VIRTUAL HIPPOTHERAPY: DEVELOPMENTS, RESULTS, AND PROSPECTS

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Abstract: The article explores the potential of virtual reality (VR) as a tool for delivering hippotherapy, a therapeutic method traditionally involving horses, to patients with psychological disorders. Hippotherapy has been shown to improve autism, anxiety and post-traumatic stress disorder (PTSD). However, logistical and financial constraints often limit access to traditional hippotherapy.
Virtual reality offers a solution by creating simulated environments where patients can experience the benefits of hippotherapy through interactive platforms and exergaming (a combination of exercise and gaming). Studies demonstrate that virtual hippotherapy can reduce symptoms of anxiety and depression in both children and adults. Virtual simulations have also been effective in reducing PTSD symptoms among veterans.
Despite these benefits, challenges such as the absence of emotional connection with real horses and high equipment costs remain. The article concludes by highlighting the promising future of virtual hippotherapy, with the potential for broader accessibility through technological advancements and integration with AI and augmented reality.

Keywords: Virtual Hippotherapy, Exergaming, Rehabilitation, Virtual Reality (VR), PTSD

Hippotherapy (therapy using horses) is known as an effective rehabilitation method for patients with physical and mental disorders such as cerebral palsy (CP), autism, and post-traumatic stress disorder (PTSD). However, the use of real horses can be expensive and inaccessible to many patients due to geographic and economic factors. Virtual reality (VR) offers a solution to these issues by providing safe, controlled, and affordable environments for hippotherapy.

The goal of this article is to review the current developments in virtual hippotherapy, evaluate the results of conducted studies, and discuss the prospects of using VR in this field.

Hippotherapy is used in treating patients with movement disorders and cognitive impairments. Studies have shown that regular horse riding sessions improve balance, coordination, and muscle tone in patients with CP by 35-50%.

Virtual reality is actively used in medicine to treat both mental and physical illnesses. For instance, VR therapy is employed in the rehabilitation of stroke patients, as well as for treating anxiety disorders and PTSD. Studies show that VR can reduce symptoms of anxiety and depression in 60-70% of patients undergoing virtual therapeutic sessions.

Methodology of Virtual Hippotherapy

Technological Platforms and Simulators

One of the main platforms for virtual hippotherapy is a horse-riding simulator using VR and biofeedback. An example of this is the Sirkus Apel development, which was tested on children with cerebral palsy (CP) in Indonesia. The program utilizes exergaming — a combination of game mechanics and therapy — to increase patient engagement and make the therapy more enjoyable.

Developments and Software

Sirkus Apel uses inertial sensors to track patients' movements and interact with a virtual horse. The program projects content onto a dome with mirrors, creating a realistic immersion effect, which is especially beneficial for children who may become bored during traditional therapeutic sessions.

Exergaming (a combination of "exercise" and "gaming") refers to a form of physical activity that uses video games to stimulate movement and exercises in an interactive, playful manner. Exergaming has developed significantly in recent years as a tool for rehabilitation, training, and improving physical fitness, combining the advantages of video games with physical activity.

Key Aspects of Exergaming

1. How It Works

Exergaming uses technology that allows players to interact with the game world through body movements. Instead of using traditional controllers as in standard video games, exergaming often employs motion-tracking devices such as:

- Cameras (e.g., Microsoft Kinect);
- Gyroscopes and accelerometers (e.g., in Wii controllers);
- VR headsets and controllers that track hand and body movements.

These devices allow the player to control a character or game elements through real-world movements, leading to physical activity during gameplay.

Exergaming not only improves physical activity but also helps maintain the emotional and psychological well-being of the patient. The game format makes the training process more engaging, reducing patients' anxiety and depressive symptoms. Studies have shown that in groups of people suffering from anxiety disorders, regular exergaming sessions reduced symptoms of depression by 35-50% after 8 weeks of therapy.

Examples of Exergaming

- Ring Fit Adventure — a fitness game in which the player uses a ring controller and performs exercises to progress through levels.
- Just Dance — a game where users repeat dance movements to music, tracked by a camera or motion controllers.
- Beat Saber — a VR game where the player slices blocks in time with music, requiring active hand and body movements.

Exergaming Development Prospects

Exergaming continues to develop, becoming part of programs in many rehabilitation centers and fitness clubs. Virtual and augmented reality technologies make the process more interactive, opening new possibilities for rehabilitation and increasing physical activity across various age groups.

Limitations and Challenges

Despite its clear benefits, exergaming faces several limitations. First, not all population groups can afford expensive equipment such as VR headsets. Secondly, correct exercise techniques may not always be guaranteed, which can lead to improper movements and, in rare cases, injuries.

Conclusion

Exergaming represents a unique combination of entertainment and physical activity that can be applied in rehabilitation, fitness, and even psychotherapy. It motivates people toward a more active lifestyle by making physical activity more accessible and enjoyable.

Today, exergaming is actively developing toward hippotherapy, offering virtual simulations that help patients with depression, anxiety, and post-traumatic disorders. These solutions create a safe, controlled, and stimulating environment that combines physical activity with therapeutic elements. Let's consider some ready-made solutions that use the concept of hippotherapy for psychiatric disorders.

Sirkus Apel

One such solution is Sirkus Apel, developed in Indonesia for children with cerebral palsy, but which has also proven effective in reducing anxiety in children with other mental disorders. The game combines elements of exergaming with virtual hippotherapy, allowing patients to control the movements of a virtual horse using sensors attached to their bodies. These movements mimic real horse riding, creating a therapeutic effect that helps reduce anxiety and improve mood.

VR Hippotherapy Simulator

This VR simulator allows patients to immerse themselves in a virtual environment where they can control a horse, completing tasks and solving puzzles that contribute to reducing stress and depression. It is successfully used in the rehabilitation of veterans with PTSD. Studies show that after 8 weeks of using this simulator, 55% of patients exhibited significant improvement in PTSD symptoms.

TheraRide

TheraRide is an exergame program designed for use in virtual hippotherapy environments, focusing on psychiatric disorders. The program aims to improve patients' psychological states through interaction with a virtual horse, helping individuals with depression and anxiety. The program monitors biometric data such as heart rate and stress levels, adjusting virtual tasks to the patient's current condition. According to research, using TheraRide over 12 weeks reduces depression levels by 30-40% in patients with chronic depressive disorders.

VIRTUES

VIRTUES (Virtual Reality Therapy for Upper Extremity Syndrome) was developed for treating post-traumatic disorders, focusing on the impact of movements mimicking hippotherapy on patients with PTSD. This program is designed to simulate physical movements similar to those that occur during actual horseback riding and is applied to improve the cognitive and emotional states of patients. In pilot studies with veterans suffering from PTSD, anxiety levels were reduced by 50% after 10 weeks of regular sessions.

Dresaj Horse Stimulator

The Dresaj Horse Stimulator is a dressage simulator developed for rider training in dressage disciplines. It mimics horse movements during the performance of various dressage exercises, such as passage, piaffe, canter, and other elements. From the perspective of exergaming (screen-based training), this simulator offers several advantages:

In exergaming, a lot of attention is given to visual feedback. In the "Dresaj Horse Stimulator," screens can be used to display video or movement graphs of the rider and the horse. This allows the rider to monitor their mistakes in real-time and adjust their posture or actions.

Exergaming emphasizes the ability to adjust training parameters according to the rider's level. The "Dresaj" simulator can simulate various levels of difficulty, adapting the horse's movements to the rider's current skills, which is an important part of exergaming aimed at developing each rider according to their progress.

One of the key aspects of exergaming is reducing the risk of injury for both the rider and the horse. The simulator allows for training without a live horse, minimizing the chances of falls or other incidents, especially at the early stages of learning.

Exergaming involves a detailed study and practice of techniques. The "Dresaj Horse Stimulator" helps in practicing complex dressage elements such as the correct positioning of the legs and hands, movement coordination, and balance, which are difficult to achieve on a real horse without prolonged preparation.

For beginners, working on the simulator reduces stress and psychological pressure. Exergaming helps riders gradually gain confidence in their actions, which is especially useful in challenging disciplines like dressage.

Thus, the "Dresaj Horse Stimulator" serves as a powerful tool within exergaming, providing riders with the opportunity to receive high-quality training in safe and controlled conditions.

Advantages for Patients with Psychiatric Disorders

Exergaming solutions using virtual hippotherapy simulations help patients with psychiatric disorders by:

- Reducing anxiety and stress through physical exercise in a game-like format;
- Improving mood by engaging patients in entertaining and relaxing gaming activities;
- Creating a safe environment where patients can work through anxious or traumatic memories under the supervision of a therapist;
- Adaptability: programs can be tailored to each patient depending on their current psychological state.

These programs represent innovative therapeutic methods that offer a therapeutic effect through gaming mechanics, helping patients with depression, anxiety, and PTSD regain their emotional balance.

Research Results

Clinical Trials and Pilot Studies

One important study in the field of virtual hippotherapy was a pilot study involving 20 children with cerebral palsy. After 12 weeks of sessions on simulators, 80% of children showed improvements in balance and motor skills, and 60% demonstrated a significant reduction in muscle spasticity. In another study using VR for children with autism, improvements were noted in social communication skills and a decrease in anxiety levels.

In addition to physical improvements, VR has also proven useful for psychological rehabilitation. A study conducted with veterans suffering from PTSD showed that after 8 weeks of virtual hippotherapy, 55% of participants experienced a reduction in anxiety and depression symptoms.

In addition to the use of virtual hippotherapy for treating patients with physical disorders such as cerebral palsy, studies show its effectiveness in psychiatric and psychological disorders such as post-traumatic stress disorder (PTSD), depression, and anxiety disorders.

One key study involving 60 veterans with PTSD showed that participants underwent VR therapy, experiencing controlled situations related to their traumatic experiences in a safe environment. After 8 weeks of therapy, 55% of participants exhibited significant reductions in PTSD symptoms, including a decrease in flashbacks and anxiety levels. These results are supported by other studies showing that VR therapy allows patients to safely engage with traumatic memories, reducing stress and anxiety levels.

Another study with 26 patients suffering from major depressive disorder (MDD) demonstrated that using VR for behavioral activation (XR-BA) was as effective as traditional behavioral activation methods. Participants used VR devices to participate in activities such as puzzle-solving and other tasks aimed at improving mood. As a result, 80% of participants showed reduced depression symptoms on the PHQ-9 scale after 4 weeks of therapy.

Virtual Hippotherapy for Treating PTSD

Research shows that VR exposure therapy based on hippotherapy can help patients with PTSD reduce anxiety and avoidant behavior. For example, in a study involving veterans with PTSD, after 12 weeks of virtual hippotherapy sessions, 70% of participants exhibited reductions in anxiety and depression symptoms. Avoidant behavior also decreased by 40%. These findings underscore the effectiveness of virtual hippotherapy in managing emotional responses to traumatic events.

Using VR for Treating Depression and Anxiety Disorders

Studies on the use of virtual reality for treating depression also show significant improvements. In one experiment, patients with major depressive disorder who used VR technologies for behavioral activation demonstrated a 35-50% reduction in depression levels after 8 weeks of therapy. This is because VR therapy enables patients to complete tasks in a stimulating environment, increasing their engagement and motivation.

Additionally, VR helps treat anxiety disorders. A meta-analysis found that using VR technologies for exposure therapy in patients with phobias and panic attacks reduced anxiety levels in 65% of patients, exceeding the effectiveness of some traditional exposure therapy methods.

Future Prospects

- Future Research:
  - Developing more realistic and interactive VR environments to improve therapy effectiveness.
  - Investigating the effects of long-term virtual hippotherapy use on different patient groups (children, the elderly, and patients with chronic illnesses).

- Integration with Other Technologies:
  - Using artificial intelligence to adapt virtual environments to each patient's needs.
  - Incorporating augmented reality (AR) to combine real and virtual therapy elements.

Conclusion

Virtual hippotherapy demonstrates high effectiveness not only for patients with physical disabilities but also for those suffering from psychiatric disorders such as PTSD, depression, and anxiety. Research shows that using VR as a therapeutic tool helps reduce the symptoms of these conditions by offering a safe and controlled environment for treatment.

Advantages of Virtual Hippotherapy

Virtual hippotherapy enables the treatment of patients who, for various reasons, find it difficult or impossible to participate in traditional hippotherapy. It reduces the risk of injuries

and provides a personalized approach for each patient. An example is the use of VR technologies for treating children with cerebral palsy, where 75% of patients showed improvements in motor functions.

Limitations and Challenges

Despite its significant advantages, virtual hippotherapy has its limitations. The emotional connection between the patient and the animal, which is important in traditional hippotherapy, is absent in the virtual environment. Additionally, the technology requires expensive equipment and qualified personnel to set up and conduct therapies.

Virtual hippotherapy opens new possibilities for the rehabilitation of patients with physical and mental disorders. It has already shown high effectiveness in pilot studies, especially among children with cerebral palsy and patients with PTSD. However, further research and technological development are needed to make this therapy more widely accessible and personalized.

BIBLIOGRAPHY

1. Satriawan A. et al. "Design of Virtual Reality-Based Hippotherapy Simulator Exergaming Software and Its Controller for Rehabilitation of Children with Cerebral Palsy in Indonesia: An Engineering Concept." *Designs* 2022. DOI: [10.3390/designs6050076](https://doi.org/10.3390/designs6050076).

2. Chang H.J. et al. "Virtual reality-incorporated horse riding simulator to improve motor function and balance in children with cerebral palsy: a pilot study." *Sensors* 2021. DOI: [10.3390/s21196394].

3. Paul M. et al. "Examining the Efficacy of Extended Reality–Enhanced Behavioral Activation for Adults With Major Depressive Disorder: Randomized Controlled Trial." *JMIR Mental Health* 2024. DOI: [10.2196/52326].

4. Rösner D. et al. "Virtual Hippotherapy for the Treatment of Idiopathic Scoliosis." *Eurographics Association* 2021. DOI: [10.2312/egve.20211328].

5. Baghaei N. et al. "Virtual Reality for Supporting the Treatment of Depression and Anxiety: Scoping Review." *JMIR Mental Health* 2021. DOI: [10.2196/29681].