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Increased joint range of motion variability during gait in patients with diabetes and peripheral neuropathy

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Background: Patients with diabetes have previously been identified to show increased stride time and length variability during gait. Variability of gait characteristics has in general been linked to an increased risk of falling in this population. High variability in other parameters such as lower limb joint ranges of motion (JRM)) during gait may increase the likelihood of foot positioning errors, especially during tasks that require accuracy of stepping such as stair negotiation. This increased JRM variability would therefore represent a risk factor for falls. The aim of this study was to investigate lower limb JRM variability during a range of gait tasks. **Methods:** 3 groups: 1. patients with diabetes and peripheral neuropathy (DPN; mean age: 56 years; $n=5$), 2. patients with diabetes but no/mild neuropathy (DM; mean age: 61 years; $n=5$) and 3. non-diabetic controls (Ctrl) (mean age: 50 years; $n=5$). Participants walked over level ground and also ascended and descended a staircase in the gait laboratory. A motion analysis system was used to provide JRM data for the lower limb joint. Ankle, knee and hip joint ranges of motion in all three planes were assessed within and between repeated gait trials for all three gait tasks. Variability in the JRM was tested for all three lower limb joints in all planes, across all gait tasks, using principal components analysis. **Results:** Variances were found to be unequal across the three participant groups (Bartlett's test: $K\text{-squared} = 54.48$, $df = 2$, $p < 0.001$), indicating an increased within- and between-trial JRM variability in the DPN group compared to DM and Ctrl groups. **Conclusions:** These preliminary results show that patients with DPN are much more variable in the range of motion their lower limb joint move through during gait. This is taking into account all three planes for ankle, knee and hip joints across the gait tasks of level walking, stair ascent and stair descent. This increased variability in JRM of motion is thought to be of particular concern for stair negotiation, where stepping accuracy is particularly important. This increased JRM variability in patients with DPN should be considered as an important risk factor contributing to the likelihood of falling.

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