Clinical Article

A Survey Study of Sedation Training in Advanced Pediatric Dentistry Programs: Thoughts of Program Directors and Students

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Abstract: ***Purpose:*** *The purpose of this study was to survey program directors and students of advanced pediatric dentistry training programs in the United States on sedation issues.* ***Methods:*** *Surveys were sent to the target audiences. Questions contained response categories ranging from fill-in-the-blank, Likert-order scale style, and categorical. The surveys resided on SurveyMonkey. A cover letter emphasizing such issues as anonymity of responses was sent via e-mail to participants using the American Academy of Pediatric Dentistry listserv. The responses were downloaded and subsequently analyzed using SPSS statistical software.* ***Results:*** *Data were obtained from 49% of program directors and 17% of students. Experience with different routes of sedative administration varied from "none" (even with the oral route) to "significant." Oral midazolam was the most-often used route and sedative. Restraint was reportedly used by the majority of programs.* ***Conclusions:*** *Strategies should be developed to strengthen consistency of competencies in sedation practices across academic training programs.* *(Pediatr Dent 2011;33:353-60) Received September 27, 2010 | Last Revision February 17, 2011 | Accepted February 19, 2011*

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Pharmacological management of children for dental care ranges from very mild sedation to general anesthesia (**GA**). Sedation, ranging from mild to deep, is a subset of behavior management techniques available to pediatric dentists in providing quality care to children who, for one reason or another, are not receptive to non-pharmacological techniques.

Many sedation studies involving children in the dental setting have been reported over the past few decades. As a whole, the knowledge gained from these studies is interesting, but as pointed out by others,[1,2] the composite picture suggestive of definitive and widely adhered to protocols in training programs and for practitioners to follow is unclear. Differences in study design and methodology throughout these studies, among other factors, probably contribute significantly to this deficiency of a widely accepted body of clinical knowledge and applicability.[2] Simple dose-response studies, a basic pharma-cological tenet, on the effectiveness of individual sedations or common combinations in children are extremely rare.[3-5]

Pediatric dentists receive training in sedation and GA during their advanced education training, but evidence suggests that, over the years, the extent of those experiences may vary widely among training programs.[1,6-9] Survey studies on the use of sedation by practicing pediatric dentists also suggest variable findings.[10-18] The items and questions used throughout these surveys have not always been consistent. For instance, the questions of Adair and colleagues[7] were phrased so that respondents indicated whether a type of behavior management technique was taught as "acceptable" or "unacceptable." Casamassimo and Wilson[8] were interested in respondents indicating how many hours or cases would be necessary for a trainee to be "proficient." Nonetheless, valuable information can be obtained from surveys, and such information can give a snapshot impression of sedation issues in advanced education training programs and in private practice.

One of the earlier survey studies of training programs in 1990 revealed that, overall, 35% of the programs were reporting a decline in the use of sedation.[6] Yet, the most recent survey in 2004 indicated that program directors (**PDs**) were predicting the change in curriculum time devoted to pharmacological management would stay the same or increase, especially with the use general anesthesia.[7] No survey studies have been published since that time, and previous studies did not address the issue of definitions of "successful" sedations. Furthermore, PDs and private practitioners have been surveyed as to their experiences associated with sedation procedures; however, opinions of students, defined as postgraduate students or residents in accredited advanced education training pediatric dentistry programs in the United States and as used throughout this article, have not. Students are the consumers of advanced education training, and their insight, as future practitioners, on sedation issues seems worthy of study. We thought it important and timely to investigate the current status and practice of sedation issues based on surveyed opinions of both PDs and advanced education students in pediatric dentistry.

The purpose of this study was to survey PDs and students of advanced education programs in pediatric dentistry to determine their opinion on topics related to pharmacological

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management including protective immobilization of pediatric patients in the dental setting.

Methods

Two separate surveys were generated targeting: (1) the 76 PDs; and (b) students of advanced education training programs in pediatric dentistry. The students targeted were mainly in their second year of training and those who had just graduated. For clarification, the survey was issued to the target audiences in late summer 2009. E-mail addresses of PDs and students were provided by AAPD headquarters. Although the request for e-mail addresses of only second-year students (ie, those who just became second-year students in July 2009 or those who were second-year students and had just graduated from their programs in June 2009), the e-mail list was blinded to the authors regarding year of training. One of the questions in the student's survey, however, was in regard to their year of training. Institutional review board process and approval from the Cincinnati Children's Hospital Medical Center was obtained prior to electronic distribution of surveys.

The program directors survey, a survey targeting current PDs, contained 18 questions. The questions contained response categories ranging from fill in the blank, Likert-order scale style, and categorical.

The advanced pediatric dentistry students survey, which targeted all students and those just newly graduated, as previously defined (a total of 773 provided by the AAPD headquarters e-mail listing), contained 11 questions—some of which were similar in style and content to those of the PDs.

The surveys resided on SurveyMonkey. A cover letter was sent via e-mail to PDs using the AAPD listserv and to the students' e-mail addresses. Neither group was told of the other's participation in a survey study. An explanation in cover letters e-mailed to participants was given for the: purpose of the study; location and link of the survey; estimated time to completion; and standard language signifying the survey as being voluntary, non-punitive, anonymous, and untraceable (ie, IP addresses blocked), and, if presented or published, would contain only summarized data without identification.

The responses of the 2 groups were independently downloaded from SurveyMonkey into Excel files and subsequently analyzed using SPSS 16 statistical software (SPSS Inc, Chicago, Ill). The analysis included descriptive statistics, frequency distribution, cross-tabulated chi-square, and summary reports.

Results

Useable data for reporting purposes was obtained from 38 (49% response rate) PDs and 135 (17% response rate) students. The distribution of students in year of advanced education training was 7 (5%) in the first year; 74 (55%) second year; and 53 (40%) third year or recently graduated. The distribution of the types of advanced training programs, according to the PDs (similar question was not asked of students) who responded, was as follows: (1) 8 (21%) university based; (2) 16 (42%) hospital-based; and (3) 13 (34%) combined hospital and university based.

The number of years since the PDs had received their training in pediatric dentistry was distributed in the following manner: 12 (32%) greater than 25 years ago; 13 (34%) 16 to 25 years ago; 6 (16%) 11 to 15 years ago; 5 (13%) 6 to 10 years ago; and 2 (5%) 1 to 5 years ago. The length of years that the PDs had been in academics was distributed, with: 8 (21%) indicating greater than 25 years; 10 (26%) 16 to 25 years; 7 (18%) 11 to 15 years; 8 (21%) 6 to 10 years; 5 (13%) 1 to 5 years. There was a significant distribution in the years since receiving a certificate with the years in academics (chi-square=38.8, $P<.001$). As expected, those who tended to be in academics longer were more likely to have had their certificate for a longer period of time.

Both groups were asked of their experiences with different routes of sedative administration. The response categories on the surveys were different for each group. PDs' response categories were "none," "minimal," "moderate," and "significant." The students, on the other hand, had a range of consecutive numbers from 1 to 10, with 1 labeled as "none" (ie, intended by the authors to be interpreted as no experience) and 10 as "excellent." For comparative purposes, the students responses were recoded and collapsed into the same labeled categories as the PDs, with 1 still representing "none," those ranging

Table 1. NUMBER OF PROGRAM DIRECTORS AND STUDENTS ESTIMATING LEVEL OF EXPERIENCE BY ROUTES OF ADMINISTRATION

Routes of administration	No experience N (%)	Minimal experience N (%)	Moderate experience N (%)	Significant experience N (%)
Oral				
Directors	0 (0)	3 (8)	5 (13)	30 (79)
Students	6 (5)	25 (19)	34 (26)	66 (50)
Intranasal				
Directors	11 (29)	16 (42)	8 (21)	3 (8)
Students	69 (54)	21 (16)	15 (12)	24 (19)
Submucosal				
Directors	15 (40)	13 (34)	7 (18)	3 (8)
Students	101 (78)	18 (14)	4 (3)	6 (5)
Intramuscular				
Directors	15 (40)	10 (26)	11 (29)	2 (5)
Students	101 (78)	18 (14)	4 (3)	6 (5)
Intravenous				
Directors	13 (34)	13 (34)	6 (16)	6 (16)
Students	67 (52)	30 (23)	17 (13)	15 (12)

Table 2. DESCRIPTIVE STATISTICS OF RATING OF PROGRAM DIRECTORS AND STUDENTS ON EMERGENCY MANAGEMENT

	N	Minimum	Maximum	Mean±(SD)
Manage airway				
Directors	37	6	10	8.7±1.1
Students	130	1	10	7.6±2.0
Recognize emergency				
Directors	37	6	10	9.0±1.0
Students	128	2	10	7.3±2.0
Manage emergency				
Directors	37	2	10	8.1±1.7
Students	129	2	10	7.0±2.0

* Mean score based on scale of consecutive numbers from 1 ("none" [intent: "no experience"]) to 10 ("excellent").

Table 3. DESCRIPTIVE STATISTICS OF ESTIMATED SUCCESS OF SEDATIONS BY PROGRAM DIRECTORS AND STUDENTS

	N	Minimum	Maximum	Mean±(SD)
Success of faculty sedations (%)	28	50	100	68.2±13.3
Success of residents rated by directors (%)	32	0	100	62.2±19.4
Success of students' sedations (%)	83	20	100	66.6±18.7

from 2 to 4 as "minimal," 5 to 7 "moderate," and 8 to 10 "significant." Table 1 shows the responses of both groups concerning their experiences with different routes of sedation administration.

Respondents were asked to rate their level of comfort, based on a scale of 1 to 10, in managing the airway of a sedated patient, recognizing a developing untoward reaction, and managing an untoward sedation reaction. Table 2 shows the responses of both groups concerning these issues. A positive association between recognizing an untoward event and managing the airway and managing an untoward event was observed (r=.76, $P<.001$ and r=.59, $P<.001$; and r=.79, $P<.001$ and r=.81, $P<.001$) for PDs and students, respectively.

Both groups were asked to rate the percent of success of sedations they did at their programs using the same rating scale. The reported mean percent success for faculty sedations was slightly higher (68%) than that reported by students (67%). Table 3 shows a summary of their responses to this question.

Although the response categories were similar for both groups for questions related to sedation and protective immobilization (ie, restraint), the question formats were different. The PDs were allowed to pick more than 1 response category for why restraint was used, whereas the students were asked to what degree they agreed with a statement about each response category of restraint using a Likert scale format. The PDs' most frequently chosen response (81%) was "routinely when using sedation". The PDs' results are seen in Table 4. The majority of PDs (68%) selected 2 or more response categories, but 16% did not respond to this question. In essence, the PDs indicated the three most frequently selected choices of restraint were "used routinely", "used to assist neurologically challenged patients", and "transient use to protect patient from reflexive movements". Table 5 shows the distribution of responses summarized by number of choices. The students disagreed or strongly disagreed that persistent use of restraint implied inadequate sedation and that sedation was only optimal if restraint or GA was avoided. However, the students agreed that success of sedation is acceptable if restraint is needed to accomplish treatment objectives. A summary of the responses of students across response category definitions is seen in Table 6.

The other questions asked of the PDs and students significantly varied from one another, and the results of those questions are reported in the following separate sections of the Results.

PDs results. PDs were asked to estimate the percentage of time that any form of sedation for patient care, excluding nitrous oxide, was used at their advanced education programs by students. The majority of responses (45%) revealed 0% to 10% of the time, with the remaining distribution decreasing from 10% to 25% (33%), 25% to 40% (14%), and 40% to 60% (6%) across time. The respondents were asked to estimate the number of sedations performed per week in their programs, and the majority indicated between 0 to 5 (36%). Ten (28%) programs disclosed 6 to 10 sedations, 8 (22%) indicated 11 to 20 sedations, and 5 (14%) reported 21 to 30 sedations.

The PDs were also asked the percentage in which various routes of administration were used at their institutions. Table 7 shows the mean percentage of the different routes used at their institution. A count of the number of routes used per institution was done. The average number of routes used at each institution was 3 (±1.6 SD) with 6 (16%) not responding, 4 (11%) using 2 routes, 11 (30%) using 3 or 4 routes, and 6 (16%) using 5 or more routes. The only finding of note concerning route of administration was that those respondents who had academic experience and had graduated from training programs more than 16 years ago were significantly more likely to have experience with the intravenous (IV) route (chi-square=9.5, $P<.02$). The mean number of GA cases performed per year by faculty and residents were 90 and 217, respectively (see Table 8).

Table 4. COUNT OF PROGRAM DIRECTORS' CHARACTERIZING USE OF RESTRAINT (PROTECTIVE IMMOBILIZATION) DEVICES IN THEIR PROGRAM

Program directors	Count	Response (%)*
Never used	0	0
Rarely used	3	10
Routinely used when using sedation	26	81
Routinely used for reflexive movements	16	50
Frequently used for inadequate sedation and movements	11	34
Assist neurologically challenged patients with or without sedation	20	63
Unanswered	7†	

* Multiple response categories per respondent were allowed, accounting for a summary greater than 100%.

† Thirty-two answered the question; 7 did not.

Table 5. DISTRIBUTION OF COUNT OF MULTIPLE RESPONSE CATEGORIES ASSOCIATED WITH RESTRAINT AND SEDATION BY PROGRAM DIRECTORS

No. of rationale chosen by program directors	Rarely used	Routinely used	Transient use for safety from reflexive movements	Used due to inadequate sedation	Used to assist neurologically challenged patients
1	2	2	–	–	2
2	1	11	5	2	7
3	–	8	6	4	6
4	–	5	5	5	5
Total	3	26	16	11	20

Table 6. NUMBER OF STUDENT RESPONSES TO STATEMENTS RELATED TO SEDATION AND RESTRAINT

Students	Strongly agree* N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)
The need for persistent use of restraint when using sedation implies inadequate sedation	10 (8)	34 (27)	26 (20)	41 (32)	16 (13)
Sedation can only be assumed to be optimal if consciousness is maintained and persistent application of restraint is not required	14 (11)	32 (25)	25 (20)	46 (37)	9 (7)
Sedation can be considered acceptable if persistent application of restraint is needed to complete visit treatment objectives	8 (6)	53 (42)	27 (22)	28 (22)	10 (8)
Sedation can be considered successful regardless of the need for restraint as long as general anesthesia is avoided	6 (5)	22 (17)	31 (25)	50 (40)	17 (13)

Table 7. DESCRIPTIVE STATISTICS OF ADMINISTRATIVE ROUTES USED IN TRAINING PROGRAMS

Route	N	Minimum	Maximum	Mean±(SD)
Nitrous used alone	32	5	96	41.4±27.0
Nitrous and other routes	31	0	100	32.0±31.0
Oral	29	2	100	30.0±35.0
Intravenous	28	0	90	6.3±18.0
Intramuscular	25	0	20	1.3±4.4
Submucosal	26	0	5	0.5±1.4
Subcutaneous	26	0	1	0.04±0.20
Rectal	26	0	0	0.0±0.0
Transdermal	26	0	0	0.0±0.0

Table 8. DESCRIPTIVE STATISTICS OF GENERAL ANESTHESIA CASES PER YEAR BY PROGRAM DIRECTORS AND STUDENTS

	N	Minimum	Maximum	Mean±(SD)
Faculty cases per year	27	0	350	89.8±91.3
Student cases per year	33	15	1000	216.5±218.0

When the PDs were asked what their rationale was for the use of nitrous oxide in conjunction with other sedation routes of administration, 100% indicated nitrous oxide is a potentiating agent at the onset of treatment (ie, permits lower dosage initially). The next most frequent rationale (76%) was related to nitrous oxide's adjunctive effects when oral agents prove inadequate; 55% responded in a related response category that nitrous oxide had titratable effects when combined with oral agents that are non-titratable. Six percent indicated that nitrous oxide facilitates venipuncture.

The most frequently used class of sedatives was benzodiazepines, with oral midazolam being the most popular with over 94% utilization among programs (Table 9). Table 10 shows the doses and age range of the agents reported.

The majority (50%) of PDs indicated that their personal training experience in the use of sedation was adequate. Forty-four percent said their training was excellent, and 6% said it was less than adequate. Significant distributions were found between the adequacy rating of the PDs' personal training experience with managing the airway (chi-square=21.7, $P<.005$), recognizing an adverse event (chi-square=21.5, $P<.001$), managing an adverse event (chi-square=36.6, $P<.001$), and level of experience with oral (chi-square=14.0, $P<.007$) and sub-mucosal routes of administration (chi-square=15.2, $P<.02$). Also, there was no significant difference between the distribution of adequacy rating of personal training with either years in academics or time since graduating from advanced training program.

When sedations proved inadequate, the overwhelming number of PDs (68%) indicated that they abandoned the regimen that failed in favor of an alternative modality, such as general anesthesia. But some (19%) selected a different regimen to use, adjusted the dose of the current regimen (3%), or selected a different route of administration (10%).

Students' results. Sixty percent of the respondents indicated that they agreed or strongly agreed with the statement of having a strong comfort level in the selection of drugs based on their training. Fifty percent indicated, however, that they disagreed or strongly disagreed with the statement of having a strong comfort level in the selection and use of various routes of drug administration. Only 40% indicated that they agreed or strongly agreed with the statement of having a strong comfort level working in each of minimal, moderate, and deep levels of sedation.

Of those responding, 93% and 7% felt their training experience with inhalation nitrous oxide was excellent or adequate, respectively. Again, only 45% and 39% felt their training experience with oral sedation was excellent or adequate, respectively. This result was in marked contrast to other routes of administration where 90% indicated inadequate experience using the sub-mucosal route, 87% using the intramuscular route, 67% the intranasal route, and 70% the IV route, respectively. Thus, the predominantly utilized routes reported were oral and inhalation.

Like the PDs, the students were asked about the drugs used in their programs. Table 11 provides a breakdown of the agents and regimens used by respondents in their training programs. Students were asked to cite the 2 most common regimens and their perceptions of the success rates they encountered. The summary results can be seen in Table 12. Consistent with the PDs, midazolam given orally was the most frequently reported drug and route used. Students were asked about their plans for sedation in the practice after graduation compared to what they do in their training programs. The results of that query can be seen

in Table 13. The majority of students indicated they would use sedation more in practice compared to that of their program experiences.

Table 9. NUMBER OF PROGRAMS USING SEDATIVES AND THEIR COMBINATIONS ACCORDING TO PROGRAM DIRECTORS

Drugs/ combinations	No. of programs used	Valid %	No. of programs not responding N (%)	No. of programs using drug alone or in combination
Chloral hydrate	14	47	8 (21)	
Chloral hydrate + hydroxyzine or promethazine	12	41	9 (24)	Chloral hydrate 19
Chloral hydrate + meperidine + hydroxyzine	9	35	12 (32)	
Diazepam alone	22	76	9 (24)	
Diazepam + meperidine	6	23	12 (32)	Diazepam 24
Meperidine + hydroxyzine or promethazine	11	41	11 (29)	Meperidine 18
Midazolam (oral)	31	94	5 (13)	
Midazolam (nasal)	11	42	12 (32)	
Midazolam + meperidine	13	34	11 (29)	Midazolam 32
Triazolam	6	22	11 (29)	
Lorazepam	3	12	12 (32)	These benzodiazepines 32
Morphine	2	8	12 (32)	
Fentanyl	5	19	12 (32)	These narcotics 22
Ketamine	6	22	11 (29)	

Table 10. DRUGS, DOSE, AND AGE RANGE USED IN PROGRAMS REPORTED BY PROGRAM DIRECTORS*

Drugs	Dose range (mg/kg)†	Age range (ys)
Chloral hydrate	20-75	2-8
Chloral hydrate + hydroxyzine or promethazine	25-75+0.25-2	2-8
Chloral hydrate + meperidine + hydroxyzine	10-45+1-2+0.5-2	2-8
Diazepam alone	0.2-0.5	3-17
Diazepam + meperidine	1.0+1.0	-
Meperidine + hydroxyzine or promethazine	1-2+0.5-1	-
Midazolam (oral)	0.25-1	2-9
Midazolam (nasal)	0.2-0.5	2-8
Midazolam + meperidine	0.25-1+0.2-2	2-8
Triazolam	0.25-0.3	7-18
Lorazepam	1-2 mg‡	12-18
Morphine	0.1	-
Fentanyl	0.125-0.025	-
Ketamine	3-5 (intramuscular) 7.5 (oral)	2-6

* Ranges are across responses, not necessarily within responses.
† Many drugs were listed as milliliters and not based on weight (eg, hydroxyzine) and are not included in this data set.
‡ Not based on weight.

Discussion

This study assessed the opinions of PDs and students of advanced education in pediatric dentistry on issues related to sedation. Almost half of the PDs (49%) responded and represented 3 different configurations of programs. The response of PDs was less than anticipated and significantly less than previous survey studies addressing sedation.[6-9] Response rates from those studies ranged from 86% to 96%. This disappointing response rate may reflect a symptom of the times, wherein PDs and other professionals are inundated with frequent survey requests by graduate students, residents, and other entities. Accreditation requirements and trends away from demanding prospective clinical and scientific investigations in favor of quick surveys may contribute to this drift.[19] This study's findings, however, may provide some insight into the current state of affairs in the teaching of sedation.

An overwhelming majority of respondents had significant experience with the oral route suggesting its dominance in pediatric dentistry, which is consistent with other more recent surveys.[1,7] Adapting to other routes of administration, especially IV, probably would require a significant period of time to implement even if the percentage of successful outcomes may increase. Potential reasons for prolonged implementation of the IV route of sedation would include first, training of educators in this technique, then training students, along with logistical issues such as sufficient pools of patients, institutional compliance, financial implications, and patient safety in a single operator-anesthetist model.

There is evidence in oral and maxillofacial surgery that this model may work relatively well[20-22]; however, some morbidity and mortality have been reported.[23,24] Also, many of the patients in the pediatric dental practice are very young and may fall outside one's comfort level of using a single operator-anesthetist model. Nonetheless, accreditation requirements for oral surgery are significantly more intense than our own.

Table 11. COUNT OF DRUGS AND DRUG COMBINATIONS USED IN PROGRAMS ACCORDING TO STUDENTS

Drugs and drug combinations	N	%
Midazolam (oral)	119	97
Diazepam	72	59
Midazolam + meperidine	48	39
Chloral hydrate	44	36
Meperidine + hydroxyzine or promethazine	42	34
Midazolam (nasal)	41	33
Ketamine	32	26
Chloral hydrate + hydroxyzine + meperidine	29	24
Chloral hydrate + mydroxyzine or promethazine	28	23
Diazepam + meperidine	20	16
Fentanyl	17	14
Triazolam	15	12
Lorazepam	14	11
Morphine	6	5

A higher percentage of students than PDs indicated that they had only minimum or moderate sedation experiences. Furthermore, 6 students indicated that they had no experience with oral sedation, and of these, 4 were in the second year of training or had just graduated. This suggests a possibility that some students of advanced training programs in pediatric dentistry may not meet minimal accreditation standards. One might also conclude that the likelihood of gaining experience and insight into the nuances and subtleties of different routes is less than optimal. Caution should be raised, however, as many PDs assign different aspects of their program to various faculty, some of whom may have excellent experience with various sedation techniques. Also, it is possible that many students are afforded training through other dental professionals (eg, dental anesthesiologist). Further information on the delegation of care in programs would be helpful in determining the extent to which graduate students are exposed to sedation. The limitations of this survey did not allow us to explore that possibility.

Table 12. DESCRIPTIVE STATISTICS OF FIRST AND SECOND MOST OFTEN USED DRUG OR DRUG COMBINATION IN PROGRAMS

First agent	Mean success (%) ± SD	N	Range
Chloral hydrate	75 ±18.9	7	50
Chloral hydrate + meperidine + hydroxyzine	73 ±12.2	8	40
Diazepam	60	1	0
Meperidine	81 ±8.2	5	20
Meperidine + hydroxyzine	82 ±9.4	15	32
Midazolam (oral)	61 ±17.7	50	75
Midazolam (nasal)	77 ± 3.5	2	5
Midazolam + hydroxyzine	74 ±10.2	6	30
Nitrous	70 ±14.1	2	20
Hydroxyzine	48 ± 29.5	4	65
Second agent			
Chloral hydrate	75 ±12.6	6	35
Chloral hydrate + meperidine + hydroxyzine	83 ±11.5	3	20
Chloral hydrate + hydroxyzine	58 ± 7.6	3	15
Dexmedetomidine + Sufentanil	70 ±	1	0
Diazepam	64 ± 17.4	9	55
Diazepam + nitrous oxide	67 ±14.4	3	25
Meperidine	71 ± 12.7	9	40
Meperidine + hydroxyzine	70 ± 10	3	20
Midazolam	49 ± 21.1	21	70
Midazolam + meperidine	68 ±15.5	4	35
Midazolam + meperidine + hydroxyzine	68 ±24.75	2	35
Midazolam + hydroxyzine	60	1	0
Nitrous oxide	50	1	0
Hydroxyzine	66 ± 13.4	13	40

Table 13. STUDENTS' OPINION ON THEIR USE OF SEDATION OR GENERAL ANESTHESIA AFTER GRADUATION

	More N (%)	The same N (%)	Less N (%)
I expect to use sedation	46 (39)	41 (34)	31 (26)
I expect to rely more on general anesthesia	32 (27)	63 (53)	23 (20)

Other survey studies have reported similar findings[11,15,18] supporting an ongoing perception of significant variability in training with little evidence of organized dentistry or academics addressing this situation. A consequence of this situation may eventually be widespread changes in state board regulation of sedation permits and more stringent control of sedation. Access to care in many parts of the country could be affected. We may be at an important junction where key considerations and decisions of our profession are necessarily influencing the direction and impact of future pharmacological management modalities of children's behavior.

This begs the question of how best to address this irregularity in training. Several possibilities can be offered, including, among others, modifying accreditation standards, developing sedation training centers or programs accommodating students who lack significant opportunities and resources for sedation experiences, and identifying experienced practitioners as mentors during student rotations.

Another insightful finding of this study was in relation to recognizing and managing emergencies. Consistently, the PDs rated themselves only slightly higher in rank in recognizing and managing the airway or a sedation emergency than did the students. Of note, though, is that the mean scores on the scale used for rating recognizing and managing emergencies would likely translate minimally to "good" rather than "excellent," suggesting that this is a critical area of sedation management that needs to be embraced and strengthened in the training programs as well.

Our findings suggest that those who reported "excellent" experience in sedation during training: expressed more confidence and comfort in recognizing and managing adverse events; were likely to have more experience in oral and submucosal administration of sedatives; and had been in academics or practice for a longer period of time. Strong evidence exists that sedations to various depths can be managed well and without significant mortality if highly motivated providers perform in well-organized sedation systems representing "best practice" care.[25]

Universal acceptance of a single pharmacological and behavioral technique may not be possible, and various definitions of success associated with sedation can be offered. In this study, we found that protective immobilization was used by most respondents for safety of the patient and dental team, some special needs patients, and during inadequate levels of sedation (ie, when the patient is uncooperative). Furthermore, the students seem to believe that restraint may be a common and valid intervention during sedation and do not necessarily support the notion that sedation has failed if used. Other perspectives are that success can be defined as avoiding GA or that some treatment is accomplished at a visit. These perspectives were supported by over 50% of the students. Yet, when sedation was inadequate, the majority of students indicated they would elect to use an alternative modality (eg, GA). Using a different regimen, adjusting the dose with the original regimen, or using different routes are other solutions. It is possible that consensus development on what constitutes an adequate definition

of sedation success may be beneficial for a broad understanding of sedation outcomes.

Another finding in our study is that a clear majority of respondents estimated that 25% or less of the patients required sedation, excluding nitrous oxide. They also estimated that 10 patients or less are sedated per week. These findings are consistent with others.[1] There is variability in the use of different sedatives, their combinations, and dosages among the programs. The age ranges of children reportedly sedated were primarily between 2 and 9-years-old.

Midazolam was found in this study as the most frequently used sedative, a finding that is consistent with recent survey and study literature.[1,5,26-34] Pervasive use of midazolam with and without other agents and in the dosages reported in this study suggest that, as a whole, the depth of sedations in training programs are "lightening." This target is laudable, but one must question the effectiveness of these drugs in preschoolers in the doses reported for anything other than very short procedures. There may also be a trend for an increased use of GA, as predicted by one recent survey[7]; however, one also wonders about issues of access to care associated with financial overlays in the current economy.

Apparently, 1 or 2 programs continue to use some drugs in dosages that have the potential for inducing deep sedation in some children (eg, chloral hydrate at 75 mg/kg). Also some drugs mentioned are clearly categorized as general anesthetics (eg, Ketamine); however, it is unclear whether the intent for these agents was deep sedation or general anesthesia and if the case(s) was managed by an anesthesiologist or someone experienced in general anesthesia.

One must consider this study's limitations. Survey design and formatting can elicit biased, limited, or guess-type responses, and thus misinterpretation. It is not possible with the design of the study to have eliminated some of these possibilities. Since this study surveyed 2 targeted groups and used different survey queries, design, and formatting, one must be cautious in interpreting the conceptual aspects of the issues addressed. No attempt was made to determine intra- or inter-respondent reliability. The response rates were less than expected, and it is possible that the respondents are not representative of the majority of both populations sampled. Nonetheless, similarities in responses by the 2 groups to similarly related topics suggest some sense of consistency in interpretation or perception of sedation training that occurs in advanced pediatric dentistry programs.

Conclusions

Based on the results of this survey study, it can be concluded that:

1. variable experiences with sedation in training programs may impact competency outcomes in the area of pharmacological management of pediatric patients;
2. strategies should be developed to strengthen consistency of competencies in sedation practices across academic training programs; and
3. benzodiazepines are the most popular sedatives administered via the oral route.

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Abstract of the Scientific Literature

Using numeric pain scores with children: What do they really mean?

The purpose of this study was to determine how self reported pain score measurements by children are interpreted for clinical meaning. This observational, prospective study evaluated the relationship between a 0 (no pain) -10 (most pain) numeric rating scale for pain and the child's perceived need for medication (PNM); their preception of feeling better or pain relief (PR); and their perceived satisfaction with pain management (PS) in an operative setting. The study received IRB approval by the University of Michgan with assent and consent forms signed by children participants and their parents. One hundred thirteen children aged 7-16 years old were in the study and 397 observations were recorded. These observations included 86 two pair sets and 19 unpaired in 10 and 1 pair in 17 cases. Each child was undergoing surgery, presenting with post operative pain. Included in the study were children who spoke English and who passed tests confirming their ability to self report post operative pain. The children used patient controlled anesthesia (PCA) and were observed for data independent of their caretakers after at least one hour of being awake. Observations were done in the first 24 hours after surgery by trained research personnel, who were blinded to clinical interventions between their observations, the children where asked to score their pain from 0-10 NRS, rate their PMN and their PS. Assessments were repeated every 2 hours. Only 1 paired observation was recorded the day of surgery. Parents were not included in the child's data observation. Data was analyzed using SPSS statistical software, and applicable statistical analyses were used resulting in P values of <0.0125 as significant. To determine if the relationships between pain scores and other measures could be modified, gender, age and previous surgeries were considered. Pain scores for perceived need (PNM) were significantly higher than the "no need" group. Pain scores associated with perceived feeling better (PS) was significantly lower for children with NRS<5. For age, gender and previous surgeries, female children with a history of previous surgeries reported somewhat or very satisfied at higher pain scores. Numerical rating scales are generally reliable in reflecting children's level of pain associated with perceived need for medication, pain relief and perceived satisfaction with pain management.

Comment: *According to this study a 0-10 numeric rating scale can be a reliable tool for evaluating pain in children. As pediatric dentists, much of what we do may provoke post –op pain in child patients. It may be worthwhile to add age appropriate pre- and post –op pain scores to our standard progress note records.* ***JGJ***

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