Introduction

Unilateral knee osteoarthritis (OA) mostly affects the medial compartment [Ahlbäck1968]. In order to prevent further progression of OA, gait modifications aim to reduce the medial knee joint load. Several studies investigated the effects of gait modifications but found controversial results [Simic et al. 2011]. The aim of this study was to gain a better understanding of the effects of gait modifications on the internal knee contact loading.

Methods

The study was approved by the local Ethics committee. Three subjects (3 male, age 63-75 years) with instrumented knee implants [Heinlein et al. 2007] gave written informed consent to participate in this study. Each subject performed walking trials, modifying their gait by contralateral cane use, lateral trunk lean, as well as toe-out and toe-in. Fifty consecutive gait cycles were collected for each gait modification. Peak medial knee forces ($F_{med}$) were telemetrically measured and computed as percent of the patient’s body weight (%BW) and then averaged intra-individually. These values were then compared to those during normal walking, using a Students-$t$-Test for unpaired samples.

Results

$F_{med}$ exhibited two peaks during the stance phase of gait. The second peak of $F_{med}$ was significantly reduced by 16% during cane use (average of 3 subjects) and by 6% during toe-out (Figure 1). The reductions during toe-in were 11% on average, but not significant in all subjects. The modifications had inverse effects between subjects: A lateral trunk lean led to a decrease of both peaks of $F_{med}$ in subject 1, but increased the knee force in subject 2. Subject 3 showed a decrease in the first peak and a subtle increase in the second peak. During the lateral trunk lean, the load was shifted towards the lateral compartment.

Discussion

Contralateral cane use and out-toeing appear to be effective methods to reduce the second peak of $F_{med}$, although the effects were not observed consistently in all subjects. A lateral trunk lean led to a shift of the force towards the lateral compartment but in one subject it was accompanied by an increase of $F_{med}$. Subjects possibly use various strategies to realise the modifications and therefore cause different effects on the knee forces. Therefore, quantification of the kinematics is needed to understand the underlying mechanisms. However, due to the small sample size, the significance of the preliminary data is limited and additional subjects are currently being measured.

References