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ALTERED JOINT LOADING DURING GAIT IS ASSOCIATED WITH HIP JOINT ABNORMALITIES IN FAI PATIENTS

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Summary: Altered sagittal plane loading exists in those with FAI and are related to pain, function and hip joint abnormalities. More specifically, the hip flexion and ankle dorsiflexion moment impulses may be important biomechanical parameters that can be targeted in rehabilitation programs, in order to reduce the onset or progression of hip joint abnormalities and to improve pain and function.

Background: The effects of FAI on lower extremity joint loading during gait and the relationship between joint loading and hip joint abnormalities are not well established and may provide insight into the pathomechanics that exist within the FAI population. Therefore, the purpose of this study was to identify the differences in sagittal plane lower extremity joint loading during gait in subjects with FAI and controls (CONT); and to determine the relationship between joint loading, hip joint abnormalities (assessed with MRI) and measures of pain and function in subjects with FAI. We hypothesized that FAI patients would demonstrate increased joint loading during gait and the magnitude of loading would be related to disease severity.

Methods: Forty-nine participants including 15 pre-surgical FAI patients and 34 CONT were enrolled in this study. All participants underwent biomechanical analyses during walking at a self-selected speed, in order to determine lower extremity sagittal plane joint moments and moment impulses. Joint moment impulse is the integral of a particular joint moment with respect to time. Each FAI patient underwent unilateral MR-imaging of the ipsilateral hip joint and hip joint cartilage lesions, in both the acetabular and femoral cartilage regions, and labrum pathology were assessed using a validated MR-based semi-quantitative method. The HOOS and six minute walk test (6MWT) was used to assess hip pain/function and physical performance, respectively, in both groups. Group differences for demographics, HOOS sub-scores and 6MWT performance were assessed using independent t-tests. Biomechanical parameters were compared between groups using a one-way ANOVA. Within the FAI group, associations between biomechanical parameters with hip joint pathology and HOOS sub-scores were performed using the Spearman's and Pearson's (r) correlations, respectively.

Results: There were no significant differences ($p > 0.05$) in age, gender, BMI, walking speeds or 6MWT performance between both groups. FAI patients reported significantly worse pain ($P < 0.01$) and function ($P < 0.01$) compared to the CONT group. FAI patients exhibited increased hip flexion (HF) moment impulse (FAI: 0.14±0.04Nm·s·kg-1; CONT: 0.11±0.04Nm·s·kg-1; $P = 0.03$), peak ankle dorsiflexion (ADF) moment (FAI: 1.64±0.16Nm·kg-1; CONT:1.46±0.30Nm·kg-1; $P = 0.04$) and ADF moment impulse (FAI: 0.39±0.07Nm·s·kg-1; CONT: 0.31±0.07Nm·s·kg-1; $P = 0.03$) during the stance phase of gait. Also, there were trends towards increased knee extension (KE) moment impulse in the FAI group (FAI: 0.10±0.03Nm·s·kg-1; CONT: 0.08±0.03Nm·s·kg-1; $P = 0.06$). Within the FAI group, an increase in HF moment impulse was associated with increased pain ($r = -0.60$, $P = 0.03$), decreased function ($r = -0.57$, $P = 0.04$) as well as an increase in acetabular cartilage lesions (spearman's =0.82, $P < 0.01$). No associations exist between HOOS sub-scores or hip abnormalities with ankle joint kinetics.

Conclusion: Altered sagittal plane loading exists in those with FAI and are related to pain, function and hip joint abnormalities. More specifically, the hip flexion and ankle dorsiflexion moment impulses may be important

biomechanical parameters that can be targeted in rehabilitation programs, in order to reduce the onset or progression of hip joint abnormalities and to improve pain and function within the FAI population.