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Interaction of motor and cognitive functions relevant to dual task costs are related with automaticity of postural control

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INTRODUCTION:

It is well known that motor and cognitive functions decline with age (1). Dual tasking can affect performance on one or both performance domains, but the opposite is also observed (2). For example, there are cases where the performance on a dual task balance test is unaffected but even improved (3) which may be explained by higher automaticity of balance control. Therefore this study aimed to investigate automaticity of balance control relations to dual-task costs of postural control.

METHODS:

Sixty-seven males and females aged 60-80 years old participated in the study. To assess balance performance a posturography method with a single piezoelectric force plate was used to measure postural sway activity. Participants were tested barefoot in two stance conditions: double-stance with eyes open (STEO) and Tandem Romberg stance with eyes open (REO).

To estimate the dynamical characteristics of the posturogram, Center of pressure (CoP) velocity vector (V_{cop}) and wavelet entropy (WE_{cop}) were calculated in both the anteroposterior (AP) and mediolateral (ML) directions. Dual task cost (DTC) was expressed as percentage of the differences in the two measures relative to their baseline single task measure. The test of repeated measures of the General Linear Model (GLM) was used to assess the condition effect (dual-task and baseline-task) on the balance performance. The correlations between DTC and both baseline entropy and baseline V_{cop} were calculated.

RESULTS:

We found that higher values of baseline entropy (i.e., better equilibrium ratio) resulted in lower values of DTC in both stance conditions, expressed by positive significant correlations between DTC and baseline entropy in all sway directions: STEOML ($p < 0.001$; $PES = 0.212$; $OP = 0.980$); STEOAP ($p < 0.001$; $PES = 0.338$; $OP = 1.000$); REOML ($p < 0.001$; $PES = 0.240$; $OP = 0.988$); REOAP ($p = 0.002$; $PES = 0.152$; $OP = 0.886$). In contrast to entropy, baseline levels of V_{cop} had no significant effect on DTC (all $p > 0.05$).

CONCLUSION:

Since the regularity of balance behavior is associated with the systems automatic control, it can be argued that better automatic control of balance results in less dual-task loss of postural control.

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Topic: Biomechanics

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