

Effects of a cognitive task on sway and postural reflex activity during standing

B.L. Julien and A.P. Bendrups, School of Human Biosciences, La Trobe University, VIC 3086, Australia.

We investigated the effects of a cognitive task, the Stroop Test, on the postural reflex activity and sway of eleven healthy adults using a protocol which controlled for the confounding factors of visual fixation and articulation. The Stroop Test consists of the words red, green and blue printed in incongruent ink (e.g. "red" printed in green); the task is to respond with the colour of the ink and not to read the word. Subjects performed the Stroop Test or a control reading task when either standing at ease with a wide base of support (BOS) or standing still with a narrow BOS. A measure of postural reflex activity was provided by stiffness at the ankle using a modified version (see Ho & Bendrups, 2002) of the protocol developed by Fitzpatrick *et al.* (1992). Ankle stiffness values were obtained from recordings of ankle torque and ankle angle in response to unperceived forward pulls and expressed as a ratio of the load stiffness, yielding the 'reflex stiffness' (see the Table). Postural sway was obtained from the SD of the body position data (see the Table). Under both postural conditions, mean sway was significantly lower during Stroop Test performance compared to control (two-way repeated measures analysis of variance, $p = 0.007$). There was no significant effect of the Stroop Test on mean reflex stiffness under either postural condition.

Postural condition	Measure	Control	SD	Stroop	SD
Ease with wide BOS	Sway (deg)	0.122	0.042	0.100	0.032
	Reflex stiffness	1.38	0.301	1.63	0.480
Still with narrow BOS	Sway (deg)	0.115	0.038	0.104	0.036
	Reflex stiffness	1.61	0.488	1.58	0.420

Subsequently, physiological and psychological variables were recorded in subjects performing the Stroop Test while seated, to seek an explanation for the between-subject variability in reflex stiffness. Increased heart rates during Stroop Test performance suggest that this task increased physiological arousal. The subjective difficulty of the Stroop Test influenced the direction of its effect on stiffness when subjects stood at ease with a wide BOS: subjects who rated the Stroop Test as being difficult had decreased stiffness and those who rated the Stroop Test as easy had increased stiffness. Both respiration rate and resting gastrocnemius activity were correlated with changes in sway during Stroop Test performance. Subjects with higher respiration rates when seated had greater postural sway when standing still with a narrow BOS, consistent with Jeong (1991). Subjects with higher gastrocnemius activity while seated had increased sway when standing at ease with a wide BOS, suggesting that this increased muscle tone may have had a destabilising effect. We hypothesised that there would be an inverse relation between stiffness and sway. However, the results show that performing the Stroop Test improved postural stability (decreased sway) without necessarily increasing stiffness.

Fitzpatrick R, Taylor J & McCloskey D. (1992) *Journal of Physiology*, **454**: 533-47.

Ho CY & Bendrups AP. (2002) *The Journals of Gerontology Series A, Biological Sciences and Medical Sciences*, **57A**: B344-50.

Jeong BY. (1991) *Archives of Physical Medicine and Rehabilitation*, **72**: 642-5.