Principle Investigator

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Statistical Analysis Plan

Ankle joint kinematics and kinetics were calculated in OpenSim using the collected three-dimensional motion capture and the ground reaction forces. The joint kinematics and ground reaction forces were filtered using a low pass fourth order recursive Butterworth filter with a cut-off frequency of 6 Hz before being used to calculate joint kinetics. The ground reaction forces were collected using two force places associated with the instrumented treadmill (Bertec Corp, Columbus, USA) collected at 1200 Hz. The resultant joint kinetics were then further filtered using the same filtering parameters. Joint power was calculated as the product of the joint moment and joint angular velocity.

EMG was collected using wireless EMG sensors (Delsys Trigno, MA, USA). A sensor was placed on the soleus (SOL) muscle belly 2/3 of the distance between the medial condyle of the femur to the medial malleolus. We computed the linear envelope for each EMG signal by demeaning, bandpass filtering between 380 and 15 Hz (fourth-order Butterworth), and then low pass filtering the rectified signal with a cutoff of 7 Hz.

For EMG analysis, the integrated soleus muscle activity was computed during the last 50% of stance phase, and the integrated vastus lateralis EMG activity was quantified during the entire stance phase. To calculate the metabolic cost of transport, the standing baseline metabolic rate for each participant and each trial was subtracted from their walking metabolic rate to estimate the net metabolic rate of walking. Next, we normalized the net metabolic rate of walking by each participant's body mass and walking speed to calculate the metabolic cost of transport, averaged over the last two minutes of each condition. To quantify peak ankle push-off power, we identified the maximum ankle and hip power during the last 50% of the stance phase for each step.

To evaluate changes in our outcome measures, we used paired T-tests to test for differences in each outcome variable between the adjustable stiffness AFO and shod walking conditions. We tested for sphericity using Mauchly's test and used the Greenhouse-Giesser correction if data did not meet the sphericity assumption Sidak adjusted p-values were used to reduce the chance of type I errors; the alpha level was set to .05. Partial eta squared was used to estimate effect size.