Practice Characteristics Among Dental Anesthesia Providers in the United States

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General descriptions or “snapshots” of sedation/general anesthesia practices during dental care are very limited in reviewed literature. The objective of this study was to determine commonalities in dental sedation/anesthesia practices, as well as to accumulate subjective information pertaining to sedation/anesthesia care within the dental profession. This questionnaire-based survey was completed by participating anesthesia providers in the United States. A standardized questionnaire was sent via facsimile, or was delivered by mail, to 1500 anesthesia providers from a randomized list using an online database. Data from the returned questionnaires were entered onto an Excel spreadsheet and were imported into a JMP Statistical Discovery Software program for analyses. Quantitative evaluations were confined to summation of variables, an estimation of means, and a valid percent for identified variables. A total of 717 questionnaires were entered for data analysis ($N = 717$). Data from this study demonstrate the wide variation that exists in sedation/anesthesia care and those providing its administration during dental treatment in the United States. The demographics of this randomized population show anesthesia providers involved in all disciplines of the dental profession, as well as significant variation in the types of modalities used for sedation/anesthesia care. Data from this study reveal wide variation in sedation/anesthesia care during dental treatment. These distinctions include representation of sedation/anesthesia providers across all disciplines of the dental profession, as well as variations in the techniques used for sedation/anesthesia care.

Key Words: Anesthesia; Dentistry; Practice characteristics; Techniques.

Pain and anxiety control techniques have constituted an essential aspect of dental practice since the first patient sat in a dental chair. The dental profession has maintained and procured this institution by continually developing and improving safe and effective sedative and anesthetic techniques. Without advancement of these modalities, various populations such as persons with special needs, children, and pa-

tients with dental phobias could not obtain comprehensive oral care.¹

Unfortunately, general descriptions or “snapshots” of sedation/anesthesia practices during dental care are very limited in the reviewed literature. This questionnaire-based study was designed to investigate common practice characteristics and techniques used by dental sedation/anesthesia providers in the United States.

METHODS

This study was designed as a questionnaire-based survey, undertaken from April 2008 to December 2008.

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Approved by the institutional review board at the University of Pittsburgh, this study was designed to identify and quantify practice characteristics and techniques commonly used by dental sedation/anesthesia providers in the United States.

Survey questionnaires were sent via facsimile or direct mail to 1500 dental sedation/anesthesia providers in the United States, using a list obtained via individual state-based online database systems that list dental anesthesia permit holders and/or dental sedation/anesthesia providers. Unfortunately, a few states such as Virginia, South Carolina, Michigan, Rhode Island, and Wisconsin did not issue sedation/anesthesia permits or had not developed an online database at the time of publication. Therefore, providers in these states were not included in the data analysis. The total list (9456 individual providers) accrued via online systems was entered into a computer software system (cnet Random Number Generator) to create a randomized list of 1500 sedation/anesthesia providers. All prospective respondents must have possessed a current dental license in the United States and must provide anesthesia (intravenous or conscious sedation, oral sedation, deep sedation, and/or general anesthesia) within their practice modalities. Additionally, respondents currently in postgraduate dental/medical training programs were not included.

Completed questionnaires were returned to a central site at the University of Pittsburgh School of Dental Medicine for processing and data entry. All survey participation requests were accompanied by a letter containing the following: a description of the purpose of the study, an explanation of how to complete and return the questionnaire, and directions on how to ensure anonymity. A total of 789 of 1500 survey questionnaires were returned, which represents a 52.6% response rate. In addition, the 789 returned questionnaires were examined for incomplete responses and unidentified or missing information. Any questionnaires that were verified to contain any of the aforementioned issues were eliminated from the data entry process. At the conclusion of this analysis, a total of 72 returned surveys were removed for incomplete questionnaires ($n = 65$) and unidentified response to survey questions ($n = 7$), leaving a total of 717 questionnaires used for data analysis ($N = 717$). Percent $\pm$ standard error was calculated on the basis of the total population of 9456, at percent $\pm$ standard error = $7.58\% \pm 0.27\%$.

Data from the returned questionnaires were entered onto an Excel spreadsheet and were imported into a JMP Statistical Discovery Software program for analyses. Quantitative evaluations were confined to standard summation, an estimation of means, and a valid percent for identified variables.

RESULTS

Demographics

Evaluation of the survey's demographic data was limited to how respondents described their main practice activity. Data analysis of this set ($N = 717$) revealed that most respondents considered oral and maxillofacial surgery (49.7%), general dentistry (20.0%), or dental anesthesiology (10.4%) as their primary practice identification. It should also be noted that periodontology (7.7%), pediatric dentistry (4.6%), endodontics (4.3%), medical (physician) anesthesiology (2.7%), prosthodontics (0.3%), and public health (0.3%) were observed with lesser frequency.

Anesthesia Training

Wide variation exists between the U.S. dental boards concerning sedation/anesthesia training requirements.² Although generalities in the type and amount of training exist, it remains difficult to distinguish a universal instructional standard. To discern training backgrounds, a series of survey questions were chosen to identify respondents' educational experiences.

Within the survey design, respondents were asked to identify how they received their sedation/anesthesia training. Evaluation of survey responses revealed that the most frequent means of sedation/anesthesia training were oral surgery residencies (48.9%), dental anesthesia residencies (13.0%), medical hospital-based anesthesia programs (10.7%), continuing education programs (8.5%), and a Dental Organization for Conscious Sedation (DOCS) training program (8.4%). Remaining responses (10.5%) included sedation/anesthesia training within pediatric, periodontic, and general practice residencies, as well as predoctoral sedation/anesthesia selective programs.

It should be noted that the format allowed for multiple answers in this category, and 50 respondents signified multiple resources for sedation/anesthesia training. The most common multiple sedation/anesthesia training tracks included oral surgery residency/dental anesthesia residency (34.0%, $N = 50$) and general practice residency/continuing education (28.0%, $N = 50$).

Additionally, analysis was completed to assess the type of sedation/anesthesia training a respondent received according to his or her identified main practice activity. A large portion of the response proved predictable, with a respondent's main route of sedation/anesthesia education corresponding to his or her main practice activity training. However, some response was

Table 1: Most common routes of anesthesia training according to the anesthesia providers' main practice activity.

Endodontists N=31	Continuing Education (41.9%) DOCS Training Program (22.6%) Hospital Based Training Program (16.1%)
M.D. Anesthesiologists N=19	Hospital Based Training Program (100%)
Dental Anesthesiologists N=75	Dental Anesthesiology Residency (84.0%) Hospital Based Training Program (16.0%)
General Dentists N=144	DOCS Training Program (24.3%) Continuing Education (21.5%) General Practice Residency (17.4%)
Periodontists N=55	Periodontic Residency (47.3%) Hospital Based Training Program (25.5%) Continuing Education (23.6%)
Pediatric Dentists N=33	Pediatric Dentistry Residency (94.0%) Continuing Education (6.0%)
Oral/Maxillofacial Surgeons N=356	OMFS Residency (92.0%) Continuing Education (3.0%) DOCS Training Program (2.0%)
Public Health Practitioner N=2	Hospital Based Training Program (50.0%) Continuing Education (50.0%)
Prosthodontists N=2	Continuing Education (100%)

of interest, with general dentists reporting their most frequent route of sedation/anesthesia training via a DOCS training program (24.3%, $N = 144$). The most common results concerning this data set are detailed in Table 1.

The authors also desired to quantify what percentage of an individual's complete training program included hospital-based sedation/anesthesia training. Overall, the mean percent of hospital-based training was 33.0% ($N = 717$). As is shown in Figure 1, additional analyses were performed to compare the mean percent of hospital-based sedation/anesthesia instruction during postgraduate training. This analysis proved to be somewhat predictable in nature, with dental anesthesia residencies (72.1%, $N = 93$) and medically related hospital-based training (71.4%, $N = 77$) demonstrating the largest mean percentage of hospital-based instruction within the total training program.

Practice Characteristics

Several survey questions were devised to evaluate the sedation/anesthesia providers' practice structure. The intent of these questions was to ascertain customary dental sedation/anesthesia practices, as well as to gather subjective information relevant to sedation/anesthesia care within the dental health care environment.

Provision of Anesthesia Service. Analysis for the practice characteristic data set began with determination of the respondent's provision of sedation/anesthesia within particular disciplines and procedures of dentistry. For this section, the survey was categorized

Figure 1. Mean percentage of hospital-based anesthesia training that occurred during a respondent's postgraduate training program.

into 8 dental case types (endodontic, general dentistry, implantology, oral surgery, pediatric dentistry, periodontics, special needs, and hospital-based dental care), and the respondent was asked to circle a single sum that most accurately depicted the number of case types seen in his or her sedation/anesthesia practice per week (never, rarely [1–10 cases], infrequently [11–20 cases], occasionally [21–30 cases], often [31–40 cases], most often [41+ cases], or my practice is exclusive to this case type).

Analysis of these data was performed using a standard mean score applied to the previously stated "sum category." The highest reported case type per week was attributed to the oral surgery case type, with 21–30 cases per week. This was followed in most by implant cases, general dentistry, and pediatric dentistry, with 1–10 cases per week, respectively.

In addition, detailed comparison was completed between the provision of sedation/anesthesia care and the respondent's description of his or her main practice activity. The data proved conventional in nature, with the largest numbers of sedation/anesthesia services rendered within the respondent's main practice activity.

Auxiliary Personnel. The opinion related to auxiliary personnel and their use within the health care system differs throughout the world. Many categories of health personnel have emerged in response to specific health care needs. Front-line health personnel and specialized and multipurpose workers differ in numbers and qualifications. Many disparities in recruitment credentials, type and extent of training, job functions, and working situations have been noted from one health care area to another.³ Given this variation, the authors included a survey question to analyze the types of auxiliary personnel used within dental sedation/anesthesia practice.

The most commonly used personnel reported by survey respondents ($N = 717$) were dental anesthesia

assistants without formal training (35.0%) and dental anesthesia assistants trained via an American Association of Oral Maxillofacial Surgeons (AAOMS) program (33.5%). These were followed by the following: no auxiliary personnel used (13.2%), dental anesthesia assistants trained via an American Dental Society of Anesthesiology (ADSA) program (7.3%), nurse anesthetists (6.7%), registered nurses (2.9%), and medical assistants (1.4%).

It also should be noted that 14.5% of the sedation/anesthesia providers surveyed use multiple designated personnel during their sedation/anesthesia service. Within this defined group, the most frequently reported multidesignated personnel included assistants with AAOMS program training and assistants without formal training (51.9%, $N = 104$), as well as assistants with ADSA program training and assistants without formal training (32.7%, $N = 104$).

No statistical difference was noted between the main practice activity of respondents and auxiliary personnel used.

Postanesthesia Care. Postanesthesia care is considered a vital aspect of any sedation/anesthesia appointment. It serves as a means to determine patient recovery and to perform an assessment of the patient's health state after the overall health care appointment. Examination of the entire survey response ($N = 717$) revealed that 51.7% of respondents conveyed that the sedation/anesthesia provider/"myself" directly provides postoperative/recovery care to patients after sedation/anesthesia administration, and 45.0% reported that an assistant or nurse provides recovery care. Additionally, it should be noted that only 3.3% of those surveyed stated that no recovery care was needed.

Another postanesthesia aspect, presented via the survey questionnaire, focused on the timing of follow-up procedures used by these sedation/anesthesia providers. Respondents were asked to identify at what time period they contact the patient once discharge has occurred. The most commonly observed responses were the following: the evening immediately following the patient's procedure (70.7%) and approximately 24 hours after the procedure (19.8%).

The final facet of assessing postanesthesia characteristics was centered on who contacts the patient for follow-up procedures after patient discharge. The most frequently observed response was that the sedation/anesthesia provider/"myself" (44.3%) contacts the patient for follow-up. This response was followed by the following: an assistant (21.5%), a secretary (19.4%), or a nurse (8.2%). In all, 6.6% of respondents conceded that no follow-up is completed.

Table 2: Most commonly used premedication agents according to the anesthesia providers' main practice activity.

Endodontists $N=31$	Sublingual Triazolam / Halcion (45.2%) Oral Triazolam / Halcion (19.5%) No Premedication Agents Used (19.4%)
M.D. Anesthesiologists $N=19$	All Agents Identified are Used (52.6%) Intramuscular Ketamine (26.3%) Oral Midazolam (10.5%)
Dental Anesthesiologists $N=75$	All Agents Identified are Used (32.0%) Intramuscular Ketamine (22.4%) Intramuscular Ketamine & Midazolam (14.7%)
General Dentists $N=144$	Oral Triazolam / Halcion (45.1%) No Premedication Agents Used (25.7%) Sublingual Triazolam / Halcion (13.9%)
Periodontists $N=55$	Oral Triazolam / Halcion (38.2%) No Premedication Agents Used (32.7%) Sublingual Triazolam (14.5%)
Pediatric Dentists $N=33$	Demerol and Hydroxyzine Elixir (36.4%) Oral Midazolam (27.2%) No Premedication Agents Used (21.2%)
Oral/Maxillofacial Surgeons $N=356$	No Premedication Agents Used (54.2%) Oral Midazolam (9.6%) Oral Triazolam / Halcion (8.1%)
Public Health Practitioner $N=2$	Oral Triazolam / Halcion (50.0%) No Premedication Agents Used (50.0%)
Prosthodontists $N=2$	Oral Triazolam / Halcion (100%)

Anesthetic Agents. This survey also investigated administration practices for local anesthesia and the anesthetic agents used by respondents for premedication. Analysis of survey data revealed that most respondents (87.9%, $N = 717$) administer their own local anesthesia during sedation/general anesthesia cases. These same findings occurred across the different categories of main practice activity, with the exception of physician anesthesiologists ($N = 19$) and dentist anesthesiologists ($N = 75$), of whom most (100% and 73.3%, respectfully) do not administer their own local anesthesia during cases.

The complementary analysis completed to determine which premedication agents are most commonly used showed that the most frequently reported agent was oral triazolam (18.0%, $n = 717$). However, it should be noted that the most common response to this question was that respondents did not use any premedication agents (38.2%, $n = 717$).

Additional analysis was completed to compare the most commonly used premedication agents among the various categories of main practice activity. Table 2 provides a detailed examination of the agents used most frequently among sedation/anesthesia providers according to their described main practice activity. Triazolam, given by oral or sublingual administration, was noted to be the most frequently used agent among endodontists (64.7%), general dentists (59.0%), periodontists (52.7%), public health practitioners (50.0%), and prosthodontists (100%) providing sedation/anesthesia services. Pediatric dentists who responded to the survey indicated that they most often use Demerol and hydroxyzine elixir (36.4%) for pre-

medication. In addition, physician anesthesiologists (52.6%) and dentist anesthesiologists (32.0%) revealed that they utilized all categorized agents in various cases during their sedation/anesthesia administration, and the preponderance of oral and maxillofacial surgeons (54.2%) responded that they did not include premedication practices while providing sedation/anesthesia care.

It should be noted that the authors recognize that the term *premedication* may involve multiple interpretations by participants. *Premedication* as used by the authors was meant to be interpreted as drugs used for anxiolysis before any procedure (dental or anesthetic) is performed. However, the authors recognize that some participants may have construed the term to include only agents used before intravenous access is obtained for advanced sedation procedures.

Patient Population. Particular information concerning patients seen within sedation/anesthesia providers' practice was also investigated via the survey. Respondents were asked to select the corresponding percentage that accurately depicted the American Society of Anesthesiology (ASA) classification demographics (ASA I–IV) of their patient populations.⁴ The percentages were grouped into 5 categories: never (0), rarely (1–20%), infrequently (21–40%), occasionally (41–60%), often (61–80%), and most often (81–100%); the respondent was asked to select a single answer for each ASA classification.

Evaluation of the overall response ($N = 717$) revealed that ASA I patients ("often": 61–80%) were most frequently seen by the surveyed providers for sedation/anesthesia care. As might be expected, this was followed by ASA II patients ("infrequent": 21–40%), ASA III patients ("rarely": 1–10%), and ASA IV patients ("never": 0).

The aforementioned data set was paralleled by most providers when compared with main practice activity. However, respondents categorized as dentist anesthesiologists and physician anesthesiologists were more likely to see patients classified as ASA II ("often": 61–80%) and ASA III ("infrequent": 21–40%).

In addition to questions on the types of ASA patients seen, the questionnaire asked those surveyed to select the approximate number of patients with special needs seen per month for administered sedation/anesthesia care. Evaluation of the entire response revealed a mean of 5.1 patients with special needs seen per month. When this data set was categorized according to main practice activity, it was revealed that dentist anesthesiologists (17.8) and pediatric dentists (10.1) had the highest mean numbers of patients with special needs seen in sedation/anesthesia practice per

Figure 2. Mean number of special needs patients seen for administered anesthesia care per month according to main practice activity.

month. A more thorough examination of special needs sedation/anesthesia care in practice activity is shown in Figure 2.

Operator/Anesthetist Practice. To discern the prevalence of operator/anesthetist practices with current dental sedation/anesthesia providers, the survey included a question that asked respondents if they ever serve as the operator/anesthetist in their practices. Analysis of returned questionnaires revealed that most respondents ($N = 717$) serve as operator/anesthetists (81.9%).

Additional evaluation was performed to discern differences between types of practice activity and operator/anesthetist practice. Little difference was found between the various categories as most responses indicated operator/anesthetist practice. However, with physician anesthesiologists and dentist anesthesiologists, the most frequent response showed that 94.7% and 68.9%, respectively, do not practice as operator/anesthetists.

Anesthesia Techniques. Additional inquiries were completed to evaluate the types of anesthesia administered by respondents. Formatted questions were created to determine the quantity of respondents' anesthesia practices that included the following: oral sedation, intravenous conscious sedation, intravenous deep sedation, and general endotracheal intubation.

Examination of the overall response, according to mean percentage, illustrated that U.S. dental sedation/anesthesia providers most commonly use intravenous deep sedation (40% of practice devoted to this technique) in their sedation/anesthesia practice. This was followed by intravenous conscious sedation (35% of anesthesia practice devoted to this technique), oral sedation (20%), and general endotracheal intubation (7%).

Figure 3. Mean percentage of categorized methods of anesthesia administration that characterize a respondent's anesthesia practice according to main practice activity.

Further analysis was done to evaluate the various sedation/anesthesia techniques used within the categories of a respondent's main practice activity. As is detailed in Figure 3, the intravenous deep sedation technique was most commonly employed by oral maxillofacial surgeons (65% of practice devoted to this anesthesia technique) and dentist anesthesiologists (60%); the oral sedation technique was the method used most frequently by pediatric dentists (63%), endodontists (68%), and general dentists (85%); intravenous conscious sedation was the most recurrent practice reported by periodontists (58%); and general endotracheal intubation was the method used most commonly by physician anesthesiologists (52%).

DISCUSSION

Data from this study demonstrate the wide variation that exists in sedation/anesthesia care and among those providing it during dental treatment in the United States. The demographics of this randomized population show variation among sedation/anesthesia providers that involves most disciplines of the dental profession, as well as significant variety in the types of modalities used for sedation/anesthesia care. The need for sedation/anesthesia services within the field of dentistry is well documented, and the variation demonstrated in this study supports a response by all dental professionals to this need.^{5–7}

When the course of sedation/anesthesia training undertaken by surveyed providers was evaluated, results showed that most professionals had received their training during respective residencies and/or advanced training programs. However, respondents who listed General Dentistry and Endodontics as their

main practice activities reported Continuing Education and the DOCS Training Program as their central means for sedation/anesthesia education. Given the noninvasive nature of the most common endodontic and general dentistry procedures, this finding may demonstrate a response to the need of these patient populations for minimal sedation, as opposed to more advanced anesthesia modalities. This proposed estimation is supported by respondents' methods of sedation/anesthesia administration within their individual practices. Examination of the data set reveals that endodontists and general dentists are more likely than their colleagues to use oral sedation than any other type of anesthesia modality.

Examination of the reported patient populations by surveyed practitioners demonstrated that most providers see healthy patients (ASA I) for sedation/anesthesia services. However, when the data set was categorized according to main practice activity, it was found that dentist anesthesiologists and physician anesthesiologists were more likely to provide services for ASA II and ASA III patients. This may be explained by the fact that these practitioners tend to have a longer training period in hospital-based anesthesia that allows for increased exposure to compromised patients, advanced anesthesia modalities, and emergency management techniques.⁸

In addition, further evaluation of respondents' patient profiles revealed a greater tendency for dentist anesthesiologists and pediatric dentists to provide sedation/anesthesia services for patients with special needs, when compared with other areas of practice activity. Given that these practitioners are provided with a higher degree of exposure to these patient populations during their respective training programs, this outcome is not unexpected.^{9–11} In fact, a study by Wolff et al¹² shows that the more encounters trainees had with people with special health care needs, the more positive their attitudes were toward treating and understanding these populations.

Additionally, the authors wished to assess the current pervasiveness of operator/anesthetist administration. The practice of the sedation/anesthesia administrator who also provides dental care has long been associated with the profession of dentistry. However, recent state regulations have begun to limit this practice, and U.S. dental schools that offer hands-on sedation/anesthesia education have shied away from teaching this method.² Data analysis of our returned questionnaires revealed that most sedation/anesthesia providers incorporated operator/anesthetist practices. The only categories that did not report a majority "Yes" response to this question were dentist and physician anesthesiologists. This most likely is due to the fact that these groups work as supportive personnel, providing most of their services in other dentists' offices.

es, as well as receiving a more elemental approach to sedation/anesthesia training.¹³ It should be noted that because changes in sedation/anesthesia regulations and training were made recently, it would have been beneficial to ask respondents when they had completed their sedation/anesthesia training. However, this information was not obtained via this survey and may prove to be an area for further investigation.

CONCLUSION

The objective of this questionnaire-based study was to explore the commonalities of dental sedation/anesthesia providers in the United States, which included practice characteristics and the techniques they used. Additionally, the intention of this study was to accumulate subjective information related to sedation/anesthesia care within the dental profession.

Data from this study indicate the wide variation in sedation/anesthesia care provided during dental treatment. These distinctions include the representation of sedation/anesthesia providers across all disciplines of the dental profession and variations in the techniques used for sedation/anesthesia care.

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