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Application of virtual reality technology in helping patients overcome treatment anxiety

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Abstract. Patients undergoing surgery face several medical anxieties such as White Coat Syndrome, Iatrophobia, and Trypanophobia, which cause great inconvenience to both the medical staff and the patients. In recent years, with the advancement of science, virtual reality technology has been developed widely and plays a significant role in dealing with anxiety issues. This paper, with the theme of VR technology helping patients overcome treatment anxiety, summarizes and discusses patients' anxiety and fear during treatment, how VR technology helps patients overcome anxiety and fear, and some challenges and prospects, analyzing the effects of VR technology in relieving patient anxiety. This paper finds that virtual reality technology is currently in the development stage in the field of medical applications, and it plays a significant role in the field of psychotherapy. It can serve as a very effective tool to help patients get better treatment.

Keywords: virtual reality, anxiety, psychotherapy.

1. Introduction

Virtual reality technology can be seen as an advanced form of human-computer interaction. Compared to standard computer equipment, it allows users to interact more naturally with computers, and provides users with an immersive sensation of what they're seeing [1]. The immersive experience brought by Virtual Reality (VR) allows users to easily immerse themselves in the scenes they see, which brings a new treatment approach to the field of psychotherapy, namely, using VR technology to treat patients' psychological disorders.

In numerous medical cases, white coat hypertension, trypanophobia, and dentophobia (dental phobia) are some of the common psychological problems that patients may encounter. Among them, white coat hypertension, simply put, refers to a condition where the patient's blood pressure level continuously rises when measured in a medical office or in the presence of a doctor, but remains normal in daily life and home environment [2]. Trypanophobia, different from aichmophobia, belonephobia, and enetophobia, was first reported in the "Diagnostic and Statistical Manual of Mental Disorders" (DSM-IV) in 1994, and is mainly related to medical fears, that is, patients have an extreme fear of bleeding, receiving injections, or being injured [3]. As for Dentophobia, it is the fear that patients have towards known or threatening objects in the dental facilities or environment during the treatment process [4]. Of course, patients undergoing treatment may encounter more than just the above psychological issues. However, what can be confirmed is that these mental illnesses will more or less impact the effectiveness of the treatment and the patient's physical and mental health. Therefore, to minimize these effects, VR

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technology can be regarded as a new approach to solving this problem. This paper, through the analysis of some anxiety issues encountered by patients during medical treatment, compares conventional psychotherapy methods with treatment methods based on VR technology. It explores the positive impacts of VR technology on patients' anxiety during medical treatment. The main research method used is literature analysis, with the aim of providing a new perspective for future researchers to solve patients' anxiety during medical treatment. This could increase the success rate of patients' treatment from a psychological perspective and serve as a relevant reference for future researchers.

2. Issues of anxiety and fear faced by patients during treatment

2.1. Problems encountered by patients during treatment

Different patients face different anxieties when facing treatment. For example, White Coat Hypertension (WCH), the Spanish ABPM registry (It was established by distributing more than 1,000 ambulatory blood pressure monitors for daily use by primary care doctors and specialists throughout Spain [5]) has recorded some data on hypertensive patients, and these data have been used for a series of studies. The research considered a variety of populations, including patients undergoing hypertension treatment and untreated hypertensive patients. Among untreated patients, the prevalence of WCH ranges from about 15.5% to 29.2%, and the prevalence of pseudo-resistant hypertension caused by WCH has exceeded 20% of treated males [6]. As for trypanophobia, also known as needle phobia, one study focused on the prevalence of this fear among adults with chronic diseases. This survey included patients with chronic diseases such as cancer, renal failure, diabetes, etc. The findings indicated that the incidence of needle phobia among cancer patients ranged from 17% to 52%; between 25% and 47% of patients with renal failure undergoing peritoneal dialysis or hemodialysis suffered from needle phobia; and this figure could be as high as 43% among those undergoing insulin therapy [7]. This suggests that the prevalence of needle phobia is high among the population of patients with chronic diseases. If timely psychological counseling is not provided for these patients, it may likely leave a psychological shadow and even delay the progress of treatment. In addition, there's also dental phobia. Among 1207 sample data, approximately 11% of individuals suffered from dental phobia, among which nearly 70% exhibited moderate fear, and the rest severe fear [8]. Of course, there are also other anxiety issues, such as fear in medical and health care environments, which inevitably impact patient psychology and treatment. Therefore, addressing these problems is a necessity.

2.2. The impact of anxiety issues on patients' lives during and after treatment

The issue of anxiety brought about by medical treatment can be said to permeate throughout the entire treatment process of patients:

Before treatment: Take for example, some patients with white coat hypertension who feel anxious when facing doctors or the medical environment. During their examinations, their blood pressure levels present a relatively high state, which could influence the doctor's judgment and lead to over-medication. This not only delays treatment, but the patient might also encounter health problems due to excessive medication.

During treatment: The fear of patients during treatment arguably has the greatest impact on the overall treatment efficacy. Firstly, patients with trypanophobia, or fear of injections, may resist treatment due to their fear, posing significant challenges to the entire process. Secondly, the anxiety issues brought about by phobias should not be overlooked. For instance, dental phobia might cause patients to become restless during treatment due to fear, severely affecting the treatment process.

After treatment: Some anxiety issues continue to significantly impact the patient's quality of life even after the completion of treatment. According to surveys, some patients with dental phobia demonstrate a 50% higher tooth loss rate than those with less severe dental phobia, indicating that patients with dental phobia are more inclined to choose tooth extraction when they have dental diseases [9]. The ultimate result might be the complete extraction of all teeth, which would greatly affect their future quality of life.

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2.3. The feasibility of VR technology in healthcare

Common methods for treating mental disorders include exposure therapy and the like. Exposure therapy involves having patients confront and interact with what they fear or the scenarios they dread, and then through continuous stimulation, patients gradually adapt to this state, thereby reducing anxiety or fear responses. Despite the abundant clinical data supporting its effectiveness, this therapy inevitably presents some issues—exposure therapy may trigger intense fear responses, which could lead to patients discontinuing therapy and, consequently, therapy failure. Additionally, exposure therapy has some limitations; it isn't suitable for patients who are anxious about specific scenarios, like surgery scenes. The advent of VR technology offers a whole new possibility for this, as VR is renowned for its immersiveness. To some extent, VR could even facilitate most forms of psychotherapy.

3. How VR technology helps patients overcome anxiety and fear

3.1. The application of VR technology in healthcare

Currently, there is existing research on virtual reality (VR) and exposure therapy, such as for post-traumatic stress disorder. Data suggests that VR exposure-based therapy (VR-EBT) is effective for patients with trauma-related disorders, and patients have high expectations for VR technology [10]. Furthermore, according to some meta-analyses, VR-EBT is effective for anxiety-related disorders and is not inferior to conventional exposure therapy. It should be considered an attractive and effective clinical tool [11]. This indicates that VR technology has already established a certain foundation in the field of psychological therapy, and with the continuous development of technology, the immersive effects of VR will only become more profound, providing even greater help to patients.

3.2. How VR technology helps patients cope with anxiety during treatment

Virtual reality technology can help patients overcome anxiety in many ways:

For patients who are unclear about the medical process, doctors can use VR technology to immerse them in the entire procedure, thereby reducing patient anxiety.

For patients with specific phobias, doctors can use VR exposure-based therapy (VR-EBT) to help them overcome their fears, making subsequent treatment processes smoother.

For patients who experience anxiety in specific medical settings, doctors can allow them to repeatedly experience these scenarios through VR, thereby alleviating their anxiety.

In summary, given sufficient model accuracy, VR technology can recreate most scenarios, and with the guidance of professional doctors, patients can fully understand all the details of the medical process and immerse themselves in the scenarios they are anxious about.

3.3. Different VR experiences needed for patients with different needs

The greatest characteristic of VR technology lies in its flexibility, as it can help different patients improve their anxiety levels through various scenarios. For instance, patients with a fear of injections can undergo treatment using VR-EBT. Considering that each patient's acceptance level may differ, patients can choose the level of realism based on their own circumstances, and they can even start with experiencing a single photograph. For anxious patients who are unfamiliar with medical environments or surgical procedures, VR can allow them to explore specific medical settings or processes to familiarize themselves with the entire procedure and alleviate anxiety. VR technology can adapt well to the changing needs of patients, significantly saving manpower and expenses.

3.4. Improvement in the relationship between doctors and patients with VR technology

The doctor-patient relationship is also an important part of the entire medical process. However, in many cases, patients' anxiety can lead to a decrease in their trust in doctors, which undoubtedly affects the effectiveness of treatment. Furthermore, some patients need to understand the entire details of certain surgeries in order to be in an accepting attitude towards the entire treatment process. Without VR technology, the success or failure of treatment relies solely on the doctor's additional explanations, which

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undoubtedly brings pressure on both the doctor and the patient. If VR technology can be applied in the corresponding field, both the details of the surgery and the patient's anxiety will be addressed, and there will be no occurrence of trust crises between doctors and patients. Undoubtedly, this will have a positive impact on the effectiveness of treatment.

4. Challenges and prospects

4.1. The difficulty for medical institutions to implement the application of VR technology

Despite the many benefits brought by VR technology, there are still some limitations. First, there is the issue of acceptance among doctors. For example, VR-EBT, despite its significant help to patients, becomes challenging to administer if the treating doctors are unable to accept this technology [12]. Secondly, there is the cost issue. Apart from the expenses for the equipment, the immersion and precision of the VR experience are crucial, which may result in significant expenses for medical institutions. Additionally, there is the matter of personnel training. VR technology requires healthcare professionals to possess specific technical knowledge and operational skills, which can also be a limitation for medical institutions. However, considering the current level of development, the popularity of VR is increasing. Currently, the primary constraint for medical institutions is the cost issue, but the prevalence of VR technology in healthcare institutions will continue to grow.

4.2. Possible directions for future innovations

A more realistic scenario would be the main innovative direction of VR technology in the field of healthcare. Due to the complexity of certain surgical procedures, it is currently difficult to achieve complete replication. Therefore, in order to ensure patient immersion, more lifelike scenes are necessary. Furthermore, there are potential areas for development and innovation in addressing issues such as "motion sickness" that some patients may experience in the future.

5. Conclusion

With the continuous development of VR technology, the integration of VR and healthcare will become a trend. This article provides a perspective on the use of VR technology in addressing patients' medical anxiety, offering a way to improve treatment efficiency in the future. The combination of VR technology and healthcare will greatly alleviate anxiety associated with medical visits. Additionally, it is important to note the adverse effects of motion sickness on patients. The area in this thesis that requires improvement is the lack of statistical data on the percentage of patients with motion sickness among those who experience anxiety about seeking medical care. In future studies, in order to further investigate the feasibility, the impact of motion sickness on the combination of VR and healthcare will be a major aspect.

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