TACSM Abstract

Effect of Diabetic Peripheral Neuropathy on Antagonistic Muscle Coactivation in Older Adults During Stand-to-Sit tasks.

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ABSTRACT

Diabetic peripheral neuropathy (DPN) affects sensory afferents, causing a greater rate of falling in older adults with DPN than in healthy older adults. During transition tasks, such as the stand-to-sit (StandTS), feedback from the proprioceptive system is essential to control coactivation of antagonistic muscles, in order to control the movement of the center of mass. However, the effect of DPN on coactivation of antagonistic muscles is not well understood. **PURPOSE**: To assess the effects of DPN on coactivation of antagonistic muscle pairs across the ankle, knee, and hip joints in older adults with DPN compared to healthy controls. **METHODS**: Four older adults with DPN (72 ± 10 yrs) and 6 healthy age-matched older adults (70 ± 10 yrs) participated. Surface electromyographic activity was recorded bilaterally from the tibialis anterior (TA), soleus (Sol), peroneus longus (PRL), rectus femoris (RF), biceps femoris (BF), adductor longus (ADL), gluteus maximus (Gmax), and gluteus medius (Gmed). Movement velocity during the StandTS were recorded with Vicon cameras. Seat contact (StandTS termination) was identified with the Bertec force plates mounted under the chair. All participants performed 3 trials of the StandTS, following by 3 maximal voluntary isometric contractions for each muscle group. The coactivation index of the ankle (TA-Sol), knee (RF-BF), and the hip (RF-Gmax, ADL-Gmed) muscles were calculated. A multivariate analysis of variance with Bonferroni post hoc testing was used to assess differences between the DPN and healthy groups. **RESULTS**: The velocity of the StandTS tasks was not significantly different between the DPN (0.3 ± 0.4 *m/s*) and healthy control (0.4 ± 0.2 *m/s*) groups. The DPN group (14.5 ± 0.9) had significantly lower coactivation than healthy control (49.9 ± 4.1) as we compare the left ankle (TA-Sol) coactivation between both groups ($P=0.001$). However, no significance was found for the right leg as we compare the ankle coactivation between DPN and healthy control. Comparing the right and left leg in the DPN group showed that the left knee, coactivation (33.3 ± 3.9) was significantly lower than in the right knee (45.8 ± 0.8, $P = 0.048$). No significant differences were found for coactivation between the left and right leg in the healthy group and no differences were found at the hip for the left and right legs. **CONCLUSION**: Our results indicated that senior adults with DPN have lower coactivation than healthy control in the ankle joints. DPN affects most distal limbs, affecting co-activation in the ankle joints. Previous studies showed that DPN increases the stiffness of the ligaments and tendons, leading to increase the ankle passive stiffness. Increase in ankle passive stiffness reduces the reliance on antagonistic co-activation in order to decrease the joint moment. This leads to lower antagonistic co-activation in the DPN group compared to healthy control during StandTS tasks. Finally, the co-activation index was significantly different between left and right ankle in older adults with DPN whereas it is not different for healthy control group. These results demonstrate that DPN affects the left and right leg differently, leading to a difference in ankle muscle co-activation.