

Cross-modal plasticity after auditory working memory training in people with stroke

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About half of stroke survivors have difficulty in daily activities due to cognitive deficits (Patel, Coshall, Rudd, & Wolfe, 2003). Rehabilitation programs that address cognitive impairments have been found to remediate a broad range of cognitive components including attention, memory and executive function (Leung et al., 2010; Rees et al., 2007; Cicerone et al., 2011). Recent reviews have found that cognitive training using auditory materials is beneficial for stroke patients who have visual-spatial neglect (Cicerone et al., 2011). However, it is largely unclear what mechanisms underlie the observable improvements or transfer of skills after cognitive training.

The present study investigated cross-modal plasticity after a course of auditory working memory training. Two clients with stroke completed auditory *n*-back tasks (1-, 2- and 3-back) in a graded manner for a total of 20 hours over a six-week period. Neuropsychological tests and neural activations on auditory and visual *n*-back tasks (1- and 2-back) were assessed before and after training. The two clients demonstrated different patterns of results. The client with intact fronto-parietal network demonstrated substantial improvement on neuropsychological tests and *n*-back performance. Additionally, the neural activation in the fronto-parietal network subsided after training in both the auditory and visual *n*-back tasks, and there were extensive activations in the cerebellum. In contrast, the client with a large area of damage in the fronto-parietal network showed no evidence of frontal and parietal activation before training, and the performance of the *n*-back tasks was comparatively poor and was mainly supported by temporal lobe activities. The results showed that effective cross-modal transfer after stroke seemed to require an intact fronto-

parietal network. Other regions including the cerebellum and parahippocampus might also contribute to cross-modal transfer. The results also shed light on the need for early cognitive intervention to obtain a better treatment outcome.