

Biomechanical analysis of lower limb for patients with hip replacement surgery post-operatively in 6 years

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INTRODUCTION

Total hip replacement (THR) is one of most routine surgeries for orthopaedic patients (Figure 1). Gait analysis for hip surgery is not routinely carried out in clinical practice. Although some studies have detected gait changes at the lower limbs, little research has focussed on the kinetic changes that occur post-operatively at the hip, knee and ankle joint. Therefore, the aim of this study was to investigate the post-operative 3D gait changes in the lower limb joints in patients with THR.

METHODS AND MATERIALS

59 patients with THR (aged 50-87 and weighing 54-113 kg) were collected for the study, and a group of healthy individuals was also collected as a control group. Gait was measured using Vicon motion capture system, force platforms and EMG devices. The gait data from patients were obtained in follow up between 1 to 6 years. The biomechanical variables from the gait data were spatial-temporal variables, joint kinematic and kinetic variables, e.g. angle, force, moment and power.

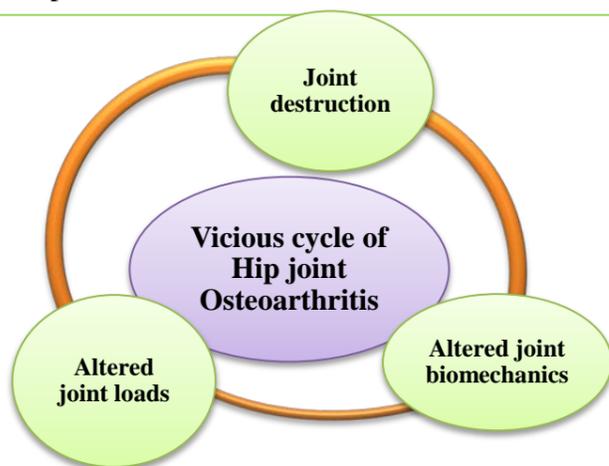


Figure 1. Hip joint changes during development

Data collection:

- Anthropometric measurements
- Marker placement
- Electromyography (EMG, TMSi®) positioning
- Vicon® Workstation and Nexus Software
- Kistler® Force platforms
- Statistical analysis (SPSS software)
- Comparison between orthopaedic patients and normal people during gait
- Data collection was done by WR in the clinical gait analysis lab.

RESULTS

The results showed that walking speed and stride length were significantly reduced when compared to the healthy normal group. The results showed that the range of joint moments in the operative hip were reduced approximately 14% in year 1-3 and 6% in year 4-6 when compared with healthy group ($p < 0.05$), i.e. improving over time. In the ankle joint, the range of moments were reduced by 8% in year 1-3 and 13% in year 4-6 respectively when compared with the healthy group ($p < 0.05$), i.e. not improving over time. In the knee joint, the moments did not change significantly when compared with the healthy group. The results showed that the range of joint forces in the operative hip reduced approximately 19% in year 1-3 and 16% in year 4-6 when compared with the healthy group ($p < 0.05$), i.e. slightly improved. In the ankle joint, the range of joint forces were reduced by 9% and 12% in year 1-3 and 4-6 respectively when compared with the healthy group ($p < 0.05$), i.e. not improving over time. In the knee joint, the range of joint forces reduced by 7% in years 1-3 and increased by 16% in 4-6 years when compared with the healthy group ($p < 0.05$) as Figures 2-3.

DISCUSSION

The range of moment and forces in the hip, knee and ankle from THR are reduced when compared with the healthy group. Regarding clinical practice, the lower limb kinematics and kinetics in THR are acceptable, because patients with THR are still able to walk very well although speeds are slower and joint moment/force is less than seen in the healthy group.

ACKNOWLEDGEMENTS

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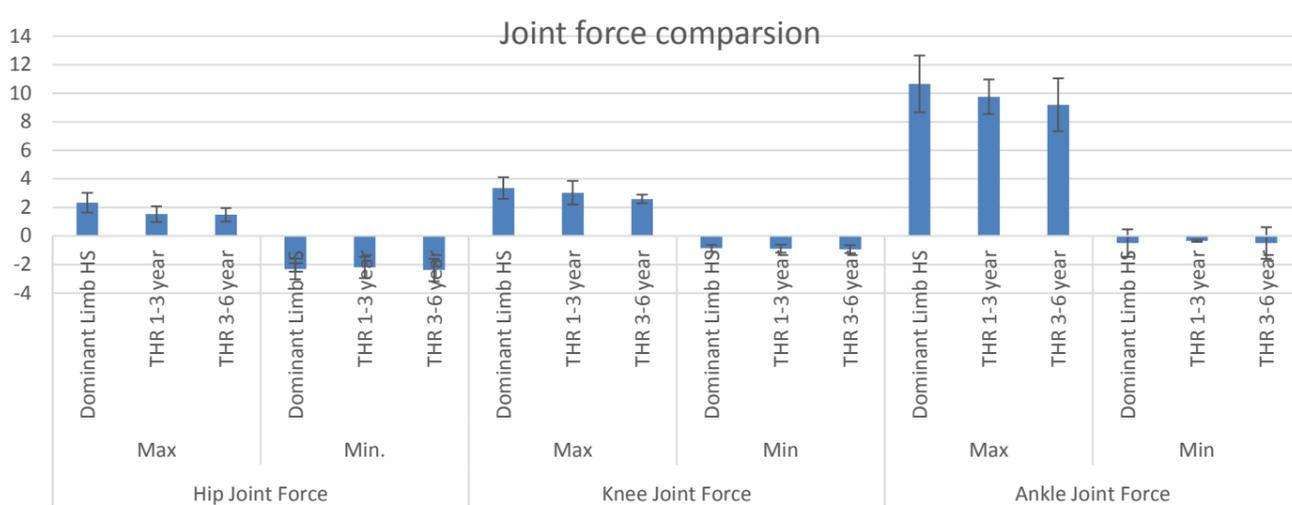


Figure 2. Joint force (N/BW) after operation THR

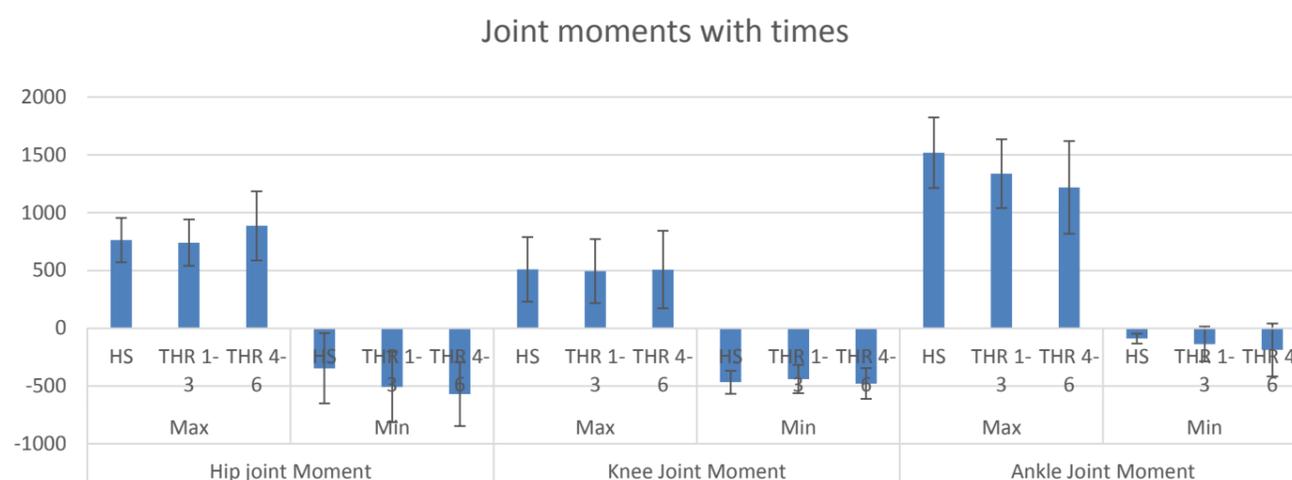


Figure 3. Comparison of joint moments (Nmm/kg)



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