

THE ACUPUNCTURE STIMULATION OF TAI CHONG (LIV3) AND HEGU (LI4) INCREASE THE DEFAULT MODE NETWORK ACTIVITY IN ALZHEIMER'S DISEASE

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Introduction: The acupuncture has been used in the therapy of patients with Alzheimer disease (AD), however, its neural underpins is still unclear. The aim of the present study is to examine the acupuncture effect on the default mode network (DMN) in Alzheimer disease (AD) by using resting state functional magnetic resonance imaging (rs-fMRI).

Methods: Twenty-eight right-handed subjects (14 AD and 14 normal controls (NC)) participated in this study. The experiment adopted a single block design with three sub-stages. rs-fMRI data were acquired before and after acupuncture, while during the acupuncture, the procession of acupuncture stimulation on the acupoints of Tai chong (Liv3) and Hegu (LI4) lasted for 3 minutes. The connectivity value of each rs-fMRI session were obtained by independent component analysis (MICA Toolbox, version 1.2, <http://www.nitrc.org/projects/cogicat/>) and then transferred to z-score.

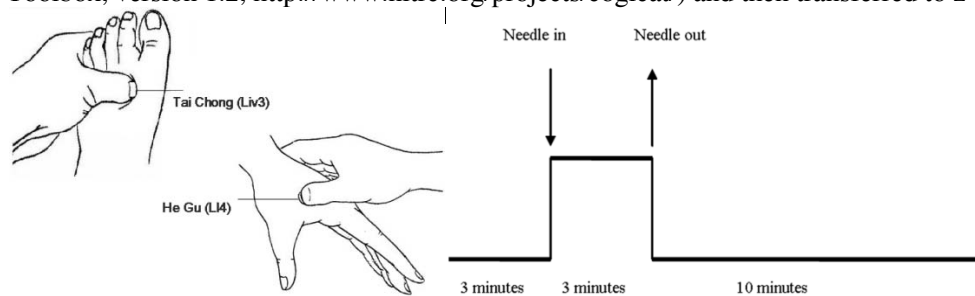


Fig.1 Locations of two acupoints and protocols for acupuncture

Results: The averaged z-score of the connectivity of different brain areas were compared between different group and conditions (Fig. 2). Region of interest (ROI) analysis showed that the impaired DMN connectivity in AD (identified by comparing the pre-acupuncture rs-fMRI of AD and NC groups), specifically the posterior cingulate cortex (PCC) and right superior parietal lobule (SPL), were significantly changed for the better. The figure 3 shows the paired-test results of the connectivity value after transformed to z-score between the two rs-fMRI session (before acupuncture and after acupuncture) for AD. The whole-brain exploratory analysis further demonstrated these results and found some new regions respond to the acupuncture effect on AD, with the medial prefrontal cortex (MPFC), left middle/inferior temporal gyrus (MTG/ITG) together with PCC showed increased within-DMN connectivity; and the bilateral superior/inferior parietal lobule (SPL/IPL) and precuneus (PCu) showed decreased within-DMN connectivity. Moreover, the acupuncture effect on a region located at the left MTG was significantly correlated with individual differences of disease severity as measured by Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) scores.

Conclusion: In conclusion, it was found that the acupuncture stimulation on the acupoints of Liv3 and LI4 could significantly modulate the DMN activity in AD patients. The current finding also suggests that the acupuncture treatment on the relative earlier AD patients might have a better therapy effect.

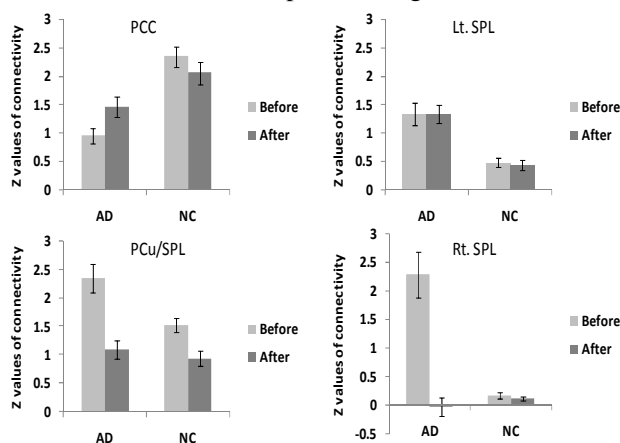


Fig.2 ROI analysis of the regions identified in the between-group comparison of NC and AD before acupuncture, in order to look at their patterns to make sure if they were affected by acupuncture.

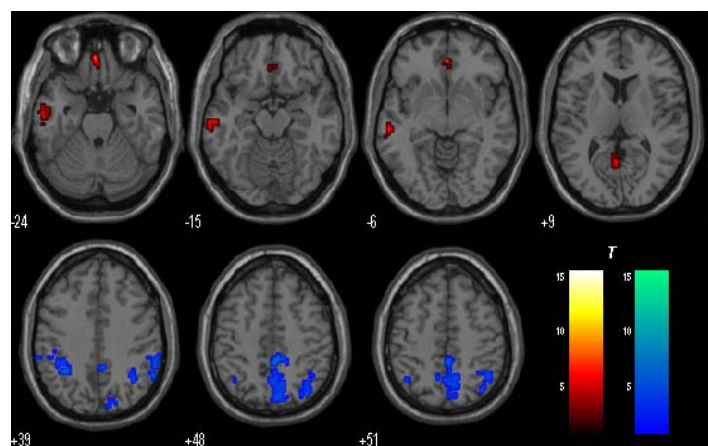


Fig.3 Regions to show the acupuncture effect on AD, based on a paired t-test. The threshold was set to a corrected threshold of $P < 0.05$, determined by AlphaSim. Warm color represents increased connectivity by acupuncture.