

Airway Management With Simulation-Based Learning Models for Oral and Maxillofacial Surgeons

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INTRODUCTION

Oral and maxillofacial surgeons have been practicing office-based anesthesia for nearly 100 years. With the responsibility of office-based anesthesia comes the requirement that oral and maxillofacial surgeons have a strong familiarity and competency with airway management. Training and education in our field for airway management has progressed significantly in the last 8-10 years as the focus has shifted away from lecture-based curriculums. One of the most significant steps in training development has been the implementation of simulation-based curricula for continuing education, residency training and office-based emergency courses for the dental profession.¹

To Err Is Human, was released by the institute of medicine (IOM) in 1999 and estimates show medical errors in hospitals account for injuries approximately 3% of hospital patients and perhaps 100,000 deaths a year in the United States.² In the years after this article's release there was a push to advance and improve medical education. As training progressed and new

techniques were developed, the authoritarian model for teaching is starting to be replaced by the facilitator model that promotes self-learning and develops critical thinking. Multiple studies have demonstrated that retention of knowledge and self-actualization through exploration with the use of simulators is ideal for teaching a scientific and medical curriculum.³

Simulation-based training allows health care professionals to gain "hands on" experience without the fears or consequences of harming real patients. Research has demonstrated that a medical simulation, specifically airway training, has been found to enhance clinical competency, improve patient safety and increase clinical confidence.⁴ It offers an opportunity to hone airway management skills, practice lifesaving emergencies simulations, and develop muscle memory with various techniques. These simulations now offer individuals the opportunity to practice the necessary skills required to manage office based airway emergencies that could not be practiced in the past and skills were only mastered with experience from true patient based emergencies. The main objective of this article is to highlight

the importance of simulated training as the optimal teaching method for airway training for the oral and maxillofacial surgeon and review the success of airway simulation training in other health care professions.

MEDICAL SIMULATION

The collaborative educational movement is underway in oral and maxillofacial surgery, which focuses on the proficiency in clinic skills with application of acquired knowledge. Clinical skill development is the single most essential module for development and retention knowledge. As oral and maxillofacial surgeons it is vital we continue to maintain strong clinic skills along with our vast area knowledge.



Figure 1.

Simulation is a generic term that refers to "Artificial representation of a real world process to achieve educational goals through experiential learning." Although new to the oral and maxillofacial surgery world, simulation training has been around for many years, specifically in aviation training with significant success for which literature states dates back to the early 1900s. In medicine, the first articles

describing simulation to practice endotracheal intubation was published in 1969.⁵

Simulators are classified into different categories by resemblance to reality. Airway management simulation is typically instrumented with a computer-based model, simulation in situ, cadavers, and porcine tracheas. My experience with porcine tracheas are that they do not provide a realistic human airway comparison. The lower-fidelity trainers may lack the situational content and realism but are beneficial in teaching and honing basic technical skills. The high-fidelity simulations combine high-tech computers that relay and control realistic physical signs and symptoms to provide real time situational feedback to the trainees' actions during simulated events. They closely resemble reality. Moderate fidelity simulators are somewhere in between. The entire spectrum of simulators are appropriate and their application depends on the specific task and the experience of the student.⁶

So where are we with simulation-based airway training? High-fidelity simulators with computer-based software can cost \$400,000. These high-end simulators are not needed when discussing airway management training exclusively. Specific low to moderate fidelity airway simulators are adequate for training that focuses on technical skill retention and improvement. The high-fidelity simulators do resemble emergency scenarios much more accurately and are extremely useful in office-based emergency training. However, if low to mid level simulators are used with a little imagination and well-planned scripts, they prove adequate for emergency training.

OMS CLINICAL COMPETENCE

Office-based anesthesia began to rise nearly 50 years ago to accommodate low-cost alternatives for minor surgical procedures. A systematic review published in 2017 investigated the death rate amongst patients undergoing outpatient anesthesia for dental treatment. The results of the review determined that the mortality rate from 1955 to 2012 was 1:327,684. The review also noted that the mortality rate per million dropped in half from 1955 to 2012, 6.2 to 3 per million.⁷ In order to maintain and continue to improve this safety tradition, it is important that airway management skills are maintained and improved. As office based anesthesia providers a certification in BLS/ACLS/PALS is required and necessary for patient safety. Currently, there are courses offered that combine simulated airway training integrated BLS/ACLS/PALS which prove to be an effective way to combine didactic recertification with practice of airway management skills.

Continuing education courses and oral and maxillofacial surgical training programs should ensure surgeons have opportunities to improve current skills and learn new techniques for airway management using simulated model training. In order to consistently monitor and maintain patient safety it is the responsibility of the surgeon to educate staff, assign emergency responsibilities, and conduct at least a bi-yearly office emergency practice drill. One of these exercises should be done in a simulator setting to offer the chance to have the most realistic drill and accurate assessment of the emergency response

skills of the entire team. The surgeons of today and tomorrow need to be superiorly skilled clinically with the urgency for ongoing improvement in all aspects of OMS instead of the routine lecture based BLS/ACLS/PALS lecture and exam-based courses.

A study published in 2019 evaluated the effectiveness of a simulation-based course in teaching dental students management of dental office emergencies. The study reported that the simulation course improved outcomes and was determined an effective method at teaching office based emergencies.⁸ This is consistent with a study published in 2013 that determined that pediatric residents had increased cognitive knowledge, procedural proficiency and comfort in pediatric resuscitation when simulation based training was utilized.⁹ In 2007, it was demonstrated that simulation based training is more effective than traditional methods in teaching airway management skills and maintenance of the skills.¹⁰

In 2014, AAOMS jump started a nationwide anesthesia simulator-based training program and is currently developing a sim lab at AAOMS headquarters. All of the current research supports that advantages of simulated training include: ¹¹

- Demonstration of symptoms that require action
- Increased information retention
- Ability to continue and repeat practice
- Invasive “hands on” experience without morbidity and mortality
- Exposure to all airway issues requiring treatment
- Implementation of didactic knowledge
- Opportunity for consistent learning

- Identification of weaknesses
- Practice using medical equipment
- Immediate feedback with debriefing sessions and video analysis

SIMULATED AIRWAY TRAINING DISCUSSIONS

A difficult airway is typically recognized as one of the most challenging situations facing anesthesia providers, including oral and maxillofacial surgeons. This is a fundamental skill that needs to be mastered. Loss or inability to maintain an airway is still a significant source of morbidity and mortality among patients receiving anesthesia.^{12, 13} One way to maintain readiness for airway emergencies is to initiate, perform, and implement simulation-based airway training for surgeons and staff. Many studies have demonstrated that management of difficult airways is significantly more difficult in an environment that is outside of the controlled operating room with up to a 10 fold increase in difficult airways prevalence.¹⁴ For a sedation-based office practice, I would argue that this might be the most important technical skill needed in our field.

We are continually focused on always improving patient safety and maintaining airway management skills, and using simulators is becoming the standard by which other training methods are compared to.



Figure 2.



Figure 3.



Figure 4.

This diligent use of simulation for training has to be developed and implemented for training in both residency programs as well as continuing education in office-based emergencies. Evidence shows sim-based airway management training improves learner outcomes, increases knowledge retention, increases confidence when emergency skills are required and improved team dynamics.^{4, 12} Some have argued that simulation airways are not the best resource for training techniques specifically due to compromised anatomy with materials used. That may be true with certain simulators, however when compared to the alternative of knowledge-based exams, simulation is unbeatable in overall airway training. Multiple studies have demonstrated the efficacy, patient safety and enhanced retention of material that simulation-based medical training provides compared to traditional methods.⁵ At the University of Oklahoma we are fortunate to have a high-fidelity simulation module that is used for training the OMFS residents three times a year. At the dental school, a low and mid fidelity simulator is used to teach dental students management of medical emergencies in the dental office. My experience has demonstrated that a low-fidelity simulator is adequate for the pre-doctoral level. With the lower cost of the low-fidelity simulators, a surgeon might contemplate purchasing a unit for office-based emergency training.

During curriculum design, the clinically significant facts of the audience were determined. Differences were noted between the clinical goals of the OMFS residents and of the pre-doctoral dental students. In relation to the clinical goals was the foundation of knowledge, which allowed for expansion and retention during simulation training. To confirm that the

simulation training is appropriately addressing the clinical and didactic needs the course objectives and design are reviewed every 6 months. It has been demonstrated that with a well-planned simulation course, complex skills can be retained for over 1 year.¹⁵ If specific skills are not deliberately practiced appropriately, little or minimal improvement will be observed clinically during testing exercises. This is why simulation is ideal for practice. It provides a stable environment and conditions with the ability to repeat protocols and tasks without affecting patient safety. Positive reinforcement also can be used by the instructor, which improves self-efficacy. With simulation training practice we are no longer attempting to maintain certain skills, but actually attempting to improve skills. Environmental factors and team building also can be improved in simulation settings. These skills include: nonverbal training, understanding structural and mechanical elements, role identification, proper communication, and the ability to reassess the scenarios. Multiple studies have demonstrated that the use of simulation training can significantly improve the communications among team members during critical situations, which has been shown to decrease mortality by 18%.^{5,16}

Simulated airway training serves to bridge the gap between classroom didactic knowledge and applied practical experience with the acquisition and development of the necessary technical skills. Multiple studies have demonstrated analysis-based support for simulation training and recommended use by medical professions including oral and maxillofacial surgery.⁴ This will assist our profession in meeting and surpassing the constantly evolving health care demands. Thoughtful

oral and maxillofacial surgery curriculum design and educated, experienced instructors is the key to optimizing utilization of simulation-based systems. Due to the multiple advantages that simulation-based training can add to professional training it is my recommendation that when you are undergoing recertification of BLS/ACLS an integrated simulated-based course is utilized. When research on simulation-based training starts to focus on all the advantages and minimal disadvantages of simulation based airway training, the data will support this change in education.

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