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*Publication date:*
2014

*Document Version*
Publisher's PDF, also known as Version of record

# Biomechanical symmetry of a hip joint altered by Perthes' disease

# 181.

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**Background:** Perthes is a disease characterized by a loss of blood supply of the hip joint resulting to malformation of the femoral head. Until now, the underlying biomechanical changes of Perthes' disease need to be further elucidated.
**Purpose / Aim of Study:** The objective of this study was to investigate the changes specifically the biomechanical symmetry of a unilateral Perthes' hip.
**Materials and Methods:** Finite Element (FE) modeling was performed to investigate the biomechanics of a healthy and diseased hip of a unilateral Perthes' case. The image MRI slices were obtained to segment the bones and cartilages, and to build the 3D models. The elastic modulus for the pelvis, femur, cartilages and necrotic bone (Perthes' hip only) were, 5 GPa, 500 MPa, 50 MPa, 20 MPa, respectively. The most distal part of the femur was fixed while the pelvis was displaced to -1.5 mm to simulate load.
**Findings / Results:** The result indicates that the symmetry of the hip joint of the unilateral Perthes' case was altered biomechanically. The highest displacement of the healthy hip occurred at the supero-medial side of the femoral head. On the other hand, in Perthes' hip, the displacement occurred at the superior part of the femoral head and gradually reduced towards the distal part of the femur. Localized contact pressure and stresses were also found in the Perthes' hip.
**Conclusions:** As a mechanical analogy, the healthy hip is experiencing bending load similar to a curved-cantilever beam where the maximum displacement is located at the end. The Perthes' hip resembles a stacked column structure where the load is transmitted through compression. This indicates an aggravation of Perthes' disease because bone overloading by compression around the proximal part might occur. The FE method developed in this study can be used to estimate the prognosis of the Perthes' disease.