

defined as a K/L grade of ≥ 2 or a total joint replacement at follow-up. The shape of the proximal femur and the acetabulum were outlined by a set of points (23 points, Figure 1) that were positioned on pre-defined anatomical landmarks on the anteroposterior pelvic radiographs using statistical shape modeling software. Using this point set, alpha and center-edge (CE) angles, parameters that quantify these deformities were calculated. Acetabular dysplasia and cam deformity were defined as the presence of a CE angle $< 20^\circ$ and an alpha angle of $> 60^\circ$, respectively (Figure 1). Using generalized estimating equation models, odds ratios were calculated to assess the associations between both hip deformities and the development of HOA.

Results: At the follow-up times, 234 and 179 cases of HOA were identified for RS-I and RS-II, respectively. Incident OA was defined in 281 hips within RS-I among that 12.2% ($n = 34$) had cam deformity and 8.3% ($n = 23$) had acetabular dysplasia, while out of 218 hips with incident OA in RS-II, 16.1% ($n = 35$) had cam deformity and 7.3% ($n = 16$) had dysplasia. In pooled data analyses (Table 1), individuals with cam deformity had a two-fold increased risk for developing osteoarthritis (OR = 2.0, 95% CI = 1.48–2.71, $p = 0.00001$) compared with individuals without cam deformity. Moreover, subtle acetabular dysplasia was significantly associated with increased risk of HOA (OR = 1.96, 95% CI = 1.35–2.84, $p = 0.0004$). Both associations were independent of known risk factors of HOA such as age, sex, and BMI and were only significantly associated with development of OA in younger individuals. These bony deformities were independently related to the outcome when included in the same model (cam deformity: OR (95% CI) = 2.03 (1.50–2.76), hip dysplasia: OR (95% CI) = 2.03 (1.41–2.92)). The results were almost consistent in both cohorts.

Conclusions: Individuals with cam deformity and acetabular dysplasia are strongly predisposed to progression to HOA independently from other well known risk factors of age, sex, and BMI. Interestingly, both deformities were only predisposing to OA in relatively young individuals. Therefore, early identification of these conditions is important and might provide an opportunity to prevent hip osteoarthritis.

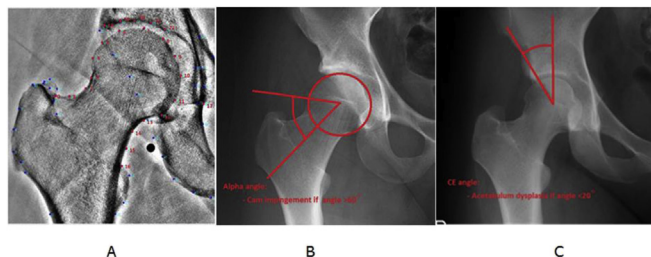


Figure 1. A) Point set (red) in statistical shape modeling software; B) Alpha angle; C) Center-edge angle.

Table 1

Association between cam deformity and acetabular dysplasia and hip osteoarthritis, stratified by age, sex, body mass index (BMI), K&L grade at baseline, and follow-up time in pooled data

	OA/no-OA	CAM deformity OR (95% CI)	Dysplasia OR (95% CI)
All subjects	413/4017	2.00 (1.48–2.71)	1.96 (1.35–2.84)
Age			
≤ 65 years	221/2488	2.92 (1.97–4.32)	2.30 (1.44–3.66)
> 65 years	192/1529	1.29 (0.81–2.06)	1.53 (0.82–2.84)
Sex			
Women	267/2225	1.74 (1.05–2.91)	2.68 (1.76–4.08)
Men	146/1792	2.20 (1.48–3.25)	0.97 (0.45–2.10)
BMI			
≤ 25 kg/m ²	120/1477	2.17 (1.21–3.87)	2.06 (1.08–3.91)
> 25 kg/m ²	293/2540	1.93 (1.36–2.76)	1.97 (1.25–3.12)
K&L grade at baseline			
Grade 0	189/5964*	1.25 (0.66–2.37)	2.72 (1.70–4.36)
Grade 1	310/2396*	2.33 (1.61–3.38)	1.59 (0.93–2.71)
Follow-up [†]			
First	308/4127*	2.16 (1.48–3.17)	2.42 (1.54–3.79)
Second	191/4231*	1.87 (1.13–3.11)	1.56 (0.80–3.01)

Models were adjusted for age, sex, BMI, K&L grade at baseline, cohort, and follow-up time; * numbers are based on hip; [†] follow-up duration was divided based on median follow-up time in combined data.

25

MOLECULAR CHANGES IN SYNOVIAL FLUID FOLLOWING HUMAN KNEE INJURY ARE ASSOCIATED WITH EARLY CLINICAL OUTCOMES

F.E. Watt[†], E. Paterson[†], A. Freidin[†], M. Kenny[‡], A. Judge[†], J. Saklatvala[†], A. Williams[‡], T. Vincent[†]. [†] Univ. of Oxford, Oxford, United Kingdom; [‡] Fortius Clinic, London, United Kingdom

Purpose: We studied whether molecules which were up-regulated within hours of surgical joint destabilisation in the mouse were also elevated in the analogous human setting of acute knee injury, how this molecular response varied between individuals, and whether it related to patient-reported outcomes in the 3 months after injury.

Methods: 7 candidate molecules were analysed in blood and synovial fluid (SF) at baseline, 14 days and 3 months following baseline visit of 150 participants in the Knee Injury Cohort @ Kennedy (KICK), who had recent structural knee injury (<8 weeks from injury). Knee injury and Osteoarthritis Outcome Score (KOOS) was collected at baseline and 3 months. Assays were by MesoScale Discovery™ platform or ELISA, and compared with age and sex-matched control samples.

Results: Participants' median age was 25, median time from injury to baseline visit was 17 days and there was substantial impairment by KOOS at baseline visit. 6/7 molecules were significantly elevated in human synovial fluid immediately after injury: IL-6, MCP-1, MMP-3, TIMP-1, activin A and TSG-6. 3/6 molecules were significantly associated with baseline KOOS₄ (those with higher SF IL-6, TIMP-1 or TSG-6 had lower KOOS₄). Each of these 3, MMP-3 and activin A were all significantly associated with greater improvement in KOOS₄ over 3 months, adjusting for relevant, pre-defined factors including time from injury to sampling, extent of injury, age and presence of heavy blood staining of synovial fluid. When all 5 synovial fluid biomarkers were included in a linear regression model, only synovial fluid IL-6 was independently associated with either baseline KOOS₄ (Coeff.-4.0 (-5.92, -2.08), $P < 0.001$), or difference in KOOS₄ over 3 months (Coeff.2.80 (0.89, 5.52), $P = 0.043$).

Conclusions: Our findings validate relevant human biomarkers of joint injury identified from a mouse model. The response, represented best by synovial fluid IL-6, has clinical relevance over this early period: a greater quantifiable inflammatory response soon after the injury is associated with increased impairment and pain by KOOS₄ at that time. Paradoxically, this same response at baseline would appear to be a good prognostic factor for change in clinical outcome over 3 months, or at least not an adverse one, in this predominantly surgically-managed cohort. Longitudinal outcomes will determine if these molecules are biomarkers of subsequent osteoarthritis risk.

26

SIGNIFICANT ASSOCIATION OF RADIOGRAPHIC FEMOROACETABULAR IMPINGEMENT WITH EARLY MRI FEATURES OF HIP DISEASE: A POPULATION-BASED STUDY

J. Cibere^{†‡}, D. Russell[†], H. Qian[§], B.B. Forster[†], H. Wong^{†§}, M. Barber[†], Y. Guo[†], J.A. Kopec^{†‡}, L. Li^{†‡}, J.M. Esdaile^{†‡}, The IMPAKT-HIP Study Group[†] Univ. of British Columbia, Vancouver, BC, Canada; [†] Arthritis Res. Canada, Richmond, BC, Canada; [§] Ctr. for Hlth. Evaluation and Outcome Sci., Vancouver, BC, Canada

Purpose: Femoroacetabular impingement (FAI) has recently been recognized as a cause of hip pain in young adults. However, it is not clear whether this mechanical abnormality invariably leads to disease and which features on MRI are associated with FAI in early disease. The purpose of this study was to evaluate the association of radiographic FAI of the hip with cartilage damage, bone marrow lesions (BMLs) and MRI-defined osteoarthritis (MRI-OA) in a population based study of young adults.

Methods: Caucasian subjects ($n = 500$) with and without hip pain, age 20–49, were recruited by random digit dialing into a population-based study to assess FAI and physical activity. From this cohort, all subjects were invited to participate in an MRI study. Subjects were excluded if they had total hip replacement or contraindications to MRI. Radiographs were obtained using a weight-bearing AP view of the pelvis (hip 15° internal rotation) and supine Dunn views (hip 45° flexion and 20° abduction). FAI was defined radiographically as lateral center edge angle $> 40^\circ$, alpha angle $> 55^\circ$ or presence of a cross-over sign. MRI was obtained on a 3T magnet and read semi-quantitatively for cartilage (0–4), BML (0–3) and other features, using the validated Hip OA MRI scoring system (HOAMS). MRI-OA was defined based on modified Hunter et al