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Awareness, Knowledge and Attitude About Virtual Reality and Augmented Reality in Physiotherapy Practice Among Physiotherapists

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Abstract

Background: The rationale for the use of Virtual Reality an Augmented Reality in rehabilitation is based on a number of unique attributes of this technology like opportunity for experiential, active learning that encourages and motivates the participant, ability of therapists to objectively measure behavior in challenging but safe and ecologically valid environments, while maintaining strict experimental control over delivery of the stimulus. A promising future requires the continued development and use of new, innovative technologies like Virtual Reality and Augmented Reality that will transform existing practices. To ensure the long- term use of such systems, it is imperative to understand the perspectives of healthcare providers in the implementation of Virtual Reality and Augmented Reality technologies.

Method: An observational cross- sectional study was done. A total of 102 physiotherapists from various fields and of different age groups and experience were included. A self- made questionnaire of 3 sections was administered to the physiotherapists using google forms.

Results: it was found that 82.4% physiotherapists knew that virtual reality and augmented reality have applications in healthcare whereas only 46.1% knew about its applications in complex musculoskeletal disorders. 90.2% think that virtual reality and augmented reality should be widely applied in clinical practice.

Conclusion: In conclusion, many of the participants were not aware about extent of Virtual Reality, Augmented Reality rehabilitation in different fields across physical therapy. Most of the participants knew about its application in the neuro physiotherapy field. More awareness needs to be spread on the widespread implementations of these technologies in the field of rehabilitation. Most of the participants have a positive attitude towards application of Virtual Reality Augmented Reality clinically.

Keywords: virtual reality, augmented reality, physiotherapy.

Introduction

The definition of virtual reality comes from the definitions for both 'virtual' and 'reality'. The definition of 'virtual' is near and reality is what we experience as humans. Virtual reality is the term used to describe a three-dimensional, computer- generated environment which can be explored and interacted with.[1] That person becomes part of this virtual world or is immersed within this environment and is able to manipulate objects or perform actions. Today virtual reality is usually implemented using computer-based technology. Virtual Reality includes three main features – immersion, perception to be present in

an environment and interaction with that environment.[2]. ·There are various systems that are used for this purpose, such as headsets, omni-directional treadmills and special gloves. These are used to actually stimulate our senses together in order to create the illusion of reality [3]. If an implementation of virtual reality manages to get the combination of hardware, software and sensory synchronicity just right it achieves something known as sense of presence. Where the person really feels like they are present in that environment. The potential entertainment value is clear. Immersive films and video games are good examples. There are a wide variety of applications which include: Architecture, Sport, Medicine, The Arts, Entertainment and many more·[4] Virtual reality can lead to new and innovative discoveries in these areas which impact upon our day to day lives.

Augmented Reality is a technology that has been gaining much of attention in recent years. It has a wide range of applications and has the potential to change the way we interact with the world. Augmented Reality technology is a type of technology that overlays digital information onto the real world, creating a hybrid environment where the virtual and physical elements coexist. Augmented reality technology uses cameras, sensors, and computer vision algorithms to track the real-world environment and superimpose digital content onto it in real-time. [5]

Augmented reality is the technology in which virtual objects are added to real world in real time. Augmented Reality can be used to project focal points based on angular measurements to help patients safely perform their routines at home. It can also be used to provide visual instructions on how to perform any routine. [5] Virtual Reality and Augmented Reality have shown positive results in telerehabilitation as well, hence Virtual Reality and Augmented Reality enhanced systems are a great possibility of training without leaving home.

Wherever it is risky, expensive or impractical to do something in reality, virtual reality is the answer. From trainee fighter pilots to medical trainee surgeons, virtual reality allows us to take virtual risks in order to gain real world experience in real time. As the cost of virtual reality goes down and it becomes more mainstream you can expect more practical uses, such as education or productivity applications·[6] Virtual reality along with augmented reality could substantively change the way we interface with our digital technologies today. Virtual reality shows promise in the application of healthcare and because it presents patients an immersive, many times entertaining, approach to accomplish the goal of improvement in performance and provide satisfactory results.

The potential for Augmented Reality technology is huge, and it's likely that we'll see significant developments in the coming years. Market projections estimate that the Augmented Reality market will reach about $198 billion by 2025. With continued investment and development, Augmented Reality and Virtual Reality surely have the potential to become a mainstream technology that is widely applied and accessible to everyone. [7]

Various attributes offered by virtual reality and augmented reality make it perfectly suitable for the achievement of many rehabilitation goals, including the encouragement of experiential, active learning; the provision of challenging but safe and ecologically valid environments; the flexibility of individualized and graded treatment protocols; the power to motivate patients to perform to their utmost ability; and the capacity to record objective measures of performance. Nevertheless, further development of Virtual and Augmented Reality based rehabilitation depends on the resolution of certain issues that currently present either technological or financial limitations. [1,7]

Today's clinician is privileged to have an access to a variety of technologies that provide tools for both research and clinical intervention and practice. Virtual Reality technologies have now begun to be used as

an assessment and treatment in rehabilitation as well. Applications have been directed at a variety of clinical populations including those with cognitive and also metacognitive deficits. Other applications are being directed at the rehabilitation of motor deficits to help provide recreational and new opportunities for people with severe disabilities. Virtual reality also shows promise for training in activities of daily living with different populations, including use of a virtual kitchen and vending machine, street crossing, and a hospital and university way-finding environment.[5]

A promising future requires the continued development and use of new, innovative technologies like Virtual Reality and Augmented Reality that will transform existing practices. To ensure the long-term use of such systems, it is important to understand the perspectives of healthcare providers in the implementation of Virtual Reality and Augmented Reality technologies. Introducing newer technologies like Virtual Reality and Augmented Reality in the rehabilitation field offers tremendous potential in making application of physiotherapy convenient, more dynamic and more efficient. The cost of equipment is decreasing and the availability of off-the-shelf software is growing such that many clinical facilities can now feasibly embrace this new upcoming technology. [8]

Methods

Research design

This study was cross sectional in nature, with the aim of assessing the knowledge, awareness and attitude of physiotherapists about Virtual Reality and Augmented Reality in physiotherapy practice. The study was therefore survey based, observational and quantitative and in the form of a self- administered questionnaire.

Participants

The questionnaire was delivered to the physiotherapists via electronic media. The informed consent requested the employees participation as well as explained the purpose and procedure of the study. The participants were included according to inclusion and exclusion criteria. A population of 120 physiotherapists was targeted, out of which 102 willingly filled the questionnaire.

Research tool

The study used a self- made questionnaire. It was validated from the ethical committee of TMV's Indutai Tilak College of Physiotherapy.

Ethics, consent and permissions

Participants in this study received a consent form which introduced the research project by including the title of the study, the aims of the study and reassuring the participants their information confidentiality as well as their responses. Consent was given by each participant.

Data collection

The study questionnaire was sent to respective participants via online platform. The collection of data started from November 2023 to March 2024. The questionnaire contained 3 sections on basic demographics, awareness and knowledge, attitude towards virtual reality and augmented reality.

Data analysis

The recorded responses were used for calculation of the frequency percentage using calculator. The results

presented cumulative frequency distribution in form of tables and figures.

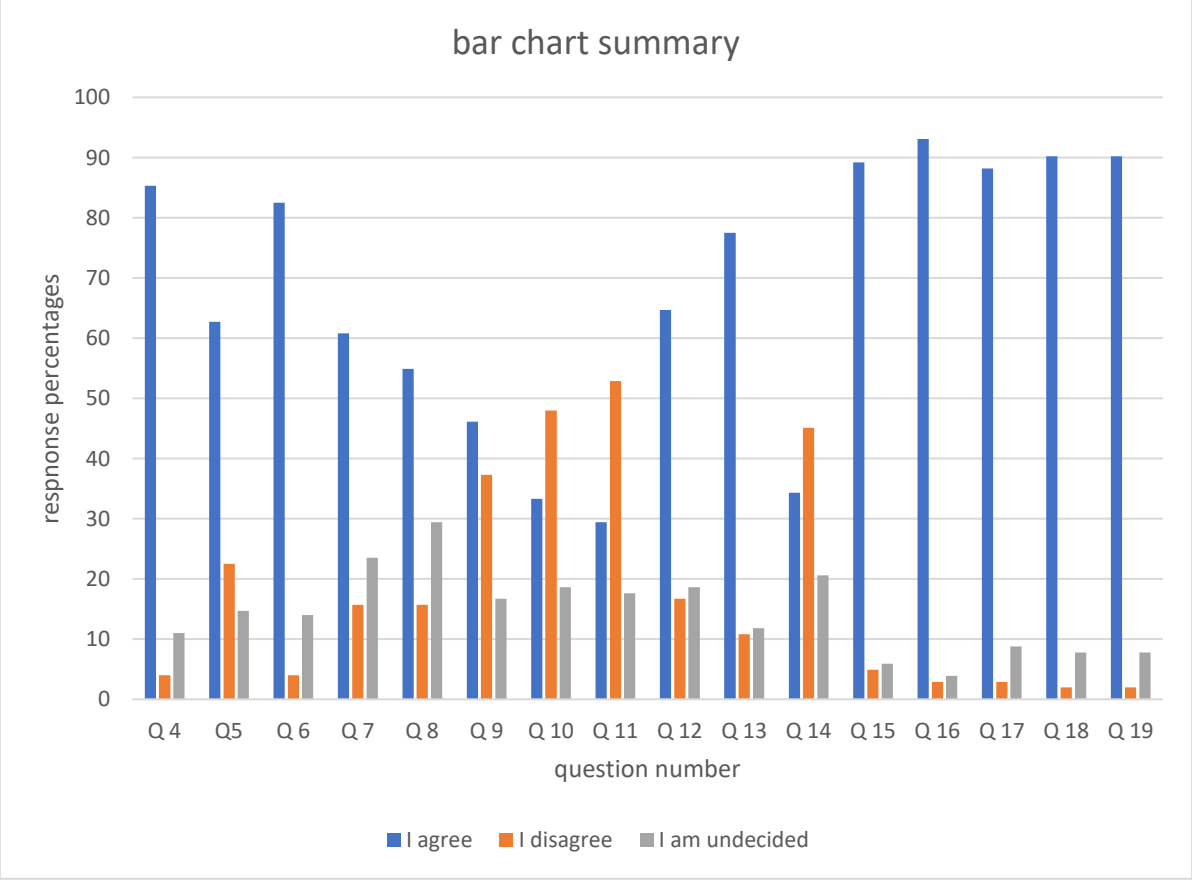
Results

Total 102 responses were recorded.

Question	I agree (n=102)	I disagree (n=102)	I am undecided (n=102)
I am aware about the popular gaming program virtual reality.	87 (85.3%)	4 (3.9%)	11 (10.8%)
I am aware about the popular gaming program augmented reality.	64 (62.7%)	23 (22.5%)	15 (14.7%)
I am aware that virtual reality and augmented reality have several applications in healthcare.	84 (82.4%)	4 (3.9%)	14 (13.7%)
I am aware about the concept of telerehabilitation.	62 (60.8%)	16 (15.7%)	24 (23.5%)
I know that virtual reality and augmented reality can be used as assessment tools.	54.9 (56%)	16 (15.7%)	30 (29.4%)
I know that virtual reality is being used to treat common musculoskeletal complains like neck and back stiffness, stiffness after total knee arthroplasty(TKA).	47 (46.1%)	38 (37.7%)	17 (16.7%)
I know that virtual reality is being used to treat complex musculoskeletal conditions like fibromyalgia and complex regional pain syndrome (CRPS).	34 (33.3%)	49 (48%)	19 (18.6%)
I know that virtual reality program can be used to treat gynaecological conditions like urinary incontinence.	30 (29.4%)	54 (52.9%)	18 (17.6%)
I know that augmented reality can be used in rehabilitation of progressive neurological conditions like multiple sclerosis.	66 (64.7%)	17 (16.7%)	19 (18.6%)
I know that virtual reality program is being used to treat complains like abnormal gait, impaired trunk control and imbalance in post stroke patients.	79 (77.5%)	11 (10.8%)	12 (11.8%)
I know that virtual reality programs can be used in effective rehabilitation of conditions like coronary artery disease	35 (34.3%)	46 (45.1%)	21 (20.6%)

(CAD) and chronic obstructive pulmonary disease (COPD).			
I think that virtual reality and augmented reality are feasible options for rehabilitation.	91 (89.2%)	5 (4.9%)	6 (5.9%)
I think that virtual reality and augmented reality programs complement conventional physiotherapy.	95 (93.1%)	3 (2.9%)	4 (3.9%)
I think that clients will feel comfortable being treated with virtual reality and augmented reality programs along with conventional treatment.	90 (88.2%)	3 (2.9%)	9 (8.8%)
I think that virtual reality and augmented reality should be widely applied in clinical practice.	92 (90.2%)	2 (2%)	8 (7.8%)
I will be open to using virtual reality and augmented reality for rehabilitation of my clients in the future.	92 (90.2%)	2 (2%)	8 (7.8%)

Table no. 1



Graph no. 1

Discussion

This study was conducted to determine the knowledge, awareness and attitude about virtual reality and augmented reality in physiotherapy practice among physiotherapists. For the selection of topic, several ideas were considered as testing effects of virtual reality training on reaction time of goal keepers, effects of augmented reality + conventional rehabilitation for ACL injury in soccer players. Then, upon finding that there is very less awareness about VR rehabilitation among players, it was important to find the same among therapists. So, a questionnaire was prepared. Most of the therapists were aware about the virtual reality and augmented reality technologies. As augmented reality and virtual reality technologies have been increasing in popularity. These programs are resurfacing in recent years due to the technological improvements in devices and processing hardware.[9]

Most of the therapists (82.4%) were also aware that virtual reality and augmented reality have several applications in healthcare. Research into application of virtual reality technology in the healthcare sector has rapidly increased. About 60.8% were aware about the concept of telerehabilitation while 15.7% were not and 23.5% were undecided.

In a study conducted by Melda Secer, majority of the participants did not have enough education and knowledge about telerehabilitation technology and its application. According to a study of nursing students in another healthcare specialty in Poland, 69% of students were in favor of telehealth – telenursing being included in the curriculum. It seems unreasonable to expect telehealth practice to be routinely applied when heath professionals are not familiar with various basic concepts, principles and practices in academic education before entering the profession.[6]

A report from the Australian Physiotherapy Association states that the future of telerehabilitation depends on the education of physiotherapists in the appropriate use of technology for telerehabilitation. It was crucial to understand if the participants are aware about this concept. Hence in accordance with the results in this study, the inclusion of courses on telerehabilitation in university syllabus and the education of physical therapy students in the field of telerehabilitation through training on various platforms such as workshops and seminars can bring about the development in the field of telerehabilitation.[10]

About 54.9% participants were aware that virtual reality and augmented reality can be used as assessment tools, 15.7% were not aware while 29.4% were undecided. Virtual reality presents a promising avenue for enhancing assessment process in physiotherapy, offering greater precision, flexibility and efficiency in evaluating patient outcomes.[19,12] The immersive experience of virtual reality enables therapists to gather more accurate and comprehensive data about clients' physical capabilities and limitations, facilitating articulation of customized rehabilitation programs. Moreover, it can be repeated easily so monitoring the progress becomes more convenient [12]

46.1% participants knew that virtual reality is being used to treat common Musculo skeletal complains like neck and back stiffness and stiffness after total knee arthroplasty, 37.3% did not know about it while 16.7% were undecided. Within the last decade, promising treatment modalities have adopted newer technologies rapidly to reduce pain and motor function outcomes. A randomized controlled clinical trial by L. Zeng found that virtual reality intervention post Total Knee Arthroplasty was major reason why knee range of motion recovered faster in experiment group than the control group.[12] 33.3% participants knew that virtual reality is being used to treat complex musculoskeletal conditions like fibromyalgia and Complex Regional Pain Syndrome, 48% did not know about it while 18.6% were undecided. The multiple factors of the pathogenesis and maintenance of condition like fibromyalgia requires a multi model treatment approach [13] Virtual reality is thought to be an effective means as adjunctive therapy for treating

fibromyalgia. In a study titled "experiences of physiotherapists considering virtual reality for shoulder rehabilitation: a focus group study" by Beate Dejaco found that physiotherapists were positive about the potential of Virtual Reality and its applicability in daily care and activities of daily living.[14]

About 29.4% participants knew that virtual reality program can be used to treat gynaecological conditions like urinary incontinence, 52.9% did not while 17.6 were undecided. A study titled virtual reality rehabilitation as a treatment approach for older women with mixed urinary continence: a feasibility study by Vallerie Elliot showed that combined PFM/VRR program is an acceptable, efficient and satisfying functional treatment for older women with Mixed Urinary Incontinence.[15]

64.7% participants knew that augmented reality can be used in rehabilitation of progressive neurological conditions like multiple sclerosis, 16.7% did not know while 18.6% were undecided. Virtual reality could be an effective method of MS rehabilitation in cognitive and motor deficits, it represents a motivational alternative.[16] 77.5% people knew that virtual reality program is being used to treat complains like abnormal gait, impaired trunk control and imbalance in post stroke patients, 10.8% did not know while 11.8% were undecided. Virtual reality applied to physiotherapy: a review of current knowledge by Polyana Brepohl found an increase in use of virtual reality technology in neurology with elderly patients.[17]

34.3% participants knew that virtual reality and augmented reality can be used in effective rehabilitation of conditions like coronary artery disease and COPD, 45.1% did not know while 20.6 were undecided. Using Virtual Reality, Augmented Reality for cardiopulmonary conditions has demonstrated positive outcomes, including improvements in exercise capacity, quality of life and clinical parameters.[18] Around 89.2% participants think that virtual reality and augmented reality are feasible options for rehabilitation, 4.9% did not agree while 5.9% remained undecided. Virtual Reality based interventions are game like and hence provide motivational environment allowing longer exercise sessions and greater adherence to therapy [19]

93.1% participants think virtual reality and augmented reality programs will complement conventional physiotherapy, 2.9% do not agree while 3.9% were undecided. Virtual reality and augmented reality complement conventional physiotherapy by enhancing engagement, motivation and outcomes for patients. It is achieved through personalized rehabilitation and real -life stimulation.[20]

88.2% participants think that clients will feel comfortable being treated with virtual reality and augmented reality programs along with conventional treatment, 2.9% do not agree while 8.8% remained undecided. A systemic review by Leong Chit et al (2021) found patients often reported positive experiences with Virtual Reality and Augmented Reality technologies. Many patients indicated preference of VR AR over traditional therapy due to the engaging and enjoyable nature of the experiences.[21]

90.2% participants think that virtual reality and augmented reality should be widely applied in clinical practice, 2% did not agree while 7.8% remained undecided. Application of these technologies depends on factors like efficacy, accessibility, cost effectiveness and patient acceptance. While there is growing evidence supporting its benefits in healthcare, further research and evaluation are necessary before widespread implementation.[22]

90.2% participants said they would be open to using Virtual Reality, Augmented Reality for rehabilitation of their clients in the future, 2% did not agree while 7.8% remained undecided. Most of the therapists are open to using Virtual Reality, Augmented Reality for rehabilitation as it offers unique opportunities for patient engagement and treatment outcomes. "virtual reality in rehabilitation medicine" – talks about its potential in various rehabilitation settings.[23]

Limitations

Limitations for the study includes, this study did not have a pre requisite for years of experience. Participants from varying range of years of experience were included.

Conclusion

In conclusion, many of the participants were not aware about extent of Virtual Reality Augmented Reality rehabilitation in different fields across physical therapy.

Most of the participants knew about its application in the neuro physiotherapy field. More awareness needs to be spread on the widespread implementations of these technologies in the field of rehabilitation. Most of the participants have a positive attitude towards application of Virtual Reality, Augmented Reality clinically. Overall, the incorporation of these technologies in physiotherapy practice represents a promising paradigm shift towards more engaging, efficient and patient centered rehabilitation approaches.

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