

Current Status of Internet Gaming Disorder

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Contributor: George Imataka, Ryoichi Sakuta, Akira Maehashi, Shigemi Yoshihara

The World Health Organization recognizes internet gaming disorder (IGD) as a disorder that causes problems in daily life as a result of excessive interest in online games. The causes of IGD have become more apparent. Because of prolonged exposure to games, the mechanisms controlling the reward system, such as the prefrontal cortex, limbic system, and amygdala of the cerebrum, do not function properly in IGD. This mechanism is similar to that of various behavioral addictions, such as gambling addiction. IGD is particularly risky in children and adolescents because it easily causes brain dysfunction, especially in the developing brain.

Keywords: internet gaming disorder ; game addiction ; adult

1. Game Addiction

1.1. Background of the Invader Game Craze: Reward System and Prefrontal Cortex

Why did the industry forgo Invader games after only 1 year, despite their strong sales? Why did the Japanese government propose to ban it? The reason for the popularity of the game was that people vs. machines, slot machines, and pachinko machines were regulated by law, whereas Invaders was accessible without age restrictions. However, this led to a sharp increase in gaming disorders among children. Although there is still insufficient evidence that children's developing brains are vulnerable to games, it was observed that children's developing brains are vulnerable to gaming ^[1]. An increasing number of Japanese children are dropping out of school as a result of their excessive reliance on video games, the Internet, and social networking services. In other words, the fact that children are more highly prone to game addiction than adults has been proven by social phenomena.

IGD is a typical example of machine dependency, and the mechanism of IGD involves the release of dopamine, a pleasure substance in the brain, which activates the "reward system", a sensor that provides a sense of accomplishment and euphoria. It was also discovered that the cause of IGD is an abnormality in the functioning of the brain that reduces the functioning of the prefrontal cortex, which controls human reasoning ^{[2][3][4][5][6]}.

1.2. Game Addiction Is Similar to Other Addictions

Screen-based media use (including Internet-related addictive behaviors) is associated with a less efficient cognitive control system in adolescence. Adolescents with IGD more frequently exhibit decreased short- and medium-range connectivity among the subcortical, frontal, and parietal regions involved in attentional and control networks, in line with other behavioral addictions ^{[7][8][9]}. IGD is linked to functional and structural neural changes in the fronto-striatal and fronto-cingulate regions ^[2]. Fronto-striatal dysfunction is also thought to promote a compulsive use of the Internet and screen devices in general. It has been reported that adolescents who play action video games more frequently struggle to maintain their attention over time ^[8]. Adolescents typically exhibit more reward anticipation brain activity than adults do. They are more susceptible to the intense rewards that are provided by gaming activities (**Figure 1**). Excessive gaming on a regular basis can reinforce adolescents' propensity to seek out instant gratification, which they value higher ^[8]. Several studies have tried to establish the dynamics involved in IGD etiology. Paulus et al. ^[10] described that IGD is a highly complex phenomenon, with interplay of psychological, sociological, and neurobiological factors. The authors proposed an integrated IGD model depicting complex interaction between several internal and external factors. Structural brain deficits in prefrontal cortex, amygdala, connectivity, dopaminergic/serotonergic system, and neurobiological deficits (self-regulation and decision making, dysregulation of mood, and reward systems) are implicated in IGD. Among external factors, poor parental care, inadequate social skills, and game-related factors such as rewards can increase the risk of IGD. Adolescents with IGD have similar traits to those with substance dependence, including higher impulsivity, greater propensity to make risky decisions, less capacity to defer gratification, and impaired ability to assess risk. Schettler et al. ^[11] reported that adolescents with problematic gaming have altered brains that show deficits in executive functioning (including working memory and attention), emotion management, and reward processing, as well as cognition, which

includes decision making. Adolescents with IGD seem to exhibit a stronger imbalance between cognitive control (including fronto-parietal areas) and the affective system (including subcortical and limbic structures) than non-IGDs [12]. Lower gray-matter density in the dorsolateral prefrontal cortex was linked to more severe IGD symptoms, more depression, more lifelong gaming, more impulsivity, and more time spent gaming. Previous neuroimaging studies revealed that IGD and addiction may have comparable neurobiological pathways, such as aberrant fronto-striatal networks that are important in reward processing and cognitive regulation [13]. Given that the DLPFC is essential to the top-down control system that manages cognition and behavior, its involvement in IGD is not unexpected. It can be assumed that the prefrontal dopaminergic system partially controls impulsivity, cravings for online gaming, and poor mood [1][2][12]. Furthermore, in response to punishment, IGDs were found to use an avoidance system, indicating a distinct pattern of reward processing among people with IGD [14]. Recent studies suggest that IGD individuals may have greater appetites for video games than for more fundamental rewards such as food, and they subjectively attach greater importance to gaming as the primary reward. When compared to food-related cues, gaming-related cues induced stronger functional connectivity in precuneus–caudate relationships in IGD individuals [15]. Patients with IGD demonstrated considerable bilateral hyperactivation in the precuneus and cingulate, as well as significant bilateral hypoactivation in the insula, during cue reactivity tasks, but there were no alterations in the striatum. Patients with IGD showed significant hypoactivation in the left inferior frontal gyrus and hyperactivation in the right superior temporal gyrus, bilateral precuneus, bilateral cingulate, and insula during executive control tasks. IGD patients showed significant hypoactivation in the left superior frontal gyrus, left inferior frontal gyrus, and right precentral gyrus during risky decision-making paradigms, as well as significant hyperactivation in the left striatum, right inferior frontal gyrus, and insula [16]. Some of these changes are linked to aspects of addiction or to changes in the brain's motor, sensory, and cognitive functions [5].

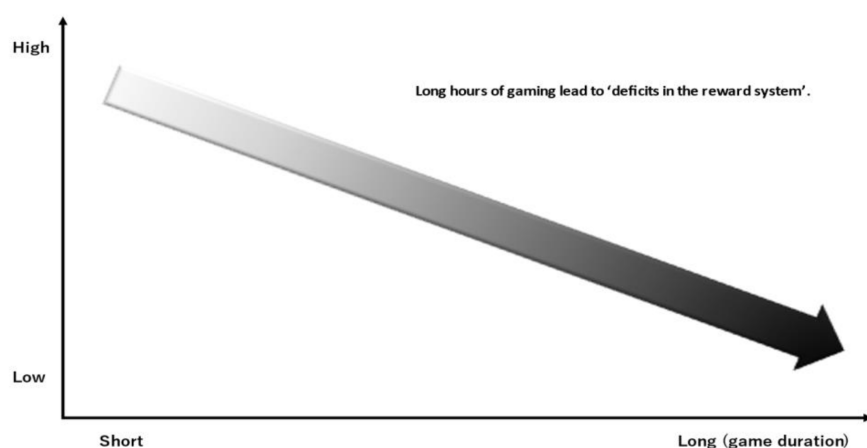


Figure 1. The reward system and the prefrontal cortex (level of satisfaction/activity of the reward system).

1.3. The Need for Treatment of Internet Gaming Disorder (IGD)

Individuals with IGD frequently overestimate the benefits of playing online games, where they invest a substantial amount of time. As a result, they neglect social and academic obligations, which can lead to social dysfunctions [17]. Therefore, IGD must be considered a disease. According to a survey by Japan's Ministry of Health, Labor, and Welfare in 2017, about 97% of teenagers in Japan use the Internet on a daily basis. The results of the survey ($n = 38,630$) reported that 59.7% of users access the Internet through a smartphone, while 52.5% of them use the Internet via desktop and/or laptop computers [18]. Approximately 1.82 million males 20 years of age and older were living with Internet addiction in 2018 in Japan, almost three times the number reported in 2013 [19]. Anecdotal evidence indicates that the majority of patients with Internet addiction are primarily addicted to gaming, and male Internet users favored online gaming through smartphones [20]. Sleep disturbance, day or night reversal, inability to get up in the morning, inability to attend school, poor concentration, irritability, lack of communication, nervous anxiety, lack of exercise, obesity, and poor academic performance [10][21][22] are all symptoms of IGD in adolescents, indicating a serious concern about the dangers of excessive gaming. Moreover, over the last decade, there has been an increase in research on the mental health issues associated with IGD. Adolescents are vulnerable to a variety of mental health issues linked to excessive online gaming, including depression, social anxiety, loneliness, and attention deficit hyperactivity disorder (ADHD) [22]. The degree of depressive symptoms and physiological resilience were found to be positively correlated in a study of large Chinese secondary school students, suggesting that psychological resilience training may be helpful as an intervention for IGD [23].

2. Approach to Game Addiction and Treatment

2.1. The Pathology of Game Addiction Is Psychological Dependence

Physical dependence requires treatment for withdrawal symptoms when the drug is discontinued. Process dependence, on the other hand, is mental dependence. Therefore, IGD is expected to have a number of clinical effects through environmental adjustment, counseling, and cognitive behavioral therapy ^{[10][24][25]}.

2.2. Diagnosis of Game Dependence

IGD is difficult to recognize until it becomes serious, and it tends to be delayed until later. Therefore, the first step in dealing with IGD is for the patient and family to self-recognize IGD. Outpatient diagnosis of IGD and counseling of the patient and family are important ^[10]. For this purpose, first, a therapeutic target should be approached from family therapy. Data on management are available for younger patients, but not for children. Few cases have been reported emphasizing early treatment in children in order to avoid a longer and more intensive approach when the child progresses to higher education. In children, the clinical approach should include assessment, rapport building, parent education, child/teenager education, child/teenager motivational interviewing, and individual therapy based on psychological symptoms.

2.3. Toward Less Games, Not More, and Zero-Game Day

The next thing to consider is the process via which gaming can be dealt with. It might be a beneficial idea to dispose of the games; however, this should be evaluated on a case-to-case basis. First and foremost, people with IGD have trouble managing their reasoning; as such, if games are forced away from them, they are at risk of impulsive behaviors, such as violence and running away from home ^{[2][10]}. Since IGD is basically a psychological dependence ^{[26][27]}, the next step is to counsel the person on how to deal with games once they are aware of the dependence. If it is difficult to stop playing games, the aim is to reduce the number of games played. Working not only with the individual but also with the family as much as possible is important. In several cases, the inability to escape IGD may be caused by members of the family ^[28].

2.4. Internet Gaming Disorder (IGD) Initiatives in Japan

According to a survey of Youth Internet Environment 2018, Cabinet Office Japan, 95.9% of senior-high-school students, 58.1% of junior-high-school students, and 30% of elementary-school students have their own smartphones ^[29]. Junior- and senior-high-school students use their smartphones for greater than 4 h a day on average, and 10–20% of Japanese junior- and senior-high-school students are already suffering from IGD. Therefore, it is important for families and schools to discuss gaming as a collective. Additionally, social regulations and measures are necessary. For example, the Japan Pediatric Association has issued a call for “Smartphone Time, What Am I Ushering in?” Kanagawa Prefecture has uploaded an animated YouTube video on its website and has over 30,000 registered users. Kagawa Prefecture enacted Japan's first gaming regulation ordinance on 1 April 2020. The ordinance states that games must be used for 60 min and 90 min on weekends and holidays, and that smartphones must be used until 9:00 p.m. for junior-high-school students and younger, and until 10:00 p.m. for all others, except for those used for study purposes ^[30]. Although the ordinance has no penalties, it has been criticized by libertarians. However, given the fact that the WHO has recognized IGD as a disease and the government has not set any laws, several people in Japan are of the opinion that the ordinance of Kagawa Prefecture should be enforced.

3. Treatment of Internet Gaming Disorder

3.1. Actual Treatment of Internet Gaming Disorder

There is a scarcity of literature on various IGD treatment methods. No standard clinical treatment protocol is currently available, and treatment techniques are typically derived from those used to treat substance use or gambling disorders. In the literature, individual, group, and family psychotherapeutic interventions, pharmacotherapy, and addiction clinics with multimodal treatment programs have all been mentioned in adolescents ^{[31][32][33]}. Importance is placed on making the person self-aware regarding the problems in their life and what they may face in the future due to gaming. In addition, the medical staff should support the individual and the family in successfully dealing with gaming and smartphones. The multidimensional family therapy (MDFT) approach seems to be a viable option for IGD. MDFT exemplifies a practical, adaptable, and widely transportable approach. The MDFT approach is being applied to IGD cases in two ongoing studies in France and Switzerland ^{[33][34]}.

Psychological counseling and discussions with other children are also important. Cognitive behavioral therapy, in which the patient and the family live in an environment without smartphones, such as camping or hospitalization, is also

important [35]. It is also necessary to visualize and self-manage the time spent gaming and on smartphones to return to the same environment after discharge [36]. To improve IGD, a multifaceted approach involving not only patients, families, and doctors, but also companies, governments, and administrators is required, and preventive measures are currently being considered in Asia from a variety of perspectives.

Medications such as bupropion, escitalopram, or methylphenidate have been used to treat IGD and/or comorbid psychopathology (e.g., depression, anxiety, and ADHD) [31]. A recent meta-analysis involving 5601 children and young adults with Internet addiction/IGD indicated that pharmacotherapy combined with CBT or multilevel counseling might be an effective therapeutic strategy for youth with gaming disorder [37].

3.2. Proposition: IGD Is a New Lifestyle-Related Disease in Children

IGD has emerged as a new behavioral addiction that appeals to the younger generation despite risks to their physical, mental, social, or financial wellbeing. With the rapid proliferation of online games, there is a risk that IGD will promote sedentary behavior, irregular eating patterns, and other unhealthy lifestyle choices in children [38]. Furthermore, several studies have found that young adolescents are at risk of substance abuse [39]. New devices are being released worldwide, and the next boom is occurring repeatedly. However, the negative effects of these devices are not observed until a little later. Today, the population of people who enjoy the Internet and games has grown too large to conclude that they are uniformly inadequate.

The concern is that IGD is now a lifestyle disease for children. The basis of measures against lifestyle-related diseases is to raise awareness in society to prevent the onset of the condition.

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