Chapter 22
Introducing Mixed Reality for Clinical Uses

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ABSTRACT

The advent of mixed reality (MR) has revolutionized human activities on a daily basis, striving for augmenting professional and social interactions at all levels. In medicine, MR tools have been developed and tested at an increasing rate over the years, playing a promising role in assisting physicians while improving patient care. In this chapter, the authors present their initial experience in introducing different MR algorithms in routine clinical practice from their implementation in several neurosurgical procedures to their use during the COVID-19 pandemic. A general summary of the current literature on MR in medicine has also been reported.

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INTRODUCTION

Mixed reality (MR) allows to visualize the real world and holographic 3D objects at simultaneously. In medicine, the real-time interaction of these two elements may allow improved understanding of the human anatomy. Detailed knowledge of each patient's represents the mainstay for optimal surgical planning. This is especially true in neurosurgery, where the target diseases are frequently located into deep sited and critical regions of the brain, needed to be treated with concurrent preservation of adjacent functionally-intact brain structures to ensure patient's optimal quality-of-life and survival. While the currently available technology in daily neurosurgical practice allows physicians only to look at a distant monitors during real-time operations, mixed reality (MR) allows to visualize directly "through" the patient's anatomy. In this way, the patient's anatomy is perceived with a greater detail, and the surgical planning may be devised within the surgeon's mind with more confidence. The hybrid visualization of virtual objects and real-world's anatomy represents the most recent advancement, which further offers the ability to customize the surgical planning and to share it with the surgical team, the patients, and their family. In this chapter we present the MR applications performed at the department of neurosurgery of the Cannizzaro Hospital, Catania, Italy, and in the two departments of C19-ICU unit and clinic for Vascular and Endovascular Surgery of the University Clinical-Hospital Centre "Dr Dragiša Mišović-Dedinje", Belgrade, Serbia.

BACKGROUND

The hardware that we use is HoloLens 2 (HL2) (Microsoft TM). It is a head-mounted display unit connected with a remote cloud for images reconstruction and audio-video storage (Figure 1).

Figure 1. HoloLens 2 (HL2) (Microsoft TM)

The headset can be adjusted on the user head and tilted up, down, forward, or backward through a posterior crown (Davies, 2015). The anterior part of the device contains several sensors and their related hardware, including the processors, cameras and projection lenses. The visor is dark-coloured and includes