Virtual Reality Device Applications in Telepresence and Robotic Surgery Mentoring: Initial Experience of a Prostate Cancer Referral Center

Evan Patel, Patrick McGuire, Ela Patel, Travis Rogers, Marcio Moschovas, Abdelrahman Jaber and Shady Saikali*

Global Robotics Institute, AdventHealth, Celebration, FL, USA

ISSN: 2832-4463

***Corresponding author:** Shady Saikali, Global Robotics Institute, AdventHealth, Celebration, FL, USA

Submission: June 22, 2023
Published: June 27, 2023

Volume 3- Issue 3

How to cite this article: Evan Patel, Patrick McGuire, Ela Patel, Travis Rogers, Marcio Moschovas, Abdelrahman Jaber and Shady Saikali*. Virtual Reality Device Applications in Telepresence and Robotic Surgery Mentoring: Initial Experience of a Prostate Cancer Referral Center. COJ Rob Artificial Intel. 3(3). COJRA. 000562. 2023.
DOI: 10.31031/COJRA.2023.03.000562

Opinion

Surgical education is an eternally evolving field with continuous integration of novel teaching techniques. The traditional concept of 'see one, do one, teach one' has naturally evolved into a more complex dynamic involving multiple bidirectional interactions between student and mentor [1]. As surgical procedures evolve quickly, even practicing physicians will require methods of learning that can satisfy their learning objective in the most practical way possible. This was traditionally achieved through conferences and workshops done in various locations, with surgeons travelling to participate. COVID 19 brought all the in-presence meetings to an abrupt halt, forcing innovative techniques and teaching platforms to be implemented allowing immersive and interactive learning models in surgical training while maintaining social distancing [2]. The interruption in physical presence during surgical teaching allowed us to examine the traditional model in place. For established surgeons, travelling to learn new surgeries forced them to take time off their practice as well as limited the ability for follow up and obtaining feedback on their newly acquired skill set [3]. Using virtual reality (VR) to achieve telepresence seems like a natural solution. Traditionally VR is used extensively in the consumer environment and mainly in the gaming industry. It has gained a popular reputation for its immersive experience and its ability to simulate realistic environments. Recently it has been more commonly used to teach basic or procedural surgical skills, with a demonstrated efficacy in improving skillset [4].

Our experience

In our high volume center, we perform over 1000 robotic radical prostatectomies a year by one expert surgeon so it seems natural for us to investigate an alternative and efficient method of broadcasting the surgeries. Our surgeon streamed a total of 10 cases over a 3 day period using a peer-peer experience collaboration platform allowing attendees to view a live 3D stream of an operating room [5]. A streaming cart was installed in the observation room near the performing surgeon and it was connected to the surgeon console, receiving visual feed from it. A small microphone was also installed on to the robotic console to receive audio input from the performing surgeon. This cart (the host computer) streamed both the audio and visual input to VR headsets that were used remotely by the attendees. The microphone built into the headsets was used to allow the attendees to converse with the performing surgeon in real-time and the audio feedback was played through the cart and not directly into the surgeon's ear. The audio feed from any headset was also heard by all attendees which creates a potential forum for live case discussion if need be. The video captured in 3D from the robotic console was then streamed as a 4K stereoscopic video with a bit rate of 10Mbps and a resolution of 4096x2048 [6]. The streaming cart was connected to the internet via ethernet, while the VR headsets were connected to the internet using the local

Wi-Fi connection available to each attendee. Different networks were used to connect to the internet on all devices (hospital local network, mobile phone hotspot, personal Wi-Fi network at home). We transmitted the surgery to a total of 6 different locations with 7 attendees at different locations on the hospital premises and 2 attendees at home.

The transmission was a stereoscopic 3D video of the expert surgeon performing the surgery in real-time and his live instruction to surgeons who were wearing the VR headset. The image feed was an identical view of what the performing surgeon was seeing in the robotic console. The audience were able to manipulate the images and adjust the size and graphics to suit them for optimal viewing. During the case, the observers were able to send questions and comments about the procedure clearly with minimal to no lag whatsoever and the performing surgeon was able to hear and respond to them in real-time. A survey was then carried out on the attending surgeons to gain feedback on their experience. They stated that they were able to engage more interactively and observe a more global view of the surgery than if they were present (due to limitation of number of consoles). They were able to simultaneously observe all maneuvers done by the surgeon on the console as well as the movement of the robotic arms within the patient.

The interactive experience allowed them to feel more engaged than in conventional live surgery streaming they were more accustomed to. From a technical aspect, the lag in transmission was perceived as minimal, so the live feed felt instantaneous to the observing surgeons. All surgeons were able to clearly hear and see all procedures performed. The performing surgeon also noted a smoother experience in surgery with minimal interruptions to discuss points (since attendees can see all aspects of the surgery).

Why use this technology?

During the COVID 19 pandemic, surgical education was impacted negatively [7]. With social distancing protocols in place globally, surgeons could not attend cutting-edge surgery to learn and adapt new techniques and as a result optimize patient care. Virtual and augmented reality present themselves as a natural alternative to in-person surgical education. This experience was previously tested in conventional orthopedic surgery with positive feedback [2]. Using VR to observe robotic surgery has a unique advantage over traditional surgical observation in that observing physicians can see the exact image the performing surgeon sees [8]. These benefits of VR can be combined with the benefits of surgical tele-mentoring, allowing the observing surgeons an optimal view of the surgery while speaking directly with the expert surgeon.

Another advantage and application of such technology is live mentoring in complications. An experienced remote surgeon could potentially guide another surgeon during a challenging case or while managing a complication. In this scenario, the same expert could potentially cover multiple streaming locations in a matter of hours from one location as well as reach surgeons in remote areas with the lack of surgical expertise on an urgent basis.

Further testing

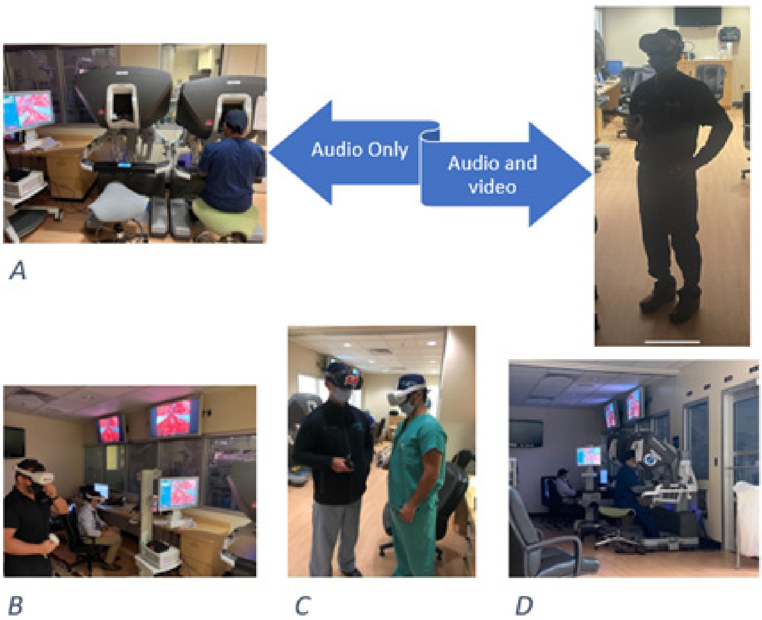

Figure 1: Representation of the setup while performing the surgery.
A. Direction of audio and visual transmission between surgeon and observer.
B. View of observers near the streaming cart.
C. Surgeons in different OR observing the surgery.
D. Positioning of cart with respect.

Some limitations of this initial project lie in the small group of surgeons attending this first case. We still need a larger sample size and further locations (e.g., multiple cities and countries) to make generalizable conclusions on the practicality of this technology. In addition, the streaming quality requires adequate network structure to support the live feed without delay, limiting remote observers' attendance to those with access to adequate internet speeds. For example, attendees on the hospital network had more obstacles to connect to the local network than attendees at home or on a personal hotspot network. However, some groups described remote robotic procedures using 5G connections with satisfactory outcomes. We believe that 5G and next generations of mobile internet upgrades will overcome the delays [8]. We believe that using commercially available virtual reality tools is a feasible option to transmit and teach surgical techniques in robotic surgery (Figure 1). The technology is a financially viable alternative to traditional in-person surgical observation and can potentially reach several surgeons from different places simultaneously. However, this is an initial trial and experiences with a larger number of attendees streaming to various networks and locations need to be done to assess and solidify it as a universal option.

References

1. Kotsis SV, Chung KC (2013) Application of the see one, do one, teach one concept in surgical training. Plast Reconstr Surg 131(5): 1194-1201.

2. Bailey SKT, Petterson SC, Friedland R (2021) Validation of live virtual reality for remote surgical education: A usability evaluation in orthopedic surgery.

3. Bailey SKT, Dean M (2020) Remote solution for immersive surgical mentoring. Med Educ 54(5): 485-486.

4. Raison N, Harrison P, Abe T, Aydin A, Ahmed K, et al. (2021) Procedural virtual reality simulation training for robotic surgery: A randomised controlled trial. Surg Endosc 35(12): 6897-6902.

5. https://www.immertec.com/

6. Celebi KC, Bailey SKT, Burns MW, Bansal K (2021) Is virtual reality streaming ready for remote medical education? measuring latency of stereoscopic VR for telementoring. Proc Hum Factors Ergon Soc Annu Meet 65(1): 757-761.

7. Patel E, Mascarenhas A, Ahmed S, Daniel S, Isabella B, et al. (2021) Evaluating the ability of students to learn and utilize a novel telepresence platform, proximie. J Robot Surg 16(4): 973-979.

8. Wagner OJ, Hagen M, Kurmann A, Horgan S, Candinas D, et al. (2012) Three-dimensional vision enhances task performance independently of the surgical method. Surg Endosc 26(10): 2961-2968.