Resting-state abnormalities in adolescents with internet addiction disorder: Amplitude of low frequency fluctuation study

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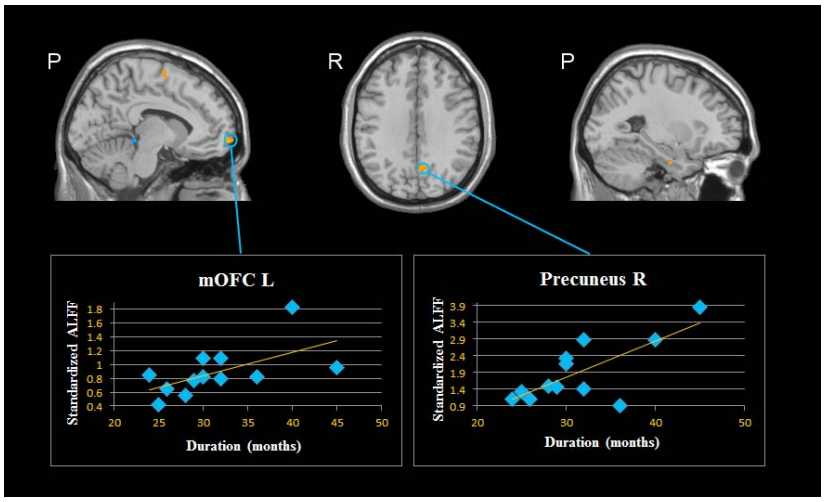
Target audience: The subjects with internet addiction disorder (IAD), psychiatrist and clinical doctors interested in IAD.

Purpose: Internet addiction disorder (IAD) is defined as maladaptive use of internet and inability of an individual to control his/her use of internet. IAD has been classified as a type of impulse control disorder (1). Majority of previous neuroimaging studies have demonstrated both structural and task-related functional abnormalities in adolescents with IAD (2). However, few functional magnetic resonance imaging (fMRI) studies have focused on the regional intensity of spontaneous fluctuations in blood oxygen level-dependent (BOLD) during the resting state.

Methods: In present study, we employed the amplitude of low frequency fluctuation (ALFF) method to explore the local features of spontaneous brain activity in patients with IAD and healthy controls during resting-state. Twelve patients with IAD and 15 age-, education- and gender-matched healthy volunteers were participated in this study.

Results: The IAD group committed more errors than the control group during incongruent condition (8.32 ± 4.51 vs. 4.31 ± 2.76; $p < 0.05$). Although, the response delay measured by reaction time (RT) during incongruent condition minus congruent conditions was not significantly different between these two groups (96.4 ± 35.27 ms vs. 93.29 ± 44.75 ms; $p > 0.05$). Compared with healthy controls, IAD patients showed a significant increase in ALFF values in the left medial orbitofrontal cortex (OFC), the left precuneus, the left supplementary motor area (SMA), the right parahippocampal gyrus (PHG) and the bilateral middle cingulate cortex (MCC). More importantly, we found that ALFF values of the left medial OFC and left precuneus were positively correlated with the duration of IAD in adolescents with IAD.

Discussion: Anatomically, the OFC has extensive connections with the striatum and limbic regions (such as the amygdala). This appears to be involved in cognitive control of goal-directed behavior through the assessment of the motivational significance of stimuli and the selection of behavior to obtain desired outcomes. The OFC's structural abnormalities and dysfunction in IAD have been reported in previous studies (2-5). Our results suggested that the abnormal metabolic activity in the area of OFC may be associated with impairment in impulse control and reward processing in patients with IAD (3). The precuneus is a brain region lies in the posteromedial cortex of the parietal lobe and plays an important role in fundamental cognitive functioning (6). The precuneus has been proposed to be involved in episodic memory retrieval, visual–spatial imagery, self-processing and consciousness (6). A recent study showed that the precuneus was associated with gaming urge, craving and severity of IAD. The study suggested that the precuneus activates to process the gaming cue, integrate retrieved memory and contribute to cue-induced craving for online gaming (7). Therefore, we suggested that the resting-state abnormalities of precuneus in patients with IAD may possibly associate with the craving in the long-term IAD.



Conclusion: Our results suggested that the spontaneous neuronal activity changes of these regions may be concerned with the underlying pathophysiology of IAD.

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