Virtual Reality and Rehabilitation

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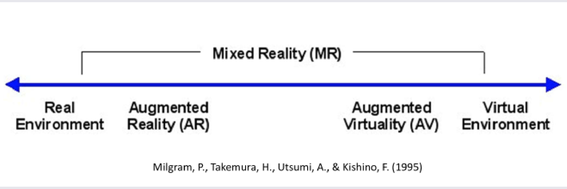
BACKGROUND

Virtual reality is a computer-based process that provides a three-dimensional interaction with a virtual environment (Ferguson, 2019). Virtual reality rehabilitation has emerged as a new treatment for neurological injuries and motor impairments. In the literature there are different types of virtual reality mixed/augmented reality and virtual reality. Mixed/augmented reality is combining both the real and virtual environments (Ferguson, 2019). Virtual reality, also called immersive virtual reality in the literature is a simulated experience that can be either similar or different than the real world and where individuals wear googles to fully interact (Ferguson, 2019).

The literary research has shown that virtual reality is beneficial in motor rehabilitation because it increases repetition, provides biofeedback, activates the mirror neuron system, promotes cortical reorganization, and is motivating for individuals (Ferguson, 2019; Moreira, de Amorim Lima, Ferraz, Benedetti Rodrigues, 2013; Villiger et al., 2017; You, Jang, Kim, 2005). Therapist can select specific games and tasks that allow increased repetitions which support neuroplasticity (Ferguson, 2019). Virtual reality treatment also supports mirror neuron stimulation by individuals being able to observe themselves completing the activity and provide real time visual feedback which stimulates the neuronal motor pathways (Prasad, Aikat, Labani, Khanna, 2018; Villiger et al., 2017; Yates, Kelemen, Sik Lanvi, 2016). The research has also showed that individuals find virtual reality treatment to be motivating and enjoyable which leads to increased participation in sessions and functional improvements (Moreira, de Amorim Lima, Ferraz, & Benedetti Rodrigues, 2013). Overall, virtual reality is valuable for physical rehabilitation.



Milgram, P., Takemura, H., Utsumi, A., Kishino, F (1995). Reality-virtuality (RV) continuum. [Photograph]. Retrieved from http://etclab.mie.utoronto.ca/publication/1994/Milgram_Takemura_SPIE1994.pdf

FOCUSED QUESTION

What is the effectiveness of using virtual reality on upper extremity rehabilitation in pediatric and adult populations?

Method

Data bases searched:

- CINAHL complete, Google Scholar, Medline, Research Gate, Sopus

Key Terms:

- Patient/Client Population – pediatric, adult
- Intervention – virtual reality, virtual rehabilitation, virtual reality rehabilitation, VR
- Outcomes: upper extremity, distal upper extremity, shoulder, hands, improved muscle function

Inclusion Criteria:

- Level I-III research studies
- Studies written in English
- Study needs to address the intervention of virtual reality for upper extremity
- Studies published earlier than 2009

Exclusion Criteria:

- Studies older than 2009
- Level IV & V research studies
- Studies not written in English
- Virtual reality rehabilitation interventions on other parts of the body other than the upper extremity
- Articles reviewed in meta-analysis

Summary of Articles Selected for Appraisal:

Levels of Evidence	Study Design	Number of Articles
Level I	Randomized Control Trial, Meta-analysis	3
Level II	Nonrandomized Control Trial	1
Level III, IV, V	One group, case study, expert opinion	0
		TOTAL: 4

Virtual reality in healthcare. (2020). https://www.google.com/search?q=virtual%20reality%20rehabilitation&tbm=isch&tbs

RESULTS

- A level one randomized control trial supported the therapeutic effectiveness of a virtual reality canoe game for stroke patients with affected upper extremities. n this study, the participants paddled by using bilateral movements in which assistance of the non-affected upper limb was used to induce movement of the affected upper limb. The fugl-Meyer assessment (FMA) was used to assess motor function of the upper extremities. The individuals in both groups showed an improvement in the FMA although the experimental group using virtual reality showed statistically greater improvement with 4.4 overall increase from pre-test to post-test and the convention group only improved 1.1 from pre-test to post-test. Overall the virtual reality intervention group showed greater improvements in use of affected upper extremity (Lee, Shin, & Shong, 2016, Level I)
- A level one randomized control trial found that the therapeutic use of virtual reality in rehabilitation in addition to convention therapy has greater outcomes on distal upper extremity motor function following stroke. The virtual reality rehabilitation used a smart glove with biofeedback and within each game participants were required to complete specific distal gross motor functionals to obtain a score. The results of the study were measured using the Fugl-Meyer assessment and the p-value of the experimental group with virtual reality was p=0.001 and the conventional group was p=0.592. Overall the study found that gross hand function was significantly improved with virtual reality plus convention therapy. (Shin, Kim, Lee, 2016, Level I)
- A level two nonrandomized clinical trial that used the Virtual Reality Rehabilitation System (VRRS) found that virtual reality rehabilitation when paired with conventional rehabilitation is more effective in restoring upper extremity motor functional than conventional therapy alone. The VRRS involved participants completing motor tasks and manipulating objects while interacting with virtual scenarios and receiving feedback from a monitor. The results were measured using the Fugl-Meyer upper extremity assessment; results found a 10% score increase in virtual reality plus convention group compared to a 4% increase in the convention rehabilitation group. (Turolla, Dam, Ventura, et al., 2013, Level II)
- A level one meta-analysis investigated the efficacy of virtual reality and gaming-based intervention for improving upper extremity function poststroke and concluded virtual reality and/or gaming-based rehabilitation is more effective than conventional methods. On average, the interventions produced 28.5% of upper extremity improvement. The results also found that virtual reality and/or gaming interventions had a 10.8% greater treatment gains vs only visual feedback. Overall, the results show that virtual reality and upper extremity based rehabilitation is a successful treatment method of poststroke (Karamians, Profitt, Kline, Gauthier, 2019).

BOTTOM LINE FOR OT

Virtual reality (VR) can be used as a purposeful and beneficial intervention with multiple pediatric and adult populations to increase their success and independence in their environment. VR incorporates element of motor learning, such as repetition, provides biofeedback, variability in the task and is enjoyable (Moreira, de Amorim Lima, Ferraz, Benedetti Rodrigues, 2013; Villiger et al., 2017; You, Jang, Kim, 2005). VR interventions are purposeful and task-oriented as they stimulate real-life situations that incorporate functional motor and cognitive skills in a safe and controlled environment where the therapist can grade the task appropriate to the patient's abilities (Ferguson, 2019; Prasad, Aikat, Labani, Khanna, 2018). VR can improve a patient's functional movement, motor planning, balance, cognition, attention, and visual-motor skills in a meaningful and motivating intervention (Yates, Kelemen, Sik Lanyi, 2016). The main occupation of children is play and virtual reality is a fun and motivating intervention for children that can be challenging and fun while increasing their independence.

Neuro rehab virtual reality, (2020). https://www.google.com/search?q=virtual%20reality%20rehabilitation&tbm

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