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Design and Validation of a Virtual Reality Software Package and Investigating its Effect on the Severity of Obsessive and Depressive Symptoms of Women Suffering from Washing Compulsion

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Abstract

Introduction: The aim of the present study was to develop and validate a virtual reality software package and to investigate its effect on the obsessive and depressive symptoms of women with washing compulsion.

Method: The present study consisted of two phases. The research method of the first phase was validation. At this stage, five psychology and virtual reality experts were selected purposefully, and the Cohen's kappa coefficient (κ) was analyzed in the software review. In the second phase, a quasi-experimental study on 22 women suffering from washing compulsion in Isfahan in 2022 which were selected by available sampling were randomly assigned to experimental and control groups, of whom seven remained in each group. The instruments namely the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) and the Beck Depression Inventory (BDI) were completed in the pre-test, post-test and one month follow-up and their results were analyzed using SPSS 27 software using the multivariate covariance method.

Results: The content validity coefficient of the package was calculated as 0.9. The results of the second phase showed that the package was effective in reducing the obsessive symptoms of patients ($P<0.05$) and its effect continued over time ($P<0.05$); however, it was not useful in reducing the depression scores ($P<0.05$).

Conclusion: This method because of its ability to induce anxiety and its generalizability to real-world settings increases commitment to treatment and can be used to strengthen the impact of the exposure method for treatment of obsessive-compulsive patients.

Keywords: Washing Compulsion, Depression, Virtual Reality, Women

Introduction

Obsessive Compulsive Disorder (OCD) is an anxiety disorder that involves excessive unwanted thoughts and fears (obsessive) and then suppressed anxiety leading to repetitive behaviors (compulsions) [1]. This disorder is the 4th most common mental disorder [2] that often develops during childhood [1]. Using the restricted DSM-5 definition, the lifetime prevalence of OCD in the general population was calculated at 2–3% [3]. The annual prevalence of this disorder in Iran is reported between 1.9% and 2.5% [4]. The main feature of this disorder is obsessions and compulsions. People with obsessions usually do things like changing uncomfortable thoughts, focus on positive thoughts, perform rituals, etc., to use as a strategy to reduce comfort when the repetitive thoughts strikes. Compulsion is a need for the sufferer to perform an action or think about a mental action repeatedly [1]. In the Diagnostic and Statistical Manual of Mental Disorder, Fifth Edition (DSM-5) OCD involves uncontrollable and persistent thoughts forcing a person to repeat specific actions [5]. The person feels unable to control these behaviors and thereby experiences severe

anxiety when facing them so these patients suffer a substantial impairment in quality of life and social functioning [2]. Among OCDs, compulsive washing is the most common clinical picture [6]. Compulsive washing is an annoying feeling based on the fact that the dirt has not been removed despite washing many times. Many people suffering from this disease believe that any accidental contact or exposure to pollution will lead to complete contamination and serious damage [7]. When the patient feels contaminated to eliminate all possibilities, the patient will perform a ritual such as cleaning himself during perhaps after coming into contact with something to prevent death or illness from occurring. The patient will perform the ritual repeatedly. The ritual is intended to be used to restore the patient's comfort [1].

Based on research, exposure and response prevention has been the first line of treatment for OCD until now [8-11]. This method involves confronting the patient with situations that cause obsessions and then preventing any behavioral or neutralizing response, followed by cognitive reconstruction with the aim of correcting ineffective beliefs and replacing them with more logical ones [12]. However, there are problems in this regard, including the possibility of infection, additional expenses due to travel and exposure in real situations, and the patient's problem in imagining the anxiety-causing stimulus [13]. Therefore, it is of high importance to replace a method and tool without the inherent limitations of the real exposure approach.

Virtual reality (VR) refers to a computer-generated, three-dimensional virtual environment that users can interact with, typically accessed via a computer that is capable of projecting 3D information via a display and thereby, immersion in the environment reaches its peak [14]. VR exposure therapy is a specialized method that increases the rate of treatment. This method has significant advantages; this exposure is completely under control of the therapist and the client and can be terminated whenever it becomes intolerable. In addition, it is possible to repeatedly confront the patient with a specific part of a fear-inducing scenario in order to desensitize. Since this method provides not only visual and auditory stimuli but also tactile and olfactory stimuli, the mental feeling that the user experiences in VR as "being there" is very similar to being in the real world [15]. It appears that this kind of active participation increases anxiety, while continuation of the treatment causes the patient to get used to it and the anxiety to gradually decrease. Another advantage of this method is its lower cost compared to traditional psychotherapy [16].

Surveys show that many people prefer VR exposure therapy to traditional exposure therapy. Carl et al. [17] have noted that 81-89% of patients preferred VR exposure to real exposure therapy. The effectiveness of this method in treating fear of spiders [18] and small animals has been demonstrated [13]. Manshai et al. [19] showed that the VR method is a good alternative for the exposure in treatment of aviophobia. Laforest et al. [13] showed that exposure to a virtual environment causes a higher level of anxiety in the patient with obsessive-compulsive contamination/cleaning compared to the control. Blloch et al. [20] also showed that the contaminated VR is able to create a sense of sufficient presence for obsessive-compulsive patients of the same experience, feeling and excitement that they have in their real daily life.

In Iran, no local treatment package of VR software has been developed for OCD, and since the exposure conditions must be designed according to the culture and real life conditions of the subjects, the first phase of the current research will be dedicated to the development and validation of a VR software package.

Another thing that should be considered is the high coexistence between OCD and clinical depression [21, 22]. In some sources, it has been mentioned that approximately two-thirds of people suffering from OCD also suffer from depression [23]. Therefore, these individuals tend to be depressed more than others, and on the other hand, according to research, depressed mood not only leads to the increase and intensification of unwanted thoughts but also increases discomfort caused by these thoughts [24]. Other researchers point to commonalities of both disorders, such as guilt, anxiety, self-doubt, low self-esteem, and a strong sense of responsibility [25]. It is also worth mentioning that when a patient suffering from obsession cannot tolerate the real exposure conditions and does not succeed in advancing the exposure therapy, he/she feels ineffective and their negative mood is intensified. Therefore in this research, in addition to the effectiveness of the VR treatment on obsessive symptoms, the usefulness of this treatment on depression symptoms will also be investigated.

Method

The first phase of the current study was a psychometric research and the second phase was a quasi-experimental design with a control group and a one month follow-up. In the first stage, professional assessors in the fields of psychology, computer and media were consulted to check the content validity of VR software based on 3D images for the face-to-face treatment of patients suffering from washing compulsion.

In the first phase of the research, the statistical population included all psychologists and experts in the field of VR in 2022, and in the second phase, the population consisted of all adult OCD patients living in Isfahan in 2022.

In the first phase of the study, five people from the statistical population were selected in a purposeful way, and in the second phase, given the Covid-19 epidemic, 22 married women with OCD diagnosed by psychologists and psychiatrists were selected as an available sample and were randomly assigned in two groups which was finally reduced to seven individuals in each group.

The inclusion criteria of this study were symptoms of washing compulsion, over 30 years of age, no other serious mental disorder, absence of physical problems including vision problems, epilepsy and dizziness, not receiving other psychological treatment during the current therapy, no exposure to VR programs or VR-based treatment, and at least six months past taking the drug in

case of consumption.

The exclusion criteria included headache and dizziness after wearing the VR headset, and unwillingness to continue the treatment and excessive absenteeism in the sessions.

The tools used in this study were as follows:

Gear 360 Spherical Cam 360° 4K Camera and VR Headset: The camera we used to create the VR software for the current research has spherical appearance with a lens on both sides, each lens with a 180° imaging capability. In total, 360° images are captured in the image set so that all the space above, below and around the camera is recorded. The quality of the camera is 15 megapixels. The camera can also be adjusted remotely by Samsung S6 series phone. If the camera is set in single-lens mode, it records 180° images or videos. On the sides of the lens, a strong sounder is embedded, which records the sounds of the environment [26]. These images are visible on a mobile phone or computer in such a way that different parts of the environment are viewed with a finger or mouse. These images can also be viewed using a VR headset. In this way, videos can be played using VR Media Player or AAA VR Cinema application installed on the mobile phone. When the mobile phone is placed in the VR headset, the person sees himself/herself in the filmed environment as if they were in place of the camera.

Yale-Brown Obsessive Compulsive Scale (Y-BOCS): This scale measures the severity and type of obsession and involves the time spent, the amount of interference, degrees of discomfort, resistance, and control, which measures the symptoms of obsessive thoughts and obsessive actions separately. Y-BOCS was created by Goodman et al. [27] in 1989. This scale has 10 items, five out of these 10 items focus on obsessions and five on compulsions [28]. Each item is scored from 0-4. If the obtained score is <10, it indicates very mild obsession, if 10-15, it shows relatively mild symptoms, if 16-25, it indicates moderate symptoms, and if >25, it shows very severe symptoms. In Iran, inter-interviewer reliability for this scale has been reported as 0.98 (r=0.98), internal consistency coefficient as 0.89 (r=0.89), and reliability coefficient by retest method in two weeks as 0.84 (r=0.84) [29].

Beck Depression Inventory: This inventory consists of 13 items referring to the measurement of depression symptoms a person has experienced during the last two weeks [30]. Each question is scored on a four-point Likert scale (0 to 3). The total score range is 0-39. The severity of depression in this inventory includes normal with a score of 0-3, mild depression 4-7, mild to moderate depression 8-11, moderate depression 12-15, and severe depression 16-39. The reliability of the test has been obtained with Cronbach's alpha of 0.89. The validity of the inventory has also been confirmed in a convergent manner, and the correlation of the inventory in the 21-item form has been reported as 0.67[31].

One of the goals of this research was to develop a VR-based software package with real videos. For this purpose, the filming scenarios of the sessions were designed according to the anxiety hierarchy of the subjects. The scenarios include four areas as follows: kitchen, bathroom, laundry, outside the house, in each of which obsessive situations are found (for example, the sensation of splashing water while washing dishes, clothes falling on the floor, the feeling of water splashing from the toilet hose, the feeling of water splashing when a car is passed, etc.). These situations have been designed by the common anxiety hierarchy list of subjects. The subjects confronted obsessive situations virtually at three stages: facing the situation by observing, facing the situation passively, actively facing the situation and interacting with it.

Some of these situations were simulated by an actor and filmed using the 360° camera set in place of the subject, which became a software package after compiling and editing. The filming environment included the kitchen, the yard, three types of toilets and three separate environments outside the house. With the help of designing experiments in these environments and situations, the subject would gradually face the situations that she had always avoided. The intervention consisted of eight sessions, in which 3-4 short films were presented in each session (30 short films in total). Each film contained at least one obsessive situation that the subject either witnessed (in which case she experienced less anxiety), or was confronted with but passively (moderate anxiety), or was faced and asked in that environment to do something or interact with the environment while wearing the headset on his/her face (in which case, they would experience higher anxiety). One of the advantages of this test was that all the conditions were real situations, in such a way that the subjects felt themselves in completely real situations causing anxiety. The filming sessions lasted for about two weeks and after the initial editing, the videos were reviewed by one of the experts. Because of the artificiality of the filming conditions, some of the videos were deemed invalid, and for this reason, a number of situations were re-filmed. Due to the fact that long-term viewing of VR videos may cause headaches and dizziness and in some cases nausea, we tried to make each video less than four minutes long.

Results

To improve the VR-based software package, the assessment form including six questions with a five-point Likert scale was provided to five experts who recorded the very good, good, average, poor and very poor answers for each questionnaire item, which is equivalent to grades 4 to 0, respectively. In this method, first, in each question, the ratio of the experts who gave that question a score of four and three (very good and good) to the total number of experts is calculated. Afterward, the average content validity index of all questions was calculated. The minimum acceptable value for CVI is equal to 0.79 [32], and average content validity index for this software package was calculated as 0.9. Therefore, the content validity of the mentioned software is highly acceptable.

In studing the effectiveness of the software, 22 people with OCD were selected as available sample and were randomly assigned into two groups. Demographic

characteristics in the experimental and control groups have been presented in Table 1 and a summary of the descriptive results of participants in the severity of obsessive and depressive symptoms in pre-test, post-test and follow-up have been presented in Table 2.

To use the multivariate covariance analysis method, the basic assumptions of this method, namely multivariate normality, homogeneity of variance-covariance matrices, homogeneity of regression coefficients, and correlation between research variables were examined and the results showed that the assumptions was met. The results of multivariate covariance analysis to investigate the effectiveness of exposure therapy with VR on the symptoms of obsession and depression have been shown in Table 3.

The results of analysis showed that the independent variable is effective on linear combination of the dependent variables, and it can be claimed that exposure to VR has been effective on at least one of the dependent variables. Next, to determine whether each of the dependent variables was influenced by the independent variable separately in the post-test and follow-up stages, the single-variable analysis of covariance test was used, the results of which have been presented in Table 4.

As it can be seen, there is a significant difference between experimental and control groups ($P<0.05$) in the mean post-test scores of the intensity of obsessive symptoms of OCD patients. However, there was no significant difference in the mean scores of the depression post-test between two groups ($P<0.05$). Furthermore, to check the stability of the effect of intervention in the experimental group on the variable of obsessional symptoms, repeated measurement test and Bonferroni's post hoc test were used. In Table 5, the within subjects effects can be seen.

Table 1. Demographic Characteristics in Experimental and Control Groups

Variables	Groups	Experimental Group	Percent	Control Group	Percent
Age	30-37	2	27%	1	14%
	38-45	3	42%	4	57%
	+45	2	31%	2	29%
	Total	7	100%	7	100%
Education	High School	1	14%	2	29%
	Diploma	2	28%	2	29%
	Bachelor's degree	3	43%	2	29%
	Master's degree	1	15%	1	13%
	Total	7	100%	7	100%
Marital Status	Single	3	43%	4	57%
	Married	4	57%	3	43%
	Total	7	100%	7	100%

Table 2. Mean and SD of Research Variables

Variables	Group	Pre-test		Post-test		Follow-up	
		Mean	Std	Mean	Std	Mean	Std
Severity of obsessive symptoms	Experiment	31.14	4.67	16.14	3.80	16	5.72
	Control	19.86	5.84	19.56	4.30	18.8	6.57
Depression	Experiment	20.43	15.43	13.71	9.34	-	-
	Control	8.58	7.00	16.57	5.91	-	-

Table 3. Results of Multivariate Covariance Analysis

Variables	Pillai's Trace	F	Df1	Df2	P	2η
Severity of obsessive symptoms	0.66	8.67	2	9	0.01	0.72
Depression	0.88	31.75	2	9	0.01	0.65
Group	0.59	6.41	2	9	0.02	0.37

Table 4. Results of Univariate Covariance Analysis

Variable	SS	Df	MS	F	P	2η
Severity of Obsessive symptoms	Pre-test	1	53.64	5.21	0.05	0.34
	Group	1	126.62	12.30	0.01	0.55
	Error	10	10.29	-	-	-
depression	Pre-test	1	455.30	31.04	0.001	0.76
	Group	1	51.12	3.49	0.09	0.26
	Error	10	14.67	-	-	-

Table 5. Test of Within-subjects Effects in the Severity of Obsessive Symptoms

Variable	SS	Df	MS	F	P	2η
Severity of Obsessive symptoms	Stages	2	4.11	60.06	0.001	0.90
	Error	12	8.65	-	-	-

It can be said that there is a significant difference in the variable of obsessive symptoms between the different stages of measurement. In the following, using Bonferroni's post-hoc test, the pairwise difference between stages was examined, the results of which have been presented in Table 6.

The results show that there is a significant difference between pre-test and the follow-up stages, but no significant difference was observed between the post-test and the follow-up stages. As a result, it can be claimed that there is stability of effect for the variable obsessive symptoms. The trend of changes in severity of obsessive symptoms and depression scores between the two groups in three evaluation phases have been shown in Figure 1.

Table 6. Bonferroni Test Results to Compare the Average of Measurement Steps

Variable	Stage	Mean difference	Std	P	Confidence Interval(0.05)	
					lower critical probability	upper critical probability
Severity of Obsessive symptoms	Pre-test/follow-up	14.85	1.93	0.001	8.50	12.21
	Post-test/follow-up	-0.14	0.50	0.94	-1.81	1.52

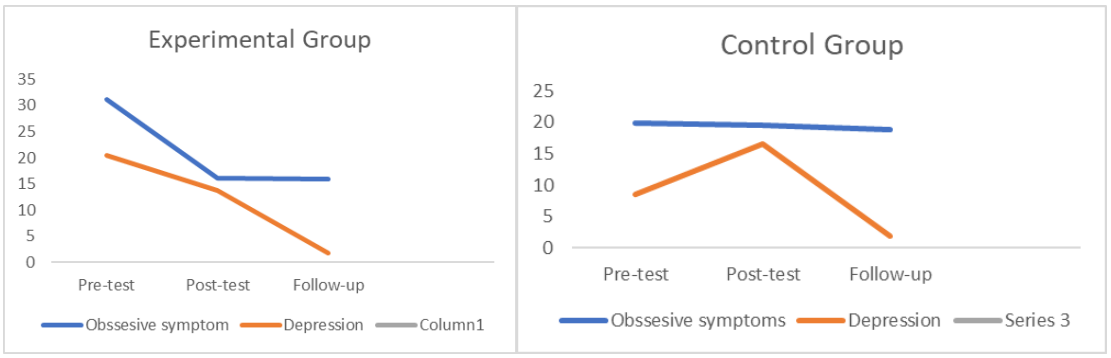

Figure 1. The trend of changes in dependent variable scores between the two groups in three evaluation phases.

Discussion

The present study aimed to design and evaluate the effectiveness of a VR software package based on real images on the severity of obsessive and depressive symptoms of adults suffering from washing compulsions. In the first phase, after filming and editing 30 films with a length of <4 minutes based on obsessive scenarios and situations according to the anxiety hierarchy of the samples, a software package was developed and provided to five experts in psychology and VR. After applying their corrective comments, a content validity index of 0.9 was obtained, which indicated a high validity of package content.

In the second phase, a preliminary implementation was carried out on a group of 14 patients suffering from washing compulsion diagnosed with obsession who were assigned to experimental and control groups. The findings showed that the average scores of obsessive symptoms of the experimental group are different in pre-test and post-test stages compared to the control group. Moreover, the difference between the scores of this group in pre-test and follow-up phase was also significant. The present finding is in line with the previous research results [33-35]. The efficiency of exposure therapy depends on both its ability to induce significant anxiety and its generalizability to real-world settings. Nevertheless, creating real-life situations in actual situations can be unpredictable, unsafe, impractical, costly, or even impossible [36]. Thus, a significant number of treatment seekers are unwilling to engage in exposure and response prevention therapy, and many drop out during treatment [37]. Although imaginary exposures could be a safer alternative, these exposures may not be realistic, and so they might not be successful in evoking anxiety.

According to investigations, VR exposure therapy is a good alternative to real exposure. In VR exposure therapy, people are immersed in a virtual environment through which they are confronted with anxiety-provoking situations or stimuli. Frequently, these stimuli are easier, more affordable and safer to access in the virtual environment than in a real one. Some studies have investigated and subsequently supported the ability of a VR environment to induce anxiety and obsessive-compulsive symptoms in OCD patients compared to healthy individuals [38].

Disgust is also an important component for the treatment of obsessive contamination exposures, and the exposure and prevention of effective response to the fear of contamination should target disgust [39]. Matts et al. [39] showed that fear and disgust decreased during exposure sessions, that the changes in fear and disgust predict the outcome of treatment, and that arousing disgust can lead to further activation of fear structures and accelerate the process of habituation during exposure therapy. Inouzo et al. [40] showed that VR could be used as a tool to induce disgust in addition to anxiety. Hence, exposure and response prevention in combination with VR technology can enable the therapist to tailor longer and more frequent exposure sessions for counteracting slower habituation and stronger levels of disgust resistance.

Another finding of the present study was that the average depression scores of the experimental group were not significantly different from the control group in pre-test and post-test stages. This finding was in line with the research of Dehn et al.[41]. The mentioned research showed that training in a comprehensive VR environment similar to everyday life is not superior to the computer

cognitive training method. Aliakbari et al. [42] investigated the effect of VR in improving psychological symptoms such as anxiety, depression and stress in people with cancer and showed that VR reduces anxiety, depression and stress of these patients, which is not consistent with the results of the present research. To justify this disparity, it should be noted that the method of VR application in Fekrati's research has been to work with the XBOX device and to perform enjoyable activities such as dancing with music and relaxing scenes, which is completely different with the intervention of the current research. Depression and obsession have many overlaps, so that it has been mentioned that two-thirds of the patients suffering from obsession are also afflicted with depression. It has also been said that depressed mood increases vulnerability to obsessive thoughts [23]. In explaining the ineffectiveness of VR exposure treatment for patients' depression, it should be noted that the present study was a behavioral treatment mostly affecting practical measures and did not intened to change and correct cognitive errors. Negative mood are mostly rooted in cognitive errors [43], and since these errors must be corrected in mood adjustment, the patient's negative mood was not significantly affected by the intervention.

Like all other studies, the current research also had limitations. One of the most important limitations of the present study was the lack of control over variables such as patient's history of obsession, the power of their spatial visualization, the patient's mood, etc., which are likely to affect the treatment outcome. It should be noted that the package of the current research was tailored to those suffering from washing/contamination obsessions, and its preliminary implementation was carried out on samples of washing compulsion. Therefore, caution should be taken in generalizing the research results to other types of obsessions.

Conclusion

The VR software package based on real images has been developed in this study for OCD patients had appropriate validity which justifies its use in clinical situations. Also from where the average scores of obsessive symptoms of the experimental group are different in pre-test and post-test stages compared to the control group, it can be concluded that this package is effective on the obsessive symptoms of the patients, but was not effective on depression of the patients.

Conflict of Interest

The authors have no conflicts of interest concerning this article.

Ethical Approval

The present research was carried out with the approval and confirmation of Ethics Committee of Arak University (Ethics Code: 1401.054).

Declaration of Generative AI and AI-Assisted Technologies

During the preparation of this work the authors did not use any AI tools.

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References

1. Yani FY, Samanik S. Obsessive Compulsive Disorder As Seen In The Main Character Of Every Last Word Novel By Tamara Ireland Stone. Linguistics and Literature Journal. 2023;4(1):73-88. DOI: https://doi.org/10.33365/llj.v4i1.1975
2. Pampaloni I, Marriott S, Pessina E, Fisher C, Govender A, Mohamed H, et al. The global assessment of OCD. Comprehensive psychiatry. 2022;118:152342. https://doi.org/10.1016/j.comppsych.2022.152342
3. Carmi L, Brakoulias V, Arush OB, Cohen H, Zohar J. A prospective clinical cohort-based study of the prevalence of OCD, obsessive compulsive and related disorders, and tics in families of patients with OCD. BMC psychiatry. 2022;22(1):190. doi: 10.1186/s12888-022-03807-4
4. Rezazadeh Z, Zarani F. Obsessive-compulsive disorder and related cultural issues in Iran: a Systematic Review. Rooyesh-e-Ravanshenasi Journal (RRJ). 2022;11(2):45-58. DOR: 20.1001.1.2383353.1401.11.2.1.0
5. Fineberg Naomi AM, Apergis-Schoute Annemieke M, Vaghi MM, Bullmore Edward T, Sahakian Barbara J, Robbins Trevor W. Mapping Compulsivity in the DSM-5 Obsessive Compulsive and Related Disorders: Cognitive Domains, Neural Circuitry And Treatment. 2017. https://doi.org/10.1093/ijnp/pyx088
6. De Silva P. Obsessive-compulsive disorder. The handbook of adult clinical psychology: Routledge; 2014. p. 511-46.
7. Abramowitz JS, Jacoby RJ. Obsessive-compulsive and related disorders: A critical review of the new diagnostic class. Annual review of clinical psychology. 2015;11(1):165-86. https://doi.org/10.1146/annurev-clinpsy-032813-153713
8. Ferrando C, Selai C. A systematic review and meta-analysis on the effectiveness of exposure and response prevention therapy in the treatment of obsessive-compulsive disorder. Journal of Obsessive-Compulsive and Related Disorders. 2021;31:100684. DOI: 10.1016/j.jocrd.2021.100684
9. Mataix- Cols D, de la Cruz LF, Nordsletten AE, Lenhard F, Isomura K, Simpson HB. Towards an international expert consensus for defining treatment response, remission, recovery and relapse in obsessive- compulsive disorder. World Psychiatry. 2016;15(1):80. DOI 10.1002/wps.20299
10. Storch EA, McGuire JF, McKay D. The clinician's guide to cognitive-behavioral therapy for childhood obsessive-compulsive disorder: Academic Press; 2018. DOI 10.1016/C2016-0-00955-5
11. Neshat Doost H, Molavi H, Abedi M, Isfahani M. The Effects of Exposure and Response Prevention by Self-treatment Method on Reduction of Obsessive-Compulsive Symptoms. Clinical Psychology and Personality. 2007;5(1):1-10.DOR: 20.1001.1.23452188.1386.5.1.1.5
12. Twohig MP, Abramowitz JS, Smith BM, Fabricant LE, Jacoby RJ, Morrison KL, et al. Adding acceptance and commitment therapy to exposure and response prevention for obsessive-compulsive disorder: A randomized controlled trial. Behaviour research and therapy. 2018;108:1-9. https://doi.org/10.1016/j.brat.2018.06.005
13. Laforest M, Bouchard S, Crétu A-M, Mesly O. Inducing an anxiety response using a contaminated virtual environment: validation of a therapeutic tool for obsessive–compulsive disorder. Frontiers in ICT. 2016;3:18. https://doi.org/10.3389/fict.2016.00018
14. Hamad A, Jia B. How virtual reality technology has changed our lives: an overview of the current and potential applications and limitations. International journal of environmental research and public health. 2022;19(18):11278. anyrecover-mac_installer (1).zip
15. Emmelkamp PM, Meyerbröker K. Virtual reality therapy in mental health. Annual review of clinical psychology. 2021;17(1):495-519. https://doi.org/10.1146/annurev-clinpsy-081219-115923

16. Rasti J, Manshaee G, Eslami P. Design and validation of virtual reality exposure therapy software for treatment of flying phobia. Knowledge Res Appl Psychol. 2018;19(4):27-35.
17. Carl E, Stein AT, Levihn-Coon A, Pogue JR, Rothbaum B, Emmelkamp P, et al. Virtual reality exposure therapy for anxiety and related disorders: A meta-analysis of randomized controlled trials. Journal of anxiety disorders. 2019;61:27-36. https://doi.org/10.1016/j.janxdis.2018.08.003
18. Musalek M, Vasek L, editors. Possibilities of using virtual reality as a means for therapy from fear of spiders. MATEC Web of Conferences; 2019: EDP Sciences. DOI:10.1051/matecconf/201929201041
19. Manshaee G, Eslami P, Hajebrahimi Z. Efficacy of virtual reality exposure therapy in reducing anxiety symptoms in Iranian individuals with flying phobia. Clinical Psychology and Personality. 2020;16(2):191-9. DOI: 10.22070/CPAP.2020.2870
20. Belloch A, Cabedo E, Carrió C, Lozano-Quilis JA, Gil-Gómez JA, Gil-Gómez H. Virtual reality exposure for OCD: is it feasible? Revista de Psicopatología y Psicología Clínica. 2014;19(1). DOI: 10.5944/RPPC.VOL.19.NUM.1.2014.12981
21. Tao H, Wang C, Guo J, Guo M. Comorbidity between neurotic depression and post-traumatic stress disorder (PTSD). World Journal of Neuroscience. 2020;10(3):135-40. DOI: 10.4236/wjns.2020.103015
22. Hofmeijer-Sevink MK, van Oppen P, van Megen HJ, Batelaan NM, Cath DC, van der Wee NJ, et al. Clinical relevance of comorbidity in obsessive compulsive disorder: the Netherlands OCD Association study. Journal of affective disorders. 2013;150(3):847-54. https://doi.org/10.1016/j.jad.2013.03.014
23. Ghasemzadeh H, Karamghadiri N, Sharifi V, Norouzian M, Mojtabai R, Ebrahimkhani N. Cognitive, Neuropsychological, and Neurological Functions of obsessive patients with and without depressive symptoms compared to each other and normal group. Advances in Cognitive Science. 2005;7(3):1-15.
24. Mohammadzadeh A KA. Comparison of depressant rumination in patients with major depressive and obsessive-compulsive disorders and normal people. . Behavioral science research 2017;15(1):21-7.
25. Arntz A, Voncken M, Goosen AC. Responsibility and obsessive–compulsive disorder: An experimental test. Behaviour research and therapy. 2007;45(3):425-35. https://doi.org/10.1016/j.brat.2006.03.016
26. F K. Improving the attention level of children with attention deficit disorder with the help of virtual reality technology based on real images. Dissertation for M.A. Isfahan: Isfahan University; 2018.
27. Goodman WK, Price LH, Rasmussen SA, Mazure C, Fleischmann RL, Hill CL, et al. The Yale-Brown obsessive compulsive scale: I. Development, use, and reliability. Archives of general psychiatry. 1989;46(11):1006-11. https://doi.org/10.1001/archpsyc.1989.01810110048007
28. MOUSAVI MN, Atashpour H, Molavi H. The influence of mindfulness group training on the rate of obsessive-compulsive disorder symptoms. 2010.
29. Izadi R, Abedi MR. Alleviation of obsessive symptoms in treatment-resistant obsessive-compulsive disorder using acceptance and commitment-based therapy. Feyz Medical Sciences Journal. 2013;17(3):275-86.
30. Beck AT, Steer RA, Brown G. Beck depression inventory–II. Psychological assessment. 1996.
31. Rajabi GR. Psychometric properties of beck depression inventory short form items (BDI-13). Journal of Iranian Psychologists. 2004.
32. Waltz CF, Bausell BR. Nursing research: design statistics and computer analysis: Davis Fa; 1981.
33. Dua D, Jagota G, Grover S. Management of obsessive–compulsive disorder with virtual reality-based exposure. Industrial Psychiatry Journal. 2021;30(1):179-81.
34. Benzina N, Morgiève M, Euvrard M, Dos Santos JFA, Pelissolo A, Mallet L. Personalised 360o video exposure therapy for the treatment of obsessive-compulsive disorder: A single case study. French Journal of Psychiatry. 2020;1:31-8. https://doi.org/10.1016/j.fjpsy.2020.02.004
35. Inozu M, Celikcan U, Akin B, Cicek NM. The use of virtual reality (VR) exposure for reducing contamination fear and disgust: Can VR be an effective alternative exposure technique to in vivo? Journal of Obsessive-Compulsive and Related Disorders. 2020;25:100518. DOI: 10.1016/j.jocrd.2020.100518
36. Gega L. The virtues of virtual reality in exposure therapy. The British Journal of Psychiatry. 2017;210(4):245-6 DOI: 10.1192/bjp.bp.116.193300.
37. Öst L-G, Havnen A, Hansen B, Kvale G. Cognitive behavioral treatments of obsessive–compulsive disorder. A systematic review and meta-analysis of studies published 1993–2014. Clinical psychology review. 2015;40:156-69. DOI: 10.1016/j.cpr.2015.06.003
38. Fajnerová I, Francová A, Taranzová K, Darmová B, Kosová E, Stopková P. Virtual reality environment for exposure therapy in obsessive–compulsive disorder: a validation study. Virtual Reality. 2023;27(3):2691-701. https://doi.org/10.1007/s10055-023-00837-5
39. Mathes BM, Day TN, Wilver NL, Redden SA, Cougle JR. Indices of change in exposure and response prevention for contamination-based OCD. Behaviour Research and Therapy. 2020;133:103707. https://doi.org/10.1016/j.brat.2020.103707
40. İNÖZÜ MERMERKAYA M, Çelikcan U, Trak E, Üzümcü E, Nergiz H. Assessment of virtual reality as an anxiety and disgust provoking tool: The use of VR exposure in individuals with high contamination fear. Cyberpsychology-Journal of Psychosocial Research on Cyberspace. 2021;15(1). DOI: 10.5817/cp2021-1-7
41. Dehn LB, Kater L, Piefke M, Botsch M, Driessen M, Beblo T. Training in a comprehensive everyday-like virtual reality environment compared to computerized cognitive training for patients with depression. Computers in Human Behavior. 2018;79:40-52. https://doi.org/10.1016/j.chb.2017.10.019
42. Aliakbari M, Alipour A, Ebrahimimoghadam H, Fekraty M. The effect of Virtual Reality (VR) on psychological disorders in cancer cases. 2017.
43. Henriques G, Leitenberg H. An experimental analysis of the role of cognitive errors in the development of depressed mood following negative social feedback. Cognitive Therapy and Research. 2002;26(2):245-60. DOI:10.1023/A:1014577904837