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Appraisal | Trial Protocol

Femoroacetabular impingement and hip OsteoaRthritis Cohort (FORCe): protocol for a prospective study

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Abstract

Introduction: Femoroacetabular impingement syndrome is a common cause of hip-related pain in active young adults. It comprises a triad of imaging findings, symptoms and signs, and is usually characterised by extra bone formation at the femoral head-neck junction known as 'cam morphology'. Cam morphology is theorised to create hip impingement in hip flexion activities, place stress on hip joint structures, and increase the risk of hip osteoarthritis over time.

Cam morphology develops during adolescence, but the natural history of, and factors associated with, structural and symptomatic disease progression in young adults with hip-related pain are unknown. Magnetic resonance images (MRI) can be used for semi-quantitative grading of lesions in cartilage, subchondral bone and soft tissues. In order to develop and test interventions that may change the natural history of hip-related pain, factors leading to hip joint deterioration must be identified.

Aims: The primary aims of this project are to: evaluate changes in hip joint structure over a 2-year period in people (football players) with hip-related pain; and determine if baseline measures of potentially modifiable factors (cam morphology, hip contact force, strength, and range of motion) predict structural decline over 2 years in people with hip-related pain. The secondary aim of this project is to determine if changes in hip-related quality of life over 2 years are related to changes in joint structure in people with hip-related pain. Additional investigations are outlined in the full protocol.

Design: Prospective cohort study conducted over two sites (Melbourne and Brisbane, Australia). Outcomes (imaging and symptoms) are measured at baseline and 2 years (follow-up). Risk factors are measured at baseline.

Participants and Setting: Two hundred participants fulfilling clinical findings indicating hip-related pain: aged 18 to 50 years; playing Australian rules football or soccer, with > 6 month history of hip and/or groin pain; symptoms indicative of impingement; and hip-related pain > 30 and < 80 on a 100-mm visual analogue scale.

Primary outcome measure: hip joint structure (baseline and 2-year follow-up)

From 3-T MRI, the Scoring Hip Osteoarthritis with MRI (SHOMRI) classification will be used to score seven features: cartilage loss, bone marrow lesions, subchondral cysts, labral abnormalities, loose bodies, joint effusion, and ligamentum teres abnormalities.

Primary predictor variables:

Cam morphology severity (baseline): the alpha angle will be measured from antero-posterior pelvis and Dunn 45° radiographs using a reliable semi-automatic statistical shape modelling approach.

Hip contact force (baseline): hip contact force during walking will be calculated using a three-dimensional computer-based musculoskeletal model implemented in OpenSim (see full protocol for further details).

Hip strength and range of motion (baseline): hand held dynamometry will be used to evaluate hip muscle strength.

A goniometer or digital inclinometer will be used to measure hip rotation and flexion range of motion.

Secondary outcome measure: hip-related quality of life (baseline, 6-month, 1-year and 2-year follow-up)

The International Hip Outcome Tool-33 (iHOT-33) will quantify hip-related quality of life.

Secondary predictor variable: change in the SHOMRI score

Changes in the SHOMRI score between baseline and the 2-year follow-up time point will be the predictor variable for the secondary aim.

Other variables to be included as covariates:

Body size: height and weight

Acetabular morphology: acetabular dysplasia and pincer morphology from radiographs

Physical activity participation: from patient report outcomes and daily steps measured with the Fitbit© in a subset of participants.

Data analysis plan: The independent association between change in SHOMRI score over 2 years and baseline measures of cam morphology, hip contact force, muscle strength and range of motion will be assessed using multivariable linear regression adjusting for potential confounding factors. Data will be transformed as necessary. Nonlinear associations will be explored and piecewise/fractional polynomial modelling used as appropriate. Estimates of association will be presented as standardised and unstandardised regression coefficients with 95% confidence intervals. Linear regression will be used to assess the strength of association between change in SHOMRI score and change in quality of life measures (iHOT-33) over 2 years.

Discussion/significance: The primary outcome will determine the amount and type of deterioration in hip joint structure in people with hip-related pain, and whether modifiable factors can predict deterioration in hip structure. If modifiable factors can be identified early in the disease process, and in younger adults (< 50 years), the potential to address these factors and reduce the impact of hip OA will be substantial.

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