

Pharmacologic management for pediatric dental patients in the 21st century

Beau D. Meyer, DDS, MPH ■ Jung-Wei Chen, DDS, MS, PhD ■ Jessica Y. Lee, DDS, MPH, PhD

Most children are able to cooperate during conventional, in-office dental treatment using traditional, communicative behavior guidance techniques that are carefully selected and applied to the developmental needs of a particular child. Children who are unable to cooperate during conventional treatment due to a lack of psychological or emotional maturity and/or the existence of a mental, physical, or medical disability may require pharmacologic techniques such as procedural sedation or general anesthesia to complete rehabilitative dental treatment. Patient safety dictates that careful preparation and robust case selection processes guide clinical decision-making related to pharmacologic behavior guidance. Before using these techniques, the sedation provider must demonstrate an adequate understanding of these techniques, from definitions and best practices to case selection and patient safety. This article presents essential information—with an emphasis on best practices and patient safety—for dentists who are considering pharmacologic behavior guidance for the children they treat.

Received: June 25, 2018

Accepted: July 31, 2018

Behavior guidance has played an important role in dental treatment for young children. The majority of children are able to cooperate for dental treatment when the dentist uses nonpharmacologic behavior guidance techniques that are chosen carefully and customized for each child. The goal is to achieve a positive and optimal dental experience for children at various levels of age, cultural, medical, social, and psychological development. If, despite the use of basic behavior guidance techniques, a child is unable to accept dental treatment due to a lack of psychological or emotional maturity and/or the existence of a mental, physical, or medical disability, then pharmacologic techniques such as procedural sedation or general anesthesia can be considered by the dental practitioner.

Responsible and ethical clinicians have a thorough understanding of pharmacologic approaches to behavior guidance before undertaking such procedures. Required areas of knowledge include definitions, best practice guidelines, patient selection, and, above all, safety and emergency care. This article presents essential information for dentists who are considering pharmacologic approaches to behavior guidance for the children they treat.

Definitions and terminology

Professional organizations have similar but slightly different definitions of pharmacologic management or methods of anxiety and pain control. Most definitions are based on the depth of sedation and route of administration (Table).¹ Most states now require dentists who wish to sedate patients in their offices to obtain a sedation permit. Rules and qualifications vary by state, but dentists generally must demonstrate that they have received training and maintain skills in advanced life support. Dentists should understand the requirements for obtaining a sedation/general anesthesia permit as well as the requirements for personnel, monitoring equipment, documentation, sedation medications, rescue drugs, and recovery facilities before offering pharmacologic management to their patients.²

Guidelines

The American Academy of Pediatric Dentistry (AAPD) and American Academy of Pediatrics (AAP) have a long history of issuing joint guidelines for pediatric sedation.² These guidelines, which were adopted in 2006 and revised and reaffirmed in 2016, emphasize case selection, adequate provider training, and monitoring before, during, and after procedural sedation. These professional guidelines should not be interpreted as standards of care; rather, they represent collections of principles and procedures that clinicians can use to aid clinical decision-making and when counseling caregivers of children who require restorative

Published with permission of the Academy of General Dentistry.
© Copyright 2018 by the Academy of General Dentistry.
All rights reserved. For printed and electronic reprints of this article for distribution, please contact jkalettha@mossbergco.com.



AMERICA'S PEDIATRIC DENTISTS
THE BIG AUTHORITY on little teeth

**GENERAL DENTISTRY
SELF-INSTRUCTION**



Exercise No. 430, p. 23

Subject code: Pediatric Dentistry (430)

Table. Summary of terminology and definitions of pharmacologic behavior management.¹

Terminology	Definition
Minimal sedation	“A minimally depressed level of consciousness, produced by a pharmacological method, that retains the patient’s ability to independently and continuously maintain an airway and respond <i>normally</i> to tactile stimulation and verbal command. Although cognitive function and coordination may be modestly impaired, ventilatory and cardiovascular functions are unaffected.”
Moderate sedation	“A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.”
Deep sedation	“A drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained.”
General anesthesia	“A drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug induced depression of neuromuscular function. Cardiovascular function may be impaired.”
Enteral route	“Any technique of administration in which the agent is absorbed through the gastrointestinal tract or oral mucosa” (oral, rectal, and sublingual routes).
Parenteral route	“A technique of administration in which the drug bypasses the gastrointestinal tract” (intramuscular, intravenous, intranasal, submucosal, subcutaneous, and intraosseous routes).

or surgical dental treatment.³ While adherence to guidelines can improve the chances of a successful outcome, in no way can the outcome of sedation be guaranteed.

The joint AAPD/AAP best practice guidelines provide a thorough review of procedural sedation for the pediatric dental patient.² Before reviewing any case selection methods or clinical techniques, the guidelines underscore child safety as the governing principle. Using the continuum of pharmacologic behavior management is a healthcare decision that can have rare but significant negative consequences—pulmonary, cardiac, and neurologic—for the health of the child, and the decision to use pharmacologic adjuncts for behavior management should be taken seriously.⁴ Adverse reactions often occur when the child passes to a deeper level of sedation than the clinician intended, so it is essential that the sedation provider have the requisite skills and training to rescue the patient from levels of sedation that are deeper than intended.

In applying the guidelines, the clinician is afforded the opportunity, and indeed encouraged, to provide individualized care as long as he or she is adequately trained and prepared.² However, to emphasize safety and consistency, the guidelines highlight preoperative assessment and emergency preparation. The preoperative assessment begins with a thorough health review of the child, including medical and family history; a review of all prescribed and over-the-counter medications, as these may interact with the sedative agent; and a focused airway evaluation to determine the ability of the child to tolerate sedation procedures.

Several airway assessment tools are available, but Mallampati and Brodsky scales are 2 tools commonly used in pediatric dental residency training programs.^{5,6} Neither scale is intended

to “clear” a child for sedation; rather, each serves as a way to measure and describe the airway. From an airway perspective, the posterior pharynx of pediatric sedation candidates should be clearly visible with a view that is minimally obstructed by the tonsils (Mallampati score 1 or 2 or Brodsky score 0, 1+, or 2+). If the oropharynx is more than half obstructed by soft tissue, the risk for an adverse event during sedation increases.⁷

If the patient’s airway is deemed suitable to allow sedation, the dentist should review the patient’s dietary intake on the day of treatment to assess and minimize the risk of pulmonary aspiration should the child pass to deeper levels of sedation than are intended and lose protective airway reflexes. If any of the assessments raises a red flag, the clinician is responsible to notify and discuss the findings with the caregiver within the context of informed consent.

Emergency preparedness for using pharmacologic management includes having readily accessible facilities, personnel, monitors, and equipment to perform a rescue from a deeper than intended level of sedation. For example, a clinician offering minimal sedation should be prepared—from the personnel, facilities, monitoring, equipment, and documentation perspectives—to rescue an emergency at the moderate level. A lack of preparedness is inconsistent with the guiding principle of child safety.

Case selection and safety

Recent tragedies and the emergence of modern disease management techniques dictate that the practitioner counsel the child’s caregiver about the risks, benefits, and reasonable treatment alternatives to pharmacologic management during the informed consent process.⁸⁻¹⁰ A recently published algorithm provides

clinical decision-making guidance at the intersection of disease management and behavior management for routine, nonemergent treatment in the pediatric patient.¹¹ The algorithm aids the dentist in counseling the caregiver about the risks, benefits, and treatment alternatives for a child who has early childhood caries.

Age, weight, and medical status are 3 factors the clinician should carefully consider when evaluating a child.¹²⁻¹⁶ A young child (younger than 24 months), an obese child, or a child with a developmental disability may pose particular management issues and should be given special consideration, depending on the results of the clinical examination. During the clinical examination, the dentist can use the focused airway evaluation to determine suitability for sedation procedures. If the clinician cannot perform a thorough airway evaluation, a second opinion from the child's physician is recommended. The dental examination should note the tooth eruption status in addition to the caries status of the patient. If not all primary teeth are erupted, it may be in the child's interest to pursue nonsurgical caries management to delay restorative and surgical treatment.

When definitive restorative and surgical treatment is indicated, the AAPD offers guidance for treatment location: conventional in-office, ambulatory surgical center, or hospital operating room.¹⁷ The AAPD urges extreme caution for definitive dental treatment in children younger than 2 years of age.¹⁷ If treatment at this age is pursued and the child cannot cooperate with conventional care, a hospital operating room should be used rather than an ambulatory surgical center or in-office location.

Medications

The medications selected for minimum to moderate sedation vary from practitioner to practitioner. Some practitioners use a single medication, while others use a combination of medications. Most dentists use a regimen that they were taught during advanced dental education (residency training).¹⁸

It is essential that providers understand the pharmacokinetics and pharmacodynamics of drugs used as part of their sedation regimen. The drugs that are often used in procedural sedation are categorized as antianxiety drugs, sedative-hypnotics, antihistamines, or opioid analgesics.² Certain classes of drugs may fit different therapeutic categories. For example, benzodiazepines act on the γ -aminobutyric acid receptor, but the therapeutic classifications of these drugs range from sedative-hypnotic and anxiolytic to anticonvulsant and muscle relaxant.¹⁹ Sedation providers must understand the therapeutic classes of the drugs they choose in order to tailor the sedation regimen to the specific needs of the patient. For example, if painful procedures are planned, it may be useful to include an analgesic in the regimen. No matter the indication for a particular drug, providers must be adequately trained and licensed for the use of that medication before selecting it.

Cases and controversies

Recently, there has been an uptick in national media coverage of sedation tragedies. In 2017, a national news network ran a segment highlighting a string of heartbreaking sedation outcomes.^{20,21} The story cited dozens of examples of children dying during or after a sedation procedure in a dental office. Reports in the peer-reviewed literature also clearly demonstrate

the seriousness of providing procedural sedation for dental treatment, especially in light of new disease management philosophies.^{8,22}

Sedation-related tragedies are rare, but even one event is too many. Many cases can be traced to a lack of preparation, preoperative assessment, and intraoperative patient monitoring.²³ The AAPD/AAP joint best practice guidelines recommend that a second individual trained in advanced life support be responsible for monitoring the child patient during sedation procedures.²

In 2016, the California state legislature passed Caleb's Law following the death of a 6-year-old boy during a fairly routine dental procedure.^{24,25} This law directed 3 major changes to the practice of procedural sedation for dental procedures²⁵:

(1) it mandated improved data collection by the Dental Board of California by requiring them to collect specified epidemiologic information for each adverse event and encouraged the dental board to contract with a nonprofit anesthesia registry to begin real-time data collection for sedation encounters in the dental office; (2) mandated that the dental board perform a study of sedation safety; and (3) specified the contents of a disclosure form for parents concerning anesthesia-related risks in a dental setting.

The mandated study has been completed, and the original law has since been amended to require continuous 1:1 monitoring between the dentist or other certified health professional and the young child undergoing deep sedation and general anesthesia.^{26,27}

Conclusion

Adverse events often occur when the child passes to a deeper level of sedation than intended, so it is vitally important that sedation providers have the requisite skills, training, and available personnel to rescue patients from levels of sedation that are deeper than intended. Preparation is key, and careful attention must be made to preoperative assessment for case selection, intraoperative monitoring, and postoperative recovery. Dentists must always keep in mind that safety of all children is the number 1 priority. Every precaution must be taken to reduce all risks associated with pharmacologic management of children.

Author information

Dr Meyer is an assistant professor, Department of Pediatric Dentistry, University of North Carolina at Chapel Hill, School of Dentistry, where Dr Lee is a distinguished professor and chair, Department of Pediatric Dentistry, and a professor, Department of Health Policy and Management, Gillings School of Global Public Health. Dr Chen is a professor and program director, Advanced Education Program in Pediatric Dentistry, Loma Linda University, School of Dentistry, California.

References

1. American Dental Association. *Guidelines for the Use of Sedation and General Anesthesia by Dentists*. October 2016. http://www.ada.org/-/media/ADA/Education%20and%20Careers/Files/anesthesia_use_guidelines.pdf?la=en. Accessed January 15, 2017.

2. Monitoring and management of pediatric patients before, during, and after sedation for diagnostic and therapeutic procedures: update 2016. *Pediatr Dent*. 2017;39(6):278-307.
3. US Library of Medicine, National Institutes of Health. Standards and guidelines. *Collection Development Manual*. February 2004. <https://www.nlm.nih.gov/tsd/acquisitions/cdm/formats46.html>. Accessed June 1, 2018.
4. Lee JH, Kim EK, Song IK, et al. Critical incidents, including cardiac arrest, associated with pediatric anesthesia at a tertiary teaching children's hospital. *Paediatr Anaesth*. 2016;26(4):409-417.
5. Mallampati SR, Gatt SP, Gugino LD, et al. A clinical sign to predict difficult tracheal intubation: a prospective study. *Can Anaesth Soc J*. 1985;32(4):429-434.
6. Brodsky L. Modern assessment of tonsils and adenoids. *Pediatr Clin North Am*. 1989;36(6):1551-1569.
7. Kumar HV, Schroeder JW, Gang Z, Sheldon SH. Mallampati score and pediatric obstructive sleep apnea. *J Clin Sleep Med*. 2014;10(9):985-990.
8. Lee H, Milgrom P, Huebner CE, et al. Ethics rounds: death after pediatric dental anesthesia: an avoidable tragedy? *Pediatrics*. 2017;140(6):e20172370.
9. Edelstein BL, Ng MW. Chronic disease management strategies of early childhood caries: support from the medical and dental literature. *Pediatr Dent*. 2015;37(3):281-287.
10. Use of silver diamine fluoride for dental caries management in children and adolescents, including those with special healthcare needs. *Pediatr Dent*. 2017;39(6):146-155.
11. Meyer BD, Lee JY, Thikkurissy S, Casamassimo PS, Vann WF Jr. An algorithm-based approach for behavior and disease management in children. *Pediatr Dent*. 2018;40(2):89-92.
12. US Food and Drug Administration. FDA drug safety communication: FDA approves label changes for use of general anesthetic and sedation drugs in young children. April 27, 2017. <https://www.fda.gov/Drugs/DrugSafety/ucm554634.htm>. Accessed September 5, 2018.
13. Baker S, Yagiela JA. Obesity: a complicating factor for sedation in children. *Pediatr Dent*. 2006;28(6):487-493.
14. American Society of Anesthesiologists. *ASA Physical Status Classification System*. October 15, 2014. <https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system>. Accessed June 1, 2018.
15. Kannikeswaran N, Mahajan PV, Sethuraman U, Groebe A, Chen X. Sedation medication received and adverse events related to sedation for brain MRI in children with and without developmental disabilities. *Paediatr Anaesth*. 2009;19(3):250-256.
16. Havidich JE, Beach M, Dierdorf SF, Omega T, Suresh G, Cravero JP. Preterm versus term children: analysis of sedation/anesthesia adverse events and longitudinal risk. *Pediatrics*. 2016;137(3):e20150463.
17. Use of anesthesia providers in the administration of office-based deep sedation/general anesthesia to the pediatric dental patient. *Pediatr Dent*. 2017;39(6):308-311.
18. Folayan MO, Faponle A, Lamikanra A. Seminars on controversial issues. A review of the pharmacological approach to the management of dental anxiety in children. *Int J Paediatr Dent*. 2002;12(5):347-354.
19. Griffen CE III, Kaye AM, Bueno FR, Kaye AD. Benzodiazepine pharmacology and central nervous system-mediated effects. *Ochsner J*. 2013;13(2):214-223.
20. Snow K. Children at risk? Kids and sedation at the dentist's office [video]. *NBC News. Sunday Night with Megyn Kelly*. July 9, 2017. <https://www.nbcnews.com/megyn-kelly/video/children-at-risk-kids-and-sedation-at-the-dentist-s-office-989892675520>. Accessed June 1, 2018.
21. Carroll L. 9 questions to ask your dentist before your kids go under sedation. *NBC News. Today*. July 10, 2017. <https://www.today.com/health/children-being-sedated-dentistry-practice-now-under-new-scrutiny-t113039>. Accessed June 1, 2018.
22. Lee HH, Milgrom P, Starks H, Burke W. Trends in death associated with pediatric dental sedation and general anesthesia. *Paediatr Anaesth*. 2013;23(8):741-746.
23. Chicka MC, Dembo JB, Mathu-Muju KR, Nash DA, Bush HM. Adverse events during pediatric dental anesthesia and sedation: a review of closed malpractice insurance claims. *Pediatr Dent*. 2012;34(3):231-238.
24. Caleb's Law. AB 2235, 2015-2016 Reg Sess (CA 2016). https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB2235. Accessed September 5, 2018.
25. Agarwal R, Kaplan A, Brown R, Coté CJ. Concerns regarding the single operator model of sedation in young children. *Pediatrics*. 2018;141(4):e20172344.
26. Dental Board of California. *Pediatric Anesthesia Study*. July 2016. https://www.dbc.ca.gov/formspubs/anesthesia_study.pdf. Accessed September 5, 2018.
27. Article 4. Suspension and Revocation of Licenses. Cal Bus & Prof Code §1682. http://leginfo.ca.gov/faces/codes_displaySection.xhtml?lawCode=BPC§ionNum=1682. Accessed September 5, 2018.