

Abstract

Research on the Influence of Taijiquan on College Students' Inhibition Control Based on fNIRS Technology[†]

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1. Introduction

Taijiquan originated in China and is popular in the world. It combines dynamic and static elements; contains a degree of relaxation; combines action, consciousness, and breathing; focuses on action; and actively controls and eliminates distractions, to achieve the effect of fitness and health. In view of the rare research on the inhibitory control effect and brain mechanism of Taijiquan, this study used near-infrared brain imaging (fNIRS) technology to study the effect and mechanism of 20 weeks of Taijiquan exercise intervention on the inhibitory control of college students. This study hypothesized that Taijiquan can improve the inhibitory control function of college students, and the improvement benefit is related to the neural activation of the prefrontal cortex.

2. Methods

In total, 60 college students, aged 21.02 ± 2.11 , were selected as experimental subjects, 30 in the Taijiquan intervention group and 30 in the control group. Independent variable 1 was the experimental conditions, including intervention group and control group; independent variable 2 was the test order, including pre test and post test.

The dependent variables were the Stroop task response time and fNIRS oxygenated hemoglobin changes with consistent and inconsistent conditions. The intervention group exercised intensively three times a week for 15 weeks, for 45 min each time. This was moderate-intensity exercise, with a heart rate of 80–100 times/min, and they wore a polar heart rate meter. The control group did not change according to the original lifestyle. The subject Stroop effect was tested. When the subject reacted to the color of Chinese characters but ignored the meaning of Chinese characters, the consistency condition was that the color of Chinese characters was consistent with the meaning, and the inconsistency condition was that the color of Chinese characters was inconsistent with the meaning. Under inconsistent conditions, the judgment speed of subjects decreased and the error rate increased. fNIRS technology used the nirport system to monitor the changes of the prefrontal oxygenated hemoglobin during the Stroop task test. fNIRS data analysis: considering the noise caused by head movement and breathing, the components with frequency > 0.1 Hz and frequency < 0.01 Hz were excluded, the changes of oxygenated hemoglobin when the subjects perform consistent and inconsistent tasks were recorded, the oxygenated hemoglobin signal by SPSS statistics was analyzed, and the oxygenated hemoglobin was compared with the original by paired t-test β ; the significant difference channels were screened out by data analysis.

3. Results

In the Stroop consistent task, the concentration of oxygenated hemoglobin in nine channels in the Taijiquan intervention group was significantly higher than that in the control group, and there was a significant difference between pre test and post test, $t = 3.28$,



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$p = 0.037$; the pre-test reaction time was 673.41 ± 168.09 , which was greater than the post-test reaction time 659.34 ± 151.06 ; there was no significant difference between pre test and post test in the control group, $t = 1.048$, $p = 0.339$. In the Stroop inconsistent task, the concentration of CH4 oxygenated hemoglobin in the intervention group increased, $t = 3.509$, $p = 0.004$, corresponding to the left dorsolateral prefrontal lobe. There was significant difference between pre test and post test in the intervention group, $t = 3.78$, $p = 0.032$; the pre-test reaction time was 814.68 ± 167.09 , which was greater than the post-test reaction time of 768.32 ± 118.72 . There was no significant difference between pre test and post test in the control group, $t = 0.906$, $p = 0.513$.

4. Conclusion

The Stroop task behavior of college students has been significantly improved after 15 weeks of Taijiquan exercise, which has significantly enhanced the neural activation level of five brain regions under different conditions. The research results provide new thinking and a scientific basis for Taijiquan to improve the inhibitory control function of college students.

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Informed Consent Statement: Written informed consent has been obtained from the patients to publish this paper.

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