EFFECT OF LEG LENGTH INEQUALITY ON HIP KINETICS AFTER TOTAL HIP REPLACEMENT
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Introduction
Following total hip replacement (THR) some patients may experience a residual leg length inequality (LLI). A small number of these cause gait abnormality or pain and are considered symptomatic [Gurney, 2002]. To the authors’ knowledge, the influence of LLI on hip joint contact forces post-THR remains unclear. Although joint forces can be measured using instrumented prostheses, such experiments are invasive and cannot be applied to cohort studies involving large numbers of subjects and so computational modelling serves as an alternative. This study compared the hip contact forces for a cohort of unilateral THR patients who had ongoing symptomatic LLI, with successful asymptomatic THR patients and with a group of normal healthy individuals, with the aim of quantifying the influence of LLI on hip contact forces.

Methods
Following ethical approval, kinematics and force data for 76 participants (23 symptomatic LLI patients with no other orthopaedic complications and > 12 months post-THR, 15 asymptomatic unilateral THR patients and 38 healthy controls) were acquired using an eight camera passive marker system (Vicon MX [T40 cameras], Oxford Metrics, UK & twin Bertec force plates, Bertec Corp, OH, USA.). Motion capture and ground reaction force data were imported into AnyBody multibody dynamics modelling system (version 5.0, AnyBody Technology, Aalborg, Denmark). Inverse dynamics were then computed employing quadratic muscle recruitment. Data are presented as mean plots (+/- 95% CI) for each cohort and the significance of discrete time points in fig 2 calculated using an unpaired t-test. Comparisons of hip contact forces were presented as the total resultant force vector.

Results
Compared with healthy controls and asymptomatic THR patients, symptomatic LLI patients exhibited significantly different hip contact forces during gait, with reduced F₁ and F₃ peaks, a less dynamic pattern and a greater midstance load (Figure 1).

Figure 1: Mean contact force ± 95% CI for LLI patients compared to normal healthy individuals and asymptomatic THR patients.

LLI patients had reduced hip contact forces on the operated limb, compared with the contralateral limb. The difference was significant for the peak value (Figure 2).

Figure 2: Mean contact force ± 95% CI for LLI patients on the operated limb (LLI-O) and non-operated limb (LLI-NO).

Discussion
During normal walking, hip contact forces in symptomatic LLI patients are less dynamic than asymptomatic THR patients and healthy controls. LLI patients load the operated limb less. It is not clear precisely how these altered loading patterns may influence implant wear.

References