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Virtual Reality in Nursing: Nasogastric Tube Placement Training Simulator

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Abstract

A virtual reality (VR) based training simulator developed for nasogastric tube (NGT) placement is presented. It leverages the advantages of VR technology – safety, flexibility, interactivity and quantitative assessment – to speed up the learning curve of NGT placement. The simulator demonstrates the potential of VR for nurse education.

Keywords:

Computer Simulation, Nursing

Introduction

Virtual Reality (VR) technologies have been advancing in the past three decades, which proliferates a wide range of applications. In health care, representative examples include virtual surgical simulators developed for training, pre-operative planning and rehearsal [3]. VR also finds applications in nursing. This paper focus on the use of VR on the training of nasogastric tube (NGT) placement, a common clinical skill.

NGT placement concerns the insertion of a plastic tube through the nose into the stomach. Since the tube cannot be seen during insertion, it may be accidentally inserted into the lung, which can lead to complications or even fatality. Training of NGT placement is conventionally conducted by practising on humans, which causes discomfort, or on rubber manikins, which is static and does not replicate human anatomy and the insertion forces.

Method

To enhance the training, VR technology is employed to develop a computerized interactive training system. It is based on human anatomy and provides visual, audio and haptic feedback. A virtual patient (upper part of the body), a virtual NGT, and the virtual hand of the user are displayed on the screen. User can control the virtual hand using a 3D user interface, which is also a force feedback device that can produce real-time insertion forces. Verbal command can be used to instruct the patient to swallow (visualized by movement of Adam's apple) to facilitate the tube's advancement. The virtual patient can gag or cough (by playing audio clips) depending on the position that the tube is reaching. The insertion forces are modelled based on physics using finite element methods [1] or expert experience using fuzzy inference [2]. Quantitative metrics including the tube's location, speed and insertion force can be recorded.

Results

The VR-based NGT placement training simulator is shown in Figure 1. Nine clinical teachers were asked to comment on the system's the feasibility for nurse training and the overall realism. A pilot study involving 80 nursing students was also conducted to evaluate system usability and their acceptance of the VR-based training approach. The feedback was positive in general, while suggestions to improve the user interface, to simulate more patient responses, and to extend the simulation for neonates were received.

Figure 1– The Training Simulator for NGT Placement

Conclusion

Taking advantages of the VR technology, the novel NGT placement training simulator provides an automated and standardized method that can increase the learning opportunity and enables asynchronous self-learning. It has the potential to speed up the learning curve so that students can be well-prepared for practice and operation in reality sooner.

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