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Postural control in older adults - Behavioral and neural adaptations to balance training

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Normal aging is accompanied by changes in the neural control of posture leading to deteriorations in postural stability and thus increasing the risk for falls in older adults. In fact, about one third of people over the age of 65 years fall at least once a year and this rate increases rapidly with age. A fall often has serious health implications for the person concerned. The age-related changes notably lead from a largely automatized to an increasingly conscious control of posture with an increasing contribution of cortical structures. Consequently, postural control becomes more attention-demanding in older adults. This is particularly obvious in so-called dual-task situations where attentional resources need to be shared between a postural and one or more additional tasks. Older adults show greater performance decrements in such dual-task situations, which further increase the fall risk in these situations. There is evidence that postural control can be improved by balance training. Much less is known, however, about the neural adaptations – especially in older adults – underlying these behavioral improvements. It was, therefore, the aim of the present work to investigate the adaptation mechanisms to balance training in older adults. In our study, the older adults showed tendencies toward an improved postural stability. At the same time, fMRI measurements showed training-related reductions in brain activity during motor simulation of a balance task in areas typically involved in postural control (primary motor, premotor and supplementary motor cortices as well as putamen). In a previous study of our group, including the same sample of older adults, we have shown that these areas are overactivated during performance of postural tasks in older compared to young adults. This suggests that balance training leads to a reduction of the cortical involvement in postural control in older adults – a mechanism that has been proposed previously. Other parameters such as spinal and cortical excitability did not show significant training-related adaptations. Since in young adults, significant adaptations have been demonstrated in these parameters after similar training interventions, we assume that neural adaptations to balance training occur at a slower rate in older adults and that longer trainings are needed in order to induce significant adaptations. Thus, in order to improve our understanding of the effect of balance training on the neural control of posture in older adults (and the time course thereof), longer training studies – ideally with intermediate measurements – including refined and more specific measurement methods are required.