

VIRTUAL REALITY IN SURGERY

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INTRODUCTION

Virtual reality, as described by Joseph Rosen, is a computer-generated technology, which allows information to be displayed in a simulated but lifelike environment. Although it sounds like something out of a science fiction movie, virtual reality has been around for several years. In the 1940s virtual reality-type simulations programmes were used to train, evaluate and certify military and commercial pilots. Over the past decade virtual reality and computer simulation have expanded into other domains, including the medical field.

Virtual reality is perhaps being used more in medicine than in any other industry, because its applications have such far-reaching benefits. It promises to bring one of the most dramatic changes to the practice of medicine over the next decade.

There are all levels of expertise in computer literacy and competence in the population, but only two groups in terms of computer comfort – younger people, who find the technology easy to use and straightforwardly simple, and the rest, who were raised in the age of the knowledge system called books.

We are becoming increasingly dependent on computerised information, the internet, e-mail and CD-ROM instructional systems. CD technology can put enormous amounts of information in a highly presentable manner to get across ideas very effectively. It is a portable, highly interactive and inexpensive medium for the distribution of information.

John Hunter applied a scientific approach to surgery 200 years ago: evidence-based surgery. Surgical training is an ongoing process and the following factors have played a major part in the rise of evidence-based surgery:

- the rapid expansion of access to information on computer databases and the resources available to guide evidence-based surgical practice, including internet sites and CD-ROMs
- the explosion in knowledge, information and the number of publications over the last 30 years

In surgical training there is often a shortfall in the required number of operations performed. One consequence is that trainees may have less practice and feel less confident about many surgical procedures and techniques. With the increasing level of difficulty in surgical procedures it has become imperative that trainees have a forgiving arena in which to learn their trade. With the advent of virtual reality, this has happened.

APPLICATIONS OF VIRTUAL REALITY

Education Virtual reality patients can be used to create an environment for learning anatomy. The advantage over traditional dissection is that the exercises can easily be reversed, allowing the models to be taken apart repeatedly and examined from multiple viewpoints.

Simulation for surgical training Virtual reality can teach surgeons new procedures and determine their level of competence before they operate on patients. It can also allow the trainee to practise a skill several times as a refresher course. One example of this is in the field of laparoscopic surgery. The first application of laparoscopic surgical procedure by virtual reality was in a virtual clinic when a prototype of a laparoscopic cholecystectomy was performed. The results were favourable and now several other projects of minimal access surgeries are being developed. Below are several new simulators that are allowing surgeons to learn and practise the skills of their trade:

Project Hippocrates This uses virtual reality to simulate, plan and execute orthopaedic surgery. The goal of this system is to allow surgeons to simulate procedures and then alter their approach to them, based on the results of the simulation. The programme offers the opportunity to plan surgery.

ERCP Georgia Tech's biomedical interactive centre has produced the endoscopic retrograde cholangiopancreatography surgical simulator. This simulator replicates an endoscopic procedure in a virtual environment. Its job is to train physicians to perform ERCP procedures by using photo-realistic and tactile environments.

TELEMEDICINE

Telemedicine is a system of electronically communicating data from one site to a distant site. An example would be transferring a patient record from a doctor in London to a surgeon in Lancaster.

TELEPRESENCE SURGERY

This is the performance of surgical procedures where the patient and surgeon are in different locations. An example of this emerging technology is the Green Telepresence Surgery System, which consists of two components, the surgical workstation and the remote work site. At the remote site are a 3-D camera system and responsive manipulators with sensory input. At the workstation are a 3-D monitor and dexterous handles with force feedback. At the present time this is an experimental tool not currently used in practice.

ADVANTAGES OF VIRTUAL REALITY

Efficiency Virtual reality simulators are more efficient than training on real patients. It eliminates the risk of harming the patient whilst trying to learn a new skill. It also eliminates the time restraints on waiting for types of cases to come up and allows the trainee to practise independently.

Objectivity Virtual reality can objectively evaluate and measure technical competence in place of the traditional subjective measures of trainee and mentor.

Ethics Using virtual patients to train on is less expensive and less contentious than training on animals.

DISADVANTAGES

Cost New technology is expensive. The cost of developing hardware and software for the application of virtual reality technology is too great for many institutions to implement at this time. Computer instrumentation is expensive after introduction but has always decreased over time, so the expectation is that as this occurs, virtual reality will eventually become more common in medicine.

Restraint The equipment used at present to create a virtual reality environment is restrictive and uncomfortable to its users. This would have to be overcome for more convenient uses in surgical procedures.

LOOKING TO THE FUTURE

Researchers are currently trying to incorporate surgery and robotics in the form of telepresent surgery. The great attraction of this system is that it would allow surgeons to observe, assist with or perform surgical procedures from some distance.

CONCLUSION

Just as simulators are now standard in the fields of aviation and aerospace, soon surgical simulators will be standard in medicine. These simulators will allow instruction in correct surgical procedures without the need for live patients. With the advent of virtual reality, surgeons will have the opportunity to learn and to practise their skills. It is a tool that has many potential applications, and I would predict that as technology continues to advance and the cost of manufacturing decreases, virtual reality will become a dominant tool for training future surgeons.

FURTHER READING

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