

The Use and Effect of VRET on Post-traumatic Stress Disorder

Zheng Ao Dan^{1,a,*}

¹*Qingdao Academy, No.111, Huazhong Road, Shibei District, Qingdao, Shandong Province, 266000, China*

a. z18669830289@163.com

**corresponding author*

Abstract: With the gradual increase in the number of patients with Post-Traumatic Stress Disorder, Virtual Reality-based Exposure Therapy has also started using progressively. This article explores how the virtual reality exposure therapy (VRET) technique has been used to treat Post-Traumatic Stress Disorder with success, by introducing the causes of it and how virtual reality can be used in treating it, reviewing a variety of experiments which applied VRET to different PTSD patients. It also focused on the comparison between VRET with other therapies and the different effects of VR therapy in different traumas. The end result is that although the technique is very effective for the patient, the therapist still has to choose the right treatment for the patient. Based on the specific causes of PTSD, Virtual Reality technology, or VR is more convenient since its effective uses of modern technology, and safer treatment methods. It should be promoted to more clinical applications.

Keywords: post-traumatic stress disorder, exposure treatment, virtual reality, VRET

1. Introduction

According to the National Institutes of Health, about 7.7 million American adults are affected by Post-Traumatic Stress Disorder, also known as PTSD, in recent years [1]. The prevalence of Post-Traumatic Stress Disorder is about 3.9% of the world's general population. Among those who had experienced trauma, the prevalence rate is 5.6% [2]. Since the increase of patients now, some modern treatments must be taken. Virtual Reality (VR) is an emerging tool to help treat post-traumatic stress disorder. VR allows users to experience computer-generated environments through computer technology. This technological interface has been increasingly used in the treatment of mental health and within clinical research [3]. This paper will focus on how Virtual Reality can deal with PTSD as a type of exposure therapy and the prospects for this treatment and view the VR treatment through each different trauma for its effect and compare it with other more mainstream interventions in terms of effectiveness.

The term "posttraumatic stress disorder" is now used to describe a mental condition brought on by various types of traumas. The only illness in the DSM-5 with a known cause is PTSD, which sets it apart from other disorders. The patient must have gone through trauma in order to receive a PTSD diagnosis [4]. Combat is still acknowledged as the experience most likely to result in PTSD, especially hand-to-hand fighting. Yet, it is now known that PTSD can also result from other traumas like car accidents, physical abuse, and natural catastrophes. Hypervigilance, avoiding

stimuli connected to the trauma that produced the disease, and emotional numbness are all signs of PTSD [4].

Hence, learning in general, and classical conditioning in particular, can be linked to the symptoms of PTSD. Those who have PTSD have conditioned reactions to stimuli connected to the traumatic incident. Because diverse situations can lead to PTSD, persons who have encountered those events may feel as though they have suffered extreme trauma as a result of the occurrence. They are capable of recalling the incident and are responsive to stimuli related to it. For instance, PTSD-affected combat veterans will be especially sensitive to scents like burning rubber and diesel that are present on the battlefield [5]. When exposed to conditioned fear stimuli, people with PTSD exhibit higher generalization, which suggests that as time passes, they will respond to more stimuli rather than fewer [6].

2. Traditional Interventions for PTSD

The common therapy of PTSD contains Cognitive Behavioural Therapy, also known as CBT, Prolonged Exposure Therapy, known as PET, and medications. For CBT, at first, patients will talk with their therapist about the traumatic events and how those events affected their thoughts and their life. Then they will write in detail about what happened. This process helps patients inspect how they think about their trauma and work out new ways to live with it. Because patients need to explore painful feelings, emotions, memories and experiences. This may cause them to feel angry, get upset or cry during the treatment. They may also feel physically drained [7]. However, this treatment method requires the patient's cooperation. Patients need more to discover their inner thoughts and change them in a positive way. This requires a lot of communication between the patient and therapist, but this method has a good effect and is effective in reducing depressive symptoms.

Since the influence of PTSD on the brain is mainly on the Hippocampus and Amygdala, The patients will experience memory disturbances and difficulty learning [8]. They are also easily triggered by events that they perceive as dangerous, whether or not this perception is correct. As a result, patients are activated to flashback to the trauma that led to their PTSD [9]. Selective Serotonin Reuptake Inhibitors are usually taken by patients to work on the brain by increasing serotonin levels. Selective serotonin reuptake inhibitors, known as SSRIs, inhibit serotonin reabsorption, enhancing and stabilizing happiness, mood, and sense of well-being. There are also other medicines in charge of treating PTSD such as Anti-anxiety medications, Mood stabilizers, and Alpha-1 blockers. But they all involve side effects such as Headache, Insomnia, Anxiety and Sexual dysfunction [10].

Prolonged Exposure is completely different from these two types of therapy. It requires patients to gradually approach trauma-related memories, feelings, and situations that they have intentionally or unintentionally avoided. Most people may think it is counter-intuitive to expose someone who has a fear of a particular thing or place to those things directly, but in fact, confronting fear is better for reducing it in the long run [11]. VR treatment has belonged to this therapy. Under this treatment, patients gradually receive stimuli that cause PTSD and reduce symptoms of PTSD. This treatment is effective, Studies have found that it produces symptom improvement from 80% to 90% [12]. However, it has to be admitted that this exposure therapy is not useful for all patients. Some patients have severe symptoms and refuse to be re-exposed to traumatic situations, and for these patients, therapists need to find other gentler methods to help them calm down.

3. The Application of Virtual Technology in Treating PTSD

3.1. The Principles of Exposure Treatments for PTSD

Full recovery calls for additional therapies like SSRIs that address these diseases, as many persons with PTSD also develop various substance use disorders [13]. Although there are many various ways to use exposure therapy, at its foundation, it is receiving some form of cognitive therapy while being exposed to a stimulus that causes PTSD symptoms or duplicates the initial trauma. The essential principles of exposure and cognitive treatment apply regardless of how they are implemented. A specific form of cognitive behavioural therapy called prolonged exposure trains patients to gradually confront the memories, emotions, and circumstances connected to the trauma. Most people try to stay away from anything that makes them think of the trauma they went through, yet doing so only feeds their anxieties. By confronting what is being avoided, a person can reduce the symptoms of PTSD by actively learning to recognise that trauma-related memories are not dangerous and do not need to be avoided [14]. Those who are scared of heights, for instance, can relax by imagining increasingly frightening situations like ascending a ladder or visiting the Empire State Building. The fear of heights should eventually lessen. Moreover, this therapy is the focus of other treatments. According to the hypothesis, people avoid similar stimuli like places, crowds, or anything else that can cause them to be reminded of the painful incident because the event is already connected to their trauma. Nonetheless, this avoidance solidifies a bad association. During exposure therapy, the stimulus can be presented to the patient again in a trauma-free environment. The brain grows used to these sensations in this way and mostly forgets the connection to the trauma [15].

3.2. VR as an Effective Complement

Usually, the therapist will give guidance to patients and let them describe the event in detail, and in the present tense. Together, the patient and therapist discuss and process the emotion raised by the imaginal exposure in the session. Imagination is a wonderful thinking ability, but it also has its limitations. This is the time VR comes in. Rather than asking the patient to imagine a scene, the scene can be rendered realistically by using VR technology. Wind, vibration, and sound can be added to make the visual experience more realistic as our height-afraid clients move around elevators, construction sites, and other high places. VR is being used to help patients recover from PTSD, such as combat veterans [16]. In these cases, smells of diesel and gunpowder can be added to enhance the realism of the virtual experience.

In addition, VR technology is based on masks and other devices, which can immerse users in the scene displayed by the device. This is not the same as watching a scene on a screen. When looking at a screen, patients don't perceive it as something that's actually happening. But when the patients are surrounded by a scene, they experience vertigo because the brain thinks what they are seeing is real, but the body's feeling doesn't match it. But when a VR device is used to simulate a scene, the perspective changes as our head moves. This unifies senses and brains, resulting in more authentic feelings.

Therefore, VR therapy is a type of effective and convenient exposure therapy for PTSD-based exposure therapy. In theory, doctors have absolute control over exposure and can place patients in a variety of different scenarios. It doesn't depend on the ability to imagine. And it's completely safe physically.

However, there still are other treatments for PTSD. Even though VR is more suitable for this disorder, it still cannot be the best way to heal all patients. After all, VR therapy is just only a type

of exposure treatment. To prove its effectiveness, a comparison has to be done by treating PTSD caused by different traumas and with other more mainstream interventions in terms of effectiveness.

3.3 VR in Actual Treatment

This therapy has already seen some results. Clinical psychologist Skip Rizzo provides a case study in which his VR platform enables clients to discuss their experiences dealing with trauma [17]. Many customization options are available. With these choices, the therapist can include auxiliary components like clouds, missiles, small-arms fire, and helicopters. Some soldiers who were getting over PTSD noticed a difference as a result of their treatment [17].

Another example is Ellie, a virtual PTSD screening tool launched by USC's Institute for Creative Technologies. Ellie provides patients with an anonymous, unrecorded interview that encourages patients to talk more openly and freely, a strategy that helps build rapport. Future developments may enable Ellie to report on veterans' susceptibility to post-traumatic stress disorder [18].

4. The Combination of VR Therapy and Traditional Therapy

After comparing VR treatment with other therapy, its effectiveness also needs to be viewed through each different trauma. As the author mentioned at the beginning, the cause of PTSD is different types of traumas such as military combat, rape, abuse, and natural disaster. Will VR treatment have a different effect on PTSD which is caused by individual traumas? Firstly, in the example of using VR to treat battlefield-induced PTSD, the experimenter simulated in a virtual reality environment the environment of the Iraq war in which the patient had been involved. In the results, a substantial drop can be found in the patient's self-reported PTSD symptoms, and the patient's life is less affected by PTSD. Thus, can find that VR treatment can be very effective for this type of PTSD. But combat or other trauma such as natural disasters and horror attacks that happened in a specific place will be easy to imitate in the virtual world. On the opposite, other trauma, for example, sexual or physical abuse, will be hard to design a helpful virtual environment for treatment. Since people are extremely diverse in terms of cultures, stage of development, identity and trauma exposure. Certain types of trauma-focused treatment will be more effective for specific groups and individuals, while others will be less effective, and researchers should continue to investigate the moderators of these treatment outcomes. For example, people with milder symptoms will benefit more from PE. This treatment is shorter, more effective and does not cause as much pain. Patients with more symptoms of PTSD, such as depression and anxiety during PTSD episodes, are more likely to need palliative care. This is the time to apply CBT to them.

Although VR can be very convenient to assist in the treatment of PTSD until the technology is fully integrated with therapy, clinicians should still use traditional therapy primarily and VR technology secondarily, and only after the patient has personally consented to the use of the technology. The authors do not recommend relying exclusively on VRET for treatment; after all, the causes of PTSD are complex and symptoms can be influenced by both the environment and the patient's physical condition. Therapy should be applied only after the patient has been assessed.

5. Conclusion

Based on the special causes of PTSD, VR technology can bring more convenient, more effective, and safer treatment methods. This can help both the patient and the therapist. But using VR therapy requires more trained mental health clinicians. There is still a lot of room for the development of this method in the future. Also, due to the author's resource constraints, it was only possible to conduct the research by looking up completed experiments and other sources. As it was not possible to find all the information needed, this could lead to some bias in the data, limitations in the

examples, and thus bias in the conclusions of this paper. The author can find information and refine this paper in more specialist publications and websites.

In the future, the combination of VR technology with treatments for PTSD may be more widely used and more virtual scenarios developed to match different patients. The author believes that more treatments of PTSD will be applied with VR together, to maximize the curative effect with minimal impact on the patients.

References

- [1] *Ptsd United, PTSD statistics, October 19th, 2022.* <https://ptsdunited.org/ptsd-statistics-2/>
- [2] *Worldwide prevalence of PTSD, 27th October 2021.* <https://library.neura.edu.au/ptsd-library/epidemiology-ptsd-library/prevalence-epidemiology-ptsd-library/worldwide-prevalence/>
- [3] *Maples-Keller, J.L., Bunnell, B.E., Kim, S., & Rothbaum, B.O. (2017) The Use of Virtual Reality Technology in the Treatment of Anxiety and Other Psychiatric Disorders [J]. Harvard Review of Psychiatry, vol.25, no.3, 103–113.*
- [4] *The Diagnostic and Statistical Manual of Mental Disorders, (2013) Fifth Edition, F43.10.*
- [5] *Rizzo AS& Difede J& Rothbaum BO& Reger G& Spitalnick J& Cukor J& McLay R. (2010) Development and early evaluation of the Virtual Iraq/Afghanistan exposure therapy system for combat-related PTSD [J] Annals of the New York Academy of Sciences., vol.1208, no.1. 114–125.*
- [6] *Kaczurkin, A. N., Burton, P. C., Chazin, S. M., Manbeck, A. B., Espensen-Sturges, T., Cooper, S. E., Sponheim, S. R., & Lissek, S. (2017) Neural Substrates of Overgeneralized Conditioned Fear in PTSD [J] The American journal of psychiatry, vol.174, no.2, 125–134.*
- [7] *Mayo Clinic, Cognitive behavioral therapy, March 16, 2019. September 18th, 2022* <https://www.mayoclinic.org/tests-procedures/cognitive-behavioral-therapy/about/pac-20384610>
- [8] *Bremner J. D. (1999) Alterations in brain structure and function associated with post-traumatic stress disorder [J] Seminars in clinical neuropsychiatry, vol.4, no.4, 249–255.*
- [9] *Morey, R. A., Gold, A. L., LaBar, K. S., Beall, S. K., Brown, V. M., Haswell, C. C., Nasser, J. D., Wagner, H. R., McCarthy, G., & Mid-Atlantic MIRECC Workgroup (2012) Amygdala volume changes in posttraumatic stress disorder in a large case-controlled veterans group [J] Archives of general psychiatry, vol.69, no.11, 1169–1178.*
- [10] *Alexander W. (2012) Pharmacotherapy for Post-traumatic Stress Disorder In Combat Veterans: Focus on Antidepressants and Atypical Antipsychotic Agents [J] P & T: a peer-reviewed journal for formulary management, vol.37, no.1, 32–38.*
- [11] *Sarah Krill Williston, Trauma-focused or non-trauma-focused treatments for PTSD: Which is more effective? August 10th, 2017.* <https://www.anxiety.org/trauma-focused-treatments-for-post-traumatic-stress-disorder-ptsd>
- [12] *Powers, M. B., Halpern, J. M., Ferenschak, M. P., Gillihan, S. J., & Foa, E. B. (2010) A meta-analytic review of prolonged exposure for posttraumatic stress disorder [J] Clinical psychology review, vol.30, no.6, 635–641.*
- [13] *Back, S. E., Killeen, T., Badour, C. L., Flanagan, J. C., Allan, N. P., Ana, E. S., Lozano, B., Korte, K. J., Foa, E. B., & Brady, K. T. (2019) Concurrent treatment of substance use disorders and PTSD using prolonged exposure: A randomized clinical trial in military veterans [J] Addictive behaviors, vol.90, 369–377.*
- [14] *American Psychological Association, Prolonged Exposure (PE), July 31, 2017.* <https://www.apa.org/ptsd-guideline/treatments/prolonged-exposure>
- [15] *Pintado, Isabel Serrano and María del Camino Escolar Llamazares. (2014) Description of the General Procedure of a Stress Inoculation Program to Cope with the Test Anxiety [J] Psychology, vol., no.5, 956–965.*
- [16] *Spira, J.L., Pyne, J.M., Wiederhold, B.K., Wiederhold, M.D., Graap, K.M., & Rizzo, A.A. (2006) Virtual reality and other experiential therapies for combat-related posttraumatic stress disorder [J] Primary psychiatry, vol.13, no.3, 58–64.*
- [17] *University of Southern California, ALBERT “SKIP” RIZZO, Director for Medical Virtual Reality,* <https://ict.usc.edu/about-us/leadership/research-leadership/albert-skip-rizzo/>
- [18] *University of Southern California, Meet Ellie: The Robot Therapist Treating Soldiers with PTSD, October 1, 2016.* <https://ict.usc.edu/news/meet-ellie-the-robot-therapist-treating-soldiers-with-ptsd/>