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VIRTUAL REALITY IN HEALTHCARE AND MEDICAL EDUCATION

Healthcare

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ABSTRACT

Virtual reality is an effective alternative to learning experiences in medical professionals and students. There are numerous applications of virtual reality (VR) in theoretical learning and clinical medicine, which are discussed thoroughly in this article. 3D models, AI-controlled virtual patients are much beneficial for learning in teaching and training of doctors. Performance of mock-surgeries, diversion of patient's attention by VR techniques, VR exercises and virtual environments can help both healthcare professionals and patients. In most of the studies focused on VR, it is found that both doctors and patients could benefit from this novel technology. Various uses, applications of VR modules and the challenges faced in implementing VR were discussed.

KEYWORDS

Virtual reality, healthcare, medical education, 3D models, AI-controlled virtual patients.

INTRODUCTION:

Virtual reality (VR) technology is revolutionizing approaches in the healthcare sector and medical education by providing a near realistic outside world to gain knowledge via practice and experience. VR-based medical education is more effective approach than traditional methods and is relatively safer for students and patients. Main objectives of VR are extreme demand for quality healthcare services and reduction of healthcare costs.

Virtual reality is a more efficient approach for recent graduates, postgraduates, and newly qualified healthcare professionals to acquire theoretical knowledge. With VR, students can examine three-dimensional models in more detail and practise communicating with computer-generated patients whose attitudes and behaviours can be easily altered to suit various learning objectives.

Working:

A motion-sensing VR headset will vanish the outside environment and replaced with a virtual world that you can enter, move around in, and interact with. Your brain can't live in two realities at once, Instead it accepts the input it's given. This sense of what is called “presence” in the virtual world means it's harder for the brain to focus on other stimuli, such as negative input like pain and anxiety. VR also triggers strong emotions, and we are primed to learn things and this emotional engagement opens up many other uses, from medical education to recovery from injuries and illness.

Applications of Virtual Reality Technology:

Health care and medical education are two of the top sectors that will continue to be early adopters of virtual reality technology. Healthcare practitioners and medical educators can interact with simulated environments designed for therapeutic VR, such as pain treatment or rehabilitation, and medical education like computer aided learning and simulative surgery training through the use of virtual reality.

Medical Education: For medical students to understand theory more effectively, virtual reality is necessary. VR helps the learners in inspecting 3D medical models with more accurate details, which can't be reproduced in physical models. Any virtual learning session can be conducted one-on-one, or in a group, with the assistance of a virtual preprogrammed software controlled guide or a real teacher who is also connected to the VR environment. Highly realistic 3D models of organs, tissues, vascular system and musculoskeletal system which help in closer virtual inspection at any angle and improves anatomy understanding significantly. It helps students develop communication skills with different patients before starting real medical practice, thus improving the healthcare. For nurses, surgeons, and ICU staff, simulation of a variety of medical operations and the process of operating medical equipment aids in skill development by allowing risk-free, hands-on practise and safe, affordable training. The biggest obstacle for medical education is developing real like virtual patients, which calls for high-quality ai technology, capable of verbal and nonverbal interactions.

Medical Training:

Medical school graduates and other healthcare workers can both benefit from VR's focus on practical medical training to develop practical abilities. Upon entering a simulated environment(VR), a user becomes a part of a training scenario that expects them to complete predetermined task, for instance, performing a medical procedure or handling medical equipment. It helps prepare surgeons, physicians, and nurses for high-stress situations like emergencies, complex surgeries etc. Simulation of an OT environment helps surgeons gain practical skills and raise competence levels in safe environment. Medical professionals can learn crisis management techniques by simulating uncommon situations, accidents with many casualties, or disease outbreaks. Since highly-detailed surfaces and vibration feedback are difficult to imitate, it is not advised to utilise VR for practising surgeries that need careful palpation or involve surgical drilling even in presence of strong haptic feedback techniques.

Surgery:

By practising mock surgeries in a virtual setting, practical skill deficiencies can be eliminated more quickly without the use of costly mannequins that are used only once. It tends to improve surgery outcomes and patient safety. Surgery simulation can provide immersive training and skills evaluation like, if a trainee needs to remove a tumor, the process of the simulation describes its location, size and looks and how these parameters change during steps of the surgical protocol. A surgeon can use virtual reality (VR) navigation to plan a surgical intervention and prepare a patient during pre-surgery planning, which involves converting patient data into 3D models. Patients can also be provided complete information on the surgical procedure via a VR application. The Challenge in application of VR in surgery is that it is difficult to measure trainees' performance for which Integration of AI in a VR system is must which will provide feedback on performance to future trainees.

Pain Management:

VR efficiently draws a patient's focus elsewhere. The usage of potentially dangerous analgesics is minimized and healthcare costs are decreased because to this kind of VR. The patient is either made to participate in an interactive, gamified experience or placed in a highly realistic environment with a relaxing ambience and acoustic stimulation. VR speeds up recovery and improve patient outcome in patients receiving burn therapy or treatment for major injuries. It helps in avoiding long-term use of pharmacological pain relief, minimizing risks of adverse effects and reducing healthcare costs. In dental work, childbirth, and other operations that cause great anguish, pain can be reduced without anesthesia. It may improve the efficacy of therapy

sessions for patients with mental illnesses. It involves highly realistic visual contents for maximum immersion , interactive scenarios for distraction from the pain and a higher level of engagement, audio stimulation with relaxing music or recorded hypnotherapy guidance and a child-focused content design with the use of bright and colorful graphics and animation.

Rehabilitation:

By moving rehabilitation exercises into the virtual environment, Through the use of virtual reality, therapy sessions become a game-like experience that inspires participants to work toward improving their outcomes. VR helps in neurological rehabilitation through recovery from brain and spinal cord damages, physiotherapy by overcoming muscle weakness and improving mobility functions and cognitive rehabilitation by improve memory, attention and problem-solving skills in hyperactivity disorder to early dementia and attention deficit. Telerehabilitation which involves a portable VR equipment, used by patients to exercise at home while being monitored remotely by a therapist via the web. This type of therapy is less expensive than in-person therapy and makes it easier for patients to receive rehabilitation services in far-off regions. VR technology with the telerehabilitation function may expose patients to certain safety risks, e.g., excessive exercising, which can be hard for a therapist to anticipate remotely.

Stroke Rehabilitation:

To effectively recover after stroke, patients re-learn to perform their typical daily actions in the virtual environment. Patients can access a wide database of exercises that help them restore motor skills or improve spatial orientation abilities without posing any risks of damage to self, others or the objects they manipulate. VR exercises helps in regaining physical function, where a patient is required to control virtual objects (pick up, squeeze, move, etc). Exercises with a specific goal and progressively harder levels of difficulty aid in the creation of new neuronal pathways that promote the development of motor abilities. These exercises also improve cognitive abilities with exposure to a varying cognitive load, e.g., from remembering the sequence of objects to plotting a plan. Basically it is focused on impairment of attention, memory, and orientation after a stroke. Some of patients may not be able to perform standard VR rehabilitation exercises or make compensatory movements while training motor skills (e.g., trunk rotation or excessive leaning forward), which activates the different muscles and obstruct the pathway of recovery. Introduction of VR module based on the mirror therapy technoque and AI-based performance assessment tool can help in abolition of these flaws.

Sports injuries:

Virtual exercises can help to recover from or prevent ACL tears, hip flexor strains, tennis elbows, and other sports-related injuries. It allows athletes to restore muscle strength and enhance reaction time even when they are on tour.

In terms of medical uses, VR is still in its early stages. In the future, VR is likely to be utilised more frequently in healthcare to increase safety and efficacy as well as in medical education to better understanding and outcome.

CONCLUSION:

Virtual reality technology has numerous applications in field of healthcare and training of medical undergraduates and postgraduates. Artificial intelligence incorporated in VR based software and equipment can further expand the horizon of virtual reality by providing feedback and eliminating challenges faced by this technology. In addition, new approaches in VR technology were addressed by critical analysis of existing literature on the efficacy of VR based medical software and equipment.

REFERENCES:

1. Samadbeik M, Yaaghobi D, Bastani P, Abhari S, Rezaee R, Garavand A. The Applications of Virtual Reality Technology in Medical Groups Teaching. J Adv Med Educ Prof. 2018 Jul;6(3):123-129.
2. Bronnimann E, Hoffmann H, Schafer J, Hahnloser D, Rosenthal R. Effect of different warm-up strategies on simulated laparoscopy performance: a randomized controlled trial. J Surg Educ. 2015;72(1):96–103.
3. Rizzo A, Kim GJ. A SWOT analysis of the field of virtual reality rehabilitation and therapy. Presence. 2005; 14:119–46. [Google Scholar]
4. Lin Y, Wang X, Wu F, Chen X, Wang C, Shen G. Development and validation of a surgical training simulator with haptic feedback for learning bone-sawing skill. Journal of biomedical informatics. 2014; 48:122–9.
5. Li L, Yu F, Shi D, Shi J, Tian Z, Yang J, Wang X, Jiang Q. Application of virtual reality technology in clinical medicine. Am J Transl Res. 2017 Sep 15;9(9):3867-3880.
6. Eldred-Evans D, Grange P, Cheang A, Yamamoto H, Ayis S, Mulla M, et al. Using the mind as a simulator: a randomized controlled trial of mental training. J Surg Educ. 2013;70(4):544–51.
7. Walsh C, Sherlock M, Ling S, Carnahan H. Virtual reality simulation training for health professions trainees in gastrointestinal endoscopy. Cochrane Database Syst Rev. 2012;13(6):CD008237.
8. Brydges R, Peets A, Issenberg SB, Regehr G. Divergence in student and educator conceptual structures during auscultation training. Med Educ. 2013;47(2):198–209.
9. Dehabadi M, Fernando B, Berlingieri P. The use of simulation in the acquisition of laparoscopic suturing skills. International Journal of Surgery. 2014;12:258–268.
10. Pottle J. Virtual reality and the transformation of medical education. Future Healthc J. 2019 Oct;6(3):181-185.
11. Khan MW, Lin D, Marlow N, Altree M, Babidge W, Field J, et al. Laparoscopic skills maintenance: a randomized trial of virtual reality and box trainer simulators. J Surg Educ. 2014;71(1):79–84.
12. DeStephano CC, Chou B, Patel S, Slattery R, Hueppchen N. A randomized controlled trial of birth simulation for medical students. Am J Obstet Gynecol. 2015;213(1):91.
13. Paschold M, Huber T, Zeissig SR, Lang H, Kneist W. Tailored instructor feedback leads to more effective virtual-reality laparoscopic training. Surg Endosc. 2014;28(3): 967–73.