PERFORMANCE OF ATTENTION-SPLITTING TASKS HAS DIFFERENT EFFECTS ON STATIC AND DYNAMIC STABILITY

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INTRODUCTION

Static and dynamic postural control requires allocation of attentional resources. Dual task, or attention splitting paradigms have been used to measure the influence of imposing secondary information processing tasks on postural control. Compared to the body of literature related to the influence of attention-splitting tasks on static postural control, there are substantially fewer studies related to performance of dynamic stability.

The purposes of this project were to determine if measures of static and dynamic stability are statistically correlated to one another and to determine if the performance of an attention-splitting task similarly influences measures of medial-lateral static and dynamic stability.

METHODS

Twenty healthy young adults participated in two separate protocols. One protocol assessed static postural stability with and without the addition of an attention splitting task. The second protocol assessed dynamic stability during locomotion on a motorized treadmill; also with and without the addition of an attention splitting task.

The attention-splitting task consisted of maintaining a light beam from a handheld laser pointer within a 10 cm circular target placed approximately six feet in front of the subjects and approximately three feet off the floor.

During the trials that assessed static postural stability, subjects stood quietly on a force plate for three randomly ordered conditions. During condition 1 the subjects stood comfortably with their arms at their side while gazing at the 10 cm circular target. During condition 2 the subjects were instructed to aim a hand-held laser pointer at the target but without activating the laser pointer. During condition 3 the subject activated the laser pointer and attempted to maintain the laser beam within the 10 cm circle. The dependent variable of interest was postural sway amplitude in the medial-lateral direction.

During the trials that assessed dynamic stability, subjects walked on an instrumented treadmill at a self-selected velocity. Similar to the static postural stability trials there were three, randomly ordered, experimental conditions. Each condition lasted approximately 10-minutes during which at least 200 consecutive steps were collected. During condition 1 the subject walked with no restrictions at their self-selected velocity. During condition 2 the subjects were instructed to aim the inactive hand-held laser pointer at the target. During condition 3 the subject activated the laser and attempted to maintain the beam within the 10 cm circle. The dependent variable of
interest was the variability of step width (Owings and Grabiner, in press).

The effect of the attention-splitting task on static and dynamic data was analyzed separately using 3 way repeated measures multivariate ANOVA. Post hoc multiple comparisons were conducted using Bonferroni-adjusted paired t-tests.

The relationships between measures of static and dynamic postural stability were measured using Pearson correlation coefficients.

RESULTS
During conditions in which subjects did not hold the laser pointer, the relationship between static and dynamic stability was moderate ($r=0.53$, $p<0.05$). However, during the conditions in which attentional resources were directed at controlling the activated laser pointer, the correlation value was weak and did not achieve significance ($r=0.43$, $p>0.05$, respectively).

Performance of the attention-splitting task did not significantly influence static postural stability ($p=0.197$, Figure 1). Performance of the attention splitting task significantly influenced dynamic stability ($p<0.001$, Figure 1). Post hoc multiple comparisons revealed that dynamic stability during the condition performed with the activated laser was significantly smaller than the other two conditions. The dynamic stability of the control condition and the condition performed with the inactivated laser pointer were not significantly different from one another ($p=0.961$, Figure 1).

DISCUSSION
The results suggest that in young subjects, the relationship between measures of static and dynamic stability are moderate, at best, during conditions in which attention is not diverted and that performance of an attention splitting task dissimilarly influences measures of static and dynamic stability.

The finding that an attention-splitting task was associated with a decrease in the measure of dynamic stability may be consistent with an increased level of control.

Aging has generally predictable effects on measures of static stability and, to some extent, dynamic stability. Further study of the relationships between static and dynamic stability during conditions in which attention is diverted seems warranted in light of the need for effective and efficient means by which fall risk can be predicted and prevented.

REFERENCES