

Postural Adaptation on in Cerebellar Disorders

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The ability to flexibly adapt one's postural orientation and equilibrium is important for sports and activities of daily living. One method of studying postural adaptation is to perturb the sensorimotor set of subjects and observe how they adapt their response. In Experiment 1, we applied somatosensory conditioning by having subjects stand blindfolded on a toes-up inclined surface for several minutes (inclined phase) followed by stance on a level surface (post-inclined phase). In healthy adult subjects, a range of postural adaptation was observed in the post-inclined phase. On one extreme, responder subjects showed a large aftereffect of the prior inclined stance by leaning their body forward. Non-responder subjects did not display the aftereffect. Instead, they remained standing upright. Individuals diagnosed with a cerebellar disorder adapted normally but all presented with high postural sway variability during the post-incline phase. In Experiment 2, subjects stood on a surface which moved, causing them to react so as not to lose their balance. Somatosensory conditioning was induced by moving the platform backwards for seven consecutive trials followed by seven rotation (toes-up direction) trials. Maintaining balance during the backward translations required gastrocnemius muscle activations while toes-up rotations induced tibialis anterior muscle activities. In healthy subjects, these muscle activities are decreased when subjects lightly touched a rigid immovable support with their fingertips. Cerebellar subjects however, showed hypermetric responses to the platform perturbations and with higher variability in onset latency and response amplitudes when compared to control subjects. The hypermetric responses indicate that the cerebellum is critically involved in modulating postural muscle gain in response to platform perturbations, more specifically in tuning down muscle responses. It remains to be studied whether long-term somatosensory conditioning is an effective method of rehabilitation to decrease the variability of onset latency and response amplitude in subjects with a cerebellar disorder.

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