Implementation of Augmented Reality In Medical Student Lumbar Puncture Simulation Training

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Introduction

Augmented reality (AR) is a mixed reality format in which most of the environment is real with supplementation of virtual objects, aka holograms. AR's unique ability to provide realistic haptic feedback and real-time performance evaluation has resulted in a surge in popularity worldwide, with applications ranging from video games to industrial training.[1] It has only recently become technically reasonable to utilize AR in simulation-based medical education and procedural training.[2-4] AR is being studied in training for procedures like laparoscopic surgeries, lumbar punctures, facet join injections, and pedicle screw placements.[5-7]

A lumbar puncture (spinal tap) is a medical procedure that requires the insertion of a needle into the lower back between two vertebrae to remove a sample of cerebrospinal fluid. This is the fluid that surrounds the brain and spinal cord and can be analyzed for a variety of diseases, like meningitis, multiple sclerosis, and certain kinds of intracranial hemorrhages.

Objectives

Aim 1: To determine the feasibility of implementing augmented reality (AR) in medical student training for lumbar puncture.

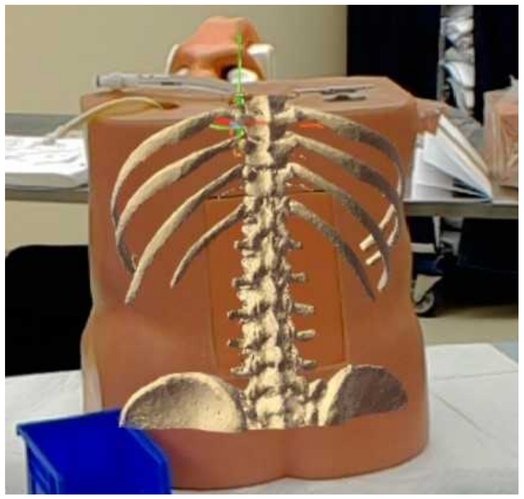
- Is the AR interface easy to navigate?
- Does AR guidance alter the time required to perform a lumbar puncture?
- Can an augmented reality model be co-registered to physical landmarks?

Aim 2: To examine the efficacy of AR-guided lumbar punctures as compared to the current standard of care.

- How does AR guidance affect the student experience in lumbar puncture training?
- How does AR guidance affect student confidence in their ability to perform a lumbar puncture?
- How does AR guidance affect student ability to perform a lumbar puncture?

Methods

We have developed a Microsoft Hololens AR application for use in the Ochsner Clinical Simulation and Patient Safety Center on a lumbar puncture/epidural trainer. Third and fourth year medical student volunteers will take a pretest and then be given training on lumbar puncture procedures and an orientation to AR equipment. After this, students will be randomized to the intervention group (using AR to perform an LP) or a control group (usual LP without AR). Data will be collected on the number of sticks required for a successful lumbar puncture, location of sticks in relation to the ideal tap location, and time required for students performing AR-guided lumbar punctures and those performing lumbar punctures using the current standard of care. Additionally a qualitative analysis consisting of open-ended questions will be used to compare student experience using the AR interface versus those using the current standard of care.



Results

We have established feasibility of creating a Microsoft Hololens based AR application that can project and register a spine hologram on to a LP trainer in the Ochsner Simulation Center. An IRB protocol has been submitted and pending approval. A fellow has been funded to execute the study. Study recruitment is expected to begin before the end of the year.

Conclusions

We have developed the technical abilities and applications for AR guided LP training. The goal of this study is to determine the feasibility of utilizing AR technology in medical simulation as well to investigate its efficacy in improving procedural training. This initial study can serve as the basis to further explore current limitations in translating and increasing adoption of AR in healthcare, like user design and image co-registration.

References

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