

EXTREME MOTION AS A POTENTIAL INITIATOR OF HIP OSTEOARTHRITIS

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Introduction:

A dynamic study of the hip in extreme positions (e.g., split) has never been investigated. It is also unknown if repetitive and extreme motion can lead to early osteoarthritis through excessive cartilage deformations. We present the preliminary results of a prospective study conducted with female professional ballet dancers. The aim of this study is to visualize in 3D extreme ranges of motion of the hip and to detect potential femoroacetabular impingements (FAI), based on computer-assisted techniques.

Methods:

10 volunteers (17-37 yrs) underwent an optical motion capture session. This system allows us to estimate the hip joint kinematics from 3D skin markers trajectories tracked with infrared cameras. The resulting computed motions (6 dancing postures) were applied to patient-specific hip joint 3D models reconstructed from MRI data. While visualizing the dancer's hip joint in motion, a collision detection algorithm was used to locate abnormal contacts between the femur and the labrum. Moreover, the surface-to-surface distance (i.e., penetration depth) was computed in order to estimate the overall FAI. Finally, the simulation results were compared with the radiological analysis.

Results:

For more than 60% of the dancers' hips, lesions were diagnosed in the posterosuperior part of the acetabular rim. The hips did not present any cam or pincer morphology. The simulation showed that strong collisions occurred at extreme hip flexions or abductions between the mid-femoral neck and the superior or posterosuperior acetabular rim. 70% of the labral collisions were located in the superior or posterosuperior area of the acetabular rim and this was correlated with diagnosed labral lesions. The mean penetration depth (std. dev.) was 2.98 mm (2.17 mm).

Conclusion:

Thanks to the use of motion capture, a new kind of FAI ("the mid-femoral neck FAI") has been actively demonstrated in vivo. Repetitive extreme motion could be thus a potential cause for the development of hip pain and osteoarthritis.