

Modulation of the cutaneous silent period in the upper-limb with whole-body instability

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Abstract

The silent period (CSP) induced by cutaneous electrical stimulation of the digits has been shown to be task-dependent, at least in the grasping muscles of the hand. However, it is unknown if the CSP is adaptable throughout muscles of the entire upper limb, in particular when the task requirements are substantially altered. The purpose of the present study was to examine the characteristics of the CSP in several upper limb muscles when introducing increased whole-body instability. The CSP was evoked in 10 healthy individuals with electrical stimulation of digit II of the right hand when the subjects were seated, standing, or standing on a wobble board while maintaining a background elbow extension contraction with the triceps brachii of ~5% of maximal voluntary contraction (MVC) strength. The first excitatory response (E1), first inhibitory response (CSP), and second excitatory response (E2) were quantified as the percent increase from baseline and by their individual durations. The results showed that the level of CSP suppression significantly decreased ($52.3 \pm 7.7\%$ to $66.2 \pm 13.2\%$ of baseline, $p = 0.019$) and there was a trend for the CSP duration to decrease ($p = 0.053$) in the triceps brachii during the wobble board task. For the wobble board task the amount of cutaneous afferent inhibition of EMG activity in the triceps brachii decreased; which is proposed to be due to differential weighting of cutaneous feedback relative to the corticospinal drive, most likely due to presynaptic inhibition, to meet the demands of the unstable task.