6th International Conference & Exhibition on
Physiotherapy & Physical Rehabilitation
August 13-14, 2018 | London, UK

Applications of Virtual Reality Technology in Rehabilitation

Călin Corciovă, Daniela Matei, Cătălina Luca

Department of Biomedical Sciences, University of Medicine and Pharmacy "Grigore T. Popa" Iaşi
calin.corciova@bioinginerie.ro

INTRODUCTION: Recent advances in rehabilitation procedures, methodologies and equipments tend to include more and more the cognitive aspects of motor control. With the exploitation of new technologies for brain imaging, it is also possible to "close the loop" from brain to action. In this multidisciplinary field, virtual reality technology gets a relevant role, which can be fruitfully employed in the rehabilitation of neuromotor functions and motor capabilities, by providing devices that are by nature flexible and programmable and that allow to set and assess of medical rehabilitation procedures.

MATERIAL AND METHODS: At the outset, our research identified literature associated with the subject matter based on searches in Pub Med, the Institute of Electrical and Electronics Engineers (IEEE), Science Direct and Google Scholar databases using various combinations of the following keywords: rehabilitation, therapy, training, movement, motion, assistance, support, virtual reality technology. The information obtained from this literature is supplemented with the data acquired from professional caregivers and manufacturers' catalogs and websites. Most of the literature reviews on virtual reality technology concentrate on devices that have already undergone clinical evaluation. Virtual rehabilitation is a concept in psychology in which a therapeutic patient's training is based entirely on, or is augmented by virtual simulation exercises. Virtual reality has emerged as a new approach to treatment in stroke rehabilitation settings over the last ten years. By simulating real-life activities, stroke patients are able to work on self-care skills in a setting that is usually impossible to create in a hospital environment.

RESULTS AND DISCUSSIONS: There are two main types of VR: **(I) Immersive**: In immersive VR, the virtual environment is delivered by equipment worn by the user (like goggles) or the person is situated within a virtual environment. This fully immersive system gives the user a strong sense of presence through the use of head-mounted displays, special gloves, and large, concave screen projections to create the sense of immersion. (II) **Non-Immersive**: Non-immersive VR is usually two-dimensional and delivered through a computer screen. The user can control what is happening on screen by using a device such as a joystick, mouse, or sensor.

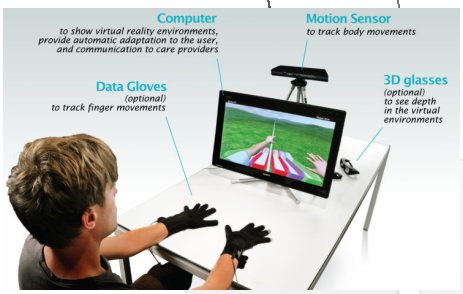


Fig. 1 *An overview of the rehabilitation system*

Type of virtual reality rehabilitation:

1.specific patient population: we can distinguish musculo-skeletal virtual rehabilitation,post-stroke virtual rehabilitation and cognitive virtual rehabilitation. Musculo-skeletal (orthopedic) patients are those that suffered a bone or muscle/ligament injury, are younger and more numerous than other patients needing rehabilitation.

2. rehabilitation protocol: we distinguish VR-augmented and VR-based therapy. In VR augmented rehabilitation patients receive a mixture of "classical" exercises, done on equipment available in the clinic (or at home), as well as a VR regiment of simulation exercises. Rehabilitation which is VR-based eliminates the classical exercises entirely, and is a newer approach compared to VR-augmented therapy.

3. *therapeutic approach:* virtual reality rehabilitation simulations differ depending on the particular therapeutic approach, such as "teaching by example," "video game-like," and "exposure therapy." Teaching by example has been used to treat post-stroke chronic patients.

4. proximity to the therapist (or therapeutic team) assisting the patient. If the therapists are nearby, the therapy is local, such as in an outpatient clinic environment. However, if the therapist is remote, then therapy is administered through a virtual reality telerehabilitation approach.



Fig. 2 *In 2016 a world leader in rehabilitation technology has developed a novel rehabilitation device combining robotics and virtual reality for faster stroke recovery.*

CONCLUSIONS: The ability to provide rehabilitation services for locations outside the clinic is an important option for clinicians and patients. Effective therapy can best be provided by the use of high-tech systems coupled to virtual reality and connected between locations via high-speed networks, reduced latency, and high-bandwidth. Using data extraction software would help analyze the data received to provide both the patient and the therapist with an assessment of current treatment and changes needed for future therapies. Virtual Reality applications for integrated cognitive and motor stroke rehabilitation show promise for providing more comprehensive rehabilitation programs.

REFERENCES:

[1]. M. Ortiz-Catalan, S. Nijenhuis, K. Ambrosch, T. Bovend Eerdt, S. Koenig, B. Lange, Virtual reality, in: Emerging Therapies in Neurorehabilitation. Springer, 2014, pp. 249–265.

[2]. Perez-Marcos D, Solazzi M, Steptoe W, et al. A fully immersive set-up for remote interaction and neurorehabilitation based on virtual body ownership. Front Neurol. 2012;3:110.

[3]. Bohil CJ, Alicea B, Biocca FA. Virtual reality in neuroscience research and therapy. Nat Rev Neurosci Nature Publishing Group. 2011;12:752–762

[4]. Laver K, George S, Thomas S, et al. Virtual reality for stroke rehabilitation. Stroke. 2012;43:e20–e21.

[5]. Morone G, Paolucci S, Mattia D, et al. The 3Ts of the new millennium neurorehabilitation gym: therapy, technology, translationality. Expert Rev Med Devices. 2016;13:785–787.