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Training for plastic surgeons with Apple Vision Pro

Entrenamiento para cirujanos plásticos con Apple Vision Pro

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1. Introduction

Virtual education refers to the use and development of teaching programs through cyberspace. This modality has been implemented since 1999 and the applications have been improved and developed over time. In 2007, the Association of American Medical Colleges (AAMC) published recommendations and guidelines for incorporating educational technologies in medical schools, explaining that this methodology provides a safe and controlled teaching space, tailored to individual needs and standardized assessments. (1). On June 5, 2023, Apple introduced a revolutionary device called Apple Vision Pro (AVP). Susana Prescott, who is the vice president of Apple said: "AVP redefines what is possible in a computing platform. Developers can start building visionOS applications using the powerful frameworks they already know and take their development even further with innovative new tools and technologies like Reality Composer Pro, to design completely new experiences for their users" (2).

2. How do Apple Vision Pro work and what is its relationship with surgery?

According to the company, Apple Vision Pro is a spatial computer that combines digital content and applications in a physical space and allows navigation using eyes, hands and voice. AVP are lenses that handle mixed reality, which means they use virtual reality and augmented reality. It has an added transparent video feature that transmits the real world through cameras to the screens in front of the user's eyes. In addition, it has two buttons on the top, one static and another rotating called "Digital Crown" (figure 1), which allows you to mix the digital content with the physical environment at will, so there is no need to remove the lenses to return. to reality (3). Immersive technologies have been used by surgeons and residents as a tool for the practice of surgical procedures, to achieve greater precision, reduce surgery times and improve patient outcomes (3). The VisionOS software is the world's first space operating system, allowing AVPs to interact with digital content in physical space by performing "gestures" directly with the user's hands (2). In addition, it has "Environments" or "environments" in Spanish, which is an application that allows you to transform the physical space where the user is, being able to recreate a virtual operating room while using other applications (figure 1) (4).

AVPs have a latency time of about 0.11 seconds (sec), this is the time it takes for the system to process a command, which provides greater reality when using this device. Previously, the latency time standard was ~0.40 sec, so Apple, in addition to beating this

time, also improved the resolution, the perception of reality and prevents the sensation of vertigo for users who use it (5), resulting in a device with excellent performance for jobs that require a lot of precision such as plastic surgery. The 3D camera would allow the surgeon and the resident to see in real time photos and videos of patient information, imaging studies that have been performed, procedure guides and capture real spaces by pressing the top button and/or Digital Crown depending on the situation. desired at the moment, and thus be able to document the step by step of the surgeries, which even makes it possible for surgeons to evaluate the surgical techniques and thus be able to make corrections if required. It also implements "Visual Search" and "Siri" to identify objects in photos and videos, and perform voice consultation if needed. This is useful for plastic surgeons who have their hands full with surgical instruments. And to achieve a more complete experience, it also includes the "facetime" application that allows you to make videoconferences in real time and share what is being done with other surgeons, being able to make queries, clarify doubts, ask for instructions and also as a method of evaluation. residents. It should be noted that battery life can be an obstacle, as it currently lasts approximately 2 hours (3).

3. What applications are useful for surgeon training?

APVs and their revolutionary technology have entered the surgical area where their innovative products have been used to improve patient outcomes, contribute to cost savings and develop research opportunities. In this way, the AVPs seek to transform clinical and surgical education, for which different applications have been created that are now available for use. For example:

- *myMako* is an application that allows surgeons to view and review surgical plans pre- and intraoperatively, allowing them to review images and evaluate changes if necessary.
- The *Fundamental Surgery app* provides surgical training through virtual simulations in controlled spaces.
- The *Medivis app* improves medical imaging increasing surgical precision and patient care.
- The *Visage Ease VP application* that was created to transform healthcare in areas such as surgical planning, education, training, allows you to view and evaluate medical images efficiently.

It should be noted that, to have better results, surgical simulations must be complemented with academia, that is, scientific texts and articles, human anatomy, surgical instruments, among others. This type of knowledge can be found in applications such as:

- *CyranoHealth* was designed for use by healthcare workers in onboarding and training new medical equipment, helping to improve confidence and reduce anxiety for frontline workers.
- *CollaboratOR 3D*, which improves the surgical learning opportunity by allowing surgical teams to expand their training.
- The *Cinematic Reality app* allows surgeons, residents and patients to view interactive, immersive holograms of the human body captured through medical scans in their real-world environment.
- *Falcon Vue* allows you to view spatial medical images in all modalities.
- *Epic Spatial Computing* allows medical staff to complete charts, review laboratory data, communicate via secure chat (6).

- *Complete HeartX* is an educational app for doctors and medical students, offering hyper-realistic 3D models, animations of the heart and other medical topics; which helps visualize and understand medical problems (2-3).

These simulations with immersive technologies offer advantages over the traditional study with cadavers, since the virtual anatomy can be molded based on examinations of real patients, providing broader and more specific training, they are also more profitable and have unlimited use (7).

Figure 1: (Source: Own creation.) Illustrates a resident with AVP, creating an operating room environment, performing surgery while making a detailed review of the anatomy he is operating on and who is accompanied by videoconference with his teaching surgeon while evaluates him.

4. Conclusions

- We are entering a generational change and although we are in the early stages, AVP is a cutting-edge device and its functions will go much further as more developers in the area of health and surgery join in.

- In the academic and surgical areas, the development of this immersive technology represents a useful tool to practice surgical procedures and thus have more precise, efficient and individualized results for each patient.

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