

Analysis of Various Treatments For Pain In Upper Limb of Patient's Post-Stroke

Vinutha K¹, Ashwini N², Bhavya G³, Jyothi S⁴

^{1,2,3}Asst. Professor, Dept of Information Science and Engineering

⁴Dept of Information Science and Engineering

^{1,2,3,4} BMS Institute of Technology and management, Bengaluru, Karnataka, INDIA

Abstract- Virtual reality is being widely used and their applications are growing drastically. Considering that, they are being implemented in healthcare industry as well. They support training medical students, treat rehabilitated patients, treat patients suffering from phobia, etc. This paper considers methods to treat post stroke patients using virtual reality. According to National Stroke Association, only 10 percent patients recover from stroke completely without any impairment. In spite recovering without impairments, they sometimes face limb pain and loose grip strength which is a hurdle in performing their day to day activities. This paper gives review on few methodologies that use virtual reality to treat post-stroke patients mentioned in the form of paper and journals. We searched papers and journals which focused on treating post stroke patients using, (i) virtual reality, (ii) upper limb in particular. Performing a search with words like (i) post stroke, (ii)rehabilitation, (iii) virtual reality, (iv) upper limb, nearly 50 references where found. Out of 50 references, we have considered 4 which fulfilled both the requirements. These four papers where diverse with parameters considered, number of patients admitted, their characteristics.

Keywords- Stroke;Upper limb, Virtual reality;

I. INTRODUCTION

Virtual reality (VR) is a computer produced, communicating simulation that records the real situation by affecting human senses, and shows all activity in real time and with real speed. This current computer technology contends with learning process in the real world, while allowing the addition of extrinsic feedback and increasing the frequency, duration, and even intensity of an exercise [3]. Virtual environment (VE) enables the user to have the opportunity to interact with objects and situations produced by the hardware. Steps in implementing virtual reality in medical field.

Research on the purpose of using the virtual reality and ways it has already been implemented successfully. Decide on the methodology to be followed while implementing the tasks. Design a sophisticated method which

is safe, creative and fulfils the purpose. Decide safe, creative Methodology

Decide on the hardware to be used. Decide on whether to use headset for immersed experience or a display screen for interactive experience. A virtual reality environment can be created using many famous software available like, unity, unreal engine, cryengine and headsets that can be used are google cardboard or for better experience oculus, rift, HTC Vive. List out other needed hardware according to the problem statement. Considering healthcare field, many electrodes and sensors for physiology check can be considered.

Next decide the software to be used. Design the environment. Create the environment using unity3D. Unity3D is a platform with sdk's that can handle any complex designing and creation of 360 visuals. It makes creation of a virtual environment easy and also allows easy collaboration with hardware used.

Final step is integrating all the hardware to be used with the virtual environment, and also setting up the system depending on the tasks prepared and also the physical movements that will be performed by the patients.

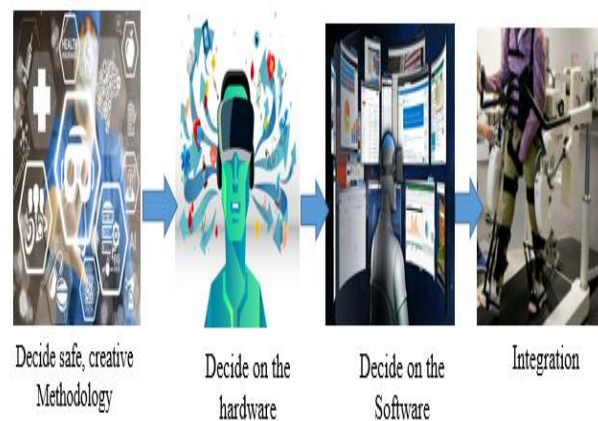


Fig1: Steps in implementing virtual reality in medical field

Stroke is sudden death of brain cells due to blood clot, low oxygen content which ruptures the artery connected to the brain. There are three types of strokes, Ischemic, hemorrhagic and transient strokes with survival rate of hemorrhagic stroke being very less. 29 percent being the recovery rate of all three strokes together, the survived patients sometimes suffer from minor impairments, sometimes impairments with severe pain, sometimes with no impairments. Patients with no impairments sometimes lose their grip strength.

Patients reach out to therapists to get them relieved from the pain. Recently, Neuro development treatment where one of the courses patients would undergo. After recovering from stroke, patient’s brain loses image of few patterns and hand movements. NDT was one way to teach the patterns to the patients and making them used to it, making it easy for the patients to recover that information. A new technology to treat post stroke was using virtual reality.

Virtual reality is a computer technology which imitates and simulates the real world. They are different from augmented reality. Virtual reality was initially used to create attractive games later it found application in healthcare industry also. So specifically in healthcare industry, treating post stroke patients is also possible. There are quiet few methods for treating loss of grip strength in upper limb through games.

This literature survey analyses the methodologies of few studies considered. It also gives conclusion on the positive effects, negative effects, absence of effects of each study guiding the clinical practice and scientific research for further use of those studies.

II. METHODS

Search strategy:

A search for methodologies for treating post stroke patients with lose of upper limb grip strength was carried out. Studies with words like (i) post stroke, (ii)rehabilitation, (iii) virtual reality, (iv) upper limb where searched and nearly 50 references where found. Filtering 50 studies.Out of 50 references obtained, only four papers satisfied the criteria of having both, (i) virtual reality, (ii) upper limb references in them.

III. RESULTS AND DISCUSSION

Considering four methodologies, few patients were included who had recovered from stroke. Addition 10 normal

volunteers free from stroke where summoned in Adyasha Dash [1]. 7 underwent sEMG based VR, 113 underwent RFVE test in Andrea Turolla [2], 36 underwent telehabilitation according to Lamberto Piron [3].

All the above three types of patients were summoned for experimental purpose but the implementation under MICHAEL TOPPING [4] was for clinical purpose. Adyasha Dash [1] used VR with other peripheral devices and sensors to measure the improvement. The results were measured based on sEMG (electrical activity in the muscles) value.

Andrea Turolla [2] used VR and ULC (Upper limb conventional) therapy. Half of the members underwent only VR and other half underwent both. Fugl-meyer upper extremity (F-M UE) and Functional Independence measure (FIM) were the parameters considered.

Lamberto Piron [3] proposed treating patients by telehabilitation with VR studio set up at patient’s place. Patients after therapy were assessed in terms of Fugl-meyer upper extremity (F-M UE), Ashworth and ABILHAND scales.

Michael Topping [4] created a robot mediated neuro rehabilitation tool with haptic interfaces. Explains the how movement of human limb is interpreted by the machine. Nearly seven models were explained

Table 1: Information about particulars of each Article

Author	Details	Results	Number of candidates	Age gap
Adyasha Dash [1]	Method: Patient are asked to sit on a chair in front of a user interface with a game to play. 2 sessions per week for 3-4 weeks.	Gradual Increase in sEMG value experiment 1 to experiment L.	7	26-70
Andrea Turolla [2]	Method: Patients were divided into two groups with one undergoing only RFVE and other group undergoing both RFVE and ULC.	Increase in F-M UE value and all the patients where fine with using the system without any side effects.	113	50-70
Lamberto Piron [3]	Method: Patients under telehabilitation are remotly controlled and VR based system is delivered via Internet. Half the group got a traditional treatment and other half got a telehabilitation.	Increase in F-M UE and Ashworth scale.	36	50-60
Michael Topping [4]	Method: Patients are asked to perform tasks on daily basis and the performance will be measured based of nearly three four models.	Provides reviews on different approaches to robot medical therapy which also provides haptic environment	-	-
Kate ELaver[7]	Examining the virtual reality methods in treating post stroke limb rehabilitation.	A trend which suggested that customized VR programs were preferred to commercial game was actually proved wrong.	72 trials, 2470 participants	25-60
Gustavo Saposnik[8]	Made half the adults to play usual recreational games like domino, jenga etc and other half was asked to undergo virtual reality tasks	The simple, less cost, and common recreational activities were found to be as effective as non-immersive VR tasks .	10 sessions for adults <3 months of stroke. 141 patients	62+12
David Jack[9]	Patients are asked to wear a RMIi Cyber Glove which is connected to the Interface unit. The glove sends signals about finger movements.	The signals generated by gloves are interpreted. The hand grasping force increases because of VR tasks and not by noncomputer tasks	3 adults, two male, one female	50-83

IV. CONCLUSION

All the studies have concluded the improvement in grip strength except Michael Topping [4] being, the references and steps of the ways that can be followed. The studies do provide the percentage of improvements in patients, meanwhile proper methodology isn't mentioned except Michael Topping [4]. Michael Topping [4] explained just the methodologies and not being experimented. Before clinical usage, trails must be made using these methodologies because the method in which patients were selected was not mentioned nor their physiology situation was described other than being a post stroke patient. There are evidences to support the improvement in their grip strength. Considering the health of the patients, the grip strength has improved according to the details provided by the studies. VR is being used in clinics. Coming to research, better study can be performed with proper details about the methods used and by considering patients randomly.

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