A Prototype of a Low-Cost, Augmented Reality Spinal Anatomy Education Tool Using ARKit

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Introduction

Augmented reality (AR) can enhance realism and feedback in procedural training, offering features such as "see-through-vision" [1, 2]. However, AR devices, like the HoloLens (Microsoft Corporation, Redmond, Washington) may be too expensive for widespread use [3]. AR frameworks that run on widely available devices may provide a cost-effective alternative.

Questions

Are modern mobile devices capable of anchoring 3D holograms in physical space with sufficient precision for procedural guidance?

Can modern mobile devices reliably track small, moving objects such as a Tuohy needle?

What is the cost associated with building a viable AR system for procedural training?

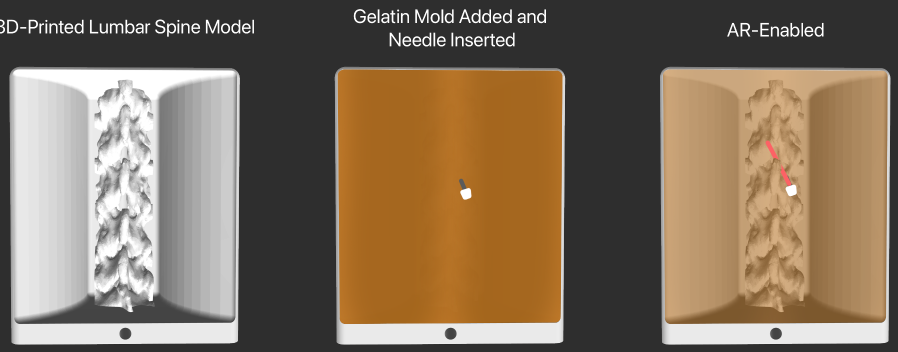
Methods

Using Apple Inc (Cupertino, California)'s ARKit in combination with a previously-described lumbar spine model developed by Manshari et al. (2018), we created a AR spine anatomy education tool that runs on iPhones and iPads.

A quick response (QR) code reference marker was used to project a virtual overlay of the lumbar spine over a physical lumbar phantom viewed through a mobile device screen.

A second QR code was used to track a Tuohy needle and overlay a virtual representation of the needle shaft.

The cost and viability of this system was determined.



Results and Discussion

Total Cost $55.25

3D-Printed Model $44
Digital Thermometer $7
Gelatin $4
Psyllium $0.25

The described AR education tool can precisely place a virtual spine model at the desired physical coordinates and allows real-time visualization of a needle during procedural training. Limitations of the system include difficulty achieving depth perception, reliance on line-of-sight, and inability to detect needle distortion. Additional research on validity is needed.

References

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