Diffusion tensor tractography reveals disrupted topological efficiency in white matter structural networks in adolescents with Internet addiction

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Background: Internet addiction (IA) has become a serious society problem due to the bad influence on the adolescents(1). Adolescence is an developmental stage, encompassed by alterations in physical, psychological, and social development, and those behavior characteristics of IA may introduce injuries to teenage development in the future. Thus, it is critical to understand the neurobiological mechanisms underlying this disorder (2). Although white matter integrity abnormalities have been reported in IA adolescents(3), little is known about the brain structural topological property changes and the relationship with the IA severity.

Methods: All procedures were approved by the First Affiliated Hospital of Xi’an Jiaotong University. Subcommittee on Human Studies and were conducted in accordance with the Declaration of Helsinki. All participants in our study gave written informed consent. According to the diagnosis of Young’s online internet addiction test (YIAT)(4), sixteen right-hand adolescents with IA participated in our study (YIAT>80). A same number of right-hand healthy controls with matching gender, age and education participated in our study (YIAT<30). All of the participated were diagnosed to exclude other psychiatric disorders. The subjects were scanned on a 3T GE HDxt scanner at the First Affiliated Hospital of Xi’an Jiaotong University. Diffusion tensor imaging and deterministic tractography were employed to derive the brain white matter (WM) networks(5-6). In addition, graph theoretical methods were applied to analyze the alterations in the global and regional properties of the WM network between IA adolescents and healthy controls. Regression analysis was also carried out to assess the relationship between the topology properties and the duration of IA.

Results: IA group showed abnormal global topological properties in the WM networks compared with the health group, i.e. decreased in global efficiency, local efficiency and increased shortest path length. In addition, reduced node efficiency was found in several brain regions, such as the temporal lobe, frontal lobe and cingulated gyrus, right olfactory cortex, right gyrus rectus, right cuneus. In addition, no significant correlation between the topology properties and IA severity was observed in the IA adolescents.

Conclusions: Relative to the healthy controls, IA adolescents showed significantly disrupted topological organization in IA adolescents. The disturbed global organization and deficits local efficiency may enhance our understanding of IA among adolescent.

Reference:

Acknowledgments
This paper is supported by the Project for the National Key Basic Research and Development Program (973) under Grant No. 2011CB707700; the National Natural Science Foundation of China under Grant No. 81271546, 81101036. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.