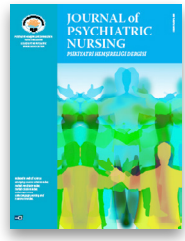
JOURNAL OF
PSYCHIATRIC NURSING

DOI: 10.14744/phd.2019.75010
J Psychiatric Nurs 2019;10(4):296-301



Review

A technological tool for treating social anxiety: Virtual reality

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Abstract

Virtual reality-based interventions are the technological instruments that have been found to be effective and used in psychological services. They have been in use for more than 20 years. Virtual reality can be used to treat many mental health issues such as anxiety disorders, depressive moods, obsessive-compulsive disorder and post-traumatic stress disorder. These interventions are based on the exposure method. With the advances in ever-developing technological products and software, more realistic and effective interventions emerge, and programs are tested by many experimental studies. The studies of virtual reality-based interventions toward social anxiety disorder, for which the virtual reality practices are used the most commonly, were examined in this compilation, the current state of virtual reality use in Turkey was explained, and recommendations for future were presented.

Keywords: Exposure therapy; social anxiety; virtual reality.

What is known on this subject?

- Virtual reality is not used for mental health care in Turkey, but it has been used to treat many psychological problems in other countries for more than 20 years.

What is the contribution of this paper?

- This study is a compilation of the studies that examine the use of virtual reality to treat social anxiety problems. It conveyed the characteristics of virtual reality interventions and presented a holistic view to the literature concerning it.

What is its contribution to the practice?

- Experimental studies of using virtual reality practices can be planned, and research projects regarding different problem fields can be conducted.

Current technological developments can solve problems more quickly and effectively, makes our daily lives easier, and increase the speed and quality of communications. Technological developments such as robotic surgery and advanced imaging methods have a significant place in the medical sector. Technology is also used in mental health care. Web-based online intervention programs and virtual reality (VR) are significant examples of technological developments in this field. VR practices are based on scenarios created with three-dimensional graphics consist of a computer program that creates visuals, glasses that make the images more realistic and expert viewers in the background who provide feedback.

Social anxiety disorder (SAD) is defined by the DSM-V as social phobia or anxiety, and it is common both clinically and socially. Although different rates have been reported by studies of its prevalence, the common belief is that SAD is a frequent problem.[1] A study conducted with a sample of college students determined that the annual prevalence of social phobia was 20.9%, and that its lifelong prevalence was 21.7%.[2] Treating social anxiety involves both medical interventions and cognitive behavioral therapy. However, with technological advances, VR has been used as a treatment in the last 20 years, and the number of studies of it has increased.[3–5] The significant components of using VR to treat social anxiety problems are the scenarios, protocols and VR

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Submitted Date: November 21, 2018 **Accepted Date:** March 18, 2019 **Available Online Date:** December 11, 2019

environments. VR-based treatment can be done in a variety of environments with the technological opportunities of researchers and their different exposure interventions. The most common environments are based on manipulating spectator reactions or performances before various spectator profiles. This study is a compilation of the studies that examine the use of VR to treat social anxiety. Its aim is to provide information about their results related to the studies in which VR interventions are used against the social anxiety problem in relation to the VR practices used in psychological assistance period, about the methodological characteristics of the studies, and about the current state in this regard in Turkey.

The Use of Virtual Reality for Psychological Assistance

VR has been used successfully to treat a variety of psychological problems. Compilation studies, experimental studies without control groups, randomized controlled studies and even meta-analyses have been conducted in this field. VR is used to treat post-traumatic stress disorder,[6–10] obsessive-compulsive disorder,[11–13] alcohol abuse,[14] eating disorders, problems related to body image[15,16] and schizophrenia.[17,18] VR has been used both as an intervention method and as a diagnostic tool.

VR treatments are based on cognitive behavioral therapy, which was developed as a treatment for anxiety disorders and is related to exposure practices[19] They were first used for specific phobias such as arachnophobia,[20,21] acrophobia,[22,23] and flying phobia.[24–28] VR is also used to treat claustrophobia, common anxiety disorder and panic attacks. VR treatments for anxiety disorders are based on exposure/facing interventions. Exposure therapy involves confronting the stimulus that causes anxiety,[29] which may be objects such as snakes or spiders, environments such as busses, restaurants or meeting halls, or situations such as speaking before an audience or communicating with the opposite gender. The main point here is confronting the issues causing disorders. Exposure, which is based on a behavioral method, is often used with the interventions based on the cognitive behavioral approach. The literature includes several types of exposure therapy. One is in vivo exposure therapy. Individuals directly confront the cause of their anxiety in vivo exposure therapy. Putting a cynophobic person and a dog in the same environment is an example of in vivo exposure therapy. Another exposure therapy type is based on the objects or environment avoided by individuals. This type of exposure therapy is called imaginal exposure therapy.[29] Another treatment, interoceptive exposure therapy, involves replicating the physical sensations that occur during panic attacks.[30] The use of digital environments created with VR has become more common. Exposure therapy in digital environments is called *in virtuo* exposure therapy. Although VR can be used to treat almost all anxiety disorders, most of the studies of this topic concern social anxiety. The details of these studies are provided under the effect title.

In addition to experimental research, there are meta-analyses that evaluate the research on VR treatments. Opriş et al.,[31] Parsons and Rizzo,[32] and Powers and Emmelkamp,[33] who have studied VR interventions in anxiety disorders, performed similar studies. Opriş et al.[31] evaluated studies of VR-based exposure therapy and included 23 studies in their analysis. They found that VR-based exposure therapy yields more positive results, and that it yields results similar to those of conventional cognitive behavioral approaches. Evidence also indicates that VR treatments are as effective as conventional approaches, that their effects are long-lasting, and that they have a dosage-response relationship. No significant differences were found between two methods in regard to in vivo exposure, VR and exposure interventions. Parsons and Rizzo's meta-analysis[32] evaluated the effectiveness of VR-based exposure therapy for anxiety problems and specific phobias and found that it was effective, although the number of analyses of moderator effects was limited due to inconsistent reporting in the literature. They included 21 studies in their meta-analysis, and it was stated that VR-based exposure therapy was an effective clinical psychology treatment for all anxiety and phobia cases (social anxiety, arachnophobia, acrophobia, panic attacks with agoraphobia and flying phobia).[32] Powers and Emmelkamp's meta-analysis[33] included 13 studies (n=397). They found that VR-based exposure therapy has a significant effect, that findings are specific to the problem, and that it is effective for subjective stress levels, and cognitive and behavioral psychophysiology. They found that results are not related to sample sizes, and that there is an exposure-response relationship in VR-based exposure therapy.[33]

The Characteristics of Virtual Reality Treatments for Social Anxiety Disorder

This section briefly describes the VR treatments for social anxiety, reviewing their common aspects, types of exposure therapy, the characteristics of study samples, and experimental patterns and scenarios. Studies of VR treatments for social anxiety have been conducted with control groups who were on the waiting list of certain studies,[3–5] who did exposure therapy using their imagination,[34,35] or in vivo exposure therapy,[36,37] making it possible to compare the effectiveness of the method with different intervention methods.

The literature has study samples with different characteristics. They were generally conducted with clinical cases.[37,38] However, one study did not have a clinical sample,[39] and another did not clearly define its sample's characteristics.[40] The participants in most of the studies were diagnosed with social anxiety.[3,36,37,41]

Bouchard et al.[36] used a program with scenarios such as giving a speech at a meeting, introducing oneself, talking to

so-called relatives in an apartment and communicating with an insistent salesperson. The same program was used by Klinger et al.[37] In the VR environment developed by Heuett and Heuett[35] for the purpose of reducing the fear of speaking before an audience, the subject stands on a stage in a conference room. Package programs can be purchased in accordance with study aims, and study-specific VR environments can be developed.[35] Some VR environments are interactive, but some environments have been designed to be non-interactive.

The Effects of Virtual Reality Treatments for Social Anxiety

Some studies have focused on whether VR environments actually cause anxiety before examining their effectiveness as a treatment for social anxiety. Pertaub, Slater and Barker[42] attempted to answer to this question and assessed the anxiety-related reactions of individuals who made a presentation before virtual audiences of eight male avatars. The experiment used three different virtual audiences: emotionally neutral spectators who were static during the entire experiment, positive spectators who displayed sincere and appreciative behaviors toward the speakers, and negative spectators who were bored and displayed hostile expressions. The study found that the negative audience clearly caused anxiety, and the participants were anxious despite their awareness that the environment was virtual.[42] Owens and Beidel[43] assessed the effects of a VR environment on 21 participants with social anxiety disorder and 24 participants with no disorders. Their study was conducted to determine the effect of giving an in vivo speech before an audience in a VR environment on physiological and subjective stimulation. All the participants had more anxiety symptoms than they did in face-to-face interactions. The evidence indicated that the VR environment significantly increased pulse rates, electrothermal activity and sinus arrhythmia, and the subjects reported that they experienced anxiety. Another significant result is that there were no significant differences in their physiological measurements during the face-to-face speech and the speech in the VR environment. Another study did physiological measurements of 12 participants who were assigned tasks in both a VR environment and real life. There were significant increases in systolic and diastolic blood pressure, and pulse rate as a response to all stressful tasks. There was also a physiological reaction. The VR treatments in the literature were reviewed from a different point of view, and their usefulness as a diagnosis instrument was assessed.[44] Among 119 participants, physiological measurements of 19 individuals who had the highest social anxiety scores and 18 individuals who had the lowest score in this regard were assessed. This pilot study found that VR solutions can also be used for diagnosis. These studies show that VR environments can successfully be used to diagnose anxiety reactions, and practices based on diagnostic assessment can be formed in the future.

Only VR is used in some of the studies that examine its effectiveness as a treatment for social anxiety. A randomized controlled study conducted by Anderson et al.[45] found that VR treatment was effective for 97 adults whose phobia was public speaking, and participants' acquisitions continued in the follow-up for one year. Some studies have compared VR treatment with other methods. Klinger et al.[37] compared virtual reality-based cognitive behavioral therapy (CBT) with group CBT. They found that both treatments effectively reduced social anxiety. In a study that evaluated whether VR-assisted CBT was an alternative to conventional CBT,[5] groups consisting of VR+CBT (n=28), CBT (n=30) and a waiting list (n=30) were compared in regard to the anxiety of speaking before an audience. The comparison of study results with the waiting list of participants who received VR+CBT treatment indicated more advancement and significant differences between the conventional CBT and VR+CBT groups. Another significant point in this study is that the early abandonment rate of the VR+CBT group was half that of the conventional CBT group. The researchers found that VR+CBT was as effective as conventional CBT, and that it was a short-term and effective option for overcoming the fear of giving a speech before an audience. In the follow-up study, participants' acquisitions continued even one year later.[34] Another study[36] compared in vivo exposure therapy to VR exposure therapy and a waiting list. A study that used the Liebowitz Social Anxiety Scale found both methods to be effective, but that VR and exposure therapy were more effective, and the acquisitions were preserved even six months later. The practitioners who participated in the study said that VR and exposure therapy was more practical. Another study that used the same methodology with 45 adults who were randomly assigned to VR+CBT, CBT and a waiting list, and VR+CBT was found to be more effective than both being on the waiting list and CBT with in vivo exposure therapy.[4] Heuett and Heuett[35] assessed the effect of VR-based exposure therapy on anxiety about public speaking using visualization and exposure therapy, and VR methods were found to be more effective than exposure therapy with visualization. Kampmann[3] compared VR+CBT with CBT that was separately conducted to contain in vivo exposure, and with waiting list. This study found that both the VR+CBT and the CBT groups had improved social anxiety symptoms, speech durations and perceived stress compared to the waiting list. The participants who received CBT in person also had less fear of negative evaluation, fewer depression symptoms and lower general anxiety levels than the waiting list, and their quality of life increased. The evidence indicated that separately-implemented CBT was more effective than VR+CBT in all fields, that VR+CBT intervention preserved the gains in perceived stress scores in the long term, and participants who received CBT in person maintained their acquisitions in all fields. This study's results differ with those of the other studies.

Conclusion and Recommendations

Technological developments affect not only our lives, but also the interventional methods in mental health. Computer-assisted programs, VR and augmented reality are often used. It is believed that VR can be used in many different fields, particularly for anxiety disorders.

VR can be used as a diagnostic instrument[44] or an effective treatment.[3,35–37] Although these methods have been found to be as effective as in vivo exposure therapy, some researchers claim otherwise and imply that in vivo exposure therapy is more effective in the long term.[3]

The number of Turkish studies of VR is quite limited and generally related to education[46] and health.[47] No studies of the use of VR for psychological treatment were found. However, Turkish researchers are interested in VR. The first study of VR in Turkey is a compilation concerning VR treatments for anxiety disorder, which was recently published.[48] The study includes the examples of VR use in many fields and serves as a starting point for researchers.

VR environments are either created specifically for the studies or sold as package programs. One of the commonly used programs belongs to Virtually Better (http://www.virtuallybetter.com/). A European company called Psious (https://www.psious.com/) also develops VR programs. In Turkey, certain companies established with the support of TUBITAK are conducting studies of VR. They include Retinas VR (http://www.retinas.co/), which generates many scenarios for treating issues ranging from anxiety disorders to post-traumatic stress disorder and sells products in the USA and Psikomerkez ARGE (https://psikomerkez.com.tr/), which focuses on social anxiety disorder and claustrophobic anxiety with a product called VR-Ex. VR studies have also been conducted by the Psychology Department at Hacettepe University.*

VR treatments have been reviewed in the literature for almost 50 years, and the number of studies that report their effectiveness has been increasing. However, VR studies are just beginning in Turkey. Programs related to VR treatments, particularly for anxiety disorders, should be developed, and scientific studies and research projects should be conducted to ensure most effective and high-quality mental health care.

**This information was obtained through personal communication.*

Conflict of interest: There are no relevant conflicts of interest to disclose.

Peer-review: Externally peer-reviewed.

Authorship contributions: Concept – Ö.Ö., M.K.Y.; Design – Ö.Ö.; Supervision – Ö.Ö., M.K.Y.; Fundings - Ö.Ö., M.K.Y.; Materials – Ö.Ö.; Data collection &/or processing – Ö.Ö., M.K.Y.; Analysis and/or interpretation – Ö.Ö., M.K.Y.; Literature search – Ö.Ö., M.K.Y.; Writing – Ö.Ö., M.K.Y.; Critical review – Ö.Ö.

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