



What is the future of minimally invasive surgery in rhinology: marker-based virtual reality simulation with touch free surgeon's commands, 3D-surgical navigation with additional remote visualization in the operating room, or ...?

Ivica Klapan^{1*}, Alen Duspara², Zlatko Majhen³, Igor Benić⁴, Milan Kostelac⁵, Goranka Kubat⁶, Nedjeljka Berlengi⁷

¹School of Medicine, Josip Juraj Strossmayer University in Osijek, Osijek, Croatia, EU.

²Klapan Medical Group University Polyclinic, Zagreb, Croatia, EU.

³Faculty of Electrical Engineering and Computing, University of Zagreb, Zagreb, Croatia, EU.

⁴Avanza, Zagreb, Croatia, EU.

⁵Juraj Dobrila University, Pula, Croatia, EU.

⁶Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Zagreb, Croatia, EU.

⁷Sunce Polyclinic, Zagreb, Croatia, EU.

Abstract

The navigation-Leap Motion-virtual endoscopy and virtual surgery suggests that real and virtual objects definitely need to be integrated by use of real 'in the air' control with simulation of virtual activities that requires real-time visualization of 3D-virtual endoscopy motions, following the action of the surgeon that may be moving in the virtual reality area. It is achievable with simple hand gestures of the surgeon, which do not differ in any way from all other natural everyday hand or body movements. In this way, the surgeon can predict the course of the surgery. He 'travels' through the virtual space, 'plays' without additional body, head and/or hand gesture changes. Simply, solely with his gaze, the surgeon coordinates his right hand movements, thus enabling, with contact free commands, the course of their preference or needs through the world of 3D-model, virtual endoscopy or virtual surgery, without stopping the endoscopic procedure in process (the endoscope is held by the left hand in the real surgery field). With this, all assumptions that the surgeon/tele surgeon is positioned in this virtual world which they entirely control but which realistically does not exist are achieved.

Keywords: Virtual reality; Leap motion; Marker-based virtual reality simulation; Gesture control; Virtual endoscopy; Virtual surgery; Tele surgery; Telemedicine

Introduction

As one of the 3D-CAS [1] (computer assisted surgery) originators and pioneers in Tele-3D- NESS [2, 3] (navigation endoscopic sinus surgery), having implemented these novel technologies for more than two decades now, occasionally we found it impossible to get an ideal perception of the surrounding world of head anatomy during real operations (nose, sinuses, base of the skull), in spite of using the latest technologies (modern CAS/NESS [4] realistic simulations of 3D volume rendering of the real intra operative anatomy, VE/virtual endoscopy, VS/virtual surgery, etc). As we know, this must be feasible completely and throughout the operation time.

Therefore, we understood the need to define a new surgical approach which would entirely satisfy the demands of the surgeon to have the impression of the presence in the virtual world of the human head anatomy and to navigate and manipulate (VS) with the virtual anatomic non-existing environment [5]. Consequently, we improved

the application of the touch screen, voice control and intelligence feedback in the OR (operating room; since 2013), with the application of the hardware and original SW (software) - solutions that enable the surgeon to touch free ('in the air') 3D simulation and motion-control of 2D and 3D-medical images, as well as VE and VS, in real time [Figure1]. For this, until now new and in many ways unique but very simple application, fast and realistic visualization of medical objects in the OR with virtual and realistic planning of the course of the future surgical procedure [6, 7] we did not feel the need to form a separate IT (information technology) control center that would control the aforementioned processes in the OR.. We did not need additional IT-personnel, equipment or cables in the OR, or additionally designed plug-and-play consoles that are currently in the phase of testing in the world for similar needs [8]. We concluded, according to long lasting experience and multiple testing in the OR, it to be unnecessary and potentially dangerous, primarily because during continuous usage there is the need for constant changes in the position of the body, head and hands of the surgeon in relation to the endoscopic display of the operative/surgical field in the patient's head operative/surgical monitor-LM controller, which severely impacts the surgeon's perception, focus, orientation and movements in the real world in correlation to the virtual environment, and vice versa. Knowing this, let us to question the surgeon's complete understanding

*Address for Correspondence: Ivica Klapan, Klapan Medical Group University Polyclinic, Ilica 191A, Croatia, Tel: 00385-91-737-9998; Fax: 00385-1-2222-736, E-Mail: telmed@mef.hr and poliklinika@poliklinika-klapan.com

Received: September 19, 2017; Accepted: October 23, 2017; Published: October 24, 2017.