Effect of suprapostural tasks on postural performance: A meta-analysis

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Introduction

- According to the classical "quite stance"-paradigm of research on postural control, quit stance without any sway is the optimal postural solution.
- However, to hold just a quit stance position is rather unusual in everyday life. Normally, some kind of superordinate task or goal has to be fulfilled.
- Stoffregen and his colleagues (Stoffregen et al., 2007) supposed from an ecological point of view that postural control is functionally integrated into a context of action, which is specified by a superordinate task.
- Stoffregen et al. (2007) established the term "suprapostural task" and differentiate between perceptual and cognitive tasks.
- From this point of view, postural performance should be superior (i.e., less sway) if a suprapostural task is given compared to a non-suprapostural task setting.
- We tested this assumption by using a meta-analytic approach.

Objective & Hypotheses

- The objective of this meta-analysis was to answer the following questions: (A) Do suprapostural tasks affect the postural performance negatively or positively (and if so to what extent)? (B) Do the following variables moderate the effect of suprapostural tasks on postural performance (and if so to what extent): Type of suprapostural task, age of subjects, visual condition, and stance condition? (C) We hypothesized that ... (A) ... suprapostural tasks affect the postural performance positively (i.e., less sway). (B) the variables moderate the effect of suprapostural tasks on postural performance significantly.

Methods

- Literature search and inclusion criteria
  A computer based search was carried out using bibliographic databases. As inclusion criteria were defined: (a) postural sway measurement with and without a suprapostural task; (b) crossover design; (c) publication in english german after 1990; (d) adequate data to calculate effect sizes.
- Data extraction and statistical analysis
  A total of 47 studies with 917 participants fulfilled the criteria and was coded independently by two raters with Cohen’s κ > .80. Mean effect sizes (Hedges’ g) were computed using the random effect-model and analyzed in terms of significance (Z), homogeneity (Q), and publication bias (Funnel plot, Orwin’s fail-safe N).

Results & Discussion

- Overall effect
  In fact, suprapostural tasks improve postural performance significantly, g = 0.35, with Z = 3.81, p < .001. Postural sway is reduced in settings in which a suprapostural task is given compared to settings in which a suprapostural task is not given. Thus, the first hypothesis is confirmed.

- Subgroup analysis
  Results of subgroup analysis showed that the variables "Type of suprapostural task" and "Age of subjects" moderate the effect of suprapostural tasks on postural performance. The sway-reducing effect is significantly greater for predominantly perceptual tasks (g = 0.84) than for predominantly motor tasks (g = 0.31). Suprapostural tasks of predominantly cognitive demands have no sway-reducing effect (g = 0.01).

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Similarly, we found a sway-reducing effect of suprapostural tasks only in young(er) adults (g = 0.43), but not in old(er) adults (g = -0.08).

Graph 2. Subgroup analysis I

Furthermore, the effect of suprapostural tasks tends to be greater under eyes closed-condition (g = 0.49) than under eyes open-condition (g = 0.34), and for unipedal stance (g = 0.64) than for bipedal stance (g = 0.35).

Graph 3. Subgroup analysis II

Discussion

Overall, results of this meta-analysis support the ecological approach to human postural control.

Reference