Applications of Virtual Reality in Medical Practice

Introduction:

References

Zajtchuk, R., & Satava, R. M. (1997). Medical applications of virtual reality.*Association for Computing Machinery.Communications of the ACM, 40*(9), 63-64. Retrieved from https://search-proquest-com.erl.lib.byu.edu/docview/237045983?accountid=4488

This article gives a brief overview of many of the ways virtual reality is being used to advance medical practice. It first talks about how virtual reality can map actual patient data into a three-dimensional model so doctors can more accurately diagnose an issue. Also due to the increased complexities of medical and surgical procedures, virtual reality is also providing advanced medical trainings to students. Virtual reality has been enabling engineers to create and test custom made medical tool and instruments for doctors and surgeons. Virtual reality is also being used in rehabilitation and psychiatry. Though this article is short and does not go into much detail, it provided an authoritative way for me to describe all the many ways virtual reality can be used in the medical practices.

Jan-Maarten Luursema, Vorstenbosch, M., & Kooloos, J. (2017). Stereopsis, visuospatial ability, and virtual reality in anatomy learning.*Anatomy Research International, 2017*doi:http://dx.doi.org.erl.lib.byu.edu/10.1155/2017/1493135

This article reports on a study that was done to see if virtual reality improves student learning by presenting three-dimensional models or the human anatomy. It first talks about some of the disadvantages other studies have found in using virtual reality to teach anatomy. However, they combat these claims by talking about new advances in virtual reality that possible have overcome these claims. The experiment used eighty first year medical students from the Radbound University in the Netherlands. In the experiment, three groups were tested stereoptic condition group (used virtual reality), non stereoptic, and a control group. The first group was given a virtual environment to help them study the anatomy of the neck. The results showed no significant difference in learning from any of these groups.

Djukic, T., Mandic, V., & Filipovic, N. (2013). Virtual reality aided visualization of fluid flow simulations with application in medical education and diagnostics.*Computers in Biology and Medicine, 43*(12), 2046-52. doi:http://dx.doi.org.erl.lib.byu.edu/10.1016/j.compbiomed.2013.10.004

This article talks about how virtual reality can be used to enhance education by giving surgeon or medical students examples of symptoms of disease. It also talks about how it can be used to help diagnose patients by presenting three-dimensional models of cat scans, x-rays or MRI’s. The article finds the ability to manipulate the organs in a three-dimension model is very helpful. Especially being able to simulate fluid flow to show the effects it is having on the organs. The biggest advantages this articles sees to virtual reality is the cost reduction of training and reduction in the amount of time needed to train medical employees.

Weghorst, S., Seibel, E., Oppenheimer, P., Hoffman, H., Schowengerdt, B., & Furness, T. A. (2008). Medical interface research at the HIT lab.*Virtual Reality, 12*(4), 201-214. doi:http://dx.doi.org.erl.lib.byu.edu/10.1007/s10055-008-0107-9

This article summarizes the experiments the Human Interface Technology Laboratory (HIT lab) has done to advance the medical field with virtual reality. The HIT lab has been able to make the therapeutic procedure for patients with Parkinson’s disease more available with virtual reality. They’ve also used virtual reality to help those classified with low vision gain greater awareness of their environment. They’ve also been able to use it to treat different anxiety disorders such as overcoming phobias or post dramatic stress disorder. It’s also been shown to distract and reduce pain patients feel during high pain procedures. Hit lab’s has also found that using virtual reality can reduce the training period students need to become proficient in the skills needed for their medical practice. They’ve also help improve complicated robotic surgery by inventing an eye tracker to that adjust the depth of the image according to the focus or your eye. They’ve also been experimenting with advanced ways of display patient data in an emergency room to make patient information more accessible. For example, having a CAT scan of the patient’s brain floating above the patient’s head.

Ferracani, A., Pezzatini, D., Seidenari, L., & Del Bimbo, A. (2015). Natural and virtual environments for the training of emergency medicine personnel.*Universal Access in the Information Society, 14*(3), 351-362. doi:http://dx.doi.org.erl.lib.byu.edu/10.1007/s10209-014-0364-1

Emergency medical simulated situations have also been a useful tool for teaching emergency medicine personnel even in its most primitive forms. Practice is a key part of learning how to react in an emergency and virtual reality provides a way to practice. Using computer-based simulations allows instructors to produce many complex scenarios at a low cost. Current robots are either too complicated to operate or are too specialized that they do not provide enough random complexities to cover most of medical emergency responses.

Ziv, A., Small, S. D., & Paul, R. W. (2000). Patient safety and simulation-based medical education.*Medical Teacher, 22*(5), 489-495. doi:http://dx.doi.org.erl.lib.byu.edu/10.1080/01421590050110777

This article compares different means of simulating patient care, such as using manikins, human cadavers, virtual-reality, etc. Manikins are cheap and provide students a way to train on basic skill of patient care. Human cadavers are popularly used but have limited availability and formalin-fixed tissues may not causes discrepancies. Screen based simulator are currently highly used because they provided specific feedback without an instructor being involved. Realistic high-tech procedural simulators (task trainers) provide models with interactive touch cues, providing a powerful mean of teaching. Ultra sound simulator have been usefully in giving doctors interactive patient experiences as well as patient care feedback after the simulation is over.

Salsabeel, F. M. A., Falah, J. F. M., Alfalah, T., Elfalah, M., Muhaidat, N., & Falah, O. (2018). A comparative study between a virtual reality heart anatomy system and traditional medical teaching modalities.*Virtual Reality,*, 1-6. doi:http://dx.doi.org.erl.lib.byu.edu/10.1007/s10055-018-0359-y

This compares whether virtual reality or the traditional medical teaching method is better for studying heart anatomy. Researcher developed a virtual heart the mimic an actual live heart in color and structure. The goal of this study was to see if virtual reality could provide a more realistic model for teaching anatomy. Each participant in the study was allowed time to explore the virtual model and then given a questionnaire to access their experience. Results from the test showed that students favored the virtual reality experience. The article concludes that this experiment shows that virtual reality can be a great tool to use in medical education.

McCloy, R., & Stone, R. (2001). Virtual reality in surgery.*BMJ : British Medical Journal, 323*(7318), 912. doi:http://dx.doi.org.erl.lib.byu.edu/10.1136/bmj.323.7318.912

This article goes over how virtual reality is used to increase the performance of surgeons. The researcher have developed MIST (minimally invasive surgical trainer) system. This system help teach students some of the common motor skill they will need to have in order to perform surgeries. The MIST system can accurately assess an inexperienced surgeon from an experienced surgeon, helping instructors know if the student is ready. The article also talks about how virtual reality can be used to practice a surgery before it happens. The study has found that many surgeons are older and not computer capable, leading to a potential problem in using these technologies in instruction. The researchers also speculate that virtual reality will be used in the future to control micro technology and developing cognitive skills now would be beneficial.

Ho, N., Wong, P., Chua, M., & Chee-Kong, C. (2018). Virtual reality training for assembly of hybrid medical devices.*Multimedia Tools and Applications, 77*(23), 30651-30682. doi:http://dx.doi.org.erl.lib.byu.edu/10.1007/s11042-018-6216-x

Lots of time and money is spent on training medical device manufacturers because high skills in this area is essential. This article reviews a virtual reality system’s performance in training manufacturers. Participants are given instructions from their virtual system on how to assemble a hybrid medical device. Results show that the company’s current method of training has significant benefits over using virtual reality training.

Lok, B., Ferdig, R., Raij, A., Johnsen, K., Dickerson, R., Coutts, J., … Lind, D. S. (2006). Applying virtual reality in medical communication education: current findings and potential teaching and learning benefits of immersive virtual patients. *Virtual Reality, 10(*3/4), 185–195. https://doi-org.erl.lib.byu.edu/10.1007/s10055-006-0037-3

This article first theorizes how virtual reality could be used in the medical field in the future. The researchers then talk about the capabilities and limitations they’ve found virtual reality to have during their own trials.