

CAN WALKING AIDS IMPEDE COMPENSATORY STEPPING?

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Introduction:

Although assistive devices such as walkers and canes are often prescribed to aid in balance control, some studies have suggested that such devices may actually increase risk of falling^{1, 2}. In this study, we investigated one possible mechanism: the potential for walkers or canes to interfere with, or constrain, lateral movement of the legs and thereby impede execution of compensatory stepping reactions during lateral loss of balance. Such compensatory stepping reactions are likely to be the only recourse in situations where the stabilizing force that can be generated by loading the device is insufficient to recover equilibrium.

Methods:

Compensatory stepping reactions were evoked, in ten healthy young adults (22-27 years), by sudden horizontal translation of a large (2mx2m) moveable platform. Perturbation direction (forward, backward, left, right) was varied unpredictably, and subjects were instructed to do whatever came naturally to prevent themselves from falling. Subjects used no assistive device, or held and loaded a walking frame or cane (instrumented to monitor loading) prior to perturbation. The cane and walker pre-perturbation loading levels were 10 and 20% of body weight, respectively. Reactions to m-l perturbation were analyzed, using video recordings to characterize the limb

movements and to determine medio-lateral (m-l) and antero-posterior (a-p) step length. Analyses focussed on the most frequent types of steps: counterlateral, side-step sequence and crossover steps (as defined in previous studies³).

Results and discussion:

Collisions between the swing foot and device were very common during the walker task, occurring in over 60% (65/103) of stepping reactions. Such collisions also occurred in 14% (16/115) of stepping reactions when using the cane. For both cane and walker, collision led to a 50% reduction in absolute m-l step length, on average, when compared to no-collision trials ($p < 0.05$). It appeared that subjects were able to avoid collision (and increase m-l step length) in no-collision trials by moving the swing foot forward or backward. This was most evident in walker trials: average absolute a-p step length in no-collision walker trials was larger by a factor of three in comparison to trials where collision occurred, and was twice as large as that occurring in no-device trials. It is also possible that collision was sometimes avoided by moving the cane laterally (15%, 18/120, of cane trials); however, attempts to lift and move the walker occurred in only three trials and all three attempts resulted in collision with the stance foot.

The observed collisions between the swing foot and mobility aid support the hypothesis

that walkers and canes can impede compensatory stepping. Subjects were sometimes able to avoid such collisions by increasing the a-p foot displacement or by lifting and moving the cane; however, swing-foot/device collisions were still remarkably frequent, particularly when using a walker.

Furthermore, such collisions appeared to alter the step characteristics, leading to a 50% reduction in m-l step length. The fact that compensatory stepping behavior was altered significantly in such a young and healthy cohort clearly demonstrates some of the limitations inherent to the design of these assistive devices. Ongoing studies with older adults are likely to yield even more compelling evidence that such devices, as currently designed, can actually jeopardize postural stabilization.

Summary:

Our study indicates that the use of an assistive device significantly alters compensatory stepping reactions among our healthy population. These findings clearly demonstrate some of the limitations inherent in the use and/or design of such assistive devices. It appears that these devices, as currently designed and utilized, may present a serious safety hazard to the user.

References:

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