

Original Article

Efficacy of Virtual Reality Based Worry Exposure Therapy on the Anxiety Severity and Worry in Generalized Anxiety Disorder

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Key words:Generalized Anxiety Disorder,
Virtual Reality,
Worry Exposure Therapy**ABSTRACT**

Background: Generalized anxiety disorder is one of the most common anxiety disorders observed in clinical centers and the general population. This study aimed to evaluate the efficacy of virtual reality-based worry exposure therapy on the Anxiety Severity and worry in patients with symptoms of generalized anxiety disorder. **Materials and Methods:** This study was conducted in the framework of a single-subject experimental design using Multiple baselines with a 6-week follow-up. Three women with GAD were selected through a structured clinical interview based on the criteria of Diagnostic and Statistical Manual of Mental Disorders 5 by Convenience Sampling among those who referred to the Counseling centers in Tabriz. The protocol of this study followed the manual by Becker and Margraf which describes imaginal exposure for GAD applied in 15 sessions. The only difference was that in this research exposure to virtual reality replaced with imagination. In this study, three 360-degree films were made by the researcher used for exposure. The content made in the form of 360-degree videos and displayed to patients through virtual reality tools. The scales to assess changes in Anxiety Severity and worry include The Penn State Worry Questionnaire and The Overall Anxiety Severity and Impairment Scale. Data analyzed with visuals inspection, improvement percentage, and reliable change index strategies. **Results:** Results showed that virtual reality-based worry exposure therapy has significant efficiency on the reduction of Anxiety Severity and worry clinically and statistically ($p < 0.05$). **Conclusion:** Virtual reality-based worry exposure therapy has appropriate efficacy in reducing GAD symptom severity.

INTRODUCTION

Based on the Fifth Diagnostic and Statistical Manual of Mental Disorders Generalized anxiety disorder is characterized by excessive anxiety and worry, difficulty in controlling anxiety as well as psychological and physical complaints, concentration and sleep problems, and irritability. An overview of different models proposed for generalized anxiety disorder indicates that Cognitive avoidance model is one of the most accepted models for explaining generalized anxiety disorder (Borkovec, Robinson, Pruzinsky and DePree, 1983).

Borkovec have defined worry as “a chain of thoughts and images, negatively affect laden and relatively uncontrollable. The worry process represents an attempt to engage in mental problem solving on an issue whose outcome is uncertain but contains the possibility of one or more negative outcomes”. Therefore, worry is closely related to the fear process. It also reflects the avoidance of distressing thoughts and emotions caused by past injuries, problems with early interpersonal relationships (such as negative attachment experiences) and current problems (weak interpersonal skills). In the cognitive avoidance model, it is believed that cognitive avoidance

occurs through the worry process (Borkovec, Robinson, Pruzinsky and DePree, 1983).

Because worry as an intellectual or verbal activity often focuses on trying to avoid future catastrophes and thus acts as an avoidance strategy in response to perceived threats (Behar Borkovec, 2005). generally, anxiety can be considered as an ineffective cognitive effort to solve problems and eliminate perceived threats while avoiding unwanted physical and emotional experiences that occur naturally during the process of exposure to fear (Borkovec, Alcaine, Behar, 2004). Also, worry is associated with low levels of mental imagery and acts as a factor in avoiding unpleasant mental imagery. thus worry prevents emotional processing and successful extinction. Hirsch and Hayes (2012) in a study showed that mental images in patients with anxiety disorders are less common and more concise.

Over the past several decade various types of psychological treatments have been developed. Most of these therapies have arisen from cognitive-behavioral theories and combine one or more techniques including cognitive reconstruction, exposure, problem-solving, relaxation, and biofeedback

(Cuijpers, Sijbrandij, Koole, Huibers, Berking & Andersson, 2014). As noted earlier, the main characteristic of patients with generalized anxiety disorder is a persistent and uncontrollable worry, and according to Borkovik worry is associated with low levels of mental imagery and acts to avoid unpleasant mental images (Borkovec, Robinson, Pruzinsky and DePree, 1983). Therefore, based on the assumptions of this theory, exposure can be a successful treatment for generalized anxiety disorder that can be applied in different forms include In vivo, Imaginal, Virtual reality, and Interoceptive exposure (Hoyer, Beesdo, Gloster, Runge, Hofler, & Becker, 2009).

Imagery exposure is a form of exposure designed by Krask, Barlow, and Leary (1992) to intervene in the pathogenic form of worry. Brown, Leary and Barlow (1993) incorporated worry exposure into the treatment package of generalized anxiety disorder. In this regard, Goldman (2007) studied the efficacy of a written worry exposure scenario in reducing worry in a nonclinical group of anxious individuals (Goldman, Dugas, Sexton, & Gervais, 2007). The results showed a significant decrease in anxiety and worry and physical symptoms of anxiety in the exposure group.

Although worry exposure is a useful approach to the treatment of generalized anxiety disorder, it has important limitations. In this method successful treatment of the disorder is highly correlated with the ability of visualization and imagination. creating a clear and objective scenario in mind will lead to successful exposure and consequently reduction in anxiety And vice versa, disability in creating mental scenarios, will lead to poor effectiveness (Rauch, Foa, Purr, & Filip 2004).

Clarity of visualization in worry exposure therapy is very important, because clients are asked to visualize future-oriented worries that have never occurred and may even never occur. For example, in post-traumatic stress disorder, you should visualize what happened before. So It is of utmost importance to devise and employ tools to facilitate this process. One of these tools is virtual reality which is a combination of software and hardware techniques and can help one immerse himself in a computer environment (Emmelkamp, Krijn, Hulsbosch, Vriese, Schuemie & Van der Mast, 2002).

Since 1992, when the first research in this field was done, the number of studies using virtual reality technology in psychological therapies has increased. Much of this research has focused on the treatment of anxiety disorders, including acrophobia (Emmelkamp, Krijn, Hulsbosch, Vriese, Schuemie & Van der Mast, 2002) Social anxiety (Anderson et al, 2013), panic disorder with agoraphobia (Vinsley, Anoly, Bouchard, Wiederhold, Zorloni & Riva, 2003), post-traumatic stress disorder (Rutbam, Hodges, Ready, Graap, Alarcon, 1999) But other psychological disorders, including eating disorder (Riva, Bachta & Barofi & Molinari 2002) and attention deficit disorder in children (Rizo et al., 2000), have also reported beneficial results.

Virtual reality-based exposure therapy has several advantages to classic exposure: including easy access to stimuli, high control over the stimulus to be exposed, reliable and flexible exposure content, solving poor mental imagination

problems, and more realistic exposure for patients (Kim, Kim & Cha 2008). An overview of the literature shows few studies using virtual reality in the treatment of generalized anxiety disorder.

Gorini (2010) performed a controlled study of a sample size of 20 patients in combination with biofeedback for patients to perform relaxation exercises during treatment. Patients were randomly assigned to the virtual reality group with biofeedback and virtual reality group without biofeedback and control group. Results showed that virtual reality can be used in the treatment of GAD (Gorini, Pallavincini, Algeri, Repetto, Gaggioli & Riva, 2010).

In another study Gittard (2019) compared the effect of exposure to a standard scenario in virtual reality and catastrophic exposure through imagination. According to the results of this study, the standard scenario created in virtual reality was able to induce anxiety significantly. However, no significant difference was reported between the effects of the two types of exposure (Guitard, Bouchard, Bélanger & Berthiaume, 2019).

Although these studies do not have sufficient power to distinguish interpersonal differences, they provide sufficient support for the application of virtual reality for patients with generalized anxiety disorder.

MATERIALS AND METHOD

This study was conducted in the framework of a single-subject experimental design using a Multiple baseline with a 6-week follow-up. The statistical population in this study was clients who referred to counseling and psychotherapy centers in Tabriz in 1398 and have been diagnosed by a psychiatrist as a patient with generalized anxiety disorder. The sampling method was convenience sampling. The psychiatrist referred the qualified patients to the therapist according to the diagnostic criteria, and after obtaining the patient's written consent, the therapist selected 3 patients with generalized anxiety disorder and entered to the treatment with a step-by-step method.

Inclusion Criteria

DSM 5 generalized anxiety disorder diagnostic criteria according to the assessment of psychiatrists, not receiving psychological treatment and medication before and during the study, a minimum of 18 years and a maximum of 50 year, Patient's consent to participate in research and signing a written informed consent.

Exclusion Criteria for Patients

Having full criteria for other mental disorders and substance abuse, Vision and hearing problems, having risks such as serious suicidal ideation that makes it impossible to stop taking the drug.

Treatment Process

The treatment process was based on the principles of a single subject with multiple baseline design. The subjects entered

the baseline stage simultaneously, and after completing 2 baseline sessions and performing the assessments, they entered the 15-session treatment phase, followed by two follow-ups (followed up over six weeks). As mentioned, the baseline phase for each case was 2 weeks, and follow-up was performed over 6 weeks. The intervention period was performed in 15 1-hour sessions, as shown in the step-by-step guide to treatment sessions. Patients were assessed in questionnaires using relevant questionnaires and psychological scales in sessions 4, 8, 12, 15.

Outcome Assessments

The Penn State Worry Questionnaire (PSWQ) is a 16-item questionnaire that aims to measure the trait of worry, using Likert rating from 1 (not at all typical of me) to 5 (very typical of me). Research suggests that the instrument has a strong ability to differentiate patients with generalized anxiety disorder (GAD) from other anxiety disorders. In Iran Dehshiri (2010) reported reliability (0.86) for the Farsi version of the scale (Dehshiri, G.H.R., Golzari, M., Botjali, Sohrabi, F., 2010).

The Overall Anxiety Severity and Impairment Scale (OASIS) is a self-assessment scale which was developed by Norman et al. (2006) to assess the clinical severity of anxiety in various domains such as functional impairment, assess the rate of increase and decrease in the severity of any anxiety disorder, and to design a brief instrument to screen in clinical situations. This is a 5-item scale that assesses the frequency and severity of anxiety symptoms, behavioral avoidance, and functional impairment related to anxiety. The results of a study by Abdi (1392) showed that the Farsi version of the scale has test-retest reliability of 0/79 during 1 week.

360-degree videos with the content of participants worries: In this study, three 360-degree films were made by the researcher used for the exposure. The content of the first film was the loss of loved ones, in which the scene of an accident and the death of a person is shown while he is on the side of the street and his body is invisible and covered with a piece of cloth. Some people are around him talking about the accident and calling for emergency help and police. During the exposure the client is asked to consider that the deceased is one of his relatives (the one who worries the most). The 360 degree film gives the person the feeling of being in that situation while watching with a virtual reality camera. The content of the second film is hospitalization, which addresses worries about illness and health. The film shows a hospital space and a patient lying on a bed and nurses walking on his bed and talking to him and making him ready for surgery. Due to the fact that the video is 360 degrees and the participant's viewing angle is in line with the viewing angle of the patient who is on the bed, it helps feeling immersed while using virtual reality glasses. The third film is about the execution of a person whose face is not recognizable, and authorities were asked to consider that the man was his brother. Displaying the film with virtual reality glasses makes the client feel present in the scene.

Virtual Reality Equipment

The camera used in this study in order to make the contents of participants' worries was gear 360 which was produced by Samsung in 2017. This model is a virtual reality camera with two 180-degree cameras that Record 15-megapixel images and produces 360-degree videos. Videos and photos recorded with this tool are observable with the help of smartphones equipped with gyroscope and virtual reality headsets.

Headsets: The Samsung Gear VR is a smartphone-based VR headset. It was produced by Samsung in 2017. The lenses used in this equipment are 42 mm and create a 101-degree viewing angle. These lenses have a high manufacturing quality, so that in sudden head movements, they create the least possible blur.

Intervention

Worry exposure Using Virtual Reality is an exposure-based model that targets worry. The protocol of this study followed the manual by Becker and Margraf (2009) which describes imaginal exposure for GAD applied in 15 sessions: Imaginal exposure treatment begins with psychoeducation, in which the disorder is primarily explained using concepts of avoidance. There is no specific references to the role of automatic thoughts or beliefs. Using the concept of habituation, patients are informed that symptom reduction could be achieved by directly exposing themselves in their imagination of feared possible events. The only difference was that in this research exposure with virtual reality replaced with imagination. Treatment commences with self-monitoring of worry. According to Becker and Margraf (2009) Virtual reality exposure begins in the 3rd session and continues through the 10th session. Concurrently, avoidance and reassurance behaviors are addressed and systematically reduced. The final stage of therapy targets generalization and relapse prevention.

In this study Worries of patients included concerns about the loss of loved ones and illness. In one patient, in addition to these content, there was severe anxiety about the execution of his brother. The content made in the form of 360-degree videos and displayed to patients through virtual reality tools.

RESULTS

The demographic characteristics of the clients are given in Table-1, and the results of Table-2 of the patients for each patient are discussed separately.

Figure 1 shows the variation in the overall anxiety scores in the baseline, intervention, and follow-up stages. The results show that in the absence of therapeutic interventions,

Table 1. demographic information of participants

number	gender	age	education	job
1	female	36	Bachelor	Housewife
2	female	25	MA	University Student
3	female	29	MA	translator

patients' scores are stable in the baseline and there is no significant change observed in patients' scores. By changing the step from baseline to intervention with a one-session latency and after the intervention, it shows a continuous decrease in the treatment process until the fourth measurement in the last session of the treatment and the slope created in the chart shows this decrease well. In the follow-up phase, there is no significant change compared to the scores in the last stage of treatment.

The values of the reliable change index obtained from the comparison of baseline and post-treatment stage and also, the last measurement in the follow-up phase at the $P < 0.05$ level indicates that the changes are significant and the improvement in the symptoms of generalized anxiety disorder is the result of the therapeutic intervention. The reliable change index (RCI) = -5 has been obtained, which is higher than 1.96. Also, by decreasing the scores of this patient to the cut point of questionnaires and the obtained improvement percentage provided in Table 2, it shows the clinically significant effect of this intervention (65.11).

As can be seen, the reduction in scores of overall anxiety Severity and Impairment scale (OASIS) in the late stages of treatment and follow-up is statistically significant, and the (RCI) after treatment as well as in the follow-up phase is significant (RCI=-4.25 and RCI= - 6.70). However, considering the improvement percentage (33% and 52.77), it can be said that there has been an acceptable improvement.

Second patient: According to Figure 2, it is observed that the patient's scores on the Penn state worry scale (PSWQ) are almost constant in the baseline stage and have a decreasing slope in the treatment stage. In the follow-up phase, in comparison with the treatment phase these changes are almost maintained and show a steady slope. The values of the RCI in the score of the PSWQ Questionnaire from baseline to treatment phase are RCI=-2/17 and in follow-up phase is RCI=-4.35. The value of RCI in the OASIS scale in the treatment

phase is RCI=-4.9 and in the follow-up phase is RCI= -7.44. As it is obvious, reliable change index is statistically significant in all cases. Also, the improvement percentage scores are given in Table 2 in the post-treatment and follow-up stages in the PSWQ scale are 28.37 and 79.22 percent, respectively, indicating the success of the treatment. In the case of overall anxiety severity and impairment scale, 42.42% and 63.63% improvement in the treatment and follow-up stages indicates the improvement and success of the treatment.

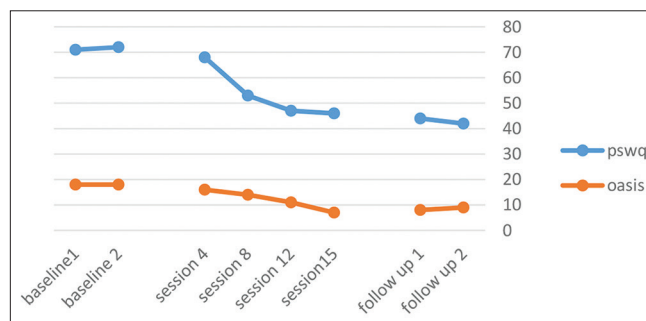


Figure 1. The trend of changes in PSWQ and OASIS scores of first patient

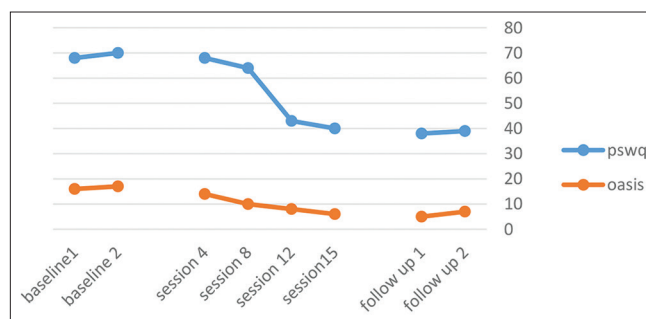


Figure 2. The trend of changes in PSWQ and OASIS scores of second patient

Table 2. Reliable change index and Improvement percentage of patients in GAD7 and CAQ

oasis			pswq			Stages
Case 3	Case 2	Case 1	Case 3	Case 2	Case 1	
18	16	18	74	68	71	Baseline1
17	17	18	76	70	72	Baseline2
17.5	16.5	18	75	69	71.5	Mean baseline
15	14	16	71	68	68	Session 4
12	10	14	46	64	53	Session 8
9	8	11	30	43	47	Session 12
5	6	7	30	40	46	Session 15
10.25	9.5	12	44.25	53.75	53.5	Treatment mean
2.58-	4.9-	4.25-	2.71-	2.17-	2.76-	Reliable change index (RCI)
70.73	42/42	33.33	41	28.37	21.67	Improvement percentage
5	5	8	27	38	44	Follow up 1
7	7	9	27	39	42	Follow up 2
6	6	8.5	27	38.5	43	Follow up mean
8.15-	7.44-	6/7-	4.89-	4.35-	-5	Reliable change index (RCI))
65.71	63.63	52.77	64	79.22	65.11	Improvement percentage
	61.03			69.44		Total Improvement percentage

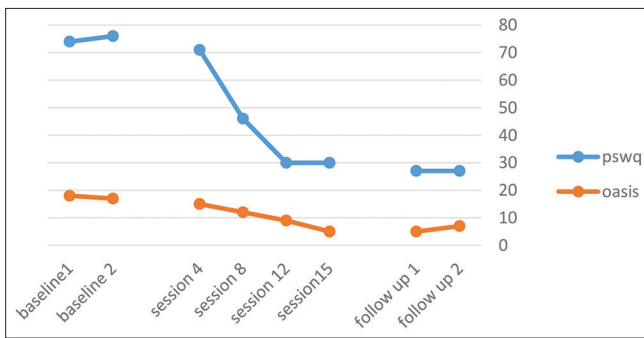


Figure 3. The trend of changes in GAD 7 and CAQ scores of third patient

Third patient: According to Figure 3 provided from the scores of PSWQ it can be seen that there is a slight fluctuation in the baseline, the trend of change starts from the fourth session of the treatment and this slope has continued until the last session. In the follow-up phase, the process of changing scores has stabilized. The value of the reliable change index obtained from the baseline stage to the post-treatment in the PSWQ is $RCI = -2.71$ and in the follow-up stage is $RCI = -4.89$. The improvement percentage of 41% in the treatment phase and 64% in the follow-up phase also indicates the success of the treatment. The results of the OASIS presented in Table 2 also show that significant changes have occurred because $RCI = -2.58$ in the treatment phase and $RCI = -8.15$ in the follow-up phase at the level of $p < 0/05$ is significant. The improvement percentage of 70.73 and 65.71, indicating the success of treatment.

DISCUSSION

This study aimed to evaluate the efficacy of virtual reality-based exposure therapy on the Anxiety Severity and worry in patients with symptoms of generalized anxiety disorder. The findings showed that this treatment in patients with generalized anxiety disorder led to a significant reduction in the Anxiety Severity and worry of patients compared to the baseline period.

As can be seen in the diagrams, all patients were stable and in the baseline stage. after entering the treatment phase and passing the latency period in the first session of treatment, understanding the nature of treatment and the formation of cognitive changes in patients led to the changes in the level of scores. At the follow-up stage, with the end of the treatment sessions, the scores slightly fluctuated and often increased, which can be due to the distance from the treatment sessions and the positive and supportive role of the therapist on the patients' performance and also from the stressors in personal life. This finding is in line with the research of Gorini et al. (2003) in a small-scale controlled study with a sample size of 20 people and a combination with biofeedback for patients. the results of this study indicated the effectiveness of virtual reality-based therapy. In another study, Gittard et al. (2019) compared the effect of exposure to a standard scenario in virtual reality and catastrophic exposure through imagination. According to the results of this study, the standard scenario created in virtual

reality was able to induce anxiety significantly. However, no significant difference was reported between the effects of the two types of exposure.

CONCLUSION

Although Using virtual reality-based worry exposure therapy has a powerful history, only a few studies have used this technology for gad. the most important reason is difficulty in application. Because worries in gad patients are heterogeneous and include a vast variety. But strong theoretical support for using worry exposure therapy and the importance of a vivid exposure in case, patients have vague worries, makes it completely crucial to develop new technologies to help patients experience a better and perhaps more complete and engaging exposure. This study was a Preliminary step to test the efficacy of using VR-based exposure therapy and the results confirmed this. But more studies with bigger samples and new methodologies will be constructive.

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