Efficacy of Virtual Reality Therapy for Treating Psychological Disorders

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ABSTRACT

Virtual Reality Therapy (VRT) has emerged as a transformative tool in mental health treatment, offering immersive and interactive experiences that enhance traditional therapeutic approaches. This literature review explores the effectiveness of VRT in addressing various psychological disorders, including anxiety, post-traumatic stress disorder (PTSD), and phobias. By synthesizing existing research, this study examines the mechanisms through which VRT facilitates cognitive and emotional engagement, providing a safe and controlled environment for exposure therapy and skill-building. Additionally, the review highlights the technological advancements that have expanded VRT's accessibility and its integration into clinical practice. While findings suggest promising outcomes, challenges such as cost, accessibility, and the need for standardized protocols remain barriers to widespread adoption. Future research should focus on refining methodologies, ensuring ethical considerations, and evaluating long-term efficacy. This review underscores the potential of VRT to revolutionize mental health interventions, bridging the gap between innovation and clinical application.

Keywords: Virtual reality therapy; phobias; exposure therapy; innovation; efficacy

INTRODUCTION

Virtual reality (VR) is a computer-based system that simulates a 3-dimensional real world, which users can interact with and experience through pictures and sounds (1). VR encompasses various virtual interactions, from simple online games to immersive experiences. It is distinctive from programs on computers, mobile apps, or external gaming consoles because it uniquely immerses

Received February 20, 2025; Accepted April 17, 2025 https://doi.org/10.70251/HYJR2348.327782 the user into the online world using headsets which allows users 3D perspectives of the virtual environments. The visual and auditory components enable a realistic experience. The immersive realism of virtual reality has sparked interest in its application for clinical treatment. Emerging evidence suggests that VR's distinctive qualities may offer significant benefits in achieving therapeutic goals (2). Specifically, virtual reality therapy (VRT) can be defined as using VR as a medium to undergo exposure therapies, practice calming exercises, and promote mental health in a safe environment (3). VRT has been most commonly utilized for the treatment of specific phobias (2), anxiety (4), and PTSD; 5). It has also been used in treating depression, and the reduction of pain (6, 7).

Virtual reality therapy is an emerging area of study, and much research is still needed to understand the

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efficacy of VRT programs. Thus, this literature review aims to investigate how VRT might address limitations of traditional forms of therapies as well as its specific benefits and its effects on the brain.

UNIQUE BENEFITS OF VRT

A distinct advantage of VRT is its ability to present highly realistic stimuli, moving beyond mere discussion or imagination to create immersive, experiential treatment environments. As such, it has proven to be especially beneficial when conducting exposure therapies. Exposure therapy is a widely-used and well-tested form of therapy to address specific phobias, anxieties, and PTSD (12) in which the patient is exposed to their phobias in a controlled and safe manner. Additionally, one method of exposure commonly used in traditional therapy is *imaginal* exposure therapy, in which the patient uses their imagination to put themselves in a certain situation (14). While this can be helpful, it may be difficult for patients who have trouble with imagination (such as those with Autism); thus VRT can aid with overcoming this barrier. Instead of having the patient imagine, the virtual reality device can personalize a situation for the exposure therapy that the user would be able to experience through visual and auditory senses. The realistic nature of VR can be useful for the immersion of the patient into scenarios featuring avoided stimuli while ensuring a level of controllability.

SPECIFIC CONDITIONS

VRT has proven to be effective for some disorders, such as phobias, while others still require more research and evaluation (15). According to an article by Eichenberg and Wolters, there is more evidence of its effectiveness for specific phobias than for panic disorder, obsessivecompulsive disorder (OCD), or PTSD. Research has been done to evaluate the efficacy of VRT for other conditions.

Alzheimer's Disease

Alzheimer's disease affects more than 6.7 million people in the U.S., and VR offers benefits that could not be gained through traditional therapeutic modalities. Alzhiemer's causes memory loss and cognitive impairment for adults over the age of 65 (16). Two common forms of traditional therapy are occupational therapy and validation therapy (17). Occupational therapy involves a therapist helping the patient with everyday tasks which they may struggle with (18). Validation therapy involves listening to the patient about their feelings and finding the root cause of a behavior (19). VRT experiences on the other hand may trigger memories with exposure to locations or experiences from patients' pasts. VR can be a helpful way to simulate calming experiences, especially as those with Alzheimers often have high anxiety and anger (16).

Depression

Depression is a mental health condition characterized by a constant state of sadness or indifference (20). It makes it difficult to feel emotions such as happiness or excitement. It may also cause fatigue, guilt, changes in appetite, or suicidal thoughts. It is treatable through medications such as antidepressants, as well as cognitivebehavioral therapy (CBT), where a therapist helps the individual combat unhealthy thought processes. Patients may also work to maintain healthy lifestyles through exercise, avoidance of alcohol, quality sleep, and healthy diets (20). While these methods are beneficial, VRT can also significantly affect patients by increasing feelings of positivity and improving visual memory, physical activity, and linguistic expression (21). Seeing as many people with depression have little desire and will to leave the house and be active, VR can allow them to experience enjoyable activities from the comfort of their own home (22). They can take fitness classes, play games, or have virtual travel experiences. Exposure to these activities in a safe space may motivate an individual to go out into the world and pursue new interests in real life.

Phobias

Phobias are intense and overpowering fears of specific stimuli (23). The therapeutic process to treat phobias involves practicing strategies to mitigate aversive responses (13). VRT can facilitate these exposures by providing access to a wide-range of stimuli which can be personalized to each individual patient (24). While it is possible to integrate exposure into in-person therapy, some forms of exposure or phobia triggers are difficult or impossible to simulate in a real-world environment. For example, repeated exposure to flight landings for aerophobia or large crowds for agoraphobia can be impractical and/or costly (4; 2). The impact of overcoming such practical obstacles is significant, as approximately 19 million people in the U.S. suffer from a phobia, which can potentially be worked through by VRT (25). Maples-Keller et al. note that virtual reality exposure (VRE) also gives the provider more control over specific parts of the VRT experience, including the level of exposure, pacing according to the patient's needs, and an individualized exposure environment (2). It also provides a safer and more

controllable environment than in-person exposure, which reduces patients' anxiety about engaging in VRT (26). Stimuli can be introduced at a pace determined based on the patient's reactions to the exposure; for example, if the patient's level of anxiety is fairly low, then the therapist can introduce higher levels of feared stimuli more quickly (27). Simulating a real-world scenario where patients are more likely to react to stimuli can aid in a quicker and more efficient recovery.

Social Anxiety Disorder

Social anxiety disorder is a mental illness involving an intense fear of judgement by others (28). It may cause avoidance of going out in public and interfere with patients' abilities to work or go to school. It is most commonly treated by CBT, where a therapist will talk the patient through strategies to combat negative mindset and change their behavior (28). It may also be treated through medications including antidepressants, beta-blockers, and anti-anxiety medications. In a study by Hur and colleagues on VRT for social anxiety, participants with social anxiety underwent a VRT program where they were subjected to three stages of difficulty: easy, medium, and hard. In the easy stage, the participant was asked to introduce themself with a normal reaction from nonplayer characters. As the difficulty increased, the nonplayer characters became increasingly distracted, ignoring the participant. During this process, the participants' heart rate, eye movements, and skin galvanic response were measured. Before and after the intervention, participants participated in fMRI tasks where they would hear 40 different words; 10 positive, 10 negative, and 20 neutral, then indicate whether or not the participants identified with each word. The participants showed activity in brain regions associated with thinking about oneself and past memories while viewing positive words during the post-intervention fMRI, and symptoms of social anxiety disorder decreased. (29). In this way, participants could be influenced by this intervention in the long-term.

EVIDENCE OF VRT TREATMENT EFFICACY

Evidence of Mental Benefits

The effectiveness of VRT treatments remains an active area of research, requiring further evidence to establish its full impact. Preliminary studies have explored the short-term effects of VRT on self-reported mental health outcomes, offering initial insights into its potential benefits. In a randomized clinical trial by Bouchard and colleagues (2011), cognitive-behavioral

therapy (CBT) plus real world exposure was compared to CBT plus VRE. While the virtual exposure was found to be effective, they found no significant difference in effectiveness compared to real world exposure (30). However, in terms of accessibility, VRE could serve as a viable alternative to in-person therapy, offering a more flexible and readily available option for individuals facing barriers to traditional treatment. There is evidence that points to an optimistic view of using VRT. In an experiment conducted by Fabri and colleagues (2007), they gathered patients suffering from autism and had them play an interactive online game with emotionally expressive avatars, in order to help them understand and express emotions (31). At the end of the process, the participants were asked to complete a questionnaire, and the results showed that 30 of 34 participants were able to adequately understand the emotions of the avatars and use them properly, something that is often a struggle for those diagnosed with ASD.. These findings suggest that as VRT technology continues to evolve and become more personalized, it holds promising potential as a valuable tool for enhancing emotional recognition and expression in individuals with ASD and beyond.

Evidence of Physical Benefits

An article by Scott and colleagues points out that there is a correlation between physical conditions and mental health, as physical conditions are likely to cause mental health problems and vice versa. Mental health can be linked to physical conditions such as heart disease, cancer, or chronic lung disease, which is why it is important to look at physical benefits along with mental benefits when examining the efficacy of VRT (32). A study by Yang and colleagues serves as an example of VRT's positive physical impacts (33). This study consisted of a VR exercise program to improve balance, which was conducted for elderly subjects with mild depression. By the end of the program, their balance had improved and depression scores were measured, showing significant reduction. Another study tested for balance in children with Down Syndrome, using the same exercise program as the study by Yang (34). After the intervention, the participants showed a much higher difference in balance, demonstrating that this VR program can effectively improve balance for children. Overall, these balancefocused programs seem to have the potential for improving both balance and mental health.

Moreover, there is evidence supporting VRT's ability to treat pain effectively. Hoffman's study in 2004 not only overcome the limitations of standard therapy but

also showcased distinctive benefits for the treatment of pain. Specifically, while undergoing a painful medical procedure, the patients were presented with both a Nintendo video game and a virtual reality program with the goal to ease the pain and general patient discomfort. They reported a significant decrease in pain while using virtual reality as compared to the Nintendo game. This is because although the Nintendo game was slightly distracting, the patients were unable to feel fully immersed in the 2D world. This shows that while regular video games might be able to somewhat help in the reduction of pain, virtual reality programs aid to a greater extent. This evidence suggests that VR programs can provide a more effective distraction than flat screen games as you are being immersed in the virtual world. It is typically very difficult to find stimuli distracting enough to aid in the reduction of pain in a medical procedure. Virtual reality's realistic nature helps overcome this limitation, which is especially helpful when the patient cannot move during a medical procedure. Thus, the immersive nature of virtual reality proves to be a powerful tool in pain management, offering a level of distraction that traditional video games cannot match, making it particularly valuable for patients undergoing restrictive medical procedures.

EVIDENCE OF VRT IMPACTS ON THE BRAIN

The primary aim of most VRT is to foster lasting improvements in mental health symptoms. Understanding its effects on brain function and structure could provide insight into the mechanisms that drive these longterm changes. In a study by Álvarez-Pérez et al., they combine a cognitive-behavioral treatment with VRT for specific phobias. After the intervention, there was an increased amount of bilateral activity in the right dorsolateral prefrontal cortex, a part of the brain involved with decision making, conflict management, cognitive flexibility, etc. (35) .These brain regions play a crucial role in assessing potential recovery from phobias. The study further highlights that the effectiveness of VRT in treating specific phobias is largely linked to functional changes in key areas, including the thalamus, amygdala, insula, anterior cingulate cortex, visual cortex, and prefrontal cortex.

Another study looked at VRT for traumatic brain injury, stroke, Parkinson's disease, and Alzheimer's disease. The study showed significant improvements in cognitive and motor functioning and reduced symptoms (36). The authors believe that the VRT may have caused improvements to processes of neural connection and function (36). The realistic and multisensory approach that VRT offers may be a cause for these connections in the brain. Furthermore, a meta-analysis on VRT for poststroke patients saw an improvement in domain-specific cognitive functions, which are functions related to a certain process of the brain (37). There was enhancement of executive function, memory, and visuospatial ability. These findings suggest that VRT's immersive and multisensory nature may play a vital role in enhancing neural plasticity, ultimately contributing to significant cognitive and motor recovery across various neurological conditions.

ON-GOING INNOVATION IN VRT PLATFORM DESIGN

Some VR tools have been adapted for smartphones and other personal mobile devices and consequently patients and clients can access them more readily from their homes or on the go at any time. These VR tools have proven to be diverse in format and in content and thus could possibly address a wide array of mental disorders in their own ways. For example, the virtual reality platform GameChanger, approved by the UK's National Health Service, has six scenarios that patients can experience, in a cafe, a pub, a waiting room, a street, a bus, and a small shop (38). The tool can be used for different types of anxiety, as well as psychosis, schizophrenia, and many other mental health disorders etc. Additionally, XAIA (extended reality artificially intelligent ally) is an AI therapist that utilizes psychotherapeutic techniques and uses cognitive-behavioral therapy through virtual means (39). These specific tools are especially useful for those who wish to use VRT from the comfort of their own homes, as they don't require in-person therapists. They are also accommodating for those looking for a specific kind of treatment or hope to overcome a specific disorder, which particular VR platforms may be designed for.

CONCLUSIONS

The new and upcoming field of VRT is forecasting benefits and promises for the future. It has distinctive benefits and ways of overcoming barriers of traditional therapy, has been shown to be effective, and has positive impacts on the brain. VRT could certainly be beneficial for the treatment of different types of psychological and cognitive disorders. However, this is a unique and new form of therapy, which offers a different manner of exposure and experience. The current literature regarding VRT has involved specific phobias, anxiety, or PTSD and more research is needed to fully understand how it could be used for dementia, eating disorders, bipolar disorders and other conditions. Many studies to date have utilized fairly small sample sizes, which may not allow for generalizable results. Larger sample sizes should be used to gain a better understanding of the therapy's effectiveness on a larger scale. The studies have also focused more on shortterm effects rather than long-term. Future studies should implement long-term follow-up through a longitudinal approach for a more comprehensive understanding. . In the final analysis these different studies provide a general and preliminary demonstration of VRT's effectiveness, use, and benefits. There will likely be further research regarding VRT and its effectiveness in the near future, exploring how it may surpass traditional forms of treatment.

DISCLOSURE OF INTEREST

The author declares that there are no conflicts of interest regarding the publication of this article.

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