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Efficacy of cognitive behavioural therapy for internet gaming disorder

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Abstract

Cognitive behavioural therapy (CBT) is considered to be an effective treatment for internet gaming disorder (IGD). This study examined the effectiveness of CBT in treating impulsivity, anxiety, avoidance, and family and environmental problems in patients. A total of 101 patients completed the CBT programme, and 104 completed the supportive therapy. The CBT programme consisted of fourteen 90-min sessions with one therapist and four to five patients, once or twice a week. The supportive therapy group visited a psychiatric outpatient department once or twice a week until they completed 14 visits. Outcomes were measured in terms of improvement in IGD, psychological symptoms, and social interaction. The CBT group (improvement: 67 [66.3%] versus non-improvement: 34 [33.7%]) showed more improvement in IGD compared with the supportive therapy group. The CBT group also showed a greater decrease in internet addiction, anxiety, impulsivity, and social avoidance. In the CBT group, among patients who improved, the greatest improvements were in internet addiction, attention, depression, anxiety, impulsivity, social avoidance, and family cohesion. Our CBT programme may be more effective than supportive therapy with regard to improvement in IGD symptoms by controlling anxiety, impulsivity, and social avoidance. In addition, CBT-related improvements in patients with IGD could be enhanced by controlling anxiety, social avoidance, and family cohesion.

KEYWORDS

anxiety, cognitive behavioural therapy, impulsivity, internet gaming disorder, social avoidance

1 | INTRODUCTION

Over the past few decades, internet gaming disorder (IGD) has been the subject of much discussion with regard to behavioural addiction or disruption of impulse control (Petry & O'Brien, 2013). Although the internet facilitates intimate friendships that transcend temporal and spatial constraints and presents entertainment and informational opportunities to support social relationships (Anderson, Steen, & Stavropoulos, 2017), excessive use or gaming can, ironically, reduce social activities and interest in regular life (Kraut et al., 1998). 10.1089/cpb.1998.1.237 (1998) regarded problematic internet use as

a behavioural addiction and set the criteria for internet addiction using the template of gambling disorder: (a) increasing internet use, (b) longer use durations than intended, (c) psychological discomfort when not using the internet, (d) continuous use despite negative consequences in regular life, social interaction, and school, and (e) failure to reduce internet use time despite active attempts. The *Diagnostic and Statistical Manual of Mental Disorders-5* (DSM-5) identified IGD as a condition requiring further study (American Psychiatric Association, 2013). Owing to the high rate of internet penetration and usage, problematic internet use and gaming have been constant problems in the South Korean population (Park, Hyun, Son, & Lee, 2015). Therefore, many studies have suggested examination of problematic internet use and treatments for it (Huang, Li, & Tao, 2010). Of the various

treatment modalities, cognitive behavioural therapy (CBT) has been employed to control excessive internet use or problematic internet gaming (Du, Jiang, & Vance, 2010).

1.1 | CBT for IGD

CBT has been thought to be effective in several clinical studies of patients with alcohol dependence and patients with pathologic gambling disorder (Assanangkornchai & Srisurapanont, 2007; Ladouceur, Boisvert, & Dumont, 1994). With regard to IGD, several studies have suggested the efficacy of CBT for symptom improvement (Du et al., 2010; Young, 2007). Du et al. (2010) reported that CBT was more effective than individual psychotherapy in an adolescent group. Young (2007) reported that eight sessions of CBT for adults could improve the symptoms of internet addiction, with the effects lasting for 6 months. In Kim, Han, Lee, and Renshaw's (2012) study, CBT was successful in improving the symptoms of IGD.

Since the inception of studies on this topic, it has been suggested that patients with IGD display high rates of psychological problems, including those related to attention, mood, loneliness, anxiety, and impulsivity (Kraut et al., 1998). In addition, environmental factors have been associated with the progression of IGD (Han, Yoo, Renshaw, & Petry, 2018; Hyun et al., 2015). Of the various psychological factors, anxiety and depression have been considered crucial as they influence the severity of IGD (Akin & Iskender, 2011). Moreover, parent-child relational problems and within-family conflicts can lead to depression, anxiety, interpersonal problems, and academic dysfunction in children (Jeffrey & Bahr, 1987; Kawabata, Alink, Tseng, van Ijzendoorn, & Crick, 2011). For children with family and environmental problems, therefore, internet gaming may be a means of escaping reality. Individuals who have a tendency to escape reality are thought to have high anxiety (Kwon, Chung, & Lee, 2011). Children and adolescents experiencing anxiety in their academic lives or interpersonal relationships have been reported to use the internet or engage in internet gaming to evade such problems (Rotunda, Kass, Sutton, & Leon, 2003). The CBT programme for IGD developed in this study took into consideration all relevant factors, including impulsivity, anxiety, avoidance, and family and environmental problems.

1.2 | Hypothesis

We hypothesized that CBT for IGD, which takes into account psychological and environmental factors, would improve IGD symptoms. In addition, it was hypothesized that psychological and environmental factors would affect the treatment results of CBT for IGD.

2 | METHODS

2.1 | Participants

All patients were recruited from among 332 adults who visited OO University Hospital from September 2014 to August 2018. Of the

Key Practitioner Message

- Our cognitive behaviour therapy programme (CBT) for internet gaming disorder (IGD) may be effective than supportive therapy in patients with IGD.
- The treatment effects of CBT were associated with improvements in various psychological and environmental factors compared with supportive therapy.
- CBT-related improvements in patients with IGD could be enhanced by controlling anxiety, social avoidance, and family cohesion.

332 original patients, 304 agreed to participate in the study. Of those 304, 205 successfully completed the 8-week treatment course and the remaining 99 (32.6%) did not. All 205 patients were asked to select either CBT for IGD or supportive psychotherapy. Considering their clinical situations, patients who were on psychiatric medications for attention deficit hyperactivity disorder (ADHD), major depressive disorder (MDD), and anxiety disorders were allowed to participate. Finally, 101 patients completed the CBT programme, and 104 completed supportive therapy. The inclusion criteria for treatment in this study were (a) aged over 20 years and (b) diagnosed with IGD based on DSM-5 criteria. Exclusion criteria were (1) intelligence quotient (IQ) <70 and (b) substance dependence and abuse.

2.2 | Study procedure

All patients met with psychiatrists to be assessed for clinical psychiatric disorders based on the Structured Clinical Interview for DSM-5. In addition, they completed questionnaires regarding the severity of their IGD, demographic characteristics, psychological status, and social interaction functioning. The Young Internet Addiction Scale (YIAS) was used to assess IGD symptom severity. Demographic data included age, sex, game genres, and alcohol and tobacco use. Regarding game genres, patients were asked to indicate their preference from among four categories: massively multi-player online role-playing games, real-time strategy, first-person shooter, or other. With regard to tobacco and alcohol use, we used Kenford et al.'s (2005) categorization: no use, occasional use (less than five cigarettes a day or drinking less than 5 days per month on average), or regular/heavy use (more than five cigarettes per day or binge drinking on 5 or more days per month; National Institute of Health, 2015).

In both groups, medication use (monotherapy) was allowed to treat co-morbidities. Selective serotonin reuptake inhibitors (SSRIs) or bupropion were applied for the IGD + MDD group. Methylphenidate, atomoxetine, or bupropion were applied for the IGD + ADHD group. SSRIs or benzodiazepines were applied for anxiety spectrum disorders.

At the beginning of treatment, IQ, ADHD, MDD, anxiety, and impulsivity were assessed. IQ was estimated using the Korean Wechsler Adult Intelligence Scale, which has an internal consistency ranging from 0.78 to 0.94 (Kim, Yum, Oh, Park, & Lee, 1992).

The YIAS is a self-report measure of routine internet use (10.1089/cpb.1998.1.237, 1998). It consists of 20 self-assessment questions with a scale of 1 to 5 (*rarely to always*). YIAS scores above 50 are thought to reflect problematic internet use. (Lee et al., 2013). The Korean version of the YIAS was verified by Lee et al. (2013). The YIAS' internal consistency (Cronbach's alpha) has been reported to be in the range of .90 to .91 (Lee et al., 2013).

The symptom severity of ADHD was estimated with the Korean version of DuPaul's (1991) ADHD Rating Scale (K-ADHD; DuPaul, Power, Anastopoulos, & Reid, 1998; So, Noh, Kim, Ko, & Koh, 2002). It is composed of 18 items (nine for attention and nine for hyperactivity assessment), and each item is rated from 0 (*rarely*) to 3 (*always*). The Korean version of the ADHD rating scale is known to have a good internal consistency (Cronbach's alpha) of .77 to .89 (So et al., 2002). The cut-off of the ADHD rating scale Korean version for ADHD was suggested to be above 17 (Park et al., 2014).

Depression symptoms were assessed using the Beck Depression Inventory (BDI), which has a good internal consistency (Cronbach's $\alpha = 0.91$), and which is a self-report inventory with 21 questions (Beck, Steer, & Brown, 1996). Each BDI item is rated from 0 (*I do not feel sad*) to 3 (*I am so sad*). The standard cut-off of total scores are as follows: 0–9 (minimal depression), 10–18 (mild depression), 19–29 (moderate depression), and 30–63 (severe depression; Beck et al., 1996).

Anxiety symptoms were assessed using the Beck Anxiety Inventory (BAI), which has good internal consistency (Cronbach's $\alpha = .93$), and which is a self-report inventory with 21 questions (Kwon, 1997). Each BAI item is rated from 0 (*not at all*) to 3 (*severely*). The standard cut-offs of the total scores are as follows: 0–7 (minimal anxiety), 8–15 (mild anxiety), 16–25 (moderate anxiety), and 26–63 (severe anxiety; Julian, 2011).

Impulsivity was assessed using the Behavioural Inhibition System/Behavioural Activation System (BIS/BAS) Scale, which has an internal consistency ranging from 0.78 to 0.79 (Carver & White, 1994; Kim & Kim, 2001). It consists of a 20-item self-rating questionnaire. Each item has four response options ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). The cut-off of the current scale was not reported.

Social interaction factors consisted of social intimacy and family cohesion. Social intimacy was assessed using the Social Avoidance and Distress Scale (SADS), which has a good internal constancy (Cronbach's $\alpha = .94$; Lee & Choi, 1997; Watson & Friend, 1969). It consists of a 28-item self-rated 5-point Likert scale. The cut-off of the current scale was not reported.

Family cohesion was estimated using the relationship domain of the Family Environment Scale (FES), which has a test–retest reliability ranging from 0.68 to 0.86 (Moos & Moos, 2002; So et al., 2002). The relationship domain consists of three subscales of cohesion, expressiveness, and conflict. Each subscale consists of nine self-rated items answered with “yes” (scoring “1”) or “no” (scoring “0”). The cut-off of the current scale was not reported.

The symptom severity of ADHD was estimated with the K-ADHD (DuPaul et al., 1998; So et al., 2002). Depression and anxiety symptoms were assessed using the BDI, which has an internal consistency ranging from 0.75 to 0.85 (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), and the BAI, which has an internal consistency of 0.93 (Kwon, 1997), respectively. Impulsivity was assessed using the BIS/BAS Scale, which has an internal consistency ranging from 0.78 to 0.79 (Carver & White, 1994; Kim & Kim, 2001).

After completing these measures, all patients were offered treatment including either CBT or supportive therapy. Medication could be used for depressive symptom reduction, improvement in attention, and impulse and behaviour control. At the end of CBT or supportive therapy, the symptoms of IGD, ADHD, MDD, anxiety, and impulsivity were measured again. In addition, a psychiatrist assessed the improvement in IGD symptoms with the Clinical Global Impressions-Improvement (CGI-I) scale.

2.2.1 | CBT and supportive therapy for IGD

The CBT programme for IGD consisted of fourteen 90-min sessions with one therapist and four to five patients. Patients underwent one or two treatment sessions per week. Table 1 shows the contents of the CBT programme for IGD.

Session 1 involved an introduction to the programme, self-introduction, and an overview of treatment goals. In Session 2, patients described their own lives, including their psychological status (mood and anxiety), social environment, and family cohesion as well as their history of internet gaming. Sessions 3–5 dealt with patients' “stress” in the following ways: (a) Defense and coping strategies were discussed; in response to stress, most patients indulged in excessive internet gaming as an avoidance defense mechanism; (b) considering the pros and cons of internet gaming, patients were asked to discuss the following: How can patients turn the cons into pros? How can internet gaming be turned into a healthy hobby? In responding to these questions, patients were able to look at themselves objectively and reflect on their impulsive internet gaming; (c) patients were educated on brain activity in response to stress associated with excessive and continuous internet use. In Session 6, patients were asked to introspect on their “self-identity,” using to-do and not-to-do lists. During Sessions 7–9, the five steps of change—precontemplation, contemplation, preparation, action, and maintenance—were discussed (Diclemente & Prochaska, 1998; Prochaska, Diclemente, & Norcross, 1992). In Session 10, patients' behaviour patterns including impulsivity, emotions, and loneliness, as well as their thinking patterns, were discussed. During Sessions 11 and 12, hurtful events provoking anxiety, depressed mood, and family conflicts were discussed. Session 13 covered the restoration of family cohesion and the social environment. In Session 14, changes that the patients had undergone were reviewed.

The supportive therapy group visited a psychiatric outpatient department once or twice per week until they had completed 14 visits. The trial outcomes of CBT or supportive therapy were

TABLE 1 Cognitive behavioural therapy for internet gaming disorder

Session	Contents
1	Introduction to programme Self-introduction Treatment goal: Controlling impulsivity
2	Drawing life map: Discussion on life and gaming history including patients' mood (depression and anxiety), loneliness, social environment, and family cohesion
3	Stress management I: Discussion on defense mechanisms: Avoidance and impulsivity
4	Stress management II: Coping patterns in response to stress Automatic thinking and cognitive distortion Other ways of thinking
5	Stress management III: Brain activity in response to stress
6	Self-identity: To do, not-to-do
7	Five steps of change: Life values and goals
8	Five steps of change: Contents of each of the five steps
9	Five steps of change: Worksheet on changes
10	Behavioural patterns: Impulsivity, emotions, and loneliness Changes from negative thinking to positive thinking
11	Emotional hurt: Identifying negative moods and family conflict
12	The meaning of hurt: Negative signals and weak points, healthy defense mechanisms for depression, anxiety, and family cohesion
13	Restoration of family cohesion and social environment: "I" message exercise
14	Review of changes in the patient

measured in terms of improvement in three domains: (a) IGD, (b) psychological symptoms, including attention, mood, anxiety, and impulsivity, and (c) social interaction, including self-avoidance and family cohesion.

2.3 | Statistical analysis

Descriptive statistics included means and standard deviations for continuous variables, as well as counts and percentages for categorical variables. Independent *t* tests compared demographic information, including age and years of education, IQ, and YIAS, K-ADHD, BDI, BAI, BIS/BAS, SADS, and FES scores between the CBT and supportive therapy groups. Chi-squared tests were used to make comparisons based on sex, game genre, smoking, and alcohol use. An $\alpha = .05$ level was considered statistically significant.

To compare the treatment efficacy of CBT and supportive therapy, chi-squared tests were used. The "improvement status in response to treatment" was determined as the dependent variable. Improvement status, which was assessed with CGI-I and YIAS scores, was classified into "improved" (coded by 1) versus "non-improved"

(coded by 0). "Improved" was defined as a clinical CGI-I score less than 4 and a YIAS score less than 50. The CGI-I is a 7-point scale. The clinician assesses how much the patient's illness has improved or worsened, compared with their baseline state at the beginning of the intervention (Guy, 1976). The results of the CGI-I rating are as follows: 1 (*Very much improved*), 2 (*Much improved*), 3 (*Minimally improved*), 4 (*No change*), 5 (*Minimally worse*), 6 (*Much worse*), 7 (*Very much worse*). In a validity study of the Korean YIAS, Lee et al. (2013) suggested that YIAS scores >50 can be regarded as indicating problematic internet use.

To assess the predictive factors for improvement in response to treatment, multiple logistic regression analysis was applied. In a multiple logistic regression analysis involving the data of the CBT group (or supportive group), a discrete set of hierarchical variables was added: demographic factors (age, education year, game genre, smoking, and alcohol use) for Model 1, clinical scales (IQ, YIAS, K-ADHD, BDI, BAI, BIS/BAS, SADS, and FES) for Model 2, medication use for Model 3, and temperament and character traits for Model 4. The dependent variable, improvement in response to completion of 14 sessions of treatment (or supportive treatment), was operationalized as a binary code (1: improved/0: non-improved).

Then, we used repeated measures analysis of variance to investigate the differences in the changes in YIAS, K-ADHD, BDI, BAI, BIS/BAS, SADS, and FES scores between the CBT and supportive therapy groups. For multiple comparison corrections, we set statistical significance to $\alpha = .007$ (0.05/7). All analyses were performed using SPSS ver.21.0 (SPSS Inc. Chicago, IL, USA).

2.3.1 | Ethics

The research procedures were performed in accordance with the Declaration of Helsinki. The institutional review board of Chung-Ang University Hospital approved the research protocol for the current study. All participants were informed about the procedures of this study and provided written informed consent.

3 | RESULTS

3.1 | Demographic characteristics

There were no significant differences in age, education years, game genre, diagnosis, clinical scale scores including IQ, YIAS, K-ADHD, BDI, BAI, and BIS/BAS, medication use, social interaction factors including SADS and FES, smoking habits, alcohol habits, and Temperament and Character Inventory scores between the CBT and supportive therapy groups.

Of the 101 IGD patients in the CBT group, 50 IGD patients (49.5%) took medications for co-morbidities. Five IGD patients with MDD took SSRIs, and 18 IGD patients with MDD took bupropion. Thirteen IGD patients with ADHD took methylphenidate, and 10 IGD patients with ADHD took atomoxetine. Three IGD patients with

MDD and ADHD took bupropion. One IGD patient with panic disorder took benzodiazepine (alprazolam).

Of the 104 IGD patients in the supportive therapy group, 58 IGD patients (55.8%) took medications for co-morbidities. Eight IGD patients with MDD took SSRIs, and 18 IGD patients with MDD took bupropion. Seventeen IGD patients with ADHD took methylphenidate, and nine IGD patients with ADHD took atomoxetine. Four IGD patients with MDD and ADHD took bupropion. Two IGD patients with social phobia took benzodiazepine (diazepam).

3.2 | Treatment efficacy and good prognosis factors

The number of patients who showed improvement in the CBT group was higher than that observed in the supportive group ($\chi^2 = 6.25, p = .02$). Of the 101 IGD patients in the CBT group, 67 IGD patients (66.3%) were improved. Of the 104 IGD patients in the supportive therapy group, 51 IGD patients (49.0%) were improved.

Of the four models employed in the CBT group, Models 3 and 4 were significantly associated with improvement in response to treatment. With the highest step chi-squared value and improvement in classification accuracy, "medication use" was the strongest factors directing "improvement." Model 3 and Model 4 significantly enhanced the prediction of internet game play, reaching an accuracy of 81.2% and 89.1%, respectively. According to the Wald statistics for all independent variables, lower ADHD scores, lower BDI scores, no use of medication, and higher harm avoidance scores represented significant predictors of improvement in response to CBT treatment (Table 2).

Of the four models employed in the supportive therapy group, no model was significantly associated with improvement in response to treatment. (Table 2).

3.3 | Comparison of changes in clinical scale scores in response to treatment

In all patients, the CBT group showed a greater decrease in YIAS ($F = 11.76, p = .001$), BAI ($F = 9.06, p = .003$), BIS/BAS ($F = 8.84, p = .003$), and SADS scores ($F = 9.90, p = .002$) compared with the supportive therapy group. There were no significant differences in changes in ADHD ($F = 1.39, p = .244$), BDI ($F = 0.95, p = .332$), and FES ($F = 0.49, p = .481$) scores between the two groups (Figure 1).

In the CBT group, among patients who got better, YIAS ($F = 52.48, p < .001$), ADHD ($F = 16.85, p < .001$), BDI ($F = 25.11, p < .001$), BAI ($F = 9.41, p = .003$), BIS/BAS ($F = 7.48, p = .004$), SADS ($F = 35.19, p < .001$), and FES scores ($F = 9.71, p = .002$) showed greater improvement compared with patients with non-improvement (Figure 2).

In the supportive therapy group, among patients who improved, YIAS ($F = 61.05, p < .001$), ADHD ($F = 28.55, p < .001$), BDI ($F = 23.83, p < .001$), and BIS/BAS ($F = 10.02, p = .002$) scores showed greater improvement compared with patients with non-improvement.

There were no significant differences in changes in BAI ($F = 0.07, p = .793$), SADS ($F = 0.02, p = .961$), and FES ($F = 0.47, p = .491$) scores between the two groups (Figure 3).

4 | DISCUSSION

The results demonstrated that CBT for IGD was more effective than supportive therapy in terms of the number of areas that showed improvement; there was a reduction in the severity of IGD, impulsivity, and social avoidance. In post hoc analysis, the treatment effects of CBT were associated with improvements in various psychological and environmental factors compared with supportive therapy.

4.1 | Treatment efficacy and good prognosis factors

The CBT programme in the current study was responsible for improvement in 17% more patients with IGD than was supportive therapy. There have been several studies of CBT for IGD that supported our results (Torres-Rodríguez, Griffiths, Carbonell, & Oberst, 2018; Wölfling et al., 2019). Torres-Rodríguez et al. (2018) suggested that CBT for IGD was effective for improvement of IGD. In addition, co-morbid conditions, interpersonal relations, and family cohesion would be important factors for facilitating behavioural changes in IGD patients (Torres-Rodríguez et al., 2018). In a multi-centre randomized clinical trial study with 143 men in four outpatient clinics in Germany and Austria, patients with 15 weeks of manualized CBT showed greater improvement, compared with patients without CBT (Wölfling et al., 2019). Moreover, the efficacy of CBT was associated with baseline internet addiction severity and co-morbidities (Wölfling et al., 2019). In our study, lower ADHD and MDD scores could also predict improvement in response to CBT.

In our previous study, CBT led to improvements in IGD severity, anxiety, and life satisfaction but produced no changes in depression scale scores (Kim et al., 2012). The CBT programme used in the previous study (Kim et al., 2012) consisted of knowledge of IGD, motivation control, problem-solving, decision-making, communication skills training, self-control skills training, and family therapy, whereas the version used in this study included stress management, anxiety control, impulse control, and environmental control, including family (Table 3).

In the CBT group, non-use of medication predicted a good prognosis. In the current study, most patients with co-morbidities took the required medication. Therefore, "non-use of medication" can be regarded as indicating "no comorbidity." In many previous studies, co-morbidities including ADHD, MDD, and anxiety affected treatment results. In a cohort study on IGD, psychological factors and environmental conditions could affect treatment results and symptom progress (Han et al., 2018; Hyun et al., 2015). In particular, ADHD, MDD, social avoidance, and family and environmental factors could predict the progress of IGD (Han et al., 2018). These results may be in accord

TABLE 2 Demographic characteristics

	CBT (n = 101)	Supportive therapy (n = 104)	Statistics
Age (years)	25.9 ± 5.1	26.5 ± 5.5	t = −0.80, p = .42
Sex (man/woman)	All men	All men	—
Education (years)	12.8 ± 1.6	13.2 ± 1.9	t = −1.62, p = .11
Game genre			
MMORPG	39 (38.6%)	38 (36.5%)	$\chi^2 = 1.01$, p = .79
RTS	40 (39.6%)	40 (38.5%)	
FPS	12 (11.9%)	11 (10.6%)	
Others	10 (9.9%)	15 (14.4%)	
Diagnosis			
Only IGD	22 (21.8%)	23 (22.1%)	$\chi^2 = 1.61$, p = .81
IGD + ADHD	32 (31.7%)	35 (33.7%)	
IGD + MDD	35 (34.7%)	37 (35.6%)	
IGD + ADHD + MDD	8 (7.9%)	4 (3.8%)	
IGD + Others	4 (4.0%)	5 (4.8%)	
Clinical scale scores			
IQ	98.2 ± 12.3	98.4 ± 12.6	t = 0.13, p = .89
YIAS	66.6 ± 13.5	66.4 ± 12.5	t = 0.11, p = .92
K-ADHD	20.2 ± 11.6	19.7 ± 10.5	t = 0.33, p = .75
BDI	14.5 ± 6.3	15.1 ± 98.9	t = 0.64, p = .52
BAI	10.4 ± 8.3	10.1 ± 7.9	t = 0.27, p = .76
BIS/BAS	53.5 ± 8.0	52.8 ± 9.0	t = 0.57, p = .57
Medication (use/non-use)	50/51		
(49.5%/50.5%)	58/46		
(55.8%/44.2%)	$\chi^2 = 0.81$, p = .40		
SSRIs	5	8	
Bupropion	21	22	
Methylphenidate	13	17	
Atomoxetine	10	9	
Benzodiazepine	1	2	
Social interaction factors			

(Continues)

TABLE 2 (Continued)

	CBT (n = 101)	Supportive therapy (n = 104)	Statistics
SADS	78.2 ± 14.7	77.7 ± 16.9	t = 0.22, p = .82
FES	10.0 ± 6.4	10.4 ± 6.5	t = 0.44, p = .66
Smoking			
Heavy smoker	9 (8.9%)	14 (13.5%)	$\chi^2 = 1.52$, p = .47
Occasional smoker	34 (33.7%)	29 (27.9%)	
Non-smoker	58 (57.4%)	61 (58.7%)	
Alcohol use			
Heavy drinker	7 (6.9%)	10 (9.6%)	$\chi^2 = 0.59$, p = .74
Occasional drinker	69 (68.3%)	67 (64.4%)	
Non-drinker	25 (24.8%)	27 (26.0%)	
TCI			
Novelty seeking	53.73 ± 10.52	56.43 ± 11.66	t = 1.74, p = .08
Harm avoidance	55.03 ± 14.01	58.31 ± 12.47	t = 1.78, p = .08
Reward dependence	43.70 ± 11.94	41.15 ± 11.57	t = 1.55, p = .12
Persistence	41.27 ± 11.48	39.54 ± 9.82	t = 1.16, p = .25
Self-directedness	41.81 ± 12.79	40.38 ± 11.41	t = 0.85, p = .39
Cooperativeness	46.45 ± 12.11	43.94 ± 10.05	t = 1.61, p = .11
Self-transference	42.27 ± 9.59	42.52 ± 8.98	t = 0.19, p = .85

Abbreviations: BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; BIS/BAS, Behavioural Inhibition System/Behavioural Activation System Scale; CBT, cognitive behavioural therapy; FES, Family Environmental Scale; FPS, first-person shooter; IGD + ADHD, internet gaming disorder + attention deficit hyperactivity disorder (ADHD); IGD + MDD, IGD + major depressive disorder (MDD); IGD + Others, anxiety spectrum disorder; IQ, intelligence quotient; K-ADHD, Korean Attention Deficit Hyperactivity Disorder Rating Scale; MMORPG, multiplayer online role-playing game; RTS, real-time strategy; SADS, Social Avoidance and Distress Scale; TCI, Temperament and Character Inventory; YIAS, Young Internet Addiction Scale.

with the current results that lower ADHD and MDD scores were associated with improvements in response to CBT.

Higher harm avoidance was another predictive factor for improvement in response to CBT in the current study. Higher harm avoidance, along with novelty seeking and reward dependence, was reported to be related to internet gaming preference (not problematic internet gaming; Seong, Hong, Kim, Kim, & Han, 2019). In addition,

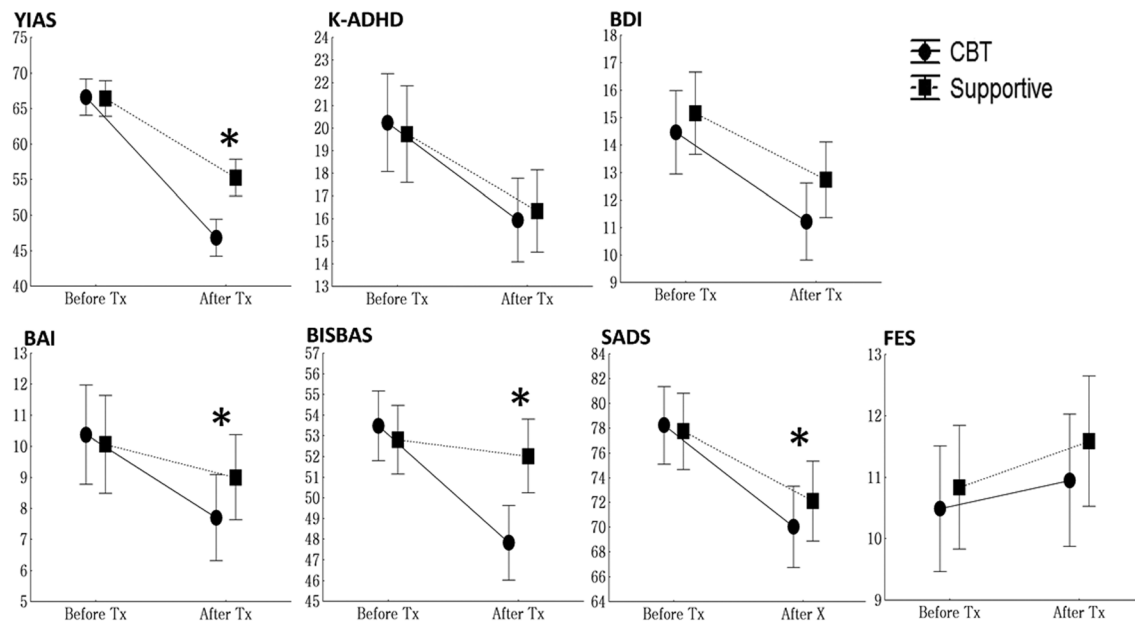


FIGURE 1 Comparison of changes in clinical scale scores in response to treatment in the CBT and supportive therapy groups. Repeated measures ANOVA. *Statistically significant. BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; BIS/BAS, Behavioural Inhibition System/Behavioural Activation System Scale; CBT, cognitive behavioural therapy group; FES, Family Environmental Scale; K-ADHD, Korean Attention Deficit Hyperactivity Disorder Rating Scale; SADS, Social Avoidance and Distress Scale; Support, supportive therapy group; YIAS, Young Internet Addiction Scale

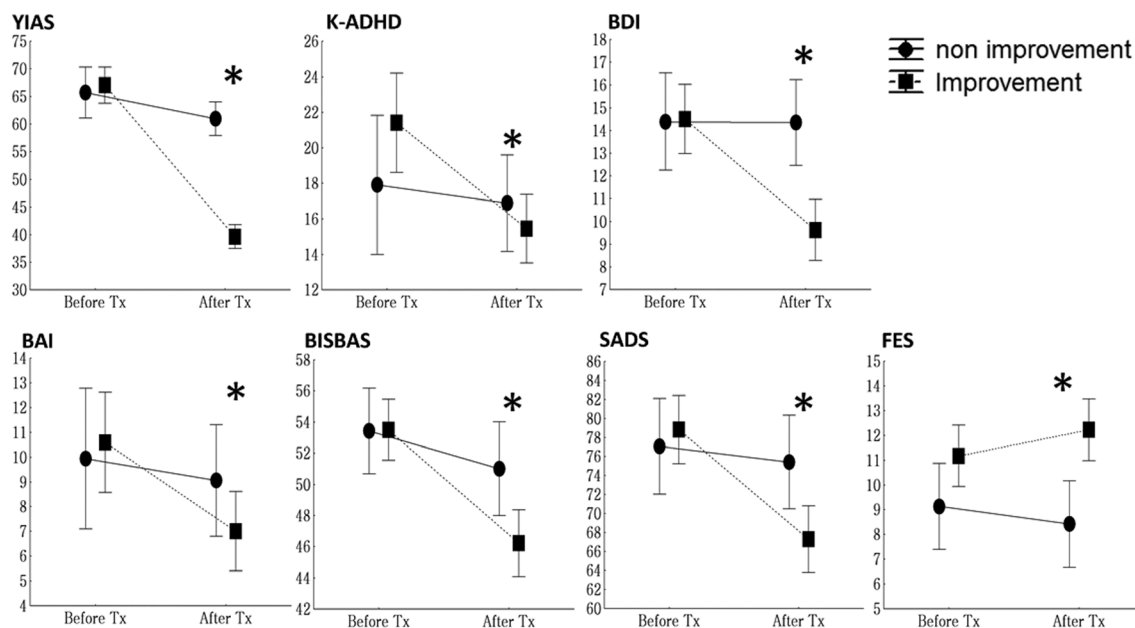


FIGURE 2 Comparison of changes in clinical scale scores in response to CBT treatment in the improvement and non-improvement groups. Repeated measures ANOVA. *Statistically significant. BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; BIS/BAS, Behavioural Inhibition System/Behavioural Activation System Scale; FES, Family Environmental Scale; K-ADHD, Korean Attention Deficit Hyperactivity Disorder Rating Scale; SADS, Social Avoidance and Distress scale; YIAS, Young Internet Addiction Scale

harm avoidance was associated with an anxious personality and introversion (De Fruyt, Van De Wiele, & Van Heeringen, 2000). As mentioned above, the CBT programme used in the current study was focused on anxiety control. We think that anxiety control in the CBT process may help introverted and highly anxious IGD patients to

improve their IGD symptoms. Interestingly, Lee et al. (2018) suggested that higher aggression and harm avoidance scores predict worse prognosis of IGD treatment. Lee et al.'s group only conducted parental coaching (no anxiety control for patients) whereas our study conducted CBT for IGD.

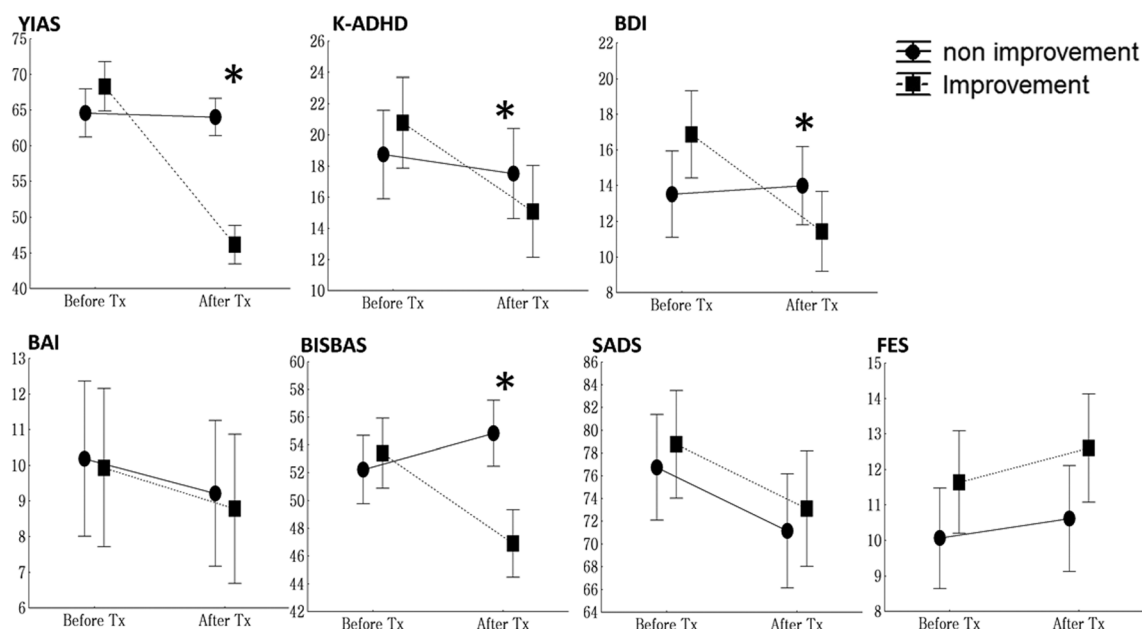


FIGURE 3 Comparison of changes in clinical scale scores in response to supportive treatment in the improvement and non-improvement groups. Repeated measures ANOVA. *Statistically significant. YIAS, Young Internet Addiction Scale; K-ADHD, Korean Attention Deficit Hyperactivity Disorder Rating Scale; BDI, Beck Depression Inventory; BAI, Beck Anxiety Inventory; BIS/BAS, Behavioural Inhibition System/Behavioural Activation System Scale; SADS, Social Avoidance and Distress Scale; FES, Family Environmental Scale

4.2 | Comparison of changes in clinical scale scores in response to treatment

The impact of this new version of CBT was represented by the effects on various psychological and environmental factors. The CBT group showed a greater decrease in YIAS, BAI, BIS/BAS, and SADS scores compared with the supportive therapy group. In post hoc analysis, patients with improvement in both the CBT and supportive therapy groups showed greater improvements in YIAS, ADHD, BDI, and BIS/BAS scores. However, improvements in BAI, SADS, and FES scores were observed only in the CBT group. This indicates that our CBT programme for IGD may be more effective for the improvement of IGD symptoms by controlling anxiety, impulsivity, and social avoidance than supportive therapy. In addition, the improvements in IGD owing to CBT could be enhanced by controlling anxiety, social avoidance, and family cohesion.

As mentioned in Session 2 of our CBT programme, anxiety and loneliness are regarded as important psychological factors in IGD treatment (Park, Han, Kim, Cheong, & Lee, 2016). Whenever patients with IGD experience academic or career-related anxiety and stress, they tend to resort to internet use to evade these feelings (Rotunda et al., 2003). Moreover, the satisfaction their virtual selves bring them further submerges them in the cyber world (Tokunaga & Rains, 2010). Individuals with high anxiety levels were reported to be more comfortable in the virtual world than in their actual lives (Morgan & Cotten, 2003). It has been found that individuals with high social anxiety and shyness or low interpersonal skills tend to overuse the internet as an interpersonal medium (Bianchi & Phillips, 2005; Campbell, Cumming, & Hughes, 2006; Chak & Leung, 2004; Engelberg &

Sjoberg, 2004). Seventy-five per cent of internet gamers make friends online and consequently find it difficult to leave the virtual world because they feel that they are more respected in that environment (Cole & Griffiths, 2007).

What is worse, this isolation causes loneliness in reality (Smahel, Blinka, & Ledabyl, 2008). In this regard, our CBT programme for IGD involved a session tackling loneliness, allowing patients with IGD to face their own feelings. Through this process, patients with IGD could recognize that loneliness may be one of the major factors inducing their engagement in problematic internet gaming. In addition, participants could learn social skills and feel confident in a group because of the emphasis on interpersonal relationships during the programme sessions. Hedman et al.'s (2013) study demonstrated that behavioural therapy in groups can reduce social avoidance and reported that in the treatment of social anxiety disorder, CBT group therapy proved as effective as phenelzine, which is known to be an effective medication for this condition.

Individuals with high impulsivity are thought to display the characteristics of quick response, lack of planning skills, poor planning for future situations, risk-taking behaviours, and difficulty in stopping and controlling their initial behaviours despite risk or disadvantage (Berg, Latzman, Bliwise, & Lilienfeld, 2015). To control impulsivity in patients with IGD, the current study's CBT programme included sessions to ponder the benefits and losses resulting from impulsive gaming, as well as sessions to imagine what their lives would be like 3, 5, and 10 years later. In addition, the CBT programme suggested that self-control (and not forced control over game playing) would lead to high life satisfaction and more subjectivity in online life. We believe these sessions were effective in controlling impulsivity.

TABLE 3 Hierarchical logistic regression analysis for improvement in CBT group

Independent variables		Model 1			Model 2			Model 3			Model 4		
		B	Wald	OR	B	Wald	OR	B	Wald	OR	B	Wald	OR
Demographic factors	Age	0.015	0.106	1.015	0.037	0.486	1.038	-0.002	0.001	0.998	-0.009	0.012	0.991
	Edu	-0.055	0.164	0.946	0.007	0.002	1.007	-0.070	0.181	0.932	-0.373	2.237	0.689
	Genre		7.376			9.235			6.366			2.008	
	MMORPG	2.056	5.188	7.813*	3.431	8.938	30.908*	3.042	6.077	20.950*	3.543	1.792	34.583
	RTS	0.877	1.071	2.403	2.350	4.483	10.489*	1.996	2.848	7.360	2.486	1.160	12.011
	FPS	1.922	3.091	6.831	2.484	3.466	11.987	1.705	1.510	5.501	3.011	1.351	20.300
	Smoking		3.563			4.470			1.743			3.485	
	Heavy	-0.068	0.005	0.934	0.480	0.179	1.616	0.176	0.018	1.192	-5.120	2.752	0.006
	Occasional	1.056	3.393	2.874	1.522	4.419	4.581*	1.019	1.704	2.770	0.635	0.219	1.887
	Alcohol		7.898			7.491			6.487			3.826	
Psychological Scales	Heavy	18.956	<0.001	1717.3	19.735	<0.001	3722.8	19.246	<0.001	2283.7*	26.032	<0.001	2021.5
	Occasional	-2.409	7.898	0.090*	-2.653	7.491	0.070*	-2.710	6.487	0.067	-4.171	3.126	0.025
	IQ				-0.053	5.476	0.948*	-0.048	3.831	0.953	-0.021	0.371	0.980
	YIAS				0.015	0.485	1.016	-0.029	1.125	0.971	-0.095	4.866	0.909*
	K-ADHD				-0.041	3.394	0.960	-0.062	5.617	0.940*	-0.166	7.393	0.847**
	BDI				0.019	0.142	1.019	0.001	0.000	1.001	-0.107	1.788	0.899
	BAI				0.006	0.024	1.006	-0.012	0.089	0.988	-0.087	1.870	0.917
	BISBAS				0.011	0.108	1.011	0.007	0.042	1.007	-0.028	0.399	0.972
	SADS				0.010	0.280	1.010	0.006	0.092	1.006	-0.052	1.931	0.950
	FES				0.042	1.057	1.043	0.049	1.076	1.050	0.111	2.588	1.117
Medication	Yes (0)/no(1)							2.750	11.533	15.635**	4.842	12.112	126.713**
TCI	NS										-0.033	0.449	0.967
	HA										0.201	9.263	1.223**
	RD										0.040	0.847	1.041
	PE										-0.053	1.614	0.948
	SD										-0.034	0.591	0.966
	CO										-0.027	0.410	0.974
	ST										0.000	0.000	1.000
Indices	Model 0	Model 1	Model 2	Model 3	Model 4								
-2LL	129.04	120.79	107.23	91.50	62.68								
Model χ^2/p	N/A	8.25/.14	21.81/.06	37.53/<.01	66.35/<.01								
Nag R^2	N/A	0.109	0.269	0.430	0.668								
Class accur	66.3	67.3	72.3	81.2	89.1								

Note. Dependent factor: improved (1), non-improved (0). The dependent variable, improvement, was operationalized based on a Clinical Global Impression-Improvement (CGI-I) scale score less than 4 (greatly improved, much improved, and minimally improved) and Young Internet Addiction Scale (YIAS) score < 50.

Abbreviations: -2LL, -2 log likelihood; BAI, Beck anxiety inventory; BDI, Beck depressive inventory; Class accur, classification accuracy; Co, cooperativeness; HA, harm avoidance; K-ADHD-RS, Korean version of the Dupauls' ADHD rating scale; Nag R^2 , Nagelkerke's R^2 ; NS, novelty seeking; Pe, persistence; RD, reward dependence; SD, self-directedness; ST, self-transcendence.

* $p < .05$; ** $p < .01$.

4.3 | Limitations

There were several limitations to the current study. First, as the results were analysed with clinical information, it was difficult to control covariate data. Although statistical control was applied, the study was unable to demonstrate the pure effects of CBT without the effects of medication. Second, the lack of randomization in the current study design suggests that the results could have been due to selection bias. The temperament and character traits of participants in the current study could have affected their decision to choose CBT. Readers should be cautious about interpreting the results. Finally, the current results merely demonstrated the short-term effects of CBT for IGD. Future studies need to focus on IGD without medication and co-morbidities as well as conducting long-term follow ups.

5 | CONCLUSION

Our CBT programme for IGD may be more effective than supportive therapy with regard to improvement in IGD symptoms by controlling anxiety, impulsivity, and social avoidance. In addition, CBT-related improvements in patients with IGD could be enhanced by controlling anxiety, social avoidance, and family cohesion.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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