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Cognitive behavioral therapy for college students with smartphone addiction

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Abstract

Cognitive behavioral therapy (CBT) is effective for people with an addiction tendency. This study aims to implement a CBT program for college students at high risk of smartphone addiction and investigate the impact of the program on their desire to use a smartphone, depression, impulsivity, and anxiety. Baseline/post-intervention evaluation and the ABA' single-case experimental design were used. The study consisted of the baseline phase (A), pre-evaluation, intervention phase (B), post-evaluation, and baseline phase (A'). Six participants were enrolled, and the main outcome variables were daily changes in the desire to use a smartphone and changes in depression, impulsivity, and anxiety after the program. Prior to the intervention, all six participants had mild to moderate depression, but after the intervention, three were normal, two had mild depression, and only one had moderate depression. Impulsivity and anxiety scores decreased after the intervention, with anxiety scores showing the most dramatic change. The percentage of non-overlapping data for the baseline phase (A)–intervention phase (B) was more than 75% and that for baseline phase (A)–baseline phase (A') was 100% for all 6 participants. This study presented a good protocol for people with low access to psychological therapy. We expect the findings will be highly useful for people suffering from psychological difficulties due to smartphone addiction.

Keywords: Smartphone addiction, Cognitive behavioral therapy, Depression, Impulsivity, Anxiety

1. INTRODUCTION

With the high penetration rate of smartphones in all age groups, the number of smartphone users has rapidly risen in recent years. Particularly, smartphone use is more quickly rising among the younger generation that uses smartphones for social media, online shopping, games, and information searching [1]. While smartphones offer convenience in various areas of daily living, owing to their easy manipulation without time and spatial restrictions and easy way of acquiring desired information, overdependence on and overuse of these devices have conceived an array of problems [2]. According to a 2018 survey of smartphone overdependence, the percentage of Korean smartphone users at risk of overdependence (high risk, potential risk groups) increased to 19.1% from 18.5% in the preceding year, and is projected to rise continuously in the coming years. By age group, the smartphone addiction rate among college students was 20.5%, 4 times higher than that among those aged in their 50s (4.8%) [3]. These statistics urgently call for measures to address the problem of smartphone addiction among college undergraduates. A recent study reported that the smartphone addiction rate among

American or European college students is on the lower side, but the rate is increasing among Korean and Chinese college students. One report attributed this to the possibility that awareness of the detrimental impact of smartphone addiction on mental health fell behind the explosive smartphone penetration in the Korean and Chinese market as a result of rapid advances in smartphone production technology [4].

Many researchers report that smartphone addicts demonstrate compulsive use, obsession, tolerance, and withdrawal symptoms, and have diminished self-control and possibly many problems in their daily lives [5].[5] Young et al. [6] stated that such features of the medium encourage people who have experienced frustration or negative emotions in real life to be more dependent on the virtual world. Furthermore, the short and intense stimulation from smartphones may bring about a pleasure-seeking tendency and make it difficult for people to focus on slow stimulation or deep thinking [7]. In general, people with overuse tendencies commonly show high impulsivity, and smartphone over-users also reportedly demonstrate high impulsivity [8]. Hwang et al. (2012) and Hong (2015) reported that negative emotions such as depression increase with the increasing use of smartphones [9, 10]. In addition, smartphone addiction triggers mental health problems such as psychological anxiety. People suffer from psychological anxiety when they do not have access to a smartphone and in addition, are severed from communication with people by overindulging in smartphone use [11].

Therefore, specific and professional intervention programs are needed to prevent and intervene in smartphone addiction. Various therapeutic approaches such as cognitive behavioral therapy (CBT), art therapy, and exercise therapy have been proposed to intervene in smartphone addiction. Specifically, CBT posits that maladaptive behaviours arise from unreasonable thinking patterns or a lack of adaptive coping strategies. As such, CBT has been applied to adolescents and adults with behavioural problems [12]. Reportedly, CBT programs are effective in alcohol and gambling addictions. Furthermore, when used for smartphone addiction, these programs aim to promote reasonable smartphone use by correcting cognitive distortions related to its overuse and fostering other constructive behaviours [13].

College students are in their late adolescence or early adulthood in terms of development. They have transitional developmental tasks, experience conflict, feel lost and confused, and are often highly stressed about various problems such as academics, their future career, and employment.[9] They may choose addictive behaviour as a coping strategy for such negative emotions, which in turn has an adverse impact on achieving their developmental tasks [14]. Regulating one's behaviours and establishing healthy lifestyle patterns in college would help students grow into more mature adults. Thus, this study aims to investigate the impact of a CBT program on the desire to use a smartphone, depression, impulsivity, and anxiety for college students at high risk of smartphone addiction.

## 2. METHODS

2.1 Participants

This study selected college undergraduates using structured interviews and a smartphone addiction scale. The inclusion criteria were as follows: (1) college students aged 20 years or older, (2) no history of diagnosis of a serious mental disorder such as bipolar disorder, (3) not currently on psychological or drug therapy, (4) no history of CBT, and (5) a smartphone addiction scale of 44 or higher (high-risk group). In total, 21 participants signed up, and per the inclusion criteria, 6 students were enrolled. The mean age was 23 years, and all participants were classified as a high-risk smartphone addiction group (S-scale > 44). Table 1 shows the participants' characteristics.

Table 1. Participant background variables

Participant	Age	Sex	Education (years)	Previous CBT	Current Medication
A	23	F	16	No	No
B	22	F	15	No	No
C	22	F	15	No	No
D	24	M	15	No	No
E	25	M	16	No	No
F	22	F	15	No	No

2.2 Research Design

This study used a pre-post evaluation and the ABA' single-case experimental design (Figure 1). Per the design, the study consisted of a baseline phase (A), pre-evaluation, intervention (B), post-evaluation, and baseline phase (A'). Frequent and continuous data collection is crucial for single-case studies, and this design is appropriate for studying smartphone addiction because the desire to use a smartphone generally occurs several times a day [15]. The study was conducted over 36 sessions, with 4 sessions in the baseline phase (A), 28 for the intervention (B), and 4 in the baseline phase (A'). The number of sessions was based on the suggestion of Kratochwill and Levin that 20–35 days are ideal for single-case experimental designs [16]. In the pre-evaluation and post-evaluation, participants' depression, impulsivity, and anxiety were measured. To carry out the research using survey contents and assessment report measurements, all details of this study's procedures received ethics approval from the Science Research Ethics, IRB number 1041107-201912-HR-039-01.
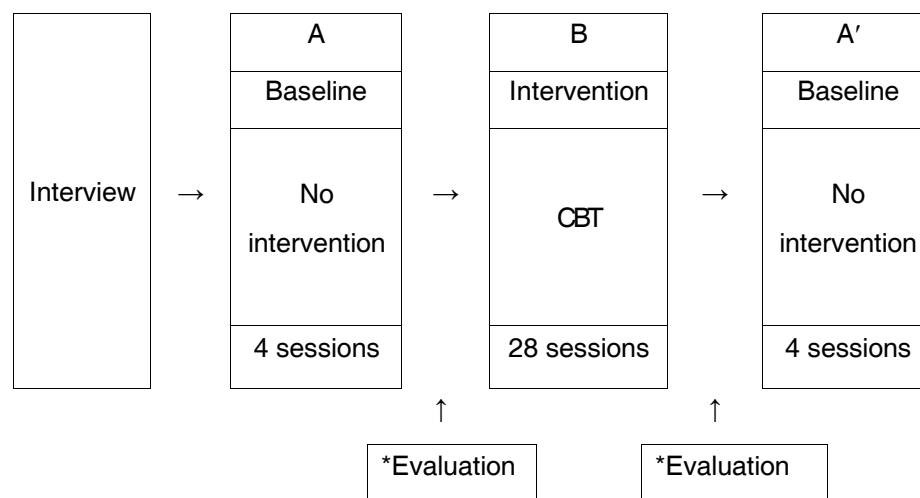
*Smartphone Addiction Scale (S-scale), Beck Depression Inventory (BDI), Barratt Impulsiveness Scale-Ⅱ (BIS -Ⅱ)

Figure 1. Flow chart

2.3 Instruments

2.3.1. Smartphone Addiction Scale (S-scale)

Smartphone addiction was measured using the Smartphone Addiction Scale (S-scale) developed by the National Information Society Agency [17]. This tool consists of 15 items, each rated on a 4-point Likert scale. The total score ranges from 0–60, with a higher score indicating more smartphone overuse. A score of 39 or lower indicates normal smartphone use, and a score of 40–43 is considered potential smartphone overuse. A score of 44 or higher is considered to indicate a high risk of smartphone addiction.

2.3.2. Beck Depression Inventory (BDI)

Depression was measured using the Beck Depression Inventory (BDI). The BDI is a self-reported survey developed to determine depression symptoms encompassing the affective, cognitive, motivational, and physiological domains [18]. The BDI comprises negative attitude, performance difficulty, and somatic elements, with more items addressing the cognitive element than somatic element [19]. Each item is rated on a 4-point scale ranging from 0–3, and the total score ranges from 0–63. Beck classified the scores as no depression (0–9), mild depression (10–15), moderate depression (16–23), and severe depression (24–63).

2.3.3. Barratt Impulsiveness Scale-II (BIS-II)

Impulsivity was measured using the Barratt Impulsiveness Scale-II (BIS-II). This tool consists of 23 items, each rated on a 4-point Likert scale. The total score ranges from 0–92, where a higher score indicates higher impulsivity [20].

2.3.4. Interaction Anxiousness Scale (IAS)

Anxiety was measured using the Interaction Anxiousness Scale (IAS). This tool consists of 15 items, each rated on a 5-point Likert scale. The total score ranges from 0–75, where a higher score indicates a higher level of anxiety [21].

2.3.5. Visual Analog Scale (VAS)

Changes in the desire to use a smartphone were measured using the Visual Analog Scale (VAS). VAS is a simple, individualised data collection option. A promising body of work in educational settings has supported the sensitivity, reliability, concurrent validity, and generalisability of the scale [22]. Participants indicated the level of their desire to use a smartphone after completing the CBT program every day on a scale ranging from 0 (no desire at all) to 10 (extremely strong desire) (Figure 2).
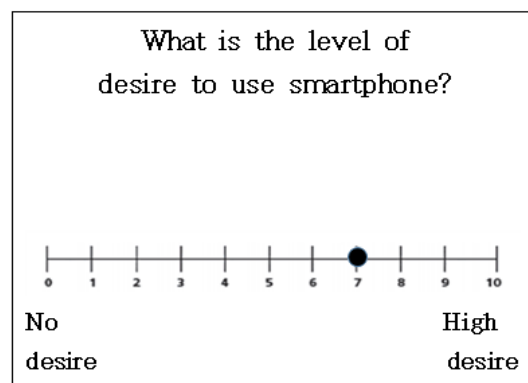

Figure 2. Sample VAS rating scale

2.4 Intervention

The CBT program used in this study was developed with reference to the cognitive behaviour model by Na and Lee [23, 24]. It aimed to induce a behavioural change (reasonable smartphone use) by reconstructing the automatic thoughts of smartphone addicts. The study facilitator is a psychosocial occupational therapist with five years of clinical experience treating patients with psychosocial disorders. The facilitator is particularly experienced with using CBT to treat the problem behaviours of children with autism or attention deficit hyperactivity deficit (ADHD). Treatment was performed through a 1:1 face-to-face session, and the facilitator met with the participant every Monday to administer a 60-minute program. After the program each Monday, participants were instructed to adhere to the treatment in their normal school lives from Tuesday to Sunday using a checklist. The program was administered for four weeks. In week 1, the program identified participants' smartphone use patterns and focused on recognising the association with emotional responses and automatic thoughts. Furthermore, participants were instructed to explore their values, choose those they consider important, and practice one every day. Through this, the program helped participants realise that knowing their values is more important than using a smartphone. In week 2, participants examined their interpersonal relationships, school studies, family situations, and health before and after smartphone overuse and identified alternative activities to using a smartphone. They were then instructed to perform these activities every day throughout the rest of the week. In week 3, the program focused on coping with their desire, and participants were instructed to write down situations in which they wanted to use a smartphone and the level of desire they felt. They shared means to cope with their desire with the therapist, and after practicing coping measures every day, indicated the level of their desire to use a smartphone. In week 4, the focus was on coping with high-risk situations. Participants set their target duration of smartphone use and had to adhere to the set target. They then kept a journal to write about the good feelings they had when achieving their goals, and were instructed to use the coping strategies learned thus far when they had an impulse to use the smartphone. The students recorded the duration of their smartphone use and level of desire to use a smartphone every day on their checklist and monitored their progress by talking with the therapist over the phone once a day.

2.5 Analysis Methods

The collected data were analysed using Microsoft Office Excel 2007 and SPSS ver. 24.0. Descriptive statistics were used for subjects' general characteristics and the results of the pre- and post-program assessments. The graphs of the results of driving simulator training were created using Microsoft Office Excel 2007 and edited using GraphPad Prism5. The means were compared to compute the mean score of desire to use a smartphone during the baseline phase (A), intervention phase (B), and baseline phase (A′). The effect size of a single-case study was computed using the percentage of non-overlapping data (PND). This is the oldest and most widely used method to compute effect size. The percentage of data overlapping between the intervention phase (B) and baseline phase (A) is an important criterion to determine the effectiveness of a treatment. A treatment is considered effective if performance in the intervention phase (B) does not overlap with that in the baseline phase (A). Parker et al. (2011) reported that an intervention is effective if the percentage is 70% or higher, doubtful if between 50–70%, and ineffective if below 50%. In this study, we computed the PND between the baseline phase (A) and intervention phase (B) and between the baseline phase (A) and baseline phase (A′) [25].

3. RESULTS

3.1   Changes in Depression, Impulsivity, and Anxiety

The following results were obtained for depression, impulsivity, and anxiety (Table 2). First, prior to the intervention, two of the six participants had mild depression and four had moderate depression. After the intervention, three students had no depression, two had mild depression, and only one had moderate depression. The scores for impulsivity decreased after the intervention, but not as much as the depression and anxiety scores. Anxiety scores changed most dramatically. The mean anxiety score decreased from 44.1±6.4 to 29.8±6.7, showing that the state of anxiety was substantially reduced overall. Most participants had a high anxiety score prior to the intervention, but the scores decreased by 7–21 points after the intervention.

Table 2. Changes in depression, impulsivity, and anxiety

Participant	Depression		Impulsivity		Anxiety	
	Pre	Post	Pre	Post	Pre	Post
A	12	8	14	13	45	26
B	16	9	18	16	35	27
C	15	7	18	12	46	39
D	22	13	21	19	49	28
E	20	15	26	22	52	37
F	19	17	19	19	38	22
Mean±SD	17.3 ±3.6	11.5±4.1	19.3±3.9	16.8±3.8	44.1±6.4	29.8±6.7

Table 3. Mean of desire to use smartphone during baseline and intervention phase

	Desire to use smartphone							
	Phase A (Baseline)	Mean±SD	Phase B (Intervention)	Mean±SD	Phase A′ (Baseline)	Mean±SD	PMD[1] (A-B)	PMD[2] (A-A′)
A	7.2		3.6		3.3		89%	100%
B	7.5		3.9		2.5		85%	100%
C	5.7		4.2		3.7		75%	100%
D	8.2	7.3±0.9	4.5	4.2±0.6	3.7	3.2±0.5	85%	100%
E	8.2		5.2		3.5		85%	100%
F	7.2		3.5		2.5		82%	100%

PMD: Percentage of non-overlapping data   PMD[1]: Phase A–Phase B percentage of non-overlapping data
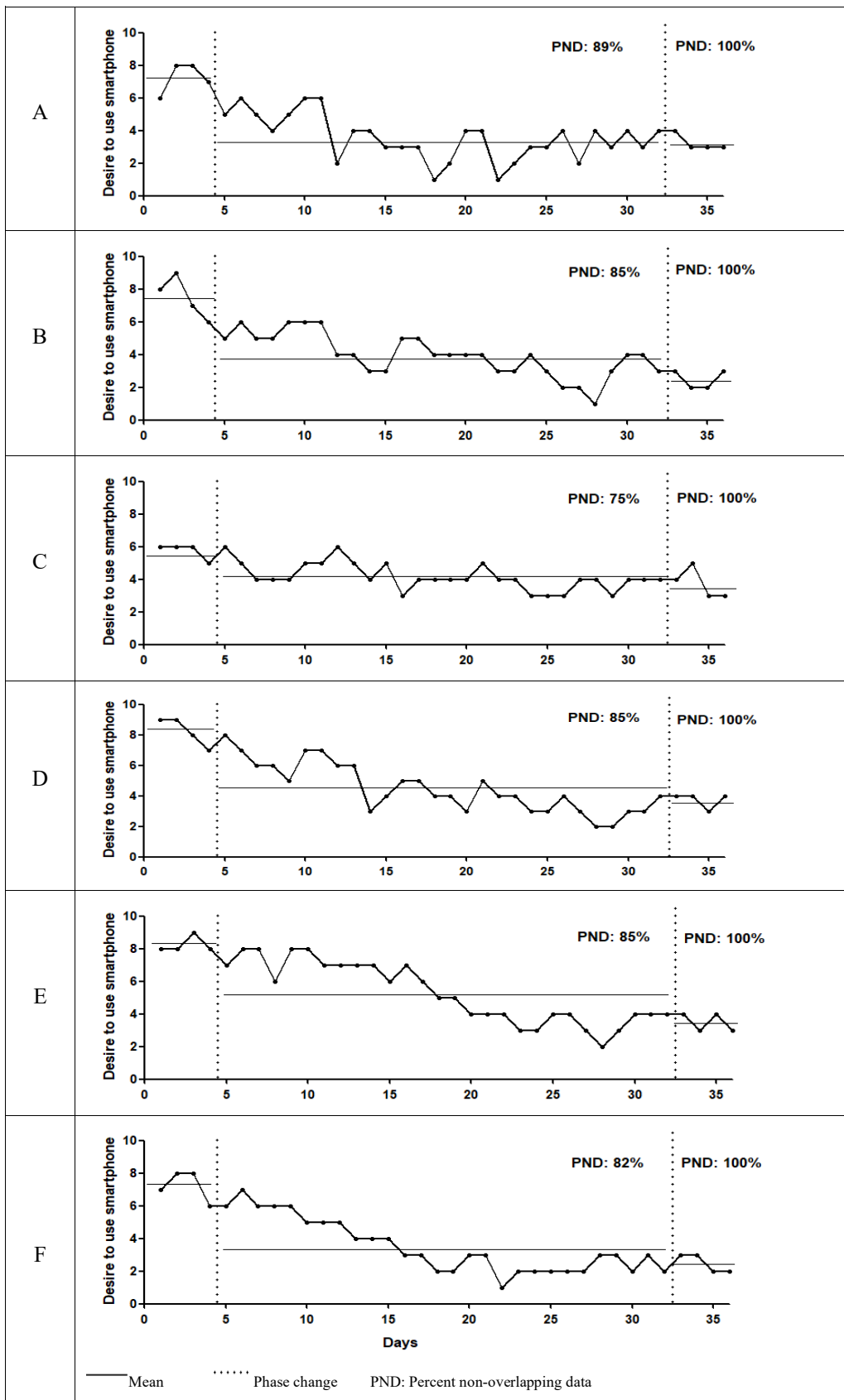PMD[2]: Phase A–Phase A′ percentage of non-overlapping data

Figure 3. Changes in the results for subjects' desire to use a smartphone

3.2   Changes in the Desire to Use a Smartphone

All six participants had a lower desire to use a smartphone during the intervention phase (B) compared to the baseline phase (A) (Table 3). The exact daily records are shown in Fig. 3. The mean score for desire to use a smartphone was 7.3±0.9 in the baseline phase (A), 4.2±0.6 in the intervention phase (B), and 3.2±0.5 in the baseline phase (A′). This shows that the generally high desire to use a smartphone before the intervention decreased in the intervention phase and further decreased after the intervention. The PND between the baseline phase (A) and intervention phase (B) was above 75% for all participants, confirming that the intervention was effective. Specifically, participants who had a high desire to use a smartphone in the baseline phase showed a greater reduction of this desire in the intervention phase. The PND between the baseline phase (A) and baseline phase (A′) was 100% for all participants, confirming that the effects of the intervention were well maintained.

4. DISCUSSION

This study aimed to investigate the effects of a CBT program on the desire to use a smartphone, depression, impulsivity, and anxiety for college students at high risk of smartphone addiction. The results showed that all six participants had mild to moderate depression before the intervention. After the intervention, three participants had no depression, two had mild depression, and only one had moderate depression. This is similar to the significant reduction of depression in the study by Choi (2019), which applied a CBT program for adolescents with Internet addiction, and research by Yim et al. (2013), which administered a CBT program for high school students with online game over-immersion [25, 26]. Jung [27] reported that CBT training, in which individuals identify their cognitive errors and distorted beliefs about negative attitudes, alter beliefs, and engage in alternative thinking, is effective in the treatment of depression. The CBT program used in this study induced cognitive reconstruction by having participants write about the automatic thoughts they have when they overuse a smartphone. Participants were also instructed to check their cognitive errors to recognise their depression responses that may result from dysfunctional thoughts. Moreover, by encouraging participants to recognise the values important to them and engage in meaningful alternative activities when such thoughts occur, they were able to think more flexibly and objectively, which is presumed to have contributed to lowering depressive emotions.

The scores for impulsivity also decreased after the intervention. These results are similar to those of a previous study that applied CBT on adolescents with online gaming addiction [28]. The CBT program used in this study aimed to convert negative thinking to positive thinking by identifying and correcting negative thoughts and those that weaken one's willpower, and encouraging students to spend more time on connecting with people and talking to their family instead of using a smartphone. Furthermore, by having students prepare measures to cope with the desire to use a smartphone, the program helped them regulate the duration of smartphone use and develop confidence in self-regulatory behaviours. These components presumably contributed to lowering impulsivity.

The scores for anxiety decreased the most compared to those for depression and impulsivity. Oh and Son (2009) reported that exposure training can reduce anxiety among college students with high anxiety, and Hofmann, Asmundson, and Beck (2013) noted that elements of behavioural therapy such as practicing self-expressive behaviours can lower anxiety [29, 30]. In our CBT program, each student met with a therapist face-to-face every week and had an opportunity to honestly express their thoughts. Students confided in the therapist about the emotions they experienced when overusing a smartphone and consequent negative thoughts. The therapist then supported students to transform these negative thoughts into more positive ones without criticising them. Ultimately, it seems that the students were able to regulate their anxiety by correcting their

distorted thoughts about themselves, engaging in better alternative activities, and alleviating their desire to use a smartphone.

All six participants showed a lower desire to use a smartphone in the intervention phase (B) compared to the baseline phase (A), and the score was maintained at a lower level in the baseline phase (A′). The PND between the baseline phase (A) and intervention phase (B) was above 75% for all participants, and that between the baseline phase (A) and baseline phase (A′) was 100% for all patients, confirming that the effects of the intervention were maintained effectively. In this study, participants were instructed to record the duration of their smartphone use and desire to use a smartphone every day so that they could understand their smartphone usage. They were also instructed to visually record the level of their desire using VAS. Using a VAS for repeated measurement of intervention responses revealed day-to-day variability that would not have been captured using a pre-evaluation and post-evaluation method alone. In addition, participants wrote about the things they have lost or gained as a result of smartphone overuse and about the pros and cons and side effects of using a smartphone. Furthermore, participants were encouraged to substitute their smartphone usage with more constructive activities. We believe that these processes ultimately curtailed their desire to use a smartphone. Overall, participant satisfaction with the treatment format appears favourable. Participants rated the overall treatment highly in terms of quality of service, the extent to which the treatment met their needs, and extent to which it helped them deal effectively with their problems. We attribute these good outcomes to the fact that the participants faithfully adhered to the activities they had learned in their weekly sessions with the therapist, and the daily phone calls to encourage them were also likely helpful. Susan et al. (2015) administered a home rehabilitation program to community-dwelling stroke patients and found marked differences in the depression and quality of life between the group that regularly received encouraging phone calls and the group that underwent the program on their own without the calls [31]. This study highlights the importance of providing participants with affectionate encouragement every day and monitoring their progress in the program.

Therapists delivering the intervention were occupational therapists qualified to deliver CBT, and as such received regular and adequate supervision. However, there was no measure of therapist integrity and therefore adherence to the CBT model. Furthermore, this study only included six participants, limiting the generalisability of the findings. However, in single-case designs, participants' data are scrutinised on an individual level and the general effects across all participants, as seen in the current study, are often perceived as generalizable [15, 16]. In addition, because there was no follow-up with participants, the long-term sustainability of therapeutic effects could not be studied.

5. CONCLUSION

This study administered a CBT program to treat smartphone addiction and examined the impact thereof. In summary, our results confirmed that the CBT program used in this study was effective in reducing depression, impulsivity, anxiety, and in lowering the desire to use a smartphone among people with smartphone addiction. Many people with psychological problems are reluctant to seek medical help or disclose their situation. Specifically, college students often cannot receive psychological therapy even if they want to because of their lack of a fixed income. This study presented a good protocol for people with low access to psychological therapy. As such, we expect that the findings will be highly useful for people suffering from psychological difficulties due to smartphone addiction.

CONFLICTS OF INTEREST

The author declares no conflicts of interest.

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