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# Efficacy of Personalized-Computerized Inhibitory Training program (PCIT) combined with exposure and response prevention on treatment outcomes in patients with contamination obsessive–compulsive disorder

Fatemeh Jafarian Dehkordi, Abbas Ramezani Farani, Banafsheh Gharraee, Mohsen Shati<sup>1</sup>, Ahmad Ashouri

## Abstract:

**BACKGROUND:** Cognitive behavioral therapy (CBT) including exposure and response prevention (ERP) is the most effective and first-line treatment for obsessive–compulsive disorder (OCD). However, a significant number of people leave it or do not respond to it effectively. The present study aimed to examine the efficacy of personalized-computerized inhibitory training (P-CIT) program combined with ERP on treatment outcomes in patients with contamination OCD.

**MATERIALS AND METHODS:** The present research method was based on an experimental design with pre-test, post-test, and the two intervention and control groups. Thirty patients with contamination OCD were randomly assigned to the two groups of intervention and control based on the inclusion and exclusion criteria. The measures used in this study were Yale-Brown Scale, Stroop task, World Health Organization's Quality of Life Questionnaire, Structured Clinical Interview for DSM-5, and Depression Anxiety and Stress Scales -21.

**RESULTS:** The results showed a significant reduction in severity of symptoms ( $F = 0.75, P < 001$ ) and severity of anxiety ( $F = 0.75, P < 001$ ) for the intervention group. Furthermore, task control ( $F = 12.44, P < 001$ ), mental health ( $F = 28.32, P < 001$ ), physical health ( $F = 2.48, P < 001$ ), and overall quality of life ( $F = 0.19, P = 001$ ) improved in the intervention group after the intervention.

**CONCLUSION:** When P-CIT is exerted along with ERP, it may enhance inhibition of compulsions and increase the efficacy of ERP through improved task control, thereby resulting in reduced symptom severity and improved treatment outcomes in patients with contamination OCD.

## Keywords:

Exposure and response prevention, obsessive–compulsive disorder, personalized-computerized inhibitory training program, task control

## Introduction

Obsessive–compulsive disorder (OCD) is the fourth most common psychiatric diagnosis.<sup>[1]</sup> Obsessions and compulsions cause significant discomfort and disrupt personal, social, educational, and

professional life.<sup>[2,3]</sup> The most common type of OCD, according to the DSM-5, is contamination obsession, followed by forced washing.<sup>[2,4]</sup> Additionally, when OCD is not treated, it becomes a chronic condition that affects various domains of life with

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Department of Clinical and Applied Psychology, School of Behavioral Sciences and Mental Health (Tehran Institute of Psychiatry), Iran University of Medical Sciences, Tehran, Iran, <sup>1</sup>Mental Health Research Center, Psychosocial Health Research Institute, Iran University of Medical Sciences (IUMS), Tehran, Iran

## Address for correspondence:

Dr. Ahmad Ashouri, Department of Clinical and Applied Psychology, School of Behavioral Sciences and Mental Health (Tehran Institute of Psychiatry), Iran University of Medical Sciences, Tehran, Iran. E-mail: ashouri.a@iums.ac.ir

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negative effects on the person's quality of life.<sup>[5-7]</sup> Albert *et al.* showed that contamination and washing obsession have a significant correlation with reduced quality of life than other patterns of OCD.<sup>[8-11]</sup>

Recommended therapies for OCD include cognitive behavioral therapy (CBT), exposure and response prevention (ERP), and medication.<sup>[12]</sup> The effectiveness of ERP has been experimentally confirmed and the American Psychological Association has shown that this treatment is one of the established therapies for OCD.<sup>[13]</sup> Research has also shown that all therapy guidelines recommend CBT as a first-line treatment for OCD.<sup>[14,15]</sup> Hezel and Simpson in a 2019 review study also found that ERP was more effective in treating OCD than other psychotherapies.<sup>[16]</sup> Investigations in Iran also showed that ERP reduced obsessions and compulsions and increased the quality of life (QoL) in people with OCD.<sup>[17]</sup>

Although ERP is one of the most appropriate modern psychotherapies for OCD, it was shown by some studies that approximately 40% of patients failed in the therapy, and some patients improved only slightly, while the symptoms and the low QoL remained static. Furthermore, some patients could tolerate the anxiety associated with ERP, and some others (20%) either left treatment or denied performing homework.<sup>[18,19]</sup> According to Ojalehto *et al.*,<sup>[20]</sup> 50% of people with OCD did not respond optimally to ERP. Therefore, it is necessary to investigate to improve this treatment or design more effective treatments by filling the existing gaps. Recent OCD conceptual models demonstrated that the best predictor of the effectiveness of ERP was the patient's adherence to inhibit compulsions.<sup>[21,22]</sup>

Over the past 50 years, great advancements have been made in the treatment of mental disorders, including the development of the internet and computer-based therapies.<sup>[23,24]</sup> According to some studies, cognitive rehabilitation (CR) can be used to improve the ability to control activity and refers to two main categories of techniques, namely, tradition rehabilitation and computerized cognitive rehabilitation (CCR). CCR uses multimedia and informatics resources with special hardware and software systems to implement cognitive education.<sup>[25]</sup> Computerized cognitive education has been effective in strengthening general cognitive control abilities in healthy individuals and a specific population of patients.<sup>[26]</sup>

The personalized-computerized inhibitory training (P-CIT) program aims to increase the effectiveness of ERP in patients with OCD. Research has shown that P-CIT is feasible, acceptable, and effective when coupled with a brief course of ERP and might enhance ERP via improving task control. When exposed to compulsions

stimulus images (which were specific to each individual due to personal obsessions), patients learned to inhibit compulsions automatically and then, generalized them to real-life which enhanced the effect of ERP.<sup>[27]</sup>

Calkins and Otto<sup>[28]</sup> conducted a study titled "Testing the Boundaries of Computerized Cognitive Control Training on Symptoms of Obsessive Compulsive Disorder". The results showed that after training, no significant difference was found between the groups in OCI-R scores, which showed that the use of cognitive control training (CCT) was ineffective in reducing obsessive-compulsive (OC) symptoms, but there were significant differences in emotion regulation. Furthermore, participants in the CCT group showed a greater decrease in negative emotions in three training sessions. Haghshenas *et al.*<sup>[29]</sup> conducted a study in 2017 to investigate the effect of computer cognitive restorative therapy on improving the executive functions of OCD patients. The results showed that computerized cognitive restorative therapy was effective in improving the executive functions of OCD patients and it could be concluded that computerized cognitive restorative therapy can be used by psychologists and therapists as a cost-effective and effective treatment to improve the executive functions of patients with OCD.

The most common symptoms of obsession in Iranian patients are contamination obsessions.<sup>[30]</sup> Thus, due to being involved in the content of OCD symptoms with culture and its importance in treatment, we were able to use this program in our research by localizing the images used in the P-CIT program according to Iranian culture and receiving their approval by OCD specialists and patients; we then confirmed the acceptability and quality of the program in their view. In general, this study—with changes in the previous study, such as more samples, considering the control group treated with ERP only, and selecting OCD people with the subtype of contamination only for more similarity of OC images (more control over disturbing variables)—sought to answer the fundamental question of whether P-CIT with ERP significantly reduces the severity of OCD symptoms and the effect on the outcome of therapy in patients with contamination OCD.

## Materials and Methods

### Study design and setting

The present research design was based on an experimental design with pre-test, post-test, and random assignment of participants to the intervention and control groups. According to the sample size formula, nine people were required in each group, but considering the probability of falling, fifteen samples in each group were considered (thirty in total). In this study, ERP was

performed in 17 individual sessions of 90–120 minutes every week based on the guidelines for exposure therapy and response prevention for obsessive-compulsive disorder.<sup>[31]</sup> One week before the start of ERP sessions, the experimental group members first observed and confirmed the OC images used in the first stage of P-CIT to personalize the program. After seven days at the clinic, they began a course of 17 sessions of ERP treatment while continuing to perform P-CIT. They performed the program 3 times a day at home during the study and delivered the result of each performance in the form of an Excel file to the therapist in the next session. The control group underwent 17 sessions of ERP without any computer program. To control the difference between the treatments, both groups were treated by a single therapist. Inclusion criteria were the initial diagnosis of contamination or washing OCD by a psychiatrist and the structured clinical interview for DSM 5 (SCID 5), and then a score of 16 or higher on the Yale-Brown Obsessive-Compulsive Disorder Scale (Y-BOCS), so that the patients are aware of the problems and disorder and also have a non-delirious understanding of the cause and meaning of the disorder; acquaintance with the computer and how to work with it; age between 18 and 55 years; and at least eight years of education to complete questionnaires and tasks. Exclusion criteria were receiving psychological and pharmacological treatments in the 3 months before inclusion in the study; comorbidity with psychotic disorders, substance-related disorders, and organic brain disorders. After the end of the treatment sessions and also 2 months after that (follow-up), post-tests were performed again for both groups by an independent evaluator-therapist. Five people (three in the experimental group and two in the control group) withdrew from the study due to COVID-19 and were replaced.

### Study participants and sampling

The statistical population of this study included all patients referred to the clinic of the Faculty of Behavioral Sciences and Mental Health, the clinic of Hazrat Rasoul Hospital, and the clinic of Iran Psychiatric Hospital in Tehran from 2020 to 2021 and who were diagnosed by a psychiatrist and SCID-5. Moreover, participants were selected using the available sampling method based on inclusion and exclusion criteria and then randomly assigned to the intervention and control groups.

### Data collection tool and technique

The purpose of designing P-CIT was to strengthen the task control in OCD patients to reduce compulsions and increase the effectiveness of ERP. The training program of each session consisted of 32 images. Patients performed the program 3 times a day at home during the study and filed related worksheets. The goal was to suppress obsessive trigger images instead of forcing or

avoiding them, which are provocative activities, and to act purposefully according to the program instructions and practice to inhibit the response when confronted with images of their OCD symptoms. Also, when they did not press any key at the time of hearing the beep and remained with the OC image until the image changed, they gained a kind of preparation for the actual exposure [Figure 1 here].

### Measures

#### *Yale-Brown Obsessive-Compulsive Disorder Scale (Y-BOCS)*

This ten-item scale was developed by Goodman *et al.*<sup>[32]</sup> Five items focus on obsessions and five others on compulsion. Scoring includes very normal (>10), normal (10–15), average (16–25), and severe (>25). The highest score is 40. The reliability among the interviewers ( $r = 0.98$ ), its internal consistency coefficient ( $r = 0.89$ ), and its reliability coefficient by retesting method at 2-week intervals ( $r = 0.89$ ) were reported in an Iranian community.<sup>[33]</sup> In a healthy Persian population, Cronbach's alpha was reported to be 0.95. Validity of two halves was 0.89, and retest validity was 0.99.<sup>[34]</sup>

#### *Stroop task*

The Stroop task was first developed in 1935 by Ridley Stroop to measure selective attention and cognitive flexibility. The interference rate is obtained by subtracting the number of congruent and incongruent points. Research has shown the appropriate validity and reliability of this tool. The validity of this test has been reported through retesting in the range of 0.80 to 0.91.<sup>[35,36]</sup> In an Iranian community, the validity of the interference score, facilitation, and the number of errors by the test-retest method was 0.9, 0.4, and 0.3, respectively.<sup>[37]</sup> In the present study, the number of errors in the third stage was used as the inability to inhibit unrelated information to provide a targeted response which was equivalent to the lack of task control.

#### **World Health Organization's quality of life questionnaire (WHOQOL-BREF)**

The hundred-item WHOQOL was developed in 1996 by a team of WHO experts. It consists of two questions about general health satisfaction and a person's overall understanding of their quality of life, and the rest of the questions measure a person's feelings and behaviors in the last 2 weeks in different dimensions of quality of life: physical, psychological, social, and environmental dimensions.<sup>[38,39]</sup> The questionnaire scores from 4 to 20. The total reliability coefficient of the test was 0.73, and the Cronbach's alpha for physical health, mental health, social relations, and environmental health were estimated to be 0.76, 0.71, 0.82, and 0.70, respectively.<sup>[40]</sup>

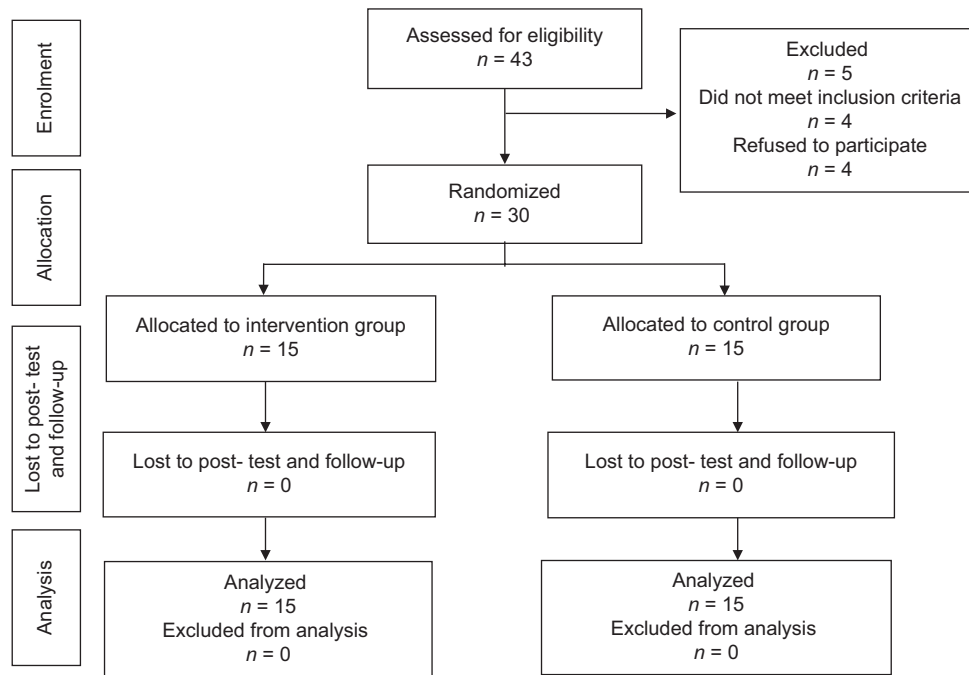


Figure 1: Participants flowchart

### Structured clinical interview for DSM-5 (SCID-5)

The SCID-5 is a semi-structured interview for the main diagnoses of DSM-5 and is conducted by a trained clinician (a psychologist or a psychiatrist) who is acquainted with the diagnostic criteria and classification of disorders in the DSM-5.<sup>[41]</sup> The validity and reliability of the SCID-5 have been reported in various studies.<sup>[42]</sup> In an Iranian population, the kappa was higher than 0.4 for all diagnoses except anxiety disorders, and the agreement was above average apart from the anxiety disorders which was moderate (kappa = 0.34) between the psychiatrist's report and the SCID interviewer.<sup>[43]</sup> Patients who had the required criteria for contamination OCD were added to the study.

### Depression, anxiety and stress scale-21 (DASS-21)

This scale is a set of three self-assessment subscales designed to measure negative emotional states of depression, anxiety and stress.<sup>[44,45]</sup> The questionnaire scores from 0 to 28 for depression, 0 to 20 for anxiety, and 0 to 33 for stress. In an Iranian community, internal consistency using Cronbach's alpha for depression, anxiety, and stress was reported 0.77, 0.79, and 0.78, respectively. The correlation between the depression subscale and Beck Depression Inventory was 0.70, anxiety subscale with Zank Anxiety Test (SAS) was 0.67, and stress subscale with Perceived Stress Test (PSS) was 0.49.<sup>[46]</sup>

### Data analysis

SPSS software version 25 was used for data analysis. In data analysis, mean, standard deviation, minimum and

maximum scores were used to describe quantitative variables in terms of conditions; and frequency report (percentage) was used for qualitative variables. Then, using skewness and kurtosis indices and the Shapiro-Wilk test, the normality of the distribution of research variables was investigated. To check the accuracy of the hypotheses and questions, a mixed analysis of variance (ANOVA) test was used to compare the mean of the variables between the two groups at baseline, post treatment, and at follow-up.

### Ethical consideration

Ethical approval for this study was obtained from the department of clinical and applied psychology, School of Behavioral Sciences and Mental Health (Tehran Institute of Psychiatry), Iran University of Medical Sciences, Tehran, Iran. Furthermore, participants were given information about the study and provided informed consent in writing.

### Results

According to Table 1, the differences between the two groups were not significant in terms of age, gender, marital status, and the mean years of education.

According to Table 2, the results of the independent *t*-test and Mann-Whitney *U* test showed that the mean of obsession, compulsion, and total OCD symptom severity in the control group was higher than the intervention group at post-test. Therefore, it can be said that P-CIT along with ERP has been effective in reducing obsession, compulsion and total OCD symptom



severity, and has continued to over time. The results of the *post hoc* test for depression showed that in both groups, there was a significant difference before and after the intervention ( $P < 0.001$ ), and between the stages before the intervention and follow-up ( $P = 0.01$ ). The results also showed that the mean severity of anxiety symptoms was not significantly different before and after the intervention in the two groups ( $P < 0.05$ ). The results of mixed ANOVA showed that the mean changes in stress were not significantly different between the two groups over time and that there was no significant difference between the two groups ( $P < 0.05$ ). However, there was a significant difference between different stages of measurement ( $P < 0.001$ ) and the results of the *post hoc* test showed that there were significant differences among the baseline, after the intervention, and follow-up ( $P < 0.001$ ). However, there was no significant difference between the post-treatment and follow-up ( $P = 0.99$ ).

### Activity control

The mean inability to inhibit response was significantly different between the intervention and control groups over time (with a small impact factor) ( $P < 0.05$ ). At the baseline, the inability to inhibit response was not significantly different in the intervention and control groups.

### Quality of life

The results of independent *t*-test and Mann–Whitney *U* test showed that the mean of mental health and overall quality of life before the intervention in the intervention and control groups were not significantly different ( $P < 0.05$ ), but after the intervention, there was

a significant difference between the intervention and control groups ( $P < 0.05$ ).

The results of mixed ANOVA showed that, over time, the mean changes in physical health were significantly different between the intervention and control groups (with a small impact factor) ( $P < 0.05$ ). Also, the results of the *post hoc* test showed that there was a significant difference between the stages before and after the intervention ( $P < 0.001$ ) and before the intervention and follow-up ( $P < 0.001$ ). However, the difference was not significant between the stages after the intervention and follow-up ( $P = 0.99$ ).

The results of the mixed ANOVA test showed that there was no significant difference in the mean of social relations over time between the intervention and control groups ( $P < 0.05$ ). The results of the Bonferroni *post hoc* test showed that there was no significant difference between the pre-intervention and post-intervention stages ( $P = 0.97$ ). There was also a significant difference between the stages before intervention and follow-up ( $P = 0.003$ ) and after intervention and follow-up ( $P = 0.004$ ).

The results of the mixed ANOVA test showed that the mean changes were not significantly different between the intervention and control groups in environmental health over time ( $P < 0.05$ ). Also, no significant difference was observed between the two groups ( $P = 0.18$ ), but there was a significant difference between different stages of measurement ( $P < 0.001$ ) [Table 3].

## Discussion

The results of the present study showed that the mean severity of OCD symptoms was significantly different between the two groups after intervention and follow-up. Kalanthroff *et al.*<sup>[27]</sup> performed P-CIT together with ERP in refractory OCD patients, resulting in significantly diminished OCD symptom severity, improved task control and an enhanced ability to inhibit compulsion. In the present study by performing PCIT for consecutive weeks, individuals gradually learned how to suppress

**Table 1: Demographic and clinical characteristics of participants**

	Intervention (n=15)	Control (n=15)	P
Mean age (SD)	37.73 (11.49)	37.47 (9.36)	0.877
Number of female patients	60% (n=9)	60% (n=9)	0.902
Marital status (married/single)	n=7/8	n=6/9	0.348
Mean years of education (SD)	16.80 (3.27)	15.60 (3.71)	0.284

**Table 2: Descriptive statistics for obsession-compulsion and DASS over the three time periods assessed in this study by condition**

Measure	Intervention Group (n=15) Mean (SD)			Control Group (n=15) Mean (SD)			F	P
	Pre-treatment	Post-treatment	Follow-Up	Pre-treatment	Post-treatment	Follow-Up		
OCD								
Obsession	12.27 (2.79)	7.07 (1.87)	6.80 (1.74)	12.47 (2.23)	10.20 (2.24)	10.47 (2.03)	1.09	0.001
Compulsion	12.47 (1.51)	4.93 (1.44)	4.80 (1.32)	12.27 (1.58)	8.40 (1.68)	9.40 (1.64)	0.42	0.001
Obsession-compulsion	24.73 (3.88)	12.00 (3.07)	11.60 (2.87)	24.73 (3.57)	18.60 (3.58)	19.87 (3.33)	0.75	0.001
DASS								
Depression	14.47 (6.96)	8.60 (4.71)	8.53 (4.39)	13.47 (6.92)	11.47 (6.27)	12.13 (5.80)	2.04	0.15
Anxiety	14.40 (6.96)	7.60 (6.96)	12.13 (6.96)	13.07 (6.96)	8.80 (6.96)	18.87 (6.96)	4.61	0.04
Stress	14.47 (5.44)	8.60 (4.53)	8.53 (4.24)	13.47 (3.74)	11.47 (3.42)	12.13 (3.50)	3.13	0.07

**Table 3: Descriptive statistics for Stroop test and quality of life over the three time periods assessed in this study by condition**

Measure	Intervention Group (n=15) Mean (SD)			Control Group (n=15) Mean (SD)			F	P
	Pre-treatment	Post-treatment	Follow-up	Pre-treatment	Post-treatment	Follow-up		
Stroop test								
Interference	13.00 (3.00)	22.07 (1.33)	22.47 (1.19)	15.60 (3.78)	17.07 (3.11)	16.27 (2.99)	12.44	0.20
Simplification	1.73 (1.34)	1.60 (1.24)	1.60 (1.18)	1.73 (1.33)	1.93 (1.28)	2.40 (1.24)	4.63	0.05
Failure to inhibit	17.07 (4.59)	13.53 (3.87)	12.27 (3.61)	17.00 (4.39)	15.40 (3.98)	15.60 (3.74)	15.31	0.001
Quality of life								
Physical health	35.71 (9.83)	57.62 (7.97)	59.29 (7.73)	30.71 (11.60)	41.90 (8.26)	39.29 (7.99)	28.32	0.00
Psychological health	33.06 (7.79)	50.56 (5.86)	51.39 (5.61)	29.17 (12.30)	32.22 (10.26)	31.11 (10.78)	2.48	0.00
Social relations	21.67 (11.27)	21.67 (11.27)	31.67 (11.87)	24.42 (11.59)	23.89 (12.55)	28.33 (13.66)	12.87	0.001
Environmental health	39.58 (8.24)	51.25 (8.50)	51.88 (8.74)	36.46 (10.74)	44.37 (9.97)	43.13 (10.24)	17.41	0.00
Total score of quality of life	23.33 (14.07)	56.67 (11.44)	56.67 (11.44)	25.83 (12.91)	42.50 (10.35)	41.67 (11.25)	0.19	0.001

compulsions and react purposefully according to the program instructions instead of applying them, resulting in strengthening their task control ability step by step. It is possible that P-CIT can enhance the ability to inhibit coercion by strengthening the control of activity that is impaired in OCD individuals and thus help improve ERP.<sup>[27]</sup> In the present study, by performing P-CIT for consecutive weeks, individuals gradually learned that when providing obsessive triggers, it was necessary to suppress them instead of performing coercions (stimulus-stimulating behaviors) and to react purposefully according to program instructions, thereby strengthening their ability to control activity over time. Following the gradual strengthening of activity control, individuals generalized this enhanced ability to the real environment while performing ERP exercises, and performed better at controlling coercion (as a stimulus behavior) when confronted with an obsessive trigger in the real environment. Therefore, strengthening the ability to control coercion made ERP more successful and, thus, further reduced the severity of OCD symptoms in the experimental group.

The results showed that the mean of task control was significantly different between the two groups after the intervention and follow-up in the intervention group. Therefore, the average inability to inhibit the dominant response to provide a targeted response was less in the intervention group, resulting in a higher ability at task control. The outcomes of the present study were in line with the study by Kalanthroff *et al.*,<sup>[27]</sup> demonstrating the effectiveness of P-CIT along with ERP on OCD symptoms and task control. Furthermore, Gerling *et al.*<sup>[47]</sup> reported that computer games were significantly effective in improving cognitive abilities. Moradi *et al.* showed that playing computer games improved the performance of individuals in the Stroop task, visual memory, and executive functioning.<sup>[48,49]</sup> The P-CIT program was designed as a game that, in the present study, people had to run several times a day for consecutive weeks. Each time the program was performed, the person was

confronted with OCD and neutral images that appeared randomly and changed at each stage of treatment, and it was necessary to stimulate stimulus behaviors, suppress them, and act purposefully according to program instructions. The scores provided routinely by the experimental group, as a result of the program, showed an increase in the correct response, so that by running the program consecutively, people were able to increase the power to control impulses, and by controlling impulses, they avoided giving wrong answers and provided the intended response to the game. In other words, they gradually learned to suppress the dominant responses and to give purposeful responses to the program; the repetition of these cases eventually led to a decreased inability to inhibit the dominant response to provide a targeted response or increase their ability to control activity compared to the control group.

The results also showed that the mean of physical health and mental health after the intervention and follow-up was higher in the intervention group. Therefore, it can be said that P-CIT along with ERP improves physical health, mental health, and overall quality of life, and its effect on increasing physical health and mental health has continued over time. It has been confirmed by many studies that there is a significantly positive correlation between OCD symptom severity and the quality of life.<sup>[5,50]</sup> In the present study, the experimental group was able to not only generalize the control of activity enhanced through the P-CIT program to the treatment environment and use it to control coercion and provide a targeted response in the ERP process, but were also able to extend it to real life. By controlling various stimulus behaviors that sometimes undermined their mental and physical health and by behaving purposefully and healthily, outcomes such as personal work, useful life, stress management, self-efficacy, and lifestyle improvements ultimately led to improved mental and physical health and quality of life. Also, one of the most important consequences of a long life with OCD is that increasing its severity ultimately hurts the quality of

life.<sup>[5]</sup> It is expected that a person's quality of life will improve after the severity of OCD symptoms reduces. On the other hand, reducing obsessive thoughts and anxieties may also lead to a better feeling of self and life.

The results of the study showed that although the mean severity of anxiety symptoms was not significantly different between the two groups after the intervention, the severity of anxiety was significantly reduced in the follow-up. It can be said that further reduction of the severity of anxiety symptoms in OCD patients may have occurred over time. Hedman *et al.*<sup>[51]</sup> reported that ERP had a significant effect on health anxiety in OCD patients. We can refer to the theory of emotion processing, which states that a new and more realistic structure that is formed by ERP and does not include the pathological fear response, does not prevent the reactivation of the fear in the future and the repeated practice of dealing with distressing situations reinforces the activation of this paradoxical structure and weakens the occurrence of the fear response.<sup>[12,52]</sup> In the present study, frequent and daily exposure to images of OCD and prevention of coercion each time the P-CIT program was performed in the experimental group was a repetitive exercise that strengthened this new structure over time, weakening the previous fear and finally, decreasing the severity of anxiety symptoms over time.

The results also showed that the mean severity of depressive symptoms was not significantly different between the two groups after the intervention and follow-up. It can be said that the P-CIT did not have a specific focus on improving the symptoms of depression.<sup>[53]</sup> Reducing OCD symptom severity was expected to diminish depression. Consistent with the present study, Hosseini *et al.*<sup>[54]</sup> showed that ERP reduced depression in women with OCD; Motivala *et al.*<sup>[55]</sup> reported that ERP was effective in reducing depression and cognitive dysfunction in OCD; Zandberg *et al.*<sup>[56]</sup> showed that treatment of OCD through exposure, in addition to reducing the symptoms of OCD, reduced the symptoms of depression; Anholt *et al.*<sup>[57]</sup> illustrated that ERP had a positive effect on reducing depressive symptoms. Because the P-CIT program did not have a specific focus on improving the symptoms of depression, its implementation (directly) did not significantly reduce the symptoms of depression in the experimental group compared to the control group. On the other hand, even though the living conditions of people with OCD led them to more distance from society and consequently depression<sup>[57]</sup> and research showed that the symptoms of depression were generally observed after the onset of OCD, reducing OCD symptoms is expected to reduce depressive symptoms.<sup>[56]</sup> In the present study, further reduction in the severity of OCD symptoms in the experimental group compared to the control group after the intervention (significantly) did not lead to a further

reduction in the severity of depressive symptoms in the experimental group compared to the control group. In both groups, the motivation of the clients may gradually increase by performing ERP steps along with providing performance-enhancing reinforcements and providing continuous home exercises, so that they are interested in doing the activity over time.

The latest findings showed that although the mean stress intensity was reduced after the intervention and follow-up in the intervention group, the effectiveness was not significant. The outcome was in line with previous research which showed that after ERP, stress was reduced.<sup>[58]</sup> It could be said that the main purpose of ERP was to confront patients with their fears to reduce their stressful responses. Explaining the finding that stress intensity decreased in both groups after the intervention and follow-up, it could be argued that the goal of exposure therapy was to make the patient afraid. After the exposure and prevention of the response, the increase in the patient's stress, both visually and real, at each stage caused their stress to gradually decrease.<sup>[59]</sup> In this way, people experienced spontaneous stress reduction and witnessed the usual consequences that they feared and that led to stress.<sup>[60]</sup> Also, according to emotion processing theory, ERP has introduced new information that contradicts the existing fear structure into their information structure and teaches that the fear of the catastrophic consequences of not doing the rituals was unreasonable. The structure of fear has gradually changed due to confrontation. It has formed new and more realistic memory structures that do not include the pathological fear response, thus reducing people's stress.<sup>[61]</sup>

### Limitations and future orientations

The present study was conducted at the same time as the prevalence of the coronavirus, followed by quarantine and successive shutdowns with the intensification and emergence of new peaks; on the other hand, the information provided by various sources about the methods of contamination with coronavirus increased the abnormal fear of OCD people with the subtype of contamination, resulting in a prolonged process of treatment and research.

### Conclusion

When P-CIT applies along with ERP in comparison with ERP alone in patients with contamination or washing OCD, the severity of OCD symptoms and severity of anxiety reduce significantly, and activity control, mental health, physical health, and the overall quality of life increase considerably. However, its effect on stress, depression, environmental health, and social relations is not significant.



Based on the findings and limitations of this study, the following components can be considered in future research: The present study investigated the effectiveness of implementing a personalized-computerized inhibitor training program with exposure to and prevention of response to treatment outcomes in patients with obsessive-compulsive disorder, and future research could replicate this treatment model in other disorders. Furthermore, it is suggested that longer follow-up periods be considered in future research to evaluate the continuity of therapeutic benefits. We also suggest that this treatment model be performed on a wider sample and different age groups.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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