Prefrontal Cortex Responses and Connection to Game Rewards and Losses: Evidences from fNIRS during Mobile Gameplay

Haibo Yang

The prefrontal cortex (PFC) plays a critical role in cognitive control and reward/loss processing, making it a key brain region in the study of addiction. This study aimed to explore differences in PFC functional connectivity between individuals with Internet gaming disorder (IGD) and recreational game users (RGU) during mobile gameplay. A total of 27 IGD-classified individuals and 28 RGU were recruited to complete both single-competitive and cooperative-competitive gaming tasks, while monitored using functional near-infrared spectroscopy. The results showed that in single-competitive mode, during both positive and negative game events, IGD individuals exhibited lower clustering coefficients, shorter characteristic path length, and higher global efficiency, indicating a shift towards a more random network pattern, and suggesting impaired cognitive control. However, no group differences were observed during cooperative-competitive gameplay. Additionally, Network-Based Statistic analyses revealed that during negative events in single-competitive mode, IGD individuals showed enhanced functional connectivity between the dorsolateral PFC and frontopolar areas, possibly reflecting compensatory hyperconnectivity. This study highlights PFC network topology changes in IGD individuals during gameplay and offering novel insights for developing targeted interventions and game-based mental health strategies.