CONFERENCE PAPER

Pharmacological Management of the Pediatric Dental Patient

Stephen Wilson, DMD, MA, PhD

Dr. Wilson is professor, chair, and associate dean for graduate studies, Department of Pediatric Dentistry, University of Colorado School of Dentistry, Denver, Colo, and Chief of Dentistry, The Children's Hospital, Denver.
Correspond with Dr. Wilson at wilson.stephen@tchden.org

Abstract

Pharmacological management of the pediatric dental patient is considered a subcategory of a broader collection of professional mediated activities known as behavior management techniques. Pharmacological techniques are generally divided into either: (1) various levels of sedation; or (2) general anesthesia. Pharmacological techniques are not universally offered by practicing dentists for a host of reasons including, but not limited to: (1) variation in practitioner training and philosophy; (2) state rules and regulations; (3) cost and reimbursement; and (4) safety issues. (*Pediatr Dent.* 2004;26:131-136)

KEYWORDS: BEHAVIOR MANAGEMENT, SEDATION, GENERAL ANESTHESIA

For the parent who never suffered the ravages of carious lesions as a child, the acceptance of patient management techniques—beyond simple communication for the treatment of his/her child in the dental operatory—may seem as disconcerting, as the child's task of coping with the discomfort and painful consequences of the disease itself. Yet, today's discussions are focused on behavior management techniques and their implications for those who treat child dental disease as well as society, which demands that such treatment be performed efficiently and humanely.

Behavior management techniques are numerous, sometimes controversial, and likely as varied in terms of style of delivery as the number of practitioners who use the techniques.[1-5] Furthermore, the extremes in types and configurations of preference of techniques available for managing the child patient are likely as diverse as the training programs that teach their use.[4,6-10] However, at least 1 behavior management technique category consistently taught, albeit in variable formats, is pharmacological management of the patient. It is also the most likely to cause potential long-term adverse outcomes.

Pharmacological management of pediatric dental patients can be divided broadly into 2 general categories: (1) sedation; and (2) general anesthesia (GA). Although the technical and pharmacological context of sedation and GA vary, each has its own merit in terms of meeting patient and professional needs. A review of the literature on behavior management techniques associated with pediatric dentistry indicates that the one technique which most articles are written about is sedation and, to a much lesser extent, GA.[2,4,6,8-63] In fact, a Medline search involving sedation and children, including medical studies, yields several hundred articles.

In deciding whether to use pharmacological management, several prominent factors must be considered—each of which is intrinsically complex when considered in the context of the pediatric dental setting. Among some of these factors are:

1. the risks involved with pharmacological management compared to routine communicative techniques;
2. past safety record of pharmacological management;
3. extent of the patient's dental needs;
4. practitioner training and experience, including the ability to "rescue" a child when significantly compromised;
5. extent of professional investment and support for the technique, influence of other professional organizations related to safety and guidelines;
6. monitoring;
7. cost and third-party payors;
8. venue issues (ie, office vs outpatient care facility);
9. parental expectations and societal changes;
10. nature of the child's cognitive and emotional needs and personality, and
11. integration of these factors into an acceptable modus operandi embraced by the dental profession.

Sedation risks and safety

There are many risks involved with child sedation for dental procedures. Brain damage and death are the most dramatic and paralyzing outcomes for the patient, family, staff, and practitioner. These tragic consequences are caused primarily by respiratory and airway compromise in sedated children.[64-67] Minor risks include vomiting, irrational and paradoxical behaviors, and extremes in physiological parameters (eg, sustained high heart rate in a lightly sedated toddler).

Any unhealthy child can be at significant risk for a sedative procedure. It is imperative that the child's health history be reviewed critically and a physical evaluation completed, including examination of the airway.[68] Depending on the child's behavior, especially when disruptive and crying behaviors dominate, the airway examination can be misleading. Therefore, in addition to an airway examination, parents must be queried about the occurrence, frequency, and degree of snoring.

Other issues such as allergies, respiratory and cardiovascular risk factors, impaired metabolic and organ functions, and the psychosocial makeup of the child are always important to address and understand. To optimize favorable sedation outcomes, only healthy children or those with very minor conditions (eg, mild cerebral palsy) should be sedated.

The orofacial complex in humans is unique. Phylogenetic and ontogenetic evolution has been designed to keep physical threats away from one's head and its surrounding "space." Even psychological invasion of that space appears to cause significant stress. Hence, the practice of dentistry may have its own intrinsic stimuli that evoke avoidance mechanisms in adults and especially in children. Despite light levels of sedation, this human attribute may activate significant behavioral consequences.

Restorative dentistry is usually performed in the mouth with an aerosol water spray. The mouth is a part of the airway, and when it is being challenged by procedural steps, the airway is also challenged. If the patient's ability to control the airway is impaired due to pharmacological override of routine airway reflexes (eg, swallowing), failure to compensate or protect those reflexes can result in more primitive reflexes such as laryngospasms. An unresolved and poorly managed laryngospasm can result in significant brain damage or death. Preventive and protective formats such as rubber dams are certainly indicated, especially in sedated patients. Nonetheless, rubber dams in children and some adults evoke feelings of suffocation. They can also aggravate a situation in which patients already feel their ability to mediate any sense of control of their environment is minimized.

Morbidity and mortality statistics related to sedation are difficult to obtain and put into a reasonable safety perspective. There is no doubt that sedation deaths involving children have occurred in the United States,[64-66] but there is no evidence suggesting that any sedation death has occurred when the practitioners faithfully followed appropriate sedation guidelines and were within the limits of professional parameters of care.

Despite estimates promulgated by various authors, it is not possible to determine the safety record associated either with sedations nor GA involving children and dentistry. There are individual reports of morbidity and mortality and quasi meta-analyses of reports and cases that can provide clues about the number of adverse outcomes. When considered in the context of time over which these incidents occurred, however, the number of cases safely completed remains unknown. Even through a generous extrapolation technique applied to published data, one might conclude that somewhere between 100,000 and 250,000 sedations involving children and dentistry are done annually.[12-14] This number would constitute the denominator upon which the reported adverse events can be placed.

Pharmacological management cost and reimbursement issues

Perhaps one of the most important issues affecting the choice of pharmacological behavior management is the cost and reimbursement for providing GA.[15] Reimbursement for services includes:

1. dental procedures;
2. anesthesia costs; and
3. facilities fees, depending on whether the procedure is done in an outpatient care facility or hospital.

Representative costs of each category may range from $500 to $1,500 for dental care, $200 to $2,000 for anesthesia, and $10 to $30/minute for facility fees. Medicaid usually pays for the cost of GA, including the 3 categories mentioned; however, the reimbursement rate from Medicaid varies considerably from state to state and is often below a "break-even" rate for practitioners.

It is probably safe to say and generally recognized by the dental community that the majority of the insurance industry does not cover the cost of GA for dental procedures in children. Comparably, the cost of GA is covered for medical procedures that, like dentistry, can be performed under local anesthesia such as removal of a splinter, myringotomies, and removal of in-grown toenails. Although the number of cases per year associated with some minor surgery may be small, certainly myringotomies, tonsillectomies, and adenoidectomies are quite common and comparable to the numbers involving carious lesions. A minority of states has statutory regulations mandating insurance coverage of GA for provision of dental care for children and the developmentally disabled. Nonetheless, some states do mandate stipulated coverage.

The justification for GA by the medical specialties is the same as that for the dental specialties—namely patient fear and anxiety associated with needles and potentially uncomfortable procedures. The medical specialists could easily use a papoose board or other immobilization technique to render care. Like dentistry, however, the likelihood of poorer procedural outcomes increases when immobilization techniques for uncooperative children are used. In fact, it may be unsafe. Yet, the insurance lobby

is strongly opposed to coverage of dental procedures. The reason seems directly related to cost containment. Dental caries is the most common chronic childhood disease, and, when it comes to cost vs screaming and a lesser quality in care delivery, cost is the winner.

Training issues and sedation as a pharmacological alternative

Sedation is a potential alternative to GA, which, like GA, has appropriate indications for use. Generally, sedation is less costly. Nonetheless and equivocally, the risk to the normal, healthy child may be increased—not due solely to the drugs, but to the training limitations of some practitioners and their adherence to sedation guidelines. In today's pediatric dental training programs, the number of sedations done by each resident varies considerably. There is no definitive statistic or data to describe the distribution in the level of sedation taught across training programs, but indirect evidence would suggest lighter sedations (eg, use of midazolam) are administered more frequently than deep sedations. Because evidence does exist supporting the notion that clinicians generally practice techniques similar to how they were trained, it is not surprising that few practitioners report using deep sedation techniques.[10] In general, dental students are not often taught how to manage patients under deep sedation, especially considering the adverse events that may manifest and require immediate intervention. Faculty are often not consistently trained and competent in handling the conditions of the deeply sedated patient and potential consequences of deep sedation.

In some situations, practitioners have been taught deep sedation or they feel the necessity to use it to address significant carious lesions in patients who are behaviorally difficult to manage. In other words, they have no other resources and feel the natural professional obligation to help the needy child who otherwise suffers dental pain and discomfort. Arguably, the consequences of an adverse reaction that cannot be handled by the practitioner in these circumstances becomes rationally minimized by the clinician, who has a false perception of competency in emergency scenarios. This perception is based on the belief that adverse events during deep sedation (eg, laryngospasms) are rare occurrences. Dentists often tell themselves "it has never happened to me" or "it won't happen to me." The perception is reinforced by the multitude of cases in which no adverse events occur or are reported—a testimonial to the physiological resiliency of the pharmacologically challenged child.

What happens, however, when the probability not only favors such an event, but the event actually occurs? The educational process and clinical experience breaks down as the responsiveness to and emphasis of patient rescue relies on the inappropriate notion of calling 911, which does not directly assist patients in their most life-threatening situations. Without satisfactory resolution of the adverse event, time becomes the enemy to the clinician and, more importantly, to the child's life.

The solutions to this issue are:

1. more extensive and standardized training across programs, as encouraged by regulatory mandates of professional organizations and state agencies;
2. resolution of the financial and political issues associated with the use of GA; or
3. continuance of the status quo.

The author believes focusing on the solution involving GA, in the long run, is the best outcome for the profession and patient. If it has worked for medical surgical specialties, why not for the dental profession?

Professional issues

Several inter- and intraprofessional issues affecting the use of pharmacological management of pediatric patients have interfered with dentistry's well-intended motives of rendering quality restorative treatment of caries lesions. Examples include subtle but distinct professional pressures, particularly by medical anesthesiologists for independence in the roles of the operator and anesthetist. Oral and maxillofacial surgeons and pediatric dentists have propagated this practice. Again, the reason for this continuance is probably embedded in financial considerations.

The extent of dental care often requires 2 or more sedation appointments because of the possibility and limitation associated with overdosing the patient with local anesthetics. The literature is very clear, however, that the cost of 2 or more sedations, when considered in terms of the quality of care delivered, is more than 1 GA procedure.

Medical professionals and the media occasionally have been most critical of the manner in which child dental patients are managed. As a result, some of our techniques—such as hand-over-mouth, voice control, and, in some instances, immobilization—have been alleged as inhumane and barbaric. Pediatric dentistry's old and deeply engrained perception is that they are appropriate, primarily because pediatric dentists have no other options.

Even sedation techniques have drawn the scrutiny of our medical anesthesiology colleagues through television, committee, and publication media, including the American Academy of Pediatric Dentistry's (AAPD) failure to use sedation guidelines consistent with medical anesthesiologists. Unfortunately, in many instances, these criticisms are made without full knowledge of their implications or, more often, without intimate knowledge of dental procedures and sedations.

For more than a decade, the American Academy of Pediatrics and the AAPD have not mutually agreed upon a set of sedation guidelines for children.[69] Most of the stumbling blocks have involved a failure to directly communicate and understand each other's position on certain issues. Sometimes the vitriolic innuendos are without the benefit of any firsthand experience of what actually happens during sedations. Arguably, the latter situation is due more to the inexperience of medical anesthesiologists with dental sedations rather than vice-versa.

Societal and parenting issues

Parents have slowly been changing their perceptions of professionals who care for their children over the last 2 or 3 decades, and are beginning to influence the professional's ability to practice as they have in the past. Unfortunately, trust is no longer a ubiquitous and integral component of the relationship a parent has with the professional. The old concept of *"in parentis loco"* is lost in the pages of textbooks published a quarter of a century ago. The reasons for the change are many.

There has been a fine balance between the professional's ability, desire, and need to act as a substitute parent and the professional duties and responsibilities associated with delivering dental care. Sometimes what a parent expects of the professional and the translation of the expectation into the reality of mediating appropriate professional care are at odds with one another in terms of physical, emotional, cognitive, and psychological factors of dental patients. As a simple, common example today, a parent may expect that a pediatric dentist can administer local anesthesia to a shy, difficult-to-manage toddler without the child crying because he/she is a "pediatric dentist."

A recent survey sample of American Board of Pediatric Dentistry Diplomates on parenting and its effects on practice indicated that children's behaviors have changed for the worse over the past decade or so.[5] They report that children tend to cry and be more disruptive today than in the past. They assign some blame to parenting, divorce, and other societal factors. Thus, the likelihood of more assertive behavior management or the use of pharmacological management increasing seems reasonable over the coming decades. A recent survey of directors of accredited pediatric dentistry training programs who report a higher incidence of sedations occurring in their program in recent years supports this conclusion.

Conclusions

GA for a healthy, fearful child is extremely safe. The medical or dental anesthesiologist (or in some states, certified registered nurse anesthetists) usually provides the GA in the dentist's private office, outpatient care facilities, or in a hospital. Some medical specialists are opposed to GA being administered outside an outpatient care facility or hospital primarily because of perceived inabilities to rescue a child in trouble; however, little evidence supporting such an opinion is available, and whatever evidence is used to sustain this opinion is fraught with questionable interpretations.

Pharmacological management of pediatric dental patients is an acceptable and desirable technique. There are many issues, both pro and con, that influence the direction of development of a philosophy of pharmacological management of children for dental procedures universally accepted in medical, dental, business, and societal communities.

To begin a movement toward such a philosophy, a well-defined approach and initiative need to be mounted. The goals and objectives that must be minimally included are:

1. a series of comprehensive, well-controlled, and parametric research endeavors associated with pharmacological patient management aimed at the development of a clinical science of safety and efficiency;
2. dissemination of current and future knowledge to a host of communities of interest concerning pharmacological management as an acceptable and desirable behavior management technique;
3. collaboration among medical and dental organizations in the pursuit of safe, reliable, and mutually acceptable guidelines;
4. political and business initiatives designed to address cost containment; and
5. development and implementation of a set of measurable, personal, and societal-contingent responsibilities designed to minimize dental disease and maximize its management.

This philosophy will necessitate time, strategic planning, and an embodiment of courage, desire, faith, perseverance, and indefatigable energies for success to occur and for children to be free of the pain, fear, and anxiety associated with oral health.

References

1. McKnight-Hanes C, Myers DR, Dushku JC, Davis HC. The use of behavior management techniques by dentists across practitioner type, age, and geographic region. *Pediatr Dent*. 1993;15:267-271.
2. Cotton KT, Seale NS, Kanellis MJ, Damiano PC, Bidaut-Russell M, McWhorter AG. Are general dentists' practice patterns and attitudes about treating Medicaid-enrolled preschool age children related to dental school training? *Pediatr Dent*. 2001;23:51-55.
3. Allen KD, Stanley RT, McPherson K. Evaluation of behavior management technology dissemination in pediatric dentistry. *Pediatr Dent*. 1990;12:79-82.
4. Nathan JE. Management of the difficult child: A survey of pediatric dentists' use of restraints, sedation and general anesthesia. *J Dent Child.* 1989;56:293-301.
5. Casamassimo PS, Wilson S, Gross L. Effects of changing US parenting styles on dental practice: Perceptions of diplomates of the American Board of Pediatric Dentistry presented to the College of Diplomates of the American Board of Pediatric Dentistry 16th Annual Session, Atlanta, Ga, Saturday, May 26, 2001. *Pediatr Dent*. 2002;24:18-22.
6. Acs G, Musson CA, Burke MJ. Current teaching of restraint and sedation in pediatric dentistry: A survey of program directors. *Pediatr Dent*. 1990;12:364-367.
7. Casamassimo PS, Wilson S. Opinions of practitioners and program directors concerning accreditation standards for postdoctoral pediatric dentistry training programs. *Pediatr Dent*. 1999;21:354-358.

8. Davis MJ. Conscious sedation practices in pediatric dentistry: A survey of members of the American Board of Pediatric Dentistry College of Diplomates. *Pediatr Dent*. 1988;10:328-329.
9. Wilson S. A survey of the American Academy of Pediatric Dentistry membership: Nitrous oxide and sedation. *Pediatr Dent*. 1996;18:287-293.
10. Wilson S, Farrell K, Griffen A, Coury D. Conscious sedation experiences in graduate pediatric dentistry programs. *Pediatr Dent.* 2001;23:307-314.
11. Houpt MI. Report of project USAP: The use of sedative agents in pediatric dentistry. *J Dent Child*. 1989;56:302-309.
12. Houpt MI. Project USAP—Part III: Practice by heavy users of sedation in pediatric dentistry. *J Dent Child*. 1993;60:183-185.
13. Houpt MI. Project USAP the use of sedative agents in pediatric dentistry: 1991 update. *Pediatr Dent*. 1993;15:36-40.
14. Houpt MI. Project USAP 2000—use of sedative agents by pediatric dentists: A 15-year follow-up survey. *Pediatr Dent*. 2002;24:289-294.
15. Lee JY, Vann WF, Roberts MW. A cost analysis of treating pediatric dental patients using general anesthesia vs conscious sedation. *Pediatr Dent*. 2000; 22:27-32.
16. Milnes AR. Intravenous procedural sedation: An alternative to general anesthesia in the treatment of early childhood caries. *J Can Dent Assoc*. 2003;69:298-302.
17. Veerkamp JS, Gruythuysen RJ, van Amerongen WE, Hoogstraten J. Dental treatment of fearful children using nitrous oxide. Part 2: The parent's point of view. *J Dent Child*. 1992;59:115-119.
18. Singh N, Pandey RK, Saksena AK, Jaiswal JN. A comparative evaluation of oral midazolam with other sedatives as premedication in pediatric dentistry. *J Clin Pediatr Dent*. 2002;26:161-164.
19. Religa ZC, Wilson S, Ganzberg SI, Casamassimo PS. Association between bispectral analysis and level of conscious sedation of pediatric dental patients. *Pediatr Dent*. 2002;24:221-226.
20. McComb M, Koenigsberg SR, Broder HL, Houpt MI. The effects of oral conscious sedation on future behavior and anxiety in pediatric dental patients. *Pediatr Dent*. 2002;24:207-211.
21. Willumsen T, Vassend O, Hoffart A. A comparison of cognitive therapy, applied relaxation, and nitrous oxide sedation in the treatment of dental fear. *Acta Odontol Scand*. 2001;59:290-296.
22. Willumscn T, Vassend O, Hoffart A. One-year follow-up of patients treated for dental fear: Effects of cognitive therapy, applied relaxation, and nitrous oxide sedation. *Acta Odontol Scand*. 2001;59:335-340.
23. Leelataweedwud P, Vann WF Jr. Adverse events and outcomes of conscious sedation for pediatric patients: Study of an oral sedation regimen. *J Am Dent Assoc*. 2001;132:1531-1539,1596.
24. Dallman JA, Ignelzi MA, Jr, Briskie DM. Comparing the safety, efficacy and recovery of intranasal midazolam vs oral chloral hydrate and promethazine. *Pediatr Dent*. 2001;23:424-430.
25. Wilson S, Easton J, Lamb K, Orchardson R, Casamassimo P. A retrospective study of chloral hydrate, meperidine, hydroxyzine, and midazolam regimens used to sedate children for dental care. *Pediatr Dent.* 2000;22:107-112.
26. Primosch RE, Buzzi IM, Jerrell G. Monitoring pediatric dental patients with nasal mask capnography. *Pediatr Dent*. 2000;22:120-124.
27. Peretz B, Faibis S, Ever-Hadani P, Eidelman E. Dental health behavior of children with BBTD treated using general anesthesia or sedation, and of their parents in a recall examination. *J Dent Child*. 2000;67: 50-54,59.
28. Eidelman E, Faibis S, Peretz B. A comparison of restorations for children with early childhood caries treated under general anesthesia or conscious sedation. *Pediatr Dent.* 2000;22:33-37.
29. Ram D, Mamber E, Chosack A, Fuks AB. The effect of metoclopramide and hydroxyzine in sedation of infants undergoing dental treatment. *J Dent Child.* 1999;66:49-52,113.
30. Primosch RE, Buzzi IM, Jerrell G. Effect of nitrous oxide-oxygen inhalation with scavenging on behavioral and physiological parameters during routine pediatric dental treatment. *Pediatr Dent*. 1999;21:417-420.
31. Carr KR, Wilson S, Nimer S, Thornton JB Jr. Behavior management techniques among pediatric dentists practicing in the southeastern United States. *Pediatr Dent*. 1999;21:347-353.
32. Rohlfing GK, Dilley DC, Lucas WJ, Vann WF Jr. The effect of supplemental oxygen on apnea and oxygen saturation during pediatric conscious sedation. *Pediatr Dent*. 1998;20:8-16.
33. Peretz B, Katz J, Zilburg I, Shemer J. Response to nitrous-oxide and oxygen among dental phobic patients. *Int Dent J*. 1998;48:17-23.
34. Veerkamp JS, Porcelijn T, Gruythuysen RJ. Intravenous sedation for outpatient treatment of child dental patients: An exploratory study. *J Dent Child*. 1997;64:48-54.
35. Primosch R, McLellan M, Jerrell G, Venezie R. Effect of scavenging on the psychomotor and cognitive function of subjects sedated with nitrous oxide and oxygen inhalation. *Pediatr Dent*. 1997;19:480-483.
36. Fukuta O, Braham RL, Yanase H, Kurosu K. Intranasal administration of midazolam: Pharmacokinetic and pharmacodynamic properties and sedative potential. *J Dent Child*. 1997;64:89-98.
37. Shapira J, Holan G, Botzer E, Kupieztky A, Tal E, Fuks AB. The effectiveness of midazolam and hydroxyzine as sedative agents for young pediatric dental patients. *J Dent Child*. 1996;63:421-425.

38. Reinemer HC, Wilson CF, Webb MD. A comparison of 2 oral ketamine-diazepam regimens for sedating anxious pediatric dental patients. *Pediatr Dent*. 1996;18:294-300.
39. Reeves ST, Wiedenfeld KR, Wrobleski J, Hardin CL, Pinosky ML. A randomized double-blind trial of chloral hydrate/hydroxyzine vs midazolam/acetaminophen in the sedation of pediatric dental outpatients. *J Dent Child*. 1996; 63:95-100.
40. McCann W, Wilson S, Larsen P, Stehle B. The effects of nitrous oxide on behavior and physiological parameters during conscious sedation with a moderate dose of chloral hydrate and hydroxyzine. *Pediatr Dent*. 1996;18:35-41.
41. Kupietzky A, Holan G, Shapira J. Intranasal midazolam better at effecting amnesia after sedation than oral hydroxyzine: A pilot study. *Pediatr Dent.* 1996;18:32-34.
42. Houpt MI, Kupietzky A, Tofsky NS, Koenigsberg SR. Effects of nitrous oxide on diazepam sedation of young children. *Pediatr Dent*. 1996;18:236-241.
43. Croswell RJ, et al. A comparison of conventional vs electronic monitoring of sedated pediatric dental patients. *Pediatr Dent*. Dilley DC, Lucas WI, Vann WF Jr. 1995;17:332-339.
44. Sanders BJ, Potter RH, Avery DR. The effect of sleep on conscious sedation. *J Clin Pediatr Dent*. 1994;18:211-214.
45. Hartgraves PM, Primosch RE. An evaluation of oral and nasal midazolam for pediatric dental sedation. *J Dent Child*. 1994;61:175-81.
46. Duncan WK, De Ball S, Perkins TM. Chloral hydrate sedation: A simple technique. *Compend Contin Educ Dent*. 1994;15:884,886-888,890,894.
47. Davila JM, Herman AE, Proskin H.M, Vitale D. Comparison of the sedative effectiveness of 2 pharmacological regimens. *J Dent Child*. 1994;61:276-281.
48. Wilson S. Facial electromyography and chloral hydrate in the young dental patient. *Pediatr Dent*. 1993;15:343-347.
49. Veerkamp JS, Gruythuysen RJ, Hoogstraten J, van Amerongen WE. Dental treatment of fearful children using nitrous oxide. Part 4: Anxiety after 2 years. *J Dent Child*. 1993;60:372-376.
50. Tilliss TS. Behavior management techniques in predoctoral and postdoctoral pediatric dentistry programs. *J Dent Educ*. 1993;57:232-238.
51. Lochary ME, Wilson S, Griffen AL, Coury DL. Temperament as a predictor of behavior for conscious sedation in dentistry. *Pediatr Dent*. 1993;15:348-352.
52. Fukuta O, Braham RL, Yanase H, Atsumi N, Kurosu K. The sedative effect of intranasal midazolam administration in the dental treatment of patients with mental disabilities. Part 1. The effect of a 0.2 mg/kg dose. *J Clin Pediatr Dent*. 1993;17:231-237.
53. Dunn-Russell T, Adair SM, Sams DR, Russell CM, Barenie JT. Oxygen saturation and diffusion hypoxia in children following nitrous oxide sedation. *Pediatr Dent*. 1993;15:88-92.
54. Alfonzo-Echeverri EC, Berg JH, Wild TW, Glass NL. Oral ketamine for pediatric outpatient dental surgery sedation. *Pediatr Dent*. 1993;15:182-185.
55. Sams DR, Thornton JB, Wright JT. The assessment of 2 oral sedation drug regimens in pediatric dental patients. *J Dent Child*. 1992;59:306-312.
56. Barr EB, Wynn RL. IV sedation in pediatric dentistry: An alternative to general anesthesia. *Pediatr Dent.* 1992;14:251-255.
57. Veerkamp JS, van Amerongen WE, Hoogstraten J, Groen HJ. Dental treatment of fearful children, using nitrous oxide. Part I: Treatment times. *J Dent Child*. 1991;58:453-457.
58. Henry RJ, Jerrell RG. Ambient nitrous oxide levels during pediatric sedations. *Pediatr Dent.* 1990;12:87-91.
59. Iwasaki J, Vann WF Jr, Dilley DC, Anderson JA. An investigation of capnography and pulse oximetry as monitors of pediatric patients sedated for dental treatment. *Pediatr Dent.* 1989;11:111-117.
60. Willumsen T, Vassend O. Effects of cognitive therapy, applied relaxation and nitrous oxide sedation. A five-year follow-up study of patients treated for dental fear. *Acta Odontol Scand*. 2003;61:93-99.
61. Bui T, Redden RJ, Murphy S. A comparison study between ketamine and ketamine-promethazine combination for oral sedation in pediatric dental patients. *Anesth Prog*. 2002;49:14-18.
62. Milano M, Seybold SV. Dental care for special needs patients: A survey of Texas pediatric dentists. *J Dent Child.* 2002;69:126,212-215.
63. Peretz B. The use of sedation while treating paediatric dental patients in Israel. *Int J Paediatr Dent*. 2002;12:355-356.
64. Cote CJ, Notterman DA, Karl HW, Weinberg JA, McCloskey C. Adverse sedation events in pediatrics: A critical incident analysis of contributing factors. *Pediatrics*. 2000;105:805-814.
65. Krippaehne JA, Montgomery MT. Morbidity and mortality from pharmacosedation and general anesthesia in the dental office. *J Oral Maxillofac Surg*. 1992;50:691-699.
66. Jastak JT, Peskin RM. Major morbidity or mortality from office anesthetic procedures: A closed-claim analysis of 13 cases. *Anesth Prog.* 1991;38:39-44.
67. D'Eramo EM, Bookless SJ, Howard JB. Adverse events with outpatient anesthesia in Massachusetts. *J Oral Maxillofac Surg.* 2003;61:793-800.
68. Fishbaugh DF, Wilson S, Preisch JW, Weaver JM 2nd. Relationship of tonsil size on an airway blockage maneuver in children during sedation. *Pediatr Dent*. 1997;19:277-281.
69. Wilson S, Creedon RL, George M, Troutman K. A history of sedation guidelines: Where we are headed in the future. *Pediatr Dent*. 1996;18:194-199.