

### **Выводы**

Синдром Прадера — Вилли представляет собой серьезную медицинскую и социальную проблему, требующую особого подхода и специальных знаний. Данный клинический случай демонстрирует важность диагностики на ранних этапах, с целью улучшения качества жизни пациента.

Раннее диагностирование и своевременное начало терапии необходимы для предотвращения развития ожирения, а также для дальнейшей работы специалистов данного профиля.

### **ЛИТЕРАТУРА**

1. Prader-Willi syndrome can be diagnosed prenatally / N. Gross [et al.] // Am J Med Genet A. 2019. № 167A. P. 80.
2. McCandless, S. E. Clinical report-health supervision for Children with Prader-Willi Syndrome, the Committee on Genetics / S. E. McCandless // Pediatrics. 2018. Vol. 127, № 1. P. 195–204.

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## **VR THERAPY IN NEUROLOGY AND REHABILITATION**

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### ***Introduction***

Virtual reality is use of instruments to create an environment which can be sensed by multiple sensory channels of the person who is experiencing it. This is used in many aspects of the society including gaming, Industries, Engineering field. Latest use of VR is in the field of medicine which is used in the treatment of patients. This includes fields such as psychology (Anxiety PTSD, Trauma), Neurology and Rehabilitation.

### ***Goal***

To provide an overview of use of virtual reality in the field of neurology and rehabilitation, to discuss about past projects done in patients using Virtual reality, Advantages and shortcomings of VR in the field of neurology and rehabilitation.

### ***Material and methods of the research***

First a search was carried in search engines such as Pubmed, Medscape and other scientific databases under the topics Neurological application of VR, Rehabilitation and physiological application of VR, Modern VR devices used in neurology, Advantages and shortcomings of VR. Then duplicate papers were removed. Article data were not also included if they do not carry information related to above mentioned topics. Articles were also excluded if they were not present in English, has augmented reality or connected with other advanced treatment methods such as robotics technology. Then the results were summarised according to the research goal.

### ***The results of the research and their discussion***

Virtual reality is the use of computer system in order to produce an artificially stimulated environment of 360 degrees which can be sensed by multiple sensory channels of the person experiencing it. VR is already used in design, engineering and manufacturing fields while the latest is its application in medicine. VR system is able to measure the performance level of each patient and design life like experience for them. The person who is experiencing VR gets the first person experience while the observer (scientist, therapist or the relavent doctor) gets a third person experience.

Base of VR in neurological and rehabilitation field was built on the base of neuroscience along with concept of motor learning. This can be achieved by two main ways.

1. VR experience gained in an environment which is initially planned according to patient's capability and built on a system of task oriented, repetitive and modified into stages of complexity to provide optimal results for the patients.

2. VR systems which allows the patients to learn by imitation where a teacher performs the task first and then patient repeats it where the task of reperformance enhances patient's mirror neurons.

VR systems allow researchers or a medical personnel to assess patient's activity by means of two main methods. First is by immersion of objects into a previously planned and controlled VR environment and the next is studying of patients physiological measurements in response to changes in the VR environment. Also VR can be used in cognition development by assessing how CNS function changes in correlation of time and performance and also by checking how cognitive abilities change in short term actions (ARCANA project = WSCT test checks the cognitive progress and associated physiological correlations of a subject) [2].

Anyway for successful outcome using VR it has to be intensive, repetitive and task oriented. There are three types of VR systems as non immersive, semi immersive and immersive.

a) Non immersive VR — This is form of VR like in a video game where the user can keep control by devices such as keyboard, mouse, controller etc. The user is not well engaged in this type of VR environment and is well connected with the real world.

b) Semiimmersive VR — This type of VR allows the user to be in a different reality when focused on digital image but also at the same time stay connected to the real physical world. The digital world is created by using 3D graphics. This type of VR is used mainly during educational fields, training purposes etc.

c) Immersive VR -This type of VR is achieved by a headmount device which allows the user to be fully immersed into the virtual world. This provides the most realistic VR experience however has some negative impacts such as motion sickness or cyber sickness in some of the users.

VR in neurology can be used in cases such as stroke, Parkinson disease, spinal cord injury and associated neuropathic pain, Multiple sclerosis and paralysis etc. A brief explanation for each disease and evidence is given below.

VR and stroke.

Stroke causes decline in quality of life of the patients. For almost forty percent of patients end up with moderate or severe impairments which makes them depend on special care for the rest of their life. VR systems composed of software and hardware components which together creates a virtual environment that produces stimulations for the patient and at the same time gives feedback on performance as well as his movements in time and space.

In the review published by Sapsonic and Levin (2017) it is stated that only moderate improvements were made in stroke Patients who underwent typical rehabilitation programs. In their research they gathered 12 patients who were aged between 22–88 years who had acute, sub acute or chronic strokes. 7 of these cases were observational and 5 were randomly controlled. These patients were supplied with VR therapy and their efficiency was assessed through Fungal Meyer assessment, Wolf Motor Function Test (WMFT) and functional independence measure (FIM). All the patients received better results in arm strength, arm motor impairment and arm motor function. Also in their review it was further stated that neither the type of VR nor severity of stroke cause an influence in positive outcome but it depends with how much time spent with the instrument practicing (repetition). Also some studies show that when mirror feedback was applied the affected primary neuron motor activity can be restored [3].

Also Laver et al (2017) gathered 72 stroke patients to apply VR therapy. They focused primarily on upper limb and secondarily on gait, balance, cognition and quality of life. Efficiency was assessed by Functional Independence Measure (FIM), Barthel index and passive driving test. All 12 cases showed positive results.

VR and parkinson disease.

Parkinson disease is a neurodegenerative disease of the CNS where patients experience problems in gait, hand tremor, limb rigidity and slowness of movement which affects the quality of life. VR therapy has several positive outcomes in Parkinson patients such as mentioned below.

- a) Improve gait and balance;
- b) Improve cognition in patients;
- c) Improve rate of movement, mobility and strength of movement;
- d) Reduces anxiety, depression.

VR in spinal cord and associated neuropathic pain.

Patients with spinal cord injury show lack of response to typical pharmacological treatments but VR provides non immersive alternative with minimum adverse effects. VR therapy helps paralyzed patients to regain muscle control after a time of period. A promising result regarding this topic was conducted by a researcher in Duke university-St. Paulo, Brazil over a time period of 28 months. The work was carried out with 8 participants with spinal cord injury and all patients involved were able to regain muscle control after a year of training. This project was named as walk again project. By walking in exoskeleton for one hour per day patients were able to reactivate their nerves to send signals to the brain again eventually causing to regain sensation and some movements in lower limb and pelvic region [4].

Multiple sclerosis VR therapy.

Multiple sclerosis is chronic inflammatory demyelinating disease of neural tissues causing neural tissue degeneration that leads to imbalance in gait, motor ability and balance. There are several impacts of VR in patients with multiple sclerosis such as; Improves motor skills.

Helps to regain functional abilities back.

Assist pain in virtual reality games.

Advantages and shortcomings of VR in neurology.

VR therapy is cost effective form of treatment when compared to other modern types of rehabilitatory programs such as robot assisted programs which has shown to be given promising results in the field of neurology. The relevant VR program can be pre designed based on the activity and situation relevant to each patient and can be kept modifying throughout the therapy process. Moreover the patients can be treated at the comfort of their own home hence VR therapy is rapidly becoming popular among neurological patients. VR devices also allows physicians to monitor the situation in real time. It also gives the feedback to the related VR activity and also shows better results than conventional treatment methods.

However despite all the advantages VR therapy is not proven to be effective individually in the absence of other conventional treatments. Sometimes patients experience motion sickness / cyber sickness when involved in VR activities making VR therapy to be applicable but with certain limitations. However it's a modern effective treatment method that yet needs to be explored.

### **Conclusion**

VR is proved to be effective in patients who have undergone Neurological diseases such as stroke, parkinson disease rather than the typical treatment methods in earlier times. This can be used in patients from the beginning of their treatment procedure or in patients who has not shown promising results under current typical treatments. However the use of VR independent from classical treatment methods is not yet proven to be effective in the field of neurology and rehabilitation.

LITERATURE

1. Nervous system correlates of Virtual reality experience. Proc. 1<sup>st</sup> Euro.conference / L. Pugntti [et al.] // Disability Virtual Relaiity and associated. Tech. MaidenHead, UK. 1996.
2. Virtual reality for individuals affected by stroke / Avery Michels [et al.] // URL: y (accessed 12.03.2022).
3. Application of virtual reality in Neuro-Rehabilitation Virtual Reality / L. F. Lucca [et al.] // December 2010. P. 429437. URL: [https://www.researchgate.net/publication/221909809\\_Application\\_of\\_Virtual\\_Reality\\_in\\_Neuro-Rehabilitation\\_An\\_Overview](https://www.researchgate.net/publication/221909809_Application_of_Virtual_Reality_in_Neuro-Rehabilitation_An_Overview) (Accessed 18.03.2022).
4. Digital therapeutics in Neurology / G. Abbadessa [et al.] // Journal of neurology. 2022. URL: <https://link.springer.com/article/10.1007/s00415-021-10608-4> (Accessed 18.03.2022).

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**THE LATEST TREATMENTS FOR MIGRAINE**

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***Introduction***

Migraine is one of the most common neurological diseases at present. It mostly occurs in women than in men with a ratio of 3:1. The prevalence of migraine in Western countries is 13 %. Also 90 % of migraine patients have to restrict their daily activities during attacks. An attack can be present with neuro-ophthalmic features including visual auras, which is the most common type of migraine aura. Additionally symptoms involving the orbit such as red and tearing eyes, miosis and ptosis, eyelids swelling, nasal congestion or runny nostrils, redness and sweating above the eyebrow often occurs along with pain.

***Goal***

To provide an overview on the current treatment methods used to treat migraine globally and to provide a better understanding on the advances of new treatment methods used to treat migraine and to show how successful these treatment methods are, using clinical trials which have been carried out globally as examples.

***Material and methods of the research***

The search of information was conducted through the research of scientific articles and systematic literature and the results were screened for the relevance review topic and also new articles were added based on the clinical knowledge of the author on the specific area. Statistical information was also obtained from clinical trials conducted on the area of review.

***Results of the research and their discussion***

There are 4 phases of a migraine headache, they are prodrome, aura, headache and postdrome. In response to changes in physiological and emotional homeostasis hypothalamic neurons activate nociceptive pathways and trigeminovascular pathways through increased parasympathetic tone. Low cyclical brain stem activity causes the lowering of threshold for hypothalamic and brainstem neurons to transmit nociceptive and trigeminovascular signals. The aura is caused by cortical spreading depression slowly propagating wave of depolarization followed by hyperpolarization in cortical neurons and glia. Initiated by local elevations in extracellular potassium ions that chronically depolarizes neurons. The throbbing pain is as a result of trigeminovascular pathway activation. Nociceptive neurons are stimulated and release vasoactive neuropeptides causing vasodilation of large cerebral arteries. Alongside input from trigeminal nerve this stimulates trigeminal neurons in an axon like reflex which converges with input in adjacent skin and muscle to trigger the trigeminal cervical complex. Ascending pathways then transmit signals to