

Short Commentary

Mixed Reality in Surgery

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Article Info

Received: Apr 13, 2023

Accepted: May 04, 2023

Published: May 11, 2023

Archived: www.jclinmedsurgery.com

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Keywords: Mixed reality; Minimally invasive surgery; Operating room; Holographic; Remote assistance; Medical training; Collaborative work; 3D images; Delphi study.

Introduction

Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) all have useful applications in the field of medicine. When it comes to using these spatial computing technologies intraoperatively, mixed reality has the greatest potential because it allows for interaction with both real and digital objects.

The COVID-19 pandemic in the “roaring 2020s” have propelled the world into the future of work, and organizations must innovate or be left behind. Mixed reality has graduated to the here and now and is successfully delivering critical value to organizations across sectors.

As well as helping patients directly, medical educators can take advantage of mixed reality solutions to train up new doctors and some organizations use mixed-reality technology to create holographic simulations of medical scenarios and allow the transfer of the knowledge into actual clinical practice. Students learn how to examine, diagnose, and treat patients in a low-risk environment that is as close to real life as possible, but devoid of real-life consequences. Even patients would be able to scroll through their own preoperative scans to see how the doctor will approach their case to ease their minds about their treatment and thus reducing the normal anxiety that occurs before surgery.

Today, these highly advanced tools for visualization are already in clinical use around the globe. They have a variety of uses, helping medical professionals with anything from teaching and training new clinicians to providing patients with a closer look at their diagnosis and treatment.

MR was first mentioned in 1994 by Paul Milgram, and is a blend of physical and digital worlds, unlocking the links between human, computer, and environment interaction and allows clinicals to do something that was previously unthinkable: be in two places at once.

Recent research has shown that with the use of advanced technological solutions such as MR, the spaces of the operating rooms tend to decrease and the number of professionals present during a surgery too, improving the efficiency in the use of resources in a hospital, whether they are human, of space, or technicians and materials and offering surgeons new preoperative planning tools, and a means to collaborate and share expertise across the globe.

MR is used to increase precision in some procedures. Before and during surgery, using MR headsets, surgeons can access all patient data, such as pathology results and imaging exams in a 3D rendered environment (including cross images) representing the anatomical structures of a concrete patient, with the possibility of superimposing and allowing the precisely identification of the lungs, bones, soft tissues, heart, and blood vessels or tumors and cancers that must be removed, keeping the view over the patient and keeping the hands free to perform the procedure. Surgeons can also do surgical planning, or implant systems and remotely interact with colleagues. All these functions are achieved without compromising sterility and have been demonstrated successfully.

Between January and February 2021, a consecutive case series of 13 orthopaedic surgeries were performed. These were performed by different surgical teams, 15 surgeons, across 13

Citation: Veloso R, Magalhães R. Mixed Reality in Surgery. *J Clin Med Surgery*. 2023; 3(1): 1093.

different countries. The procedure types performed were predominantly joint replacement surgeries. Surgical teams used the HoloLens V2 MR headset system. Each team was able to visualize and perform operation using holograms, share a visual representation of the operation in real time, thanks to which they had the expertise of their colleagues at a distance on various clinical cases; train their colleagues at a distance, thus enriching their surgical practice. Audio-visual MR footage from each surgery was then edited and then shown to expert panels from multiple international centres over a 24-hour period. Detailed feedback was obtained from the surgical teams involved using an electronic questionnaire: The overall surgeon satisfaction with the MR headset technology platform used was 52.9% reporting being very satisfied, and 47.1% satisfied and 94.1% surgeons reported that they would continue to use the MR headset technology in their future clinical practice.

During June 2022, based on a previous literature review, a preliminary Delphi study was performed to obtain the opinion of a panel of 22 experts from several hospitals in Portugal on the use of MR tools, such as the HoLoLens 2, in surgeries.

After two rounds of data collection, a consensus letter was signed. According to experts, the most useful areas are medical education and surgical planning.

As a future work, a scenario for surgeons and a scenario for nurses will be designed using HoLoLens2 that include some of the functionalities identified by the specialists in the present study and then applied in the context of the operating room. After its use in a simulation environment, a questionnaire of the usability of the tool will be presented to these professionals to assess the impacts of using these tools in performing surgeries.

The power of MR is very ample: reduce errors and rework and mitigate issue, streamline and accelerate processes (training an education), ensure operation continuity, protect worker health and safety, better attract, hire, and retain employees and improve bottom-and top-line business results [1-8].

Declarations

Conflicts of interest: The authors have no conflicts of interest to declare.

Financial support: This work has not received any contribution grant or scholarship.

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