd ranks). Fig. 1 shows the LSC for mode 1. Visual inspection ranked the wedge first for rotation ($P = 0.056$) and interference and second for the other criteria. Although full-leg ranked first for processes, joint space and flexion ($P < 0.05$) it ranked last for interference and equal last for rotation.

Conclusions: Deciding which positioning protocol to adopt for future studies has to combine the needs of the patient, radiographer and the