

EDITORIAL

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Simulation in dentistry

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According to Greek mythology, the god Apollo instructed the centaur Chiron, who became his apprentice and learned, among other disciplines, the arts of medicine and healing. Chiron, in turn, took Asclepius as his apprentice and instructed him in these same pursuits. These teachings came to be known as the healing arts, that is, the teachings of Chiron (1). In ancient times, it was customary for apprentices to enter the profession at a very young age (2). During the early years, the apprentice was responsible for transporting, washing, and sharpening instruments, as well as assisting with the activities performed by the master. After years of support and delegating responsibilities, it was time to begin supervised care. During the training process, the apprentice's living expenses were covered by the master, which generated a debt that, together with the cost of the instruments required to practice the trade, had to be repaid once the apprentice became self-sufficient in his or her professional practice, a process that could take eight or nine years. Upon completion, the apprentice was released from this obligation, became the owner of their instruments, and was authorized to work without supervision, even having the opportunity to take on an apprentice and become a mentor.

An important characteristic of this type of training was that learning took place directly with the patient, so that the apprentice's errors were corrected, as much as possible, by the mentor. However, in many cases, the error was irreversible, and the patient could suffer severe harm or even die, causing distress for both the apprentice and the mentor. For many years, the value placed on human life was influenced by factors such as slavery and different socioeconomic statuses; therefore, the death of a patient—even if it had an impact on the mentor-apprentice relationship—was not always considered a serious matter.

The training of dentists as we know it today can be attributed to the efforts of Dr. Pierre Fauchard, who published *The Surgeon Dentist* in 1728. This work laid the foundation for the establishment of the Baltimore College of Dental Surgery in Maryland in 1840. This school introduced a different approach to the education of dentists. The mentor was replaced by professors, who became responsible for supervising groups of apprentices, who came to be known as students. The training period was shortened, and students became responsible

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for their own financial support. In essence, this new organizational structure created a more open and accessible educational system, but it also reduced the support provided by the mentor to the apprentice, to the detriment of the patient, who continued to bear the consequences of errors inherent to the learning process.

In 2004, the World Health Organization (3) launched the World Alliance for Patient Safety, to reduce adverse events associated with healthcare and, consequently, those occurring during the learning process. In this context, clinical simulation emerged as an educational methodology that, in addition to its academic benefits, contributes to patient safety. Rather than demonizing errors, it uses them as valuable learning experiences in an environment that closely resembles reality, providing safety for patients, students, faculty, and the institutions responsible for their training. In the 1960s, the first simulation-based practices for cardiopulmonary resuscitation were introduced. Basic simulators soon evolved into more complex systems, accompanied by increasingly sophisticated simulation scenarios and higher levels of fidelity. Thus, the educational methodology associated with the use of simulators and constructivist teaching techniques makes it possible to use errors as learning tools without the negative consequences to the patient's physical health. Patients should only be involved once students have achieved an optimal level of competence, thereby establishing a framework to protect the patient's mental health. Therefore, better training in technical and nontechnical skills within safe, standardized, and controlled environments improves learning outcomes and ensures patient safety (4, 5).

Dentistry has been closely associated with simulation since its beginnings, particularly in the development of technical skills. However, higher-fidelity simulation devices have become increasingly available and enable faculty to train students in the laboratory without exposing them to ethical dilemmas arising from the need to balance students' training requirements with the actual healthcare needs of patients who participate in teaching activities during clinical care.

Today, we have access to devices that enable the creation of more reliable and higher-fidelity simulation environments. However, it is important to emphasize that simulation is not merely the device itself; rather, it is a technique that allows educators to train students by exposing them to complex situations in which they must learn to make decisions and perform appropriate actions. Therefore, we should focus on training faculty in effective simulation techniques that facilitate student learning without placing students in situations in which academic requirements may conflict with patients' actual healthcare needs, while adhering to the ethical principles of beneficence and nonmaleficence (6).

Artificial intelligence is a tool that facilitates the creation of improved simulation environments and scenarios, increasing fidelity and bringing us ever closer to reality. This technology will enable better student training, allowing students to approach dental care more responsibly and ethically, receive more comprehensive preparation, and provide greater safety when treating a patient for the first time.

Thus, simulation is an educational strategy that supports comprehensive clinical training. These are achieved not only through simulation devices but, more importantly, through careful planning of scenarios, preparation of simulation environments, execution of actions, and appropriate individual feedback or debriefing exercises that allow educators to explore the underlying causes of errors and implement the necessary corrective measures. This makes the simulation technique itself more relevant than the technical device known as the simulator.

As schools of dentistry, educational institutions, mentors, and educators, it is our responsibility to improve simulation, recognize that this methodology encompasses much more than the use of devices, and address the challenge of training faculty who can work in multidisciplinary teams to design simulation experiences that ensure safer and more ethical learning for both students and patients. Simulation and practice-based learning, as educational strategies, enable learners to progress along the knowledge spiral, reaching a higher level with each challenge until they achieve mastery of their profession (7).

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