

JOINT CONTACT FORCES IN HIGH AND LOW FUNCTIONING TOTAL HIP REPLACEMENT PATIENTS

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Summary: Introduction

In pre-clinical testing of total hip replacement (THR) implants, inter-patient functional differences are usually ignored. Some cohort studies have explored stratification and identified that THR patients function differently [1]. The aim of this study was to better understand the effect of patient characteristics on hip motions and forces.

Methods

140 THR patients, at least 12 months post-surgery, underwent 3D kinematic (Vicon, Oxford, UK) and kinetic (AMTI, USA) analysis whilst walking at self-selected walking speed. From this cohort, two subsets were identified representing low and high functioning patients. The low functioning group (LF) comprised all cases with a gait speed <0.93 m.s⁻¹ (i.e. the cohort mean of 1.1m/s ≤ 1 SD) and the high functioning group (HF) comprised cases walking ≥ 1.26 ms⁻¹. Joint contact forces (JCF's) were calculated through multibody modeling (AnyBody Technology, Aalborg Denmark). Comparisons were made between groups using descriptive statistics and 95% confidence intervals (CI).

Results

Nineteen patients (12 male, age 68.7 \pm 6.7 years, BMI 27.3 \pm 3.0) were HF and nineteen patients (6 male, age 77.0 \pm 5.9 years, BMI 28.3 \pm 4.8) were LF. The LF group exhibited reduced total joint excursion for sagittal plane hip motion, 31.89° (CI 29.19 to 34.58) compared to 36.93° (CI 34.50 to 39.39) for the HF group. LF patients demonstrated reduced GRF's, which was reflected in the hip moments. Peak resultant hip contact forces were 318.9N/BW in the LF group compared to 369.8N\BW in HF cases. The characteristic double hump pattern usually seen was present in the HF group but absent in the LF group.

Discussion

There were systematic kinematic and kinetic differences between the groups, which contribute to differences in modeled JCF's. The HF patients achieved hip extension, absent in the LF group, who also had reduced sagittal ROM and adduction angle, consistent with previous literature [1]. The JCF's were non-normal in the LF group compared to the HF. THR patients are heterogeneous and preclinical testing should reflect differences better than currently required by the ISO-14242 standard.

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References

[1]Bennett et al. Gait Posture. 2017 Mar; 53:173-178