

Acupuncture Enhances Brain Activity In MRI Investigation

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Researchers find acupuncture effective for improving alertness and executive functions. In a controlled experiment, researchers tested human subjects by needling one acupuncture point. After completion of acupuncture, the researchers performed the Attention Network Task (ANT) to determine changes in the subjects. The ANT measures reactions to visual stimuli presented on a computer monitor. Subjects use a computer mouse to provide feedback to visual cues. Subjects receiving acupuncture demonstrated significant improvements in their ANT scores. Based on the data, the researchers conclude that acupuncture improves alertness and executive functions.



In another investigation using MRIs of the brain, researchers determined that acupuncture regulates emotions and memory. The results indicate that the regulatory effect of acupuncture on advanced cognitive activities such as emotional and memory disorders is likely due to its two-way regulatory effect on various cerebral zones, by increasing or attenuating their functional connectivity. Let's start with a look at the Attention Network Task (ANT) research and then take a look at the MRI investigation.

Anhui Provincial Hospital researchers (Liu et al.) determined that acupuncture improves executive control network efficiency and improves reaction times. Executive functions are cognitive processes

involved in controlling behavior. The research demonstrates that acupuncture enhances the ability to control behaviors towards the attainment of goals. The results of the investigation were published in the *Chinese Journal of Behavioral Medicine and Brain Science*.

The researchers chose only one acupuncture point for use on all participants receiving acupuncture. The selection of the acupuncture point was based on the results of a prior experiment by Qiu et al., whose findings determined that needling Zusanli (ST36) increases alertness and executive functions. The work of Sun et al. was also influential in the choice of the acupuncture point for use in the study. Sun et al. determined that electroacupuncture at ST36 regulates neurological functions in the prefrontal and temporal lobes of the brain. Sun et al. determined that needling ST36 increases concentrations of dopamine, a neurotransmitter, in the hypothalamus and midbrain.

Acupuncture Procedure

For the experiment, acupuncture was applied bilaterally to ST36 with patients in a seated position. Deep perpendicular insertion of sterile filiform acupuncture needles was applied. Initially, the needle was retained without the application of manual acupuncture techniques. After two minutes, the needles were rotated for an additional two minutes. Next, the needles were retained without rotation for an additional three minutes. Next, an additional two minutes of needle rotation was applied. In the last step, needles were retained without manual stimulation for an additional minute. During rotation of the needles, mild reinforcing and reducing techniques were applied. Based on the results, the researchers conclude that acupuncture improves alertness, executive function, and cognitive control.

MRI Study

In related research, researchers (Han et al.) conclude that acupuncture regulates emotions and memory. A clinical study from the Henan University of Traditional Chinese Medicine and Chinese PLA Information Engineering University determined that acupuncture has a regulatory effect on different cerebral zones by either enhancing or attenuating their functional connectivity with the posterior cingulate cortex. Based on

the data, the researchers determined that acupuncture regulates brain functional connectivity, thereby helping to control emotions and memory.

The researchers studied the effect of acupuncture on the resting state functional connectivity of different cerebral zones within the posterior cingulate cortex in healthy people. Han et al. found that acupuncture on the jueyin pericardium channel led to either attenuated or increased functional connectivity within the posterior cingulate cortex, dependent upon on the specific cerebral zone. Acupuncture produced consistent regulatory effects on the brain's functional connectivity.

The jueyin pericardium channel is an important acupuncture channel commonly selected for the treatment of advanced cognitive dysfunctions related to emotion or memory, such as emotional disorders or memory impairment. Researchers (Zhang et al.) find that acupuncture on the pericardium channel brings about significant changes in the amplitude of low frequency fluctuation (ALFF) signals in the prefrontal cortex, posterior cingulate cortex, amygdaloid, and hippocampal gyrus.

The default mode network (DMN) mainly includes the posterior cingulate cortex, prefrontal cortex, precuneus, inner temporal lobe, and hippocampus. DMN nodes are used to conduct functional connectivity analyses and results of functional connectivity analyses are indicators of the integration and connectivity of the DMN. The DMN involves related areas of the brain for processing information when the brain is not engaged in an active task. The DMN is involved in the conception of oneself and others, including moral and emotional judgements related to actions, as well as ruminations on past and future events. It is made up of a network of distinct areas of the brain connected both anatomically and functionally.

In this study, different cerebral zones showed different degrees of functional connectivity with the posterior cingulate cortex (PCC) during three separate treatment phases. In the rest phase before acupuncture, PCC functional connectivity was enhanced in the precuneus, left limbic lobe, superior frontal gyrus, middle frontal gyrus, hippocampal gyrus, and middle temporal gyrus. During acupuncture, PCC functional connectivity was enhanced in the temporal gyrus and inferior temporal gyrus, and attenuated in the left middle frontal gyrus, inferior frontal gyrus, and right cerebellar lobe. In the rest phase after acupuncture, PCC functional connectivity was attenuated in the superior temporal gyrus and insular cortex.

A total of 14 healthy subjects participated in this study. They received acupuncture therapy and underwent functional magnetic resonance imaging (fMRI) to test functional connectivity. The fMRIs were conducted in three phases: Rest 1 (R1), Acupuncture (AP), and Rest 2 (R2). R1 was conducted before acupuncture, AP during acupuncture needle retention, and R2 after needle removal. For the fMRI testing, a Philips Achieva 1.5T magnetic resonance imaging device was used. During the scan, the patients rested in a supine position on the examination bed and remained conscious. Anatomy imaging and functional imaging were then performed.

Technical Settings

For anatomy imaging, a T1W-3D-FFE sequence was used for T1 structure imaging. The scanning parameters were: FOV = 230 mm x 230 mm, matrix = 256 x 256, slices = 160, slice thickness = 5 mm, gap = 1 mm, TR = 7.1 ms, TE = 3.2 ms, period = 10 min, 13 sec. A total of 160 images were obtained. TSE sequence was used for T2 structure imaging. The scanning parameters were: FOV = 230 mm x 230 mm, matrix = 256 x 256, slices = 22, slice thickness = 5 mm, gap = 1 mm, TR = 4560 ms, TE = 100 ms, period = 2 min, 12 sec. Resting state scanning was conducted for patients without cerebral structural anomaly. A total of 32 images were obtained.

For functional imaging, an EPI-BOLD sequence was used in transverse view, at a 90° reversal angle. The scanning parameters were: FOV = 230 mm x 230 mm, matrix = 64 x 64, slices = 22, slice thickness = 5 mm, gap = 1 mm, TR = 2000 ms, TE = 50 ms, period = 8 min, 6 sec. The first fMRI scan (R1 phase) was conducted according to the aforementioned functional imaging parameters. Thereafter, patients received acupuncture per the following protocol.

Methods and Conclusion

The nine acupoints between and including Tianchi and Zhongchong, along the pericardium channel, were selected for acupuncture. After standard disinfection, a custom demagnetized acupuncture needle was inserted into each acupoint. Upon elicitation of a deqi sensation, mild reinforcement and attenuation was used to manipulate each needle. The rotation manipulation technique was then used to stimulate each

acupoint for 30 seconds, at a 180° total rotation amplitude. After rotation, the needles were retained and AP phase functional imaging was conducted per the same parameters. Next, the needles were removed and R2 phase functional imaging was conducted per the same parameters. The clinical results of this study indicate that the known regulatory effect of acupuncture on advanced cognitive activities such as emotional and memory disorders is likely due to its two-way regulatory effect on various cerebral zones, by increasing or attenuating their functional connectivity with the PCC.

References

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