

A novel treatment program for adolescents with post traumatic stress disorder with virtual reality technology

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Abstract. Recent advancements in the study of posttraumatic stress disorder (PTSD) have led to the discovery of innovative improvements to therapies that have already received empirical validation. The purpose of this paper is to investigate the theoretical feasibility and expected effects of a new treatment approach for the adolescent PTSD patient population that combines VR virtual reality technology with traditional treatment modalities by referring to relevant studies, literature, and survey feedback from the relevant groups. The main focus is on the use of virtual reality technology to address the reluctance of the adolescent patient population to accept treatment and to explore other possibilities for the development of a relevant target population. The limitations and drawbacks of current VR systems in the treatment of psychological disorders are also discussed, but theoretical solutions are also given. The specific role of the senses in the theoretical model and the role and usefulness for patients, physicians, and others, respectively, are also given.

Keywords: Adolescent PTSD Patients, Virtual Reality Technology(VR), Resistance of Adolescent Patients, Treating Post-Traumatic Stress Disorder, Third-party Complementary Therapy

1. Introduction

People who experience one or more traumatic incidents, such as purposeful acts of interpersonal violence, major accidents, natural catastrophes, or military activity, may acquire post-traumatic stress disorder (PTSD), which can strike anybody at any age, including children[1]. Post-traumatic stress disorder(PTSD) was officially recognized as a disorder in 1980, and now we know that adolescents and children are also susceptible to this disorder. PTSD has different characteristics in different age groups, and it is because of the age difference that the treatment of the adolescent population cannot be replicated in the adult population. The majority of psychotherapy approaches are based on adult therapies. Due to their immaturity in terms of development, the stigma that many teenagers associate with psychotherapy, and the sensation of being coerced into psychotherapy, these strategies typically fail to engage adolescents[2]. But the use of virtual reality technology can be a good way to ease the resistance of teenagers. First, a computer-generated simulation is referred to as virtual reality and may be accessed by users of specialized electronic equipment in a manner that appears to be real or tangible. Second, the subject of this study was the use of VR virtual reality technology in combination with traditional behavioral cognitive therapy for a population of adolescents with PTSD. The current vision is to use VR

technology to build a virtual room that can be changed according to patient preferences to engage and guide adolescent patients through treatment in a novel and interesting way. The use of this new treatment model not only addresses the resistance of adolescent patients, but also reduces the burden on the patient's family and the pressure on the physician. The specific software model is based on "Bravemind", a role-playing game that incorporates the traumatic events experienced by adolescents with PTSD to complete the exposure therapy.

2. Related article

After suffering stress that results in extreme mental trauma that is life-threatening, posttraumatic stress disorder (PTSD) is a psychological reaction[3]. VR systems have gradually been accepted in the medical field, especially in psychotherapy with very good results. Intuitively, it aids in reducing pain, tension, and anxiety in a fictitious setting, and VR enables effective educational and psychological training without endangering patients. [4]. One of the research directions is to build a virtual treatment room that can change at will according to the patient, which is actually very important. The virtual environment is perfect in the sense that its flexibility and adaptability make it the best choice for the emotion processing theory (EPT), which emphasizes exposing and altering each person's individual fear structure [5]. The theoretical vision of the virtual environment must ensure that it is flexible to meet the differences in the treatment environment requirements of different patients. In addition, haptic feedback system is also considered, the general idea is to monitor the patient's heart rate and blood pressure in real time through the haptic feedback system, specifically through the visual panel and auditory feedback to the doctor. Another research hypothesized that VR with skin conductance reactivity is both a diagnostic and therapeutic tool for PTSD[6]. The image of the doctor is also flexible and variable, taking into account the specificity of this group of adolescents. In addition, VR technology allows the patient's family to observe the event from the patient's point of view, and allows others, such as medical students, to observe the treatment in an "invisible" state.

3. Theoretical Assumptions and Advantages

3.1. Environment

Because of the flexibility and extensibility of the virtual treatment room, it allows patients to find an environment where they feel safe, comfortable and relaxed, which helps them to open up, relax and speed up the whole treatment process. It's also important to note that VR systems can offer well-controlled virtual worlds with moderate ease[7]. Based on this flexible and variable virtual environment some other sensory stimuli can be added to further relax the patient. With the current state of technology, special natural scents (e.g., floral scents) or chemical scents (e.g., gaseous sedatives) can be effective in helping patients enter a state of relaxation more quickly.

Ideally, the patient would be presented with a VR device that looks a bit like the interface of a "Ready Player One" scenario. The doctor's role is more like that of a "game guide", guiding the "player" through each treatment "mission". Therefore, by integrating exposure therapy with this game-like treatment, the desired therapeutic effect can be achieved and the resistance of the adolescent PTSD patients can be addressed. Research demonstrates that patients are satisfied with VR-based therapy and may find it more acceptable than conventional methods [8][9].

3.2. For Adolescent clients

Adolescent clients (ACs) are challenging to treat in psychotherapy for at least two reasons: they usually lack confidence in adults and have low treatment motivation[10]. This point about distrusting adults can be perfectly solved by transforming the image of the doctor using the VR system. For example, turning the doctor into a person of the same age as the patient or their favorite character from movies and anime. According to the survey, most people want to meet with their favorite movie characters or anime characters. So this motivates adolescent PTSD patients to receive treatment without having to face adult doctors who make patients feel distrustful.

3.3. For the doctors

From the doctor's point of view, the doctor can free his hands to record the points related to the patient directly to the cloud through voice or video, so that he can specialize in master and treatment. This online virtual treatment room also allows others to enter the room in an "invisible" state, such as medical students who can learn from actual treatment cases, or family members of patients who can learn how to get along with patients and assist in treatment by watching the process. According to studies, PTSD symptoms are less severe in kids and teenagers who have more family support and less parental concern [11]. This is why it is beneficial to involve family members in the treatment process.

4. Limitations of the current stage

4.1. From the virtual world to the real world

The currently known virtual reality environment models lack a certain degree of realism. However, according to the results of the user survey, there are many people who are concerned about whether the treatments and therapeutic effects they receive in the virtual world will continue once they return to the real world.. The simple summary is the sense of difference and abruptness in the process of switching from two different worlds. And we need to make a database of virtual environments large enough and large enough to accommodate the different requirements of different patients for the treatment environment. So the time and money costs are huge and there is still some time to go before it is fully rolled out and used.

4.2. Side effect

The majority of people may experience severe pain after using VR apps, since motion sickness can cause eye fatigue, headaches, nausea, and perspiration[12]. Retinal damage caused by dry eyes and blue light from monitors overheating in enclosed spaces is also a concern, although with the development of technology these problems will gradually be solved, but at present only a few large institutions can make high-quality low-hazard VR devices and put into the medical field.

4.3. Addicted to the virtual world

Another pitfall is the potential for patients to become addicted to the virtual world when using VR devices to treat patients with psychiatric disorders, somewhat similar to Internet addiction. Adolescent patients, in particular, have less self-control than adults, so it is important to receive guidance on how to avoid this when using virtual reality technology for treatment. If there is no corresponding solution, the symptoms may worsen, and in severe cases may be accompanied by depression, social phobia, etc., and eventually become a "puppet" living only in the virtual world.

5. Improvement methods

5.1. World transform

A "virtual hall" with buffering effect can be established, through which patients will pass before and after each treatment. This "hall" adopts the environment of the treatment room in the real world, and a "secondary door" is set up in the hall as the entrance to the virtual world. Regarding the solution of financial costs, considering the specificity of the adolescent population, a uniform investigation and treatment by the school is the relatively best way. Both reduce the amount of demand for equipment and can quickly get a large number of data samples, of course, in the future after more mature technology can even do as the current cell phone hand one.

5.2. discomfort and other problems,

With the current level of technology can do the most simple and effective solution is to specify the wearing time. For example, each time you receive treatment with VR devices, you are not allowed to wear the device for more than two hours.

5.3. *prevent addicted to the virtual world,*

Preventing addiction to virtual worlds requires limiting usage time and ensuring that doctors are trained on the proper use of VR before treating patients. In addition, parents need to guide adolescents to effectively prevent addiction symptoms. But it's not hard to imagine a future in which there will be a set of regulations and training methods to help doctors and patients with this type of treatment.

5.4. *Sensory*

5.4.1. *Visual.* After the patient puts on the VR headset, the first thing to do is pass through a "hall", open the "hall" in the "next door" can see their favorite environment, the image of the face of the doctor is also their favorite movie characters or anime characters. Considering that it is a group of adolescents with PTSD, the whole treatment approach is more game-oriented, which is more attractive to patients to accept the treatment and the effect will be more significant. After starting the treatment, the patient can clearly see the task guide icons (here is the example of exposure therapy), and the patient will not be particularly affected by recreating the traumatic events at that time with specific task goals.

From the doctor's point of view, the doctor can be the patient's "teammate" in the game therapy, or he or she can be the game guide who knows how the patient should accomplish the "task". The doctor can also see the patient's heart rate, blood pressure and other physical conditions displayed on the translucent panel above the patient's head in real time so that he or she can make appropriate changes at any time.

Other bystanders (such as the patient's family or other medical students) can observe the physician-patient interaction from a broader perspective, but they are not able to intervene in the entire treatment process. And neither the doctor nor the patient can see anyone else, which ensures that the entire treatment process goes smoothly and quickly.

5.4.2. *Auditory.* First of all, the patient will first hear a background music similar to soft music after putting on the VR device to help the patient relax. After officially entering the treatment process, it will simulate the sound effects of the corresponding environment according to the patient's actual situation while the guidance received from the doctor is also transmitted through sound. For example, if you need to simulate a car accident scene, sound is also an important item to increase the immersion.

From the physician's perspective, the main audio feedback comes from the patient's heart rate and other body indicators, which allows both focus on the treatment process and real-time monitoring of the patient's condition.

5.4.3. *Smell.* Similar to the auditory sense, the patient enters the "virtual hall" with the music and releases some scents that make people relax more quickly. In the treatment process in order to make the environment more realistic can add some special smell to increase the authenticity of the conditions (for example, the event of encountering a fire can add some soot flavor).

6. **Conclusion**

VR-based treatments for different mental health conditions have produced positive findings but unfortunately many of the articles are case studies or quasi-experiments[13]. But in fact virtual reality demonstrates the possibility of changing their current symptoms by effectively exposing the source of their fear. Modern VR systems can provide an ideal, comfortable therapeutic environment to help people face their problems with equanimity, where not only will doctors help patients solve their problems in real time, but also have controlled virtual sensory stimulation to assist them in their treatment. Especially for adolescents with PTSD, the new treatment model is interesting and new enough to attract them to volunteer for treatment. In the theoretical model described in this paper, it works not only for adolescents with PTSD, but also for doctors to reduce time and families to reduce time and money costs. However,

there is still a long way to go before the real application to the whole society, and there are many practical problems that need to be solved one by one, such as dizziness, dry eyes and retinal damage, etc.

References

- [1] Leicester Gaskell(UK; 2005). Post-Traumatic Stress Disorder: The Management of PTSD in Adults and Children in Primary and Secondary Care(NICE Clinical Guidelines, No. 26.). National Collaborating Centre for Mental Health (UK).PMID: 21834189; Bookshelf ID: NBK56494
- [2] Bolton Oetzel, K., & Scherer, D. G. (2003). Therapeutic Engagement With Adolescents in Psychotherapy. *Psychotherapy: Theory, Research, Practice, Training*, 40(3), 215–225.
- [3] Rothbaum BO, Hodges L, Watson BA, Kessler CD, Opdyke D. Virtual reality exposure therapy in the treatment of fear of flying: a case report. *Behav Res Ther* (1996) 34:477–81. doi: 10.1016/0005-7967(96)00007-1
- [4] Mantovani F, Castelnuovo G, Gaggioli A, Riva G. Virtual reality training for health-care professionals. *Cyberpsychol Behav* (2003) 6:389–95. doi:10.1089/109493103322278772
- [5] Norr AM, Smolenski DJ, Reger GM. Effects of prolonged exposure and virtual reality exposure on suicidal ideation in active duty soldiers: an examination of potential mechanisms. *J Psychiatr Res* (2018) 103:69–74. doi: 10.1016/j.jpsychires.2018.05.009
- [6] Van 'T Wout M, Spofford CM, Unger WS, Sevin EB, Shea MT. Skin conductance reactivity to standardized virtual reality combat scenes in veterans with PTSD. *Appl Psychophysiol Biofeedback* (2017) 42:209–21. doi:10.1007/s10484-017-9366-0
- [7] Mi Jin Park, Dong Jun Kim, Unjoo Lee, Eun Jin Na and Hong Jin Jeon(19 July 2019). A Literature Overview of Virtual Reality (VR) in Treatment of Psychiatric Disorders: Recent Advances and Limitations. *Frontiers in Psychiatry;Mini Review*(Volume 10, Article 505). doi:10.3389/fpsy.2019.00505
- [8] Maples-Keller JL, Bunnell BE, Kim S-J, et al(2017). The use of virtual reality technology in the treatment of anxiety and other psychiatric disorders. *Harv Rev Psychiatry*(25:103–113).
- [9] Mazurek J, Kiper P, Cieřlik B, et al(2019). Virtual reality in medicine: A brief overview and future directions. *Hum Mov*(20:16–22).
- [10] Sommers-Flanagan, J., & Sommers-Flanagan, R. (1995). Psychotherapeutic techniques with treatment-resistant adolescents. *Psychotherapy: Theory, Research, Practice, Training*, 32(1), 131–140.
- [11] Jessica Hamblen, Ph.D.(7/14/2008). PTSD in Children and Adolescents - (National Center for PTSD).Page 1 of 4. http://www.ncptsd.va.gov/ncmain/ncdocs/fact_shts/fs_children.html
- [12] Ohyama S, Nishiike S, Watanabe H, Matsuoka K, Akizuki H, Takeda N, et al(2007). Autonomic responses during motion sickness induced by virtual reality. *Auris Nasus Larynx*(34:303–6). doi: 10.1016/j.anl.2007.01.002
- [13] Błażej Cieřlika, Justyna Mazurekb, Sebastian Rutkowskic, Paweł Kiperd, Andrea Turollad, Joanna Szczepańska-Gieracha(2020). Virtual reality in psychiatric disorders: A systematic review of reviews. *Complementary Therapies in Medicine* 52 (2020) 102480.