

Plastic surgery in the metaverse: challenges and opportunities

The metaverse is a digital world where individuals can interact with one another through avatars, creating a “parallel reality” to the physical world. This concept has garnered significant interest in recent years, with a growing number of applications in various industries, including healthcare and education^[1,2]. In the field of plastic and reconstructive surgery, the metaverse presents unique challenges and opportunities. This essay will explore the potential uses and the potential barriers of integrating the metaverse into plastic surgery practice, education, and consultation.

Opportunities

1. Improved patient education, treatment, and consultation

The metaverse allows for immersive patient education through virtual consultation rooms and interactive simulations; this technology can help patients to better understand the surgical procedures they may undergo, leading to more informed shared decision-making^[2]. Patients can visualize their potential outcomes, explore different treatment options, and gain a deeper understanding of the risks and benefits associated with each procedure. Consequently, patients may feel more confident and comfortable with their decisions, resulting in increased satisfaction and potentially reduced anxiety. In straightforward terms, this will lead to overall happier patients and overall fewer medico-legal encounters, meaning this is a benefit to both patients and the profession.

Moreover, consultations can be conducted remotely, allowing patients to access expert advice regardless of their geographical location^[3]. This is particularly beneficial for patients living in rural or remote areas where access to specialized care is limited or impossible to access. It also reduces the burden on patients who may struggle to travel long distances for consultations and follow-up appointments.

2. Better pre-operative planning and simulation, and therefore patient outcomes

Pre-operative planning is a rapidly advancing space within plastic and reconstructive surgery. The most commonly used techniques currently are still reliant on visible markings, visualization, imaging, and anatomical knowledge and understanding, however with the rise in popularity of 3D printing, it has become easier for surgeons to visualize treatment plans, make necessary flap measurements and even educate patients on their surgeries^[4]. Moving forward into the future pre-operative planning in plastic surgery can be further improved through the use of metaverse technology. Virtual and augmented reality simulations enable surgeons to visualize the expected outcomes of a procedure before it is performed, enhancing surgical planning and reducing the likelihood of complications^[5]. By practicing various techniques and assessing the impact of different surgical approaches, surgeons can optimize their plans to achieve the best possible outcome for the patient.

Furthermore, the use of metaverse technology in pre-operative planning can facilitate better communication between the surgical team, improving efficiency and reducing the risk of errors^[6]. Overall, these improvements in planning and communication can lead to better patient outcomes and increased satisfaction with the patient’s surgical results.

3. Improved professional training and education and global surgery

The metaverse offers the potential to revolutionize medical education, including the training of plastic surgeons. Most of the medical schools in the UK use blended educational methods, whereby traditional lectures and tutorials are combined with virtual activities such as quizzes and supplementary online lectures; medical school teaching, and junior doctor training can be enhanced through immersive learning experiences, such as virtual operating theatres, allowing trainees to practice surgical techniques in a controlled environment^[7]. These virtual experiences can provide trainees with valuable feedback on their performance, allowing them to refine their skills and improve their surgical technique. In addition to this, the volume of exposure to different cases and niche skills can be increased, leading to more confident and prepared junior trainees, given that metaverse simulations have an appropriate level of fidelity. Thinking beyond this, perhaps the metaverse can improve multidisciplinary learning and reflection by recreating previous surgeries to be watched in multidisciplinary meetings in the metaverse to foster open discussion and suggestions for improvements in the future.

Moreover, the metaverse facilitates collaboration between institutions worldwide, enabling the sharing of expertise and resources to improve the quality of surgical training globally^[8]. Through international cooperation, trainees can gain exposure to a diverse range of surgical techniques and approaches, broadening their knowledge and skill set. The metaverse can also help address disparities in access to surgical education, providing opportunities for trainees in low-resource settings to receive high-quality training and mentorship.

4. Enhanced remote collaboration for both clinical and academic activities

Remote collaboration is made possible by the metaverse, providing opportunities for plastic and reconstructive surgeons to consult with colleagues, exchange knowledge, and collaborate on research projects, regardless of their physical location^[9]. This enhanced collaboration can lead to increased innovation and the development of new techniques, benefiting the entire field of plastic surgery.

For example, a surgeon in one country could seek the advice of an expert in another country on a complex case, leading to better patient care and outcomes. Furthermore, the metaverse enables faster dissemination of new research findings and innovations, facilitating the adoption of evidence-based practices across the field.

Challenges

1. Privacy and data security

As with any digital technology, the metaverse presents potential risks to patient privacy and data security. Ensuring the protection of sensitive patient information is paramount, and robust measures must be implemented to prevent unauthorized access or data breaches^[10]. This includes the development of secure communication channels, stringent authentication protocols, and ongoing monitoring of data access and storage systems^[11]. The collaboration between healthcare providers, technology companies, and regulatory bodies is crucial in developing comprehensive data security frameworks that can adapt to the rapidly evolving digital landscape.

A lack of public trust that their data is protected due to a history of technology companies selling private user data to marketing companies may slow down the adoption of metaverse technology in healthcare; therefore, appropriate measures must be taken to reduce the risk of this happening.

2. Technical limitations

The integration of the metaverse into plastic and reconstructive surgery is not without technical limitations. High-quality virtual environments require advanced hardware and software, which may be expensive and difficult to access for some institutions, particularly those in low-resource settings^[12]. Additionally, the effectiveness of metaverse-based training and consultation is dependent on the availability of stable, high-speed internet connections, which may not be universally accessible^[13]. To overcome these challenges, it is essential to invest in the development of cost-effective, scalable solutions that can be adapted to various settings, ensuring equitable access to metaverse-based resources.

3. Resource limitations

The implementation of metaverse technology in plastic and reconstructive surgery requires significant financial and human resources. The development, maintenance, and updating of virtual environments and simulation tools can be costly and time-consuming^[3]. Furthermore, the training of healthcare professionals to effectively use these tools may require additional resources, including time and specialized instruction^[14]. To address these challenges, healthcare institutions and governments must consider long-term investments in metaverse technology and allocate resources for the continuous training and development of healthcare professionals in the digital age.

4. Managing patient expectations

Finally, it is essential to consider that the use of the metaverse in plastic and reconstructive surgery may lead to unrealistic patient expectations regarding functional and aesthetic surgical outcomes^[5]. Virtual simulations can provide patients with a visual representation of possible results, but these simulations may not always accurately represent the actual outcome following surgery^[1]. It is essential for healthcare providers to manage patient expectations and ensure that they understand the limitations of virtual simulations and the potential variability in surgical outcomes. This may involve refining simulation tools to better represent real-life outcomes, as well as emphasizing the importance of open communication between patients and their healthcare providers.

In conclusion, the metaverse holds significant promise for the field of plastic surgery, offering numerous opportunities to improve patient education, treatment, and consultation, as well as enhancing surgical training and facilitating collaboration among professionals. Additionally, it provides the opportunity for surgeons and students to innovate and be entrepreneurial for the betterment of patient experiences with plastic surgery and the profession. However, challenges such as ethical considerations, privacy and data security, technical and resource limitations, and managing patient expectations must be addressed to ensure the successful integration of the metaverse into plastic surgery practice. By carefully considering these challenges, managing them to limit their impacts, and capitalizing on the opportunities presented, the metaverse has the potential to revolutionize the field of plastic surgery and enhance patient care.

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