Guideline on the Elective Use of Minimal, Moderate, and Deep Sedation and General Anesthesia for Pediatric Dental Patients

Originating Group
American Academy of Pediatric Dentistry

Review Committee
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Purpose

The American Academy of Pediatric Dentistry (AAPD) intends this guideline to assist practitioners in using sedation or general anesthesia for managing pediatric dental patients in an outpatient or private practice site. These modalities are part of the continuum of both nonpharmacological and pharmacological behavior management techniques which are described in another AAPD guideline.[1] The guideline must be tailored to the individual patient and practitioner, and safety and quality of care are of the utmost importance. The recommendations in this document may be exceeded at any time if the outcome of the change involves improved safety and is supported by currently-accepted practice (evidence-based dentistry and medicine) and peer-reviewed research. This guideline is not intended to include the use of nitrous oxide/oxygen inhalation sedation delivered through nasal mask when used alone or in conjunction with local anesthesia.

In addition, it is beyond the scope of this document to dictate the use of any specific agent or agents and doses for the purpose of sedation. Monitoring and equipment appropriate for medications and doses must be provided consistent with the level of sedation achieved rather than that intended by the practitioner. The practitioner must be prepared for inadvertent changes in the depth and length of the sedation and be able to provide a safe environment for the procedure's successful outcome.[2,3]

Methods

This clinical guideline replaces the document entitled "Clinical Guideline on the Elective Use of Conscious Sedation, Deep Sedation, and General Anesthesia in Pediatric Dental Patients".[4] This new document reflects the many changes in delivery and definitions that have occurred in these modalities since the original document was proposed and accepted. Advances in pain and anxiety control, pharmacology and pharmacokinetics, monitoring, and patient safety are represented. Specific monitoring equipment and recommendations are listed in the template of these guidelines (Appendix I). Research will continue to improve the many aspects of care given to the pediatric patient and will be represented in future revisions.

Background

The number of sedation and general anesthesia procedures performed on dental patients in nontraditional settings (ie, office or outpatient facilities) has risen over the last few years as needs have increased, reimbursement levels for in-hospital procedures have decreased, and the safety and effectiveness of drugs and monitors have improved significantly.[5-8] There also has been recognition by the profession and state boards for increased sedation training when provided in outpatient facilities, including the private dental office.

Studies have demonstrated the safety and effectiveness of sedation when and if the practitioner follows sedation guidelines and uses drugs in recognized therapeutic levels.[9-12] It is understood that there is extreme variability in the physiology of children, even those of the same age. Their response to all medications, including sedative and anesthetic agents, is only generally predictable for the average child. This guideline cannot and does not predict nor guarantee a specific patient outcome. Unintended loss of protective reflexes as well as recognition of other sedation-related untoward episodes will lead the trained practitioner to provide the currently-recognized concept of rescue from deeper levels of sedation or other emergencies. Advanced training in recognition and management of pediatric emergencies is crucial to providing safe sedation and anesthetic care.

Some children and developmentally-disabled patients require general anesthesia services to receive comprehensive dental care in a humane fashion. Access to hospital-based general anesthesia may be limited for a variety of reasons, including restriction of coverage by certain insurance companies. Many pediatric dentists (and others who treat children) have sought to provide general anesthesia in their office or other facilities (eg, outpatient care clinics). General anesthesia may be used when indicated for the delivery of oral health care to pediatric patients. It must be provided only by qualified and appropriately-trained individuals and in accordance with state regulations. Such providers may include pediatric dentists who have completed advanced education in anesthesiology, dental or medical anesthesiologists, oral surgeons, or certified registered nurse anesthetists.

As outlined in the guideline, the following are all essential to minimize the risk for the patient receiving sedation or general anesthesia:

1. facilities and equipment;
2. selection of pharmacologic agents and dosages;
3. monitoring and documentation;
4. patient selection utilizing physical status and indication for anesthetic management;
5. preoperative evaluation;
6. appropriately-trained support personnel;
7. emergency medications, equipment, and protocols.

Appropriate levels of training required for the administration of sedation and general anesthesia are found in other guidelines and policy statements[13,14] and the appropriate sections of the American Dental Association Guidelines for Teaching the Comprehensive Control of Anxiety and Pain in Dentistry.[12]

Definition of terms

For the purpose of this document, the following definitions shall apply:

Guidelines: are systematically-developed recommendations to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints. Guidelines are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome. Like a recommendation, it originates in an organization with acknowledged professional stature. Although it may be unsolicited, it usually is developed following a stated request or perceived need for such advice or instruction.

Pediatric dental patients: includes all patients who are infants, children, and adolescents less than the age of majority.

Must or shall: indicates an imperative need and/or duty; as essential or indispensable; mandatory.

Should: indicates the recommended need and/or duty; highly desirable.

May or could: indicates freedom or liberty to follow a suggested or reasonable alternative.

Continual: repeated regularly and frequently in a steady succession.

Continuous: prolonged without any interruption at any time.

Time-oriented record: documentation of physiologic data obtained at appropriate intervals during patient monitoring and of other related material (eg, drugs, doses, route of administration).

Immediately available: on site in the facility and available for immediate use.

Sedation: Pharmacological sedation is mediated by the administration of an agent or combination of agents causing alterations in the level of consciousness, cognition, motor coordination, degree of anxiety, and physiological parameters. These changes are dependent on the drug, dose, route of administration, and individual sensitivity to the agent(s). Because of differences among individuals, the process of clinical sedation requires the practitioner to have special knowledge, training, and consistent application of sedation principles and management of the patient in a setting optimal for safety and positive outcomes. Sedation is not defined by specific medications or their doses, but instead by the patient's response. Therefore, the practitioner must be able to respond appropriately to unintended levels or changes in levels of sedation to provide a safe outcome for the patient.

Minimal sedation (AAPD 1998 level 1[4]) is a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may somewhat be impaired, ventilatory and cardiovascular functions are unaffected.

Moderate sedation (AAPD 1998 levels 2, 3[4]) is a drug-induced depression of consciousness during which patients respond purposefully to verbal commands (eg, "open your eyes"), either alone or accompanied by light tactile stimulation. For older patients, this level of sedation implies an interactive state if prompted by the provider; for younger patients, age-appropriate behaviors (eg, crying) occur and are expected. Reflex withdrawal, although a normal response to a painful stimulus, is not considered acceptable as the only purposeful response for this level of sedation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate unless maneuvers mediated by the procedure and practitioner potentially affect the airway. Such maneuvers should be corrected immediately as a part of facilitating the patient's ability to maintain airway patency. Cardiovascular function usually is unaffected.

Deep sedation (AAPD 1998 levels 3, 4[4]) is a drug-induced depression of consciousness during which patients cannot be easily aroused, but may respond purposefully following repeated verbal or painful stimulation. The ability to maintain ventilatory function independently may be impaired. Patients may require assistance in maintaining a patent airway, regardless of the procedure and practitioner manipulations, and spontaneous ventilation may be inadequate. Cardiovascular function usually is unaffected. Reflex withdrawal from a painful stimulus may occur, but is not considered as a higher-functioning and purposeful response. It may be accompanied by a partial or complete loss of protective airway reflexes. The state and risks of deep sedation may be indistinguishable from those of general anesthesia.

General anesthesia (AAPD 1998 level 5[4]) is a drug-induced loss of consciousness during which the patient is not arousable, even by painful stimulation. The ability to maintain ventilatory function independently often is 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.

Rescue: It is not always possible to achieve the intended level of sedation for any given patient, and some patients may progress to a deeper level of sedation or general anesthesia than the practitioner expects.[2,3] The patient may demonstrate an inability to maintain his/her airway independently, and hypoventilation, obstruction, and/or cardiovascular compromise may occur. The practitioner must have the training, skills, and equipment to identify and manage such an occurrence until either assistance arrives (emergency medical services) or the patient returns to the intended level of sedation without airway or cardiovascular complications.

Recommendations

General considerations

Goals of sedation and general anesthesia

The sedation of children for the delivery of oral health care is recognized as a unique clinical challenge. Consideration must be given to such factors as patient's age and corresponding levels of cognitive and coping skills. Because of patient extremes in responsiveness and acceptability of treatment modalities, the intended goals and outcome of sedations will depend on a host of factors. This guideline should aid clinicians in achieving the benefits of sedation while minimizing associated risks and adverse outcomes for the patient. The goals of sedation in the pediatric dental patient are to:

1. facilitate and augment the provision of quality care;
2. minimize the extremes of disruptive behavior;
3. promote a positive psychological response to treatment;
4. promote patient welfare and safety;
5. return the patient to a physiological state in which safe discharge, as determined by recognized criteria (Appendix II), is possible.

The goal of general anesthesia in the pediatric dental patient is to eliminate cognitive, sensory, and skeletal motor activity to facilitate the delivery of quality comprehensive diagnostic, restorative, and/or other dental services.

Indications for sedation and general anesthesia

Indications for minimal or moderate sedation include:

1. preschool children requiring dental treatment who cannot understand or cooperate for definitive treatment;
2. patients requiring dental care who cannot cooperate due to lack of psychological or emotional maturity;
3. patients requiring dental treatment who cannot cooperate due to a cognitive, physical, or medical disability;
4. patients who require dental care but are fearful and anxious;
5. patients who require extensive dental care and would require or benefit from prolonged visits.

The indications for deep sedation and general anesthesia include:

1. patients who are unable to cooperate due to a lack of psychological or emotional maturity and/or mental, physical, or medical disability;
2. patients for whom local anesthesia is ineffective because of acute infection, anatomic variations, or allergy;
3. the extremely uncooperative, fearful, anxious, or uncommunicative child or adolescent;
4. patients requiring significant surgical procedures;
5. patients for whom the use of deep sedation or general anesthesia may protect the developing psyche and/or reduce medical risks;
6. patients requiring immediate, comprehensive oral/dental care.[1]

Local anesthesia considerations during sedation

All local anesthetic agents can become cardiac and central nervous system (CNS) depressants when administered in excessive doses. There is a potential interaction between local anesthetic and sedatives used in pediatric dentistry which can result in enhanced sedative effects and/or untoward events. Therefore, particular attention should be paid to doses used in children. To avoid excessive doses for the patient who is going to be sedated, a maximum recommended dose based upon mg/kg or mg/lb should be calculated. The dose of all sedatives and local anesthetics administered must be recorded on the time-based record for each patient. It is beyond the scope of this document to recommend specific dosages of local anesthetic agents.

Candidates

Patients who are American Society of Anesthesiologists (ASA) Class I or II (Appendix III) may be considered candidates for minimal, moderate, or deep sedation or general anesthesia. Patients in ASA Class III or IV present special problems, and treatment in a hospital setting should be considered.

Responsible adult

The pediatric patient shall be accompanied to and from the treatment facility by a parent, legal guardian, or other responsible adult who shall be required to remain at the facility for the entire treatment period. A second responsible person is encouraged to accompany the patient to assist the parent, legal guardian, or other responsible adult in observing the patient while being transported in a motor vehicle.

Facilities and equipment

Facilities

The practitioner who utilizes any type of sedative or local anesthetic in a pediatric dental patient shall possess appropriate training and skills and have available the proper facilities, personnel, and equipment to manage any reasonably foreseeable emergency. All newly installed systems or remodeled facilities for delivering nitrous oxide and oxygen must be checked for proper gas delivery and fail-safe function prior to initial use. Where equipment and facilities are regulated by state law, such statutes shall supersede these guidelines.

Equipment

A positive-pressure oxygen delivery system that is capable of administering greater than 90% oxygen at a 10 L/minute flow for at least 60 minutes (650 L, "E" cylinder) must be available. When a self-inflating bag valve mask device is used for delivering positive pressure oxygen, a 15 L/minute flow is recommended. Equipment must be able to accommodate children of all ages and sizes.

A functional suction apparatus with appropriate suction catheters (eg, tonsillar, flexible) must be immediately available. A sphygmomanometer with cuffs of appropriate size for pediatric patients shall be immediately available and utilized during the procedure and the recovery phase of the procedure, as recommended. Monitoring devices such as pulse oximeters, end tidal carbon dioxide monitors, and automated blood pressure cuffs must be maintained and safety tested regularly according to manufacturer's guidelines or regulations to guarantee their correct function.

Inhalation sedation equipment must have the capacity for delivering 100%, and never less than 25%, oxygen concentra-

tion at a flow rate appropriate to the child's size and a fail-safe system that is checked and calibrated annually. If nitrous oxide and oxygen delivery equipment capable of delivering more than 75% nitrous oxide and less than 25% oxygen is used, an in-line oxygen analyzer must be used. The equipment must have an appropriate scavenging system.

Equipment that is appropriate for the technique used and capable of monitoring the physiologic state of the patient before, during, and after the procedure must be present. Specific monitoring equipment and recommendations are listed in the sections on minimal, moderate, and deep sedation and general anesthesia and in the template of these guidelines (Appendix I).

An emergency cart or kit (Appendix IV) must be readily accessible and should include the necessary drugs and age- and size-appropriate equipment to resuscitate and rescue a nonbreathing and unconscious pediatric dental patient and provide continuous support while the patient is being transported to a medical facility. Documentation that all emergency equipment and drugs are checked and maintained on a regularly scheduled basis (eg, monthly) must be kept.

Backup emergency services

Backup emergency services should be identified. A protocol outlining necessary procedures for their immediate employment should be developed and operational for each facility. For nonhospital facilities, an emergency assist system should be established with the nearest hospital emergency facility and ready access to ambulance service must be assured. Additionally, office protocols for staff assistance during emergencies or untoward events should be developed and emergency scenarios practiced on a regular basis.

Documentation

The practitioner must document each sedation or general anesthesia procedure in the patient's record. Documentation shall include the following:

Informed consent

Each patient, parent, or other responsible individual is entitled to be informed regarding benefits, risks, and alternatives to sedation or general anesthesia and to give consent. The patient record shall document that appropriate informed consent was obtained according to the procedures outlined by individual state laws and/or institutional requirements.

Instructions to parent or responsible individual

The practitioner shall provide verbal and written instructions to the parent(s) or responsible individual. Instructions should be explicit and include an explanation of presedation and postsedation dietary precautions, potential or anticipated postoperative behavior, and limitation of activities. A 24-hour contact number for the practitioner should be provided to all patients.

Dietary precautions

The administration of sedative drugs or general anesthetic agents shall be preceded by an evaluation of the patient's food and liquid intake. Intake of food and liquids should be limited prior to treatment as follows:

1. no milk, breastmilk, formula, or solids for 6 hours for children 6 to 36 months and 8 hours for children 36 months and older;
2. clear liquids up to 3 hours before procedure for children ages 6 months and older.

The dental procedure must be postponed if the recommendations are not followed because of an increased risk of aspiration should there be unintended loss of protective reflexes during sedation. Patients requiring general anesthesia for emergency procedures may proceed if appropriate pharmacologic and physical means are used to protect the airway before and after the procedure. Patients with a known history of gastroesophageal reflux or with a high potential for aspiration would benefit from appropriate pharmacologic treatment or an appropriate increase in N.P.O. interval to reduce gastric volume and increase gastric pH.[15-17]

Preoperative health evaluation

The patient shall be under the routine care of a physician or appropriate medically-trained and licensed personnel.

Prior to the administration of sedatives, the practitioner shall obtain and document information about the patient's current health status. This focused health status evaluation should include:

1. Health history, including:
   a. allergies and previous allergic or adverse drug reactions;
   b. current medications (prescription, over-the-counter, and herbal), including dose, time, route, and site of administration;
   c. diseases, disorders or physical abnormalities, and pregnancy status;
   d. previous hospitalization to include the date, purpose, and hospital course;
   e. history of general anesthesia or sedation and any associated complications;
   f. family history of diseases or disorders, especially those which might impact sedation and general anesthesia;
   g. review of systems;
   h. age in years and months;
   i. name, address, and telephone number of the child's pediatrician or family physician. It should be determined that the patient has been evaluated recently by the physician or his/her licensed designee.
2. Physical evaluation, including:
   a. weight in kilograms or pounds;
   b. vital signs, including heart and respiratory rates and blood pressure;
   c. evaluation of airway patency and tonsil size;
   d. risk assessment (eg, ASA classification).

Hospitalized patients

The current hospital record may suffice for adequate documentation of presedation health. A brief note shall be written documenting that the record was reviewed, positive findings were noted, and there were no contraindications to the planned procedure(s).

Rationale for sedation or general anesthesia

The practitioner shall briefly document the reason for the need for sedation or general anesthesia.

Baseline vital signs

Before administration of sedatives or general anesthesia, a baseline determination of vital signs (heart and respiratory rates and blood pressure) should be documented in the patient's record. If determination of baseline vital signs is prevented by the patient's physical resistance or emotional condition, the reason(s) should be documented.

Vital signs

The patient's record shall contain documentation of intermittent quantitative monitoring and recording of oxygen saturation (pulse oximetry); heart and respiratory rates, and blood pressure, as recommended for specific sedation techniques. Patient responsiveness must be monitored and documented at specific intervals before and during the procedure and until the patient is discharged. Inability to accurately monitor and record vital signs at appropriate intervals because of adverse or uncontrollable patient behavior should be documented, but clinical observation must continue.

Drugs

The patient's record shall document the name, dose and route, site, and time of administration of all drugs, including local anesthetics, administered. The maximum recommended dose should be calculated and the actual dose given shall be documented in milligrams. The practitioner should calculate or have readily available the dosages of emergency drugs and, if appropriate, reversal agents. The concentrations, flow rate, and duration of administration of oxygen and anesthetic gases, including nitrous oxide, shall be documented.

Recovery

The child's condition and the time of discharge from the treatment facility should be documented in the record. Documentation shall include that appropriate discharge criteria have been met (Appendix II). The record also should identify the responsible adult to whose care the patient was discharged.

Continuous quality improvement

To reduce medical errors, including those related to sedation and general anesthesia, a careful examination of index events with a complete and thorough analysis of cause and effect should be undertaken. The practitioner should maintain records that track events, such as nonbehavioral mediated desaturations, prolonged sedation, apnea events, unexpected airway interventions (eg, jaw thrust and/or positive pressure ventilation prior to, during, or after procedures), and unintended hospital admission. Consequently, such events can be examined and assessed for future risk reduction and patient safety.

Prescriptions

Home administration of sedative medications poses an unacceptable risk for infants, toddlers, and young children traveling in car seats.[18] Their breathing is not easily observed, and the risk of medication administration error by untrained personnel is a possibility. Administration of anxiolytic medications may be beneficial in older patients, but such medications, when used in therapeutic doses, must not possess significant sedative effects capable of rendering loss of consciousness or protective reflexes. If a prescription is written or medication is given for home use, the amount must be for a single administration to avoid medication administration errors. Specific instructions for the anxiolytic or minimal sedation medication, including adverse and untoward reactions, must be discussed with the parent(s) or responsible adult. Administration of repeated oral doses of sedative medications is not an acceptable therapeutic modality in children.

Minimal and moderate sedation

Personnel

The practitioner responsible for the treatment of the patient and/or the administration of drugs for minimal and moderate sedation shall:

1. be appropriately trained in the use of such drugs and techniques;
2. provide appropriate monitoring;
3. be capable of managing and rescuing the patient from any reasonable foreseeable complications, including loss of airway, hypoxia, apnea, or unintended progression to a deeper level of sedation.

Training and certification in basic life support (BLS) or equivalent is required; training and certification in advanced pediatric airway management and advanced life support, such as Pediatric Advanced Life Support (PALS) or Advanced Cardiac Life Support (ACLS) or equivalent, is recommended.

Drugs used for the purpose of minimal or moderate sedation shall be administered in the treatment facility and shall be prescribed, dispensed, or administered only by appropriately licensed individuals, or under the direct supervision thereof, according to state law. In addition to the operating practitioner, an individual trained to monitor appropriate physiologic parameters and to assist in any supportive or resuscitative measures required shall be present. This individual must:

1. have training and certification in basic life support;
2. have specific assignments;
3. be familiar with the emergency cart (kit) inventory.

The practitioner and all treatment facility personnel should participate in periodic reviews of the office's emergency protocol, the emergency drug kit, and simulated exercises to assure proper emergency management response.

Operating facility and equipment

The operating facility used for the administration of minimal and moderate sedation shall have available all facilities and equipment previously recommended and outlined in Appendix I. During minimal sedation, the patient remains fully awake and communicative, but may exhibit unexpected changes in level of consciousness and depth of sedation. The practitioner must maintain the equipment necessary and the ability to monitor the patient at the level to which this change may occur until such time as the patient returns to the original level of cognitive and physiological function. Minimum monitoring equipment for

moderate sedation shall be a pulse oximeter, precordial stethoscope, and sphygmomanometer; capnography is desirable and may be substituted for the precordial stethoscope.

Monitoring procedures before and during treatment

Whenever drugs for minimal or moderate sedation are administered, the patient must be monitored continually for patient responsiveness and airway patency. For the patient whose sedation level is moderate, oxygen saturation and heart and respiratory rates shall be recorded at specific intervals throughout the procedure until the child has met documented discharge criteria. A precordial/pretracheal stethoscope and/or end tidal carbon dioxide monitor shall be used for obtaining information on respiratory rates and for monitoring airway patency during moderate sedations. Clinical observation should accompany all levels of sedation.

Protective stabilization devices should be checked periodically to prevent airway obstruction or chest restriction and ensure limb perfusion. The child's head position shall be checked frequently to ensure airway patency. A patient who has received sedation medication must be observed continually by a trained individual.

Recovery

After completion of the treatment procedures, vital signs should be recorded at specific intervals. The patient who has received moderate sedation must be observed in a suitably equipped recovery facility in which there is the availability of high volume suction, oxygen with bag/mask/valve supplementation, and access to emergency equipment. The practitioner or his/her designee must assess the patient's responsiveness and discharge the patient only when the appropriate discharge criteria have been met (Appendix II).

Deep sedation

Personnel

Deep sedation techniques require the following 3 individuals:

1. the treating practitioner, who may direct the sedation[8,10];
2. a qualified individual to assist with observation and monitoring of the patient and who may administer drugs if appropriately licensed[8,10];
3. other personnel to assist the operator as necessary.

Of the 3 individuals, 1 shall have training and certification in advanced pediatric airway management and advanced life support, such as PALS, ACLS, or equivalent. The other 2 shall be currently trained and certified in BLS or equivalent.

If a certified registered nurse anesthetist is permitted to function under the supervision of a dentist, the dentist is required to have completed training in deep sedation and be licensed or permitted, as appropriate, as specified above.

Operating facility and equipment

In addition to the facilities and equipment previously recommended for minimal and moderate sedation, deep sedation requires an electrocardiograph (ECG) and a capnograph in conjunction with pulse oximetry. The availability of a defibrillator appropriate for pediatric patients is required.

Intravenous access

Patients receiving deep sedation should have an intravenous line in place or have immediately available an individual skilled in establishing vascular access in pediatric patients. In special circumstances, induction of deep sedation may begin prior to vascular access because of patient uncooperativeness or may occur without vascular access for a very short procedure.

Monitoring procedures before and during treatment

The sedated patient shall be monitored continuously by an appropriately trained individual. There shall be continual monitoring of oxygen saturation by oximetry and expired carbon dioxide concentration via capnography, heart and respiratory rates, and blood pressure, all of which shall be recorded minimally every 5 minutes. A pulse oximeter and capnograph, precordial/pretracheal stethoscope, ECG, and blood pressure cuff are required. Temperature monitoring is desirable. The child's head position must be checked frequently to ensure airway patency. The operator should observe the patient as well as the monitors and observe trends in the data obtained from the monitors. An appropriately trained individual continuously must observe the patient until discharge.

Recovery

After treatment has been completed, the patient must be observed in a suitably equipped recovery facility. This facility must have a functioning suction apparatus and suction catheters of appropriate size as well as the capacity to deliver greater than 90% oxygen and provide positive pressure ventilation for pediatric patients. An individual experienced in recovery care must be in attendance at all times to assess and record vital signs, observe the patient, and ensure airway patency until the patient is stable. The patient must remain in the recovery facility until cardiovascular and respiratory stability are ensured and appropriate discharge criteria have been met (Appendix II).

General anesthesia

Personnel

The provision of general anesthesia requires the following 3 individuals:

1. a physician or dentist who has completed an advanced training program in anesthesia or oral and maxillofacial surgery and related subjects beyond the undergraduate medical or dental curriculum and who is responsible for anesthesia and monitoring of the patient[8,10];
2. a treating dentist, responsible for the provision of dental services[8,10];
3. other personnel to assist the operator, as necessary.

Of these individuals, the anesthetist shall have training and certification in advanced pediatric airway management and/or advanced life support, such as PALS, ACLS, or equivalent. The others shall be trained and currently certified in BLS or equivalent. If a certified registered nurse anesthetist is permitted to function under the supervision of a dentist, the dentist is required to have completed training in general anesthesia and be trained and certified in advanced cardiac life support or advanced pediatric airway management, as previously specified.

Operating facility and equipment

In addition to the facilities and equipment previously recommended for deep sedation (ie, pulse oximeter, capnograph, precordial stethoscope, blood pressure monitor, and ECG), a temperature monitor and pediatric defibrillator also are required.

Intravenous access

Patients receiving general anesthesia should have an intravenous line in place or have immediately available an individual skilled in establishing vascular access in children. In special circumstances, induction of general anesthesia may begin prior to vascular access because of patient uncooperativeness or may occur without vascular access for a very short procedure.

Monitoring procedures

The anesthetized patient shall be monitored continuously by the anesthesia provider. There shall be continual monitoring of oxygen saturation by pulse oximetry, expired carbon dioxide concentration via capnography, heart and respiratory rates, and blood pressure, all of which shall be recorded minimally every 5 minutes. The anesthesia provider should visualize the patient as well as the monitors and observe trends in the data obtained from the monitors. An appropriately trained individual must continuously observe the patient until discharge.

Recovery

After treatment has been completed, the patient must be observed continuously and monitored appropriately in a suitably-equipped recovery facility until the patient exhibits respiratory and cardiovascular stability through continual monitoring. This facility must have a functioning suction apparatus and suction catheters of appropriate size as well as the capacity to deliver greater than 90% oxygen and provide positive pressure ventilation for pediatric patients. An individual experienced in recovery care must be in attendance at all times to assess and record vital signs, observe the patient, and ensure airway patency. The patient must remain in the recovery facility until cardiovascular and respiratory parameters and function are stable and appropriate discharge criteria have been met (Appendix II).

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Appendix I. Template of Definitions and Characteristics for Levels of Sedation and General Anesthesia

	Minimal sedation	Moderate sedation	Deep sedation	General anesthesia
Goal	Decrease or eliminate anxiety; facilitate coping skills.	Decrease or eliminate anxiety; facilitate coping skills. Younger patients show age-appropriate behaviors, including crying; older patients demonstrate interactive state.	Eliminate anxiety; coping skills unaffected and overridden. Patient uneasily aroused but may respond to purposeful stimulation.	Eliminate sensory and skeletal motor activity; autonomic activity depressed.
Patient responsiveness	Subjectively, the patient may sense and/or express less anxiety about the clinical procedure compared to presedation periods. Objectively, the patient may appear more calm, less overtly responsive to clinical stimuli, and purposefully interactive with the clinician compared to presedation periods.	Subjectively, the patient may sense and/or express less anxiety about the clinical procedure, compared to presedation periods. Objectively, the patient may appear less tense, cognizant of, but less overtly responsive to, clinical stimuli, and purposefully interactive with the clinician, compared to presedation periods. The patient, if behaviorally and cognitively cooperative, should be able to independently move his/her head and/or mandible, as directed by the clinician and to assist in maintaining optimal airway patency.	Subjectively, the patient may sense and/or express limited or no feelings of anxiety associated with the clinical procedure. Objectively, the patient may appear very relaxed, not cognizant of and minimally or nonresponsive to clinical stimuli, and noninteractive with the clinician at any time. The patient would not be able independently to move his/her head and/or mandible to maintain optimal airway patency consistent with the clinical situation. Under these circumstances, the patient requires continuous monitoring of the airway and continual assistance of the clinician (eg, head tilt, chin lift procedure).	Unconscious and unresponsive to surgical stimuli.
Physiologic changes	Patient remains stable and within age-appropriate and health status norms for parameters involving hemodynamic, ventilation, and oxygenation functions. No loss of protective reflexes.	Patient remains stable and within age-appropriate and health status norms for parameters involving hemodynamic, ventilation, and oxygenation functions. No loss of protective reflexes.	Patient remains stable and either minimally or moderately below the patient's age and health status norms for hemodynamic, ventilation, and oxygenation functions. Accompanied by partial or complete loss of protective reflexes.	Partial or complete loss of protective reflexes, including the airway; does not respond purposefully to verbal command or physical stimulus.
Personnel needed	2	2	3	3
Monitoring equipment	Clinical observation unless patient becomes moderately sedated, then appropriate monitoring needed.	BPC, PO; PC or capno.	BPC, PO, PC, capno, ECG.	BPC, PO, PC, capno, ECG, temp.
Monitoring information and frequency	Skin color, respiratory effort (continual).	HR, RR, BP, SaO_2 (q15m).	HR, RR, BP, SaO_2, $ETCO_2$, EC (q5m).	HR, RR, BP, SaO_2, $ETCO_2$, temp, EC (q5m).

BP=blood pressure; BPC=blood pressure cuff/sphygmomanometer; capno=capnograph/end tidal carbon dioxide monitor; EC=electrical conductivity as demonstrated on ECG; ECG=electrocardiograph; $ETCO_2$=end tidal carbon dioxide; temp=temperature; HR=heart rate; PO=pulse oximetry; PC=precordial/pretracheal stethoscope; RR=respiratory rate; SaO_2=oxygen saturation.

Appendix II. Recommended Discharge Criteria

1. Cardiovascular function satisfactory and stable.
2. Airway patency uncompromised and satisfactory.
3. Patient easily arousable and protective reflexes intact.
4. State of hydration adequate.
5. Patient can talk, if applicable.
6. Patient can sit unaided, if applicable.
7. Patient can ambulate, if applicable, with minimal assistance.
8. For the child who is very young or disabled and incapable of the usually expected responses, the presedation level of responsiveness or the level as close as possible for that child should be achieved.
9. Responsible individual is available.

Appendix III. American Society of Anesthesiologists Classification (Modified)

- **Class I:** a normally healthy patient with no organic, physiologic, biochemical or psychiatric disturbance, or disease.
- **Class II:** a patient with mild-to-moderate systemic disturbance or disease.
- **Class III:** a patient with severe systemic disturbance or disease.
- **Class IV:** a patient with severe and life-threatening systemic disease or disorder.
- **Class V:** a moribund patient who is unlikely to survive without the planned procedure.
- **Class VI:** a patient declared brain-dead whose organs are being removed for donor purposes.
- **E:** emergency operation of any variety; used as a modifier.

Appendix IV.

Appropriate emergency equipment should be available whenever sedative drugs capable of causing cardiorespiratory and central nervous system depression are administered. The items below should be used as a reference, which should be modified, depending on the individual practice circumstances.

Emergency medications

1. oxygen
2. ammonia spirits
3. glucose (50%)
4. atropine
5. diazepam
6. epinephrine
7. lidocaine (cardiac)
8. diphenhydramine hydrochloride
9. hydrocortisone
10. pharmacologic antagonists (as appropriate):
    - naloxone hydrochloride;
    - flumazenil.

Airway management equipment

1. nasal and oral airways of assorted pediatric and adult sizes;
2. portable oxygen delivery system capable of delivering bag and mask ventilation greater than 90% at 10 L/minute flow for at least 60 minutes (eg, "E" cylinder);
3. "self-inflating" breathing bag and reservoir with masks that will accommodate children and adults of all sizes;
4. deep sedation and general anesthesia:
    - assorted pediatric endotrachial tubes;
    - laryngoscopes with straight and curved blades;
    - Magill forceps.

Intravenous equipment (deep sedation and general anesthesia)

1. gloves
2. alcohol wipes
3. tourniquets
4. sterile gauze pads
5. tape
6. intravenous solutions and equipment for administration appropriate to the patient population being treated:
    a. intravenous catheters (22, 24 gauge)
    b. intravenous administration set (tubing) (microdrip 60 drops/ml)
    c. intravenous fluids
    d. assorted needles for drug aspiration and administration
    e. appropriately sized syringes