

Influence of stair descent strategies and step height on centre of mass and gait kinetics in the elderly

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Introduction:

Age-associated alterations in balance mechanisms and deteriorations in muscle strength may necessitate alternate stair descent strategies to ensure safe negotiation. The aim of the study was to compare the influence of increased step height and stair negotiation strategies; step-over-step (SoS) and step-by-step (SbS) on gait patterns in the elderly.

Methods:

Eleven elderly participants descended a four step custom built instrumented staircase at a self-selected speed. Participants descended using a SoS or SbS strategy on two step configurations: a rise height of 170mm (STD) and a rise height of 255mm (INC). A 3D motion analysis system synchronised with force platforms embedded into the staircase, was used to capture whole body centre of mass (CoM) velocity, acceleration and kinetic data of the leading limb.

Results:

Compared to STDSoS, STDSbS resulted in reduced CoM vertical (-0.48m/s vs -0.09m/s) and A/P velocity (0.50m/s vs 0.21m/s) during late stance and swing transition with similar reductions in vertical and A/P velocity in INCSoS vs INCSbS (-0.67m/s vs -0.11m/s and 0.49m/s vs 0.23m/s). INCSoS resulted in increased plantarflexor (1.10Nm/kg vs 1.45Nm/kg) and hip extensor moment (-0.08Nm/kg vs 0.43Nm/kg) compared to STDSoS with no differences seen in SbS strategy.

Discussion:

An alternate stair descent strategy offers greater CoM control in the potentially dangerous transition between stance and swing. Concurrently, the tandem double stance period negates the need for increased muscle moments in late stance required to eccentrically control the falling body mass in the traditional SoS strategy. SbS could offer increased CoM control and stability during stair descent.