The Development of Dental Anesthesiology As a Discipline and Its Role As a Model of Interdisciplinary Collaboration

Joseph A. Giovannitti Jr., DMD; Richard J. Montandon, DDS; Andrew Herlich, DMD, MD, FAAP

Abstract: The majority of dental procedures can be performed with an awake patient and the use of a local anesthetic, but when deep sedation and general anesthesia are needed, they typically are provided by those dentists with advanced training in anesthesiology, i.e., oral and maxillofacial surgeons and dentist anesthesiologists. Dental anesthesiology began with the discovery of anesthesia by a dentist in 1844 and has been recognized as a separate discipline in dentistry for nearly 70 years. Training over this time evolved from apprenticeships to one-year training programs, and in 2007, the Commission on Dental Accreditation (CODA) began accrediting two-year dental anesthesiology training programs. Since 2015, in recognition of the increasing complexity of the discipline, training has required three years of postgraduate study. The number of dentist anesthesiologists has grown with the increasing demand for anesthesia services by both the public and the profession. However, the present number of dentist anesthesiologists is not sufficient to meet the demand, so additional programs and growth in current programs are needed. Another valuable aspect of this discipline is its role as a positive example of interdepartmental collaboration since dental anesthesiology faculty, as members of a support discipline, typically work across many of the other departments in a dental school. This article reviews the history of the discipline, describes the educational goals and CODA standards for dental anesthesiology programs, using one program as an example, and discusses the needs and challenges that will shape the discipline’s development in the future.

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Dental professionals rely heavily on various anesthetic modalities to perform dental treatment. The majority of dental procedures can be performed with an awake patient and the use of a local anesthetic to block nerve impulses where painful stimuli are being generated. Dental patients exhibiting mild to moderate anxiety or a hyperactive gag reflex are more successfully treated with a conscious sedation technique, which can be accomplished with enteral sedatives, nitrous oxide, intravenous sedatives, or some combination of those techniques. Patients undergoing that level of sedation maintain their ability to at least respond purposefully to verbal commands, either alone or by light tactile stimulation. Patients with the inability to cooperate, higher levels of anxiety, the need for complex procedures, or special needs often require deep sedation or general anesthesia in order to receive the needed dental treatment. Deep sedation is a level of anesthesia on the continuum between moderate-conscious sedation and general anesthesia. General anesthesia is administered as intravenous medications, inhaled gases, or a combination of techniques. A patient treated under general anesthesia is unaware of what is happening during the procedure and is not arousable, even with painful stimulation. Deep sedation and general anesthesia are typically provided by those dentists with advanced training in anesthesiology, i.e., oral and maxillofacial surgeons and dentist anesthesiologists.

Dental anesthesiology has been in existence since Horace Wells discovered anesthesia in 1844. It has been recognized as a separate discipline in dentistry for almost 70 years. Initially, training in anesthesiology for dentists was by apprenticeship since no formal discipline existed. As more individu-
als received training and developed greater interest in anesthesia, training programs became more formalized and offered a one-year course of study. Many dentists received this training and went on to other dental disciplines or specialties, such as oral and maxillofacial surgery and pediatric dentistry. Those individuals who wished to practice and teach anesthesiology sought multiyear training opportunities. In the 1960s and ’70s, many such opportunities for dentists existed in hospital-based programs. As a result, a two-year training program was formalized, but as more dentists began competing with physicians for residency positions, training opportunities dwindled until only a handful of programs were available for dentists.

In 2007, the Commission on Dental Accreditation (CODA) agreed to begin accrediting two-year dental anesthesia training programs. In 2008, the University of Pittsburgh Advanced General Dentistry Education Program in Dental Anesthesiology was the first to receive this accreditation. Since then, ten programs have received CODA accreditation. There are many advantages to CODA accreditation, one of which is eligibility for access to funding through the Graduate Medical Education (GME) program. Under that program, residents receive a stipend, and funds flow to the sponsoring hospitals and dental schools. These educational programs, therefore, become self-sustaining.

Over the last several years, the body of knowledge has increased exponentially in dental anesthesiology with the advent of new drugs, regulatory mandates, technologies, and improvements in medicine that have significantly increased the number of medically complex dental patients. In response to this exploding knowledge base, medicine and nursing saw the need to increase the duration of anesthesiologists’ training. Dentistry followed suit, and as of 2015 all new residents in dental anesthesiology receive a CODA-mandated three years of postgraduate training. Aside from more time in the operating room, residents receive more off-service training in areas such as internal medicine, emergency medicine, cardiology, and critical care. They also have more time and opportunity for research, publication, and teaching, which better prepares them as dental educators and clinicians.

In 2015, the American Dental Education Association (ADEA) Council of Hospitals and Advanced Education Programs held a symposium to address conflicts over teaching and practicing procedures between disciplines and provide examples of successful collaborative models. One such model is the incorporation of dental anesthesiology into the dental school environment as an aid to curricular development for predoctoral and postdoctoral education. Its clinical capabilities act to support other disciplinary departments such as periodontics, pediatric dentistry, endodontology, oral and maxillofacial surgery, and special needs dentistry. Under this model, anesthesiology is an income generator that does not burden but enhances the financial stability of the institution. Additionally, dentist anesthesiologist faculty members serve as positive role models for those students interested in anesthesiology as a viable career option. After reviewing the history of the discipline, this article describes the educational goals and CODA standards for dental anesthesiology programs, using one program as an example, and discusses the needs and challenges that will shape the discipline’s development in the future.

**Dental Anesthesiology Educational Goals**

According to the CODA accreditation standards for advanced general dentistry education programs in dental anesthesiology, these programs are “designed to train the dental resident, in the most comprehensive manner, to use pharmacologic and non-pharmacologic methods to manage anxiety and pain of adults, children, and patients with special care needs undergoing dental, maxillofacial, and adjunctive procedures, as well as to be qualified in the diagnosis and non-surgical treatment of acute orofacial pain and to participate in the management of patients with chronic orofacial pain.” The overall goal of these programs is to educate residents in the primary areas of dental anesthesiology, patient care, and community service. Residents obtain didactic and clinical training while providing multidisciplinary comprehensive anesthesia services to a diverse population with various needs. The resident, under supervision, manages the delivery of anesthesia care to patients who require coordination of their overall health care issues, while recognizing and practicing the values of cultural diversity and professional ethics.

Dental anesthesia residents are educationally prepared to meet these goals through a comprehensive, three-year program that adheres to the six CODA standards. The next section summarizes and reviews these standards as they pertain to the
CODA Standards for Dental Anesthesiology

Standard 1: Institutional and Program Effectiveness

Dental anesthesiology advanced education is based upon the concept that dental anesthesiology is an integral and interactive part of total health care. The program is designed to expand the scope and depth of the graduates’ knowledge and skills in order to enable them to provide comprehensive dental anesthesia services to a wide range of population groups. An area of emphasis is the anesthetic management of patients with special health care needs. Patients with special needs have been largely mainstreamed into the community and are in need of specially trained providers capable of assessing and managing their dental needs in the office environment. Anesthesia providers with specific training in special needs patient care are an essential component of a community-based health care system.

At the University of Pittsburgh, the dental anesthesiology residency program is sponsored by the University of Pittsburgh Medical Center (UPMC) Medical Education Program (MEP) and is administered by the School of Dental Medicine (SDM). The UPMC MEP consists of stakeholders from all of the teaching hospitals, while the program director, based at the SDM, is responsible for the day-to-day activities of resident training. The UPMC Health System provides space, faculty, and resident support to allow the program to achieve its goals and objectives. Stipends for residents are fully funded by federal GME monies similar to other hospital-based dental programs.

The program’s mission statement is as follows: “The Department of Dental Anesthesiology is a group of highly committed individuals dedicated to the education and training of dental students, dentists, and dentist anesthesiologists in the best principles and practices of dental anesthesiology.” Its vision statement is as follows: “Our goal is to be the premier academic center for innovation and excellence in dental anesthesiology. We will:

• Foster ethics and professionalism as well as leadership through example.
• Dedicate ourselves to excellence in education, patient care, and research.
• Strive to always ensure the well-being and safety of all of our patients, with special consideration for children, the elderly and infirm, and those with special health care needs.
• Maintain and nurture our interprofessional associations.”

Standard 2: Educational Program

The program must provide a comprehensive didactic and clinical curriculum plan that is designed to achieve the competency requirements set forth in this CODA standard. Records of resident clinical activity must be kept in the form of case logs to track progress and to ensure requirements are being met. Resident performance is continually evaluated through written examinations, mock written and oral board examinations, faculty evaluations, case conferences, and journal club presentations.

Specific competency requirements must be met by the completion of the training program. In order to meet these competency requirements, at least two of the three years of the program must be spent in clinical anesthesiology training. A minimum of six months of this training must be devoted to dental anesthesiology. The minimum clinical experiences required of the resident after completion of three years are outlined in Table 1.

Standard 3: Faculty and Staff

The role of individual faculty members in supporting the mission of the university depends upon the specific missions of their departments or schools. At UPMC, all faculty members have the responsibility to commit themselves fully to their teaching obligations, to participate in the development of

Table 1. Minimum clinical experiences required in three-year dental anesthesiology programs as defined by the Commission on Dental Accreditation

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Minimum Clinical Experiences</th>
</tr>
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<tbody>
<tr>
<td>Total Cases</td>
<td>800 (500)</td>
</tr>
<tr>
<td>Intubated General Anesthetics</td>
<td>300 (200)</td>
</tr>
<tr>
<td>Nasal Intubations</td>
<td>50 (25)</td>
</tr>
<tr>
<td>Advanced Airway Management</td>
<td>25 (12.5)</td>
</tr>
<tr>
<td>Children Age Seven and Under</td>
<td>75 (50)</td>
</tr>
<tr>
<td>Patients with Special Needs</td>
<td>75 (50)</td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses are case requirements for the previous two-year training programs.
In addition to the three treatment areas in the department, there are six operating suites in the Center for Special Needs, two operating suites in the Department of Pediatric Dentistry, and one suite in the Implant Center. There are four equipped mobile carts that are used to provide sedation services in the oral surgery, endodontic, and phobia clinics. Secretarial and clerical assistance is essential for smooth program functioning. The residency coordinator has oversight of resident didactic and clinical schedules, credentialing, and general well-being. Additional clerical support is available for departmental clerical duties and administrative support.

**Standard 6: Research**

Residents must engage in at least one month of scholarly activity and present their results in a scientific/educational forum. At the SDM, anesthesiology residents fulfill this requirement by participating in or developing at least one research project, presenting their findings at a national meeting, or submitting one article to a dental, dental anesthesiology, or medical anesthesiology publication for review. From July 1, 2013, through June 30, 2014, dental anesthesiology residents at the SDM participated in one funded and one unfunded research project and published ten journal articles, three book chapters, and four abstracts.

**Role of Dental Anesthesiology in the Dental School**

Dental anesthesiology is a support discipline that is intimately involved in all areas of dental education. At the University of Pittsburgh SDM, the Department of Dental Anesthesiology is responsible for predoctoral didactic education in local anesthesia, nitrous oxide and enteral sedation, medical emergencies, and clinical medicine. The department is responsible for the assessment of clinical competencies in basic and advanced local anesthesia techniques, nitrous oxide administration, and the management of various medical emergency scenarios utilizing high-fidelity human simulation. In addition, a year-long selective course in intravenous moderate sedation with progression to competence is offered to qualified students. Another area of responsibility and competency assessment is the process of obtaining medical consultations. The department has developed criteria
for medical consultation. Faculty members work with individual students to obtain and discuss necessary medical information to make informed treatment decisions for medically complex patients. This activity provides needed interdisciplinary interaction between dental students and various medical professionals.

Dental anesthesiology faculty members are involved in many service capacities at the SDM including membership on such committees as Curriculum, Dean’s Council, Clinical Affairs, and Infection Control. The department is responsible for providing and maintaining current basic life support certification to all students, faculty, and staff and acts as first responders to all medical emergencies that occur within the SDM. A major service activity provided by the department is a sedation and anesthesia service for the patients of predoctoral students and residents in various specialties. Under direct supervision, dental anesthesiology residents and selected dental students provide these services for oral surgery, pediatric dentistry, special needs dentistry, general dentistry, and endodontic and periodontal therapies. In addition to supporting these other departments, these services generate income, averaging just under $0.5 million per year. During their allotted time at the SDM, the dental anesthesiology residents are given didactic and clinical teaching responsibilities that prepare them for future careers in dental education as these opportunities become available.

Residents are also actively involved in scholarly pursuits through participation in departmental research projects, faculty publications, and interdepartmental collaborations. For example, members of the department’s faculty are collaborating with the Departments of Pediatric Dentistry and Dental Public Health in a $2 million grant from the U.S. Health Resources and Services Administration. Anesthesia departmental support will be needed since this project involves advanced training in the management of special needs and underserved populations.

Discussion

There is a need for anesthesia and sedation services in dentistry, and the ability to care for patients with dental fear, special needs, and medical complexities is an essential part of dental practice. Dental students have recognized that dental anesthesiology is a growing discipline that is needed in their predoctoral education and represents a desirable future career option (see the statement from one student in Table 2). Most dental educators recognize the importance of anesthesia education, but logistical issues such as lack of adequate facilities and/or qualified faculty often preclude full incorporation of this educational modality into the predoctoral curriculum. In a 2005 national survey of general practitioners recently graduated from U.S. dental schools, 76.4% of the respondents perceived that their education in enteral sedation was below average or poor, and 67.9% perceived their education in intravenous sedation was below average or poor (Figure 1). However, a national survey of the Canadian population disclosed a high level of desire among dental patients for sedation and anesthesia across all disciplines.

Dental students must become adept at clinical modalities of anxiety control, such as nitrous oxide and enteral sedation, that can be easily taught in a predoctoral curriculum to a level of clinical competence. In this manner, students will be immediately able to identify and manage dental anxiety upon graduation, rather than wait to acquire the knowledge through continuing education at an added expense. In addition, when dental schools prepare for their predoctoral education accreditation site visits, they need to demonstrate how their basic science and clinical curricula have been integrated. Incorporating anesthesia and sedation education into the predoctoral curriculum facilitates this integration. Treatment decisions for patients requiring anesthesia or sedation will necessitate that students be able to clinically apply the basic science knowledge acquired in courses such as behavioral science, anatomy, physiology, pharmacology, and clinical medicine. Students may use these integrated skills while reviewing the patient’s medical and medication histories, performing a medical consultation, and selecting the appropriate anesthetic and sedation modality.

A five-year outcome assessment of perceived preparedness in dental anesthesia among graduates of the University of Pittsburgh SDM found that those who had participated in the anesthesia selective program reported feeling more prepared in more areas relating to anesthesia and patient care than their counterparts who received only basic anesthesia instruction. Specifically, graduates with additional anesthesia training reported feeling better prepared to assess medical histories and manage medical emergencies and were more willing to treat medically complex patients and those with special needs. In that study, 73% of those dentists who took the anesthesia selective provided care for patients with special needs, while only 50% of those who did...
Table 2. Statement from a DMD student about the value of dental anesthesiology

Today, the profession of anesthesiology is an indispensable and integral part of the world of medicine and surgery, yet most dental students do not receive the full benefit of this discipline in their predoctoral curricula. In this statement, I present a student’s perspective on why dental anesthesiology should become part of our education and why all my peers should learn the nuances of anesthesia and sedation in dentistry.

I will begin by relating my own experiences and struggles during my residency in pediatric dentistry in India. Behavior management is an essential tool for any pediatric dentist, but when it is the only medium you have for treating patients, it results in a frustrated dentist and disappointed patients. Every time I encountered a young patient or one with physical and mental disabilities or extreme fear, I was compelled to either use protective stabilization or recommend an expensive and extensive general anesthetic procedure. My decision to come to the United States, and in particular to apply to the University of Pittsburgh, was inspired by a need to fill this gap in my training. This rationale also applies to every general dentist or specialist who not only wishes to enhance his or her practice, but also provide a service to society by offering pain-free dentistry. The comfortable and competent care provided under sedation allows us to liberate patients who are trapped by the crippling fear of dental work or by medical and intellectual disabilities.

Another very practical and essential implication of anesthesiology is our ability to reduce stress and anxiety due to prolonged and often painful dental procedures. Most medical emergencies in dentistry are precipitated by these two factors, but dentists are often ill equipped to react quickly and efficiently. As a student who has dental anesthesiology in my curriculum, I have been exposed to comprehensive education and hands-on training for handling such adverse events. Under my faculty members’ guidance, I have learned to decode the implications of a patient’s medical history, obtain necessary medical consultations, and adroitly discuss treatment alterations with physicians. Additionally, by availing oneself of the highly competitive one-year selective program, predoctoral students in my school can become qualified to obtain a moderate conscious sedation permit.

Furthermore, I have observed the dental anesthesiology residents and faculty interact with members of other departments in the school, especially in the Center for Patients with Special Needs and the Departments of Pediatric Dentistry and of Oral and Maxillofacial Surgery. These departments have benefitted immensely from the easy availability of sedation options and the medical proficiency of the anesthesiology faculty. Personally witnessed this expertise in action recently when my teammate’s patient developed sudden chest pain. The anesthesia residents, who are always on call, were paged immediately, and they managed to competently contain the situation until the EMS arrived. All of these first-hand experiences and observations leave no doubt in my mind that an early introduction to anesthesiology is imperative for every dental student and that the establishment of CODA-accredited programs in schools will inspire many students to seek a residency in this distinguished field.

Finally, there is an essential lesson I have learned from my dental anesthesiology lectures. While advocating the merits of sedation, we have been cautioned against its inappropriate application. I consider myself fortunate that unlike many students who upon graduation must rely on continuing education courses for information, I was offered instruction and practical exposure to clinical sedation while still in school. I have thus come to the conclusion that learning sedation is like learning to drive: you need expert guidance, thorough knowledge of the rules and regulations, and most importantly, the understanding that your negligence could cost someone’s life.

In light of all this, I conclude that the introduction of dental anesthesiology programs in dental schools will support the two essential pillars of dentistry: Beneficence, by providing comfortable and competent treatment, and Nonmaleficence, by putting the welfare and safety of the patient ahead of all else.

Ntasha Sethi, BDS, MDS (Pediatric Dentistry),
University of Pittsburgh School of Dental Medicine DMD student (Class of 2017)
Figure 1. Recent graduates’ (N=718) perceptions in 2006 of quality of their predoctoral dental anesthesia education in nitrous oxide sedation, enteral sedation, and intravenous sedation

The department also teaches a didactic course in pain and anxiety control to residents in pediatric dentistry, prosthodontics, periodontics, endodontics, and advanced education in general dentistry. Residents are taught how to integrate anxiety control measures such as nitrous oxide, enteral, and parenteral sedation modalities into their practice. Pre-anesthetic assessment and patient selection are stressed, and a clinical component is provided. In periodontics, there is a requirement for programs to have sedation education to receive CODA accreditation. Dental anesthesiologists are involved in the periodontics didactic and clinical curricula not only at the SDM but at other institutions as well. In pediatrics, dental anesthesia faculty members participate in the pediatric residents’ didactic as well as clinical program, and the department provides general anesthesia services for comprehensive dental care. Department faculty members also provide lectures to oral and maxillofacial surgery residents on such topics as pediatric sedation and anesthesia, deep sedation, and airway management and work with those residents in close clinical cooperation. Thus, predoctoral students and

**Figure 2. Influence of additional predoctoral anesthesia education on general dentists’ treatment of patients with special needs: those who took the anesthesia selective vs. those who did not**

residents see how dental anesthesia is an integral part of the practice of dentistry across all disciplines on a daily basis and accept it as a routine part of their practice life.

Training that adheres to the six CODA standards for dental anesthesia ensures that dentist anesthesiologists are uniquely qualified as clinicians and educators. A list of the duties, functions, and responsibilities of a dental anesthesiologist is shown in Table 3. With the growing demand for office-based dental anesthesia services in the dental community and the increased interest in anesthesia as a viable career option among predoctoral students, it makes sense that dental schools become open to the addition of dental anesthesiologists to their faculty rosters. Each year, approximately 37 new dentist anesthesiologists enter the workforce. Currently, according to the American Society of Dentist Anesthesiologists, there are approximately 305 dentist anesthesiologists practicing in the United States and Canada (Figure 3). A golden opportunity exists for these individuals to become affiliated with dental schools throughout North America.

<table>
<thead>
<tr>
<th>Predoctoral</th>
<th>Postdoctoral</th>
<th>Service</th>
<th>Research</th>
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<tr>
<td>Local anesthesia</td>
<td>Medical emergencies</td>
<td>Committee activity</td>
<td>Clinical research</td>
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<tr>
<td>Pain and anxiety control</td>
<td>Pain and anxiety control</td>
<td>Sedation and anesthesia services</td>
<td>Publications</td>
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<tr>
<td>Medical emergencies</td>
<td>BLS, ACLS, PALS</td>
<td>Faculty practice</td>
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<td>Clinical medicine</td>
<td>Interdisciplinary teaching and training</td>
<td>Continuing education</td>
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<td>Medical consultation</td>
<td>Dental anesthesia residency direction</td>
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</tr>
<tr>
<td>BLS</td>
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</tbody>
</table>

BLS=Basic Life Support; ACLS=Advanced Cardiac Life Support; PALS=Pediatric Advanced Life Support

Challenges

As with any valuable pursuit, there are challenges in dental anesthesia that will need to be addressed. Programs may face financial challenges if there are cuts to national health care funding for training programs or to the Affordable Care Act as it now stands. The opening of new postdoctoral programs, or the expansion of existing ones, may be limited by relatively flat federal budgets. Such challenges will require ingenuity to maintain those programs’ viability, even in the face of continuing demand for services.

In addition, in hospital operating room rotations, dental anesthesia trainees could possibly face the challenge of increased competition for cases due to the Affordable Care Act. Although more patients are now covered by health care insurance, out-of-pocket expenses have dramatically increased for all types of care including surgery. Patients may not be able to afford the co-pay for procedures such as total joint replacements previously covered with a minimal co-pay. If caseloads diminish, trainees will have to share cases needed to meet their numerical requirements—a situation that may have particular relevance for dental anesthesia trainees in large academic medical centers. Dental anesthesia programs may have to search for other training sites for their residents as well as increasing the volume of procedures done at the dental school. Hospital-based dental anesthesia programs that have difficulty meeting numerical requirements may need to enhance residents’ experiences through rotations with affiliated dental anesthesiologists in the community in order to maintain levels needed for CODA accreditation. Rigorous evaluations will be needed to guide each program in making adjustments to ensure quality training is maintained and to prevent program suspension or closure.

Conclusion

Dental anesthesia and dentist anesthesiologists have become part of the mainstream in dentistry over the past 70 years. Training has improved from early apprenticeships to the current three-year CODA-accredited programs needed to keep pace with the explosive advances in medicine and anesthesia drugs and technologies. A few dental schools employ dental anesthesiologists and utilize their capabilities in a variety of curricular endeavors. As the number of dental anesthesia residency programs has
expanded, the demand for residency positions has reached record highs. The services of dental anesthesiologists are becoming available in areas and communities where they never existed in the recent past. As patients begin to realize that they can access these services in their own dentists’ offices, the demand for trained dentists will increase. Of course, dental anesthesiologists will be able to satisfy some of this demand, but there will be a growing need for general dentists, periodontists, pediatric dentists, and oral and maxillofacial surgeons to service the community as well. Dental anesthesiologists are uniquely trained and qualified as dental educators to aid in the anesthesia development across disciplines. As such, it would benefit dental schools to consider the addition of a qualified dentist anesthesiologist to their faculties and to integrate those individuals fully into their curricular, service, and research activities.

REFERENCES