

Moderate Sedation in Pediatric Dentistry

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Abstract: Conscious sedation has undergone much change including the term conscious sedation which is now called as **Moderate sedation** to as new additions like SOAPME, requisites to be satisfied before patient is considered for sedation, documentation and more importantly monitoring techniques which include must have along with basic vital signs monitoring, the pulse oximetry, transcutaneous oximetry. Recently more promising technology to detect apnea appears to be capnography and bispectral analysis (BIS) for additional monitoring. A set of discharge criteria proposed by AAPD need to be met before discharging patient. It is also must to keep a functioning airway maintenance apparatus which should be guided by a Anesthetist. A new method of delivering supplemental oxygen via saliva ejector rather than nasal cannula has also been tried which is less irritating to children. Regarding drugs, most of today's work is focused on intranasal midazolam, though none of drugs used as far have proved ideal. In conclusion sedation is widely accepted and used and now considered as viable alternative to General anesthesia.

I. Introduction

The majority of pediatric dental patients can be treated in the conventional dental environment. By establishing good rapport with the patient and parent and by relying on sound behavior management techniques, the anxiety and pain of many pediatric dental patients can be managed effectively using local anesthesia alone. In a few children who are unable to tolerate dental procedures comfortably despite gentle encouragement and adequate local anesthesia, then the use of pharmacologic management should be considered. Hence the primary purpose of pharmacologic management of young patients is to minimize or eliminate anxiety, which can be achieved through sedation (conscious sedation, deep sedation and/or general anesthesia) which in turn is a continuum. General anesthesia totally eliminates anxiety and the pain reaction threshold. Sedation, depending on its depth, produces a relative reduction in anxiety facilitating the opportunity to invite the patient to use learned coping skills and raising of the pain reaction threshold. However, sedation and general anesthesia are not without significant risks against which the benefits of these techniques must be measured. The degree of sedation depends on a host of factors with the more prominent being dose, rate, and route of drug administered and patient metabolic rate, surface area, age, and general health.¹

The term conscious sedation has been used in the past to imply a patient who is awake, responsive and able to communicate indicating adequate level of consciousness and maintenance of protective reflexes.² Partial or complete loss of protective reflexes and inability to maintain an airway independently as seen in deep sedation and general anesthesia, may lead to laryngospasms, apnea, or hypoxemia which may be serious or life-threatening complication. Since conscious sedation is neither associated with loss of protective reflexes nor inability to maintain airway independently, it carries minimal risk of life threatening complications, provided care is taken so that patient does not enter state of deep sedation or loss of consciousness. Conscious sedation helps to reduce fear and anxiety and enables the anxious but potentially cooperative child not only to accept dental treatment but also to cooperate better with dental care in future.

Traditionally, this continuum has been divided into the broad classes of "conscious sedation" and "deep sedation" based on conventional wisdom. American academy of Pediatric dentistry divides conscious sedation into three distinct levels: level 1, mild sedation or anxiolysis; level 2 interactive; and level 3, noninteractive to arousable with mild to moderate stimulus.² In recent years the term "conscious sedation" has received considerable scrutiny; hence the term "minimal and moderate sedation" has replaced "conscious sedation" and is now the standard terminology in medical settings. Minimal and moderate sedation is a depressed level of consciousness in which the patient retains the ability to maintain a patent airway independently and continuously and to respond appropriately to light physical stimulation or verbal command. Loss of consciousness should be unlikely is particularly a important part of the definition of minimal and moderate sedation, and the drugs and techniques used should carry a margin of safety wide enough to render unintended loss of consciousness unlikely. Moderate sedation suggests that a child may be in a state wherein eyes are temporarily closed; however, the child is arousable following a verbal prompt or responds to the degree that crying and withdrawal reflexes occur following mildly painful stimulus such as an injection of local anesthetic. Crying and withdrawal reflexes are prominent at this level of sedation, whereas deeper levels of sedation may result only in moaning or withdrawal reflexes. If arousal, as described above, does not occur, especially following a repeated moderately painful stimulus (e.g., trapezius muscle pinch), then the child is in a

state of deep sedation and must be monitored accordingly.

Minimal and moderate sedation or conscious sedation as named earlier is particularly advantageous in pediatric patients who are anxious, frightened but are capable of cooperating when the anxiety levels are reduced. It reduces the stress to both child and dentist, and respiratory depression is less likely than with the use of deep sedation. Conscious sedation also produces some degree of mood alteration, amnesia, and analgesia. If the child is too uncooperative to allow induction with drug, alternative approaches, such as deep sedation or general anesthesia, must be considered.¹

Definition of conscious sedation

AAPD in 2011

“Moderate sedation (old terminology “conscious sedation” or sedation/analgesia). 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—a light tap on the shoulder or face, not a sternal rub) following light tactile stimulation.”²

Documentation

Meticulous and accurate documentation of sedation experience is imperative. In the event of an adverse reaction, best insurance is an accurate, clear, continuous documented account of what occurred before, during after the encounter.

PEDIATRIC DENTISTRY OUTPATIENT SEDATION RECORD Appendix 1

Date: _____ Sex: _____ Service Location: _____
 Weight: _____ lb. Height: _____ ft. _____ in. Operating Dentist: _____
 _____ kg. Age: _____ yr. _____ mo. Assistant: _____
 Hct: _____ % UA: _____ Anesthetist: _____
 Preoperative Health Evaluation: _____ ASA 1 2 3 4 5 E

Preoperative Behavior Evaluation: _____
 Frankl Scale: definitely + , + , - , definitely -
 North Carolina Scale: Hands , Legs , Crying , Physical resistance
 Reason for Sedation: _____
 Preoperative External Sedation Medication:
 Drug: _____ Route: _____ dose (mg): _____ time: _____
 Drug: _____ Route: _____ dose (mg): _____ time: _____
 I.V.: arm hand foot foot R L B.P. Cuff P.C. Steth. Temp. Probe
 Other Monitoring Devices: _____

TIME

Respiration rate/min.																				
Pulse rate/min.																				
Blood Pressure																				
2% Xylo epi.																				
N ₂ O - O ₂ (% Nitrous)																				
Alphaprodine (Nisentil)																				
Hydroxyzine (Vistaril)																				
Promethazine (Phenergan)																				
Diazepam (Valium)																				
Naloxone (Narcan)																				

Airway Support Needed Fluids: _____ Temp. preop.: _____ postop.: _____
 Sedation Course: _____

Level of Sedation: Unconscious/unresponsive Heavily sedated/slightly passive
 Lightly sedated/moderately responsive Alert/very responsive
 Behavior During Treatment: definitely + , + , - , definitely -
 Treatment: Time started _____ Time completed _____ Elapsed time _____ hr. _____ min.
 Services Provided: _____

Postoperative Course and Evaluation:	Patient Identification
_____	# _____
Disposition: _____	Name _____
Time of Discharge: _____ Signature: _____	DOB _____

Intraoperatively documentation should include:

- Vital signs,
- Type,dose,route,site and time of administration of drug
- Copy of prescription used if any.

PEDIATRIC DENTISTRY OUTPATIENT SEDATION RECORD

Patient: _____ Date: _____ Service Location: _____
 Student: _____ # _____ Weight: _____ lb. _____ kg. Age: _____ yrs. _____ mo.
 Faculty: _____ Preoperative Health: _____
 Preoperative Behavior: Definitely pos. _____ Positive _____ Negative _____ Definitely neg. _____
 (✓) Reason for Medication: Immature _____ Apprehensive _____ Hysterical _____ Uncooperative _____
 Fearful _____ Language _____ Retardation _____ Hyperactive _____ Other _____
 Medical Problem (specify) _____
 Preoperative Medication Drug _____ Route _____ Dosage(mg) _____ Time _____
 Drug _____ Route _____ Dosage(mg) _____ Time _____
 (✓) Monitoring Devices: P.C. Steth. _____ B.P. Cuff _____ Temp. Probe _____
 Other _____

Vital Signs:

	Premed.	Before tx.	After tx.	Dismissal
Respiration rate/min.				
Pulse rate/min.				
Blood Pressure	S D	S D	S D	S D

Medication Administered:

	Dosage (mg)	Route (✓):	Oral	IM	SC	SM	Time Adminis.
2% Xylo _____ epi mg	_____						_____
N ₂ O-O ₂ (% Nitrous)	_____						_____
Alphaprodine (Nisentil) mg	_____						_____
Hydroxyzine (Vistaril) mg	_____						_____
Promethazine (Phenergan) mg	_____						_____
Diazepam (Valium) mg	_____						_____
Chloral Hydrate (Noctec) mg	_____						_____
Mereridine (Demerol) mg	_____						_____
Naloxone (Narcan) mg	_____						_____
Other _____ mg	_____						_____

Restraints: Yes _____ No _____ Papoose _____ Other _____
 (✓) Level of Sedation: Unconscious/unresponsive _____ Heavily sedated/slightly passive _____
 Lightly sedated/moderately responsive _____ Alert/very responsive _____
 Airway support _____ Fluids _____ Temp. _____
 (✓) Side Effects: Nausea _____ Dizziness _____ Vomiting _____ Headache _____ Other _____
 (✓) Behavior During tx.: Definitely pos. _____ Positive _____ Negative _____ Definitely neg. _____
 Treatment time: Start _____ Completed _____ Elapsed time _____ hr. _____ min.
 Services Provided: _____ Efficiency of Med.: _____ good _____ fair _____ poor _____
 (✓) Next Visit: Same drug _____ Same dosage _____ Other drug _____ No drug _____
 (✓) Discharge Evaluation: Unconscious _____ Drowsy _____ Alert _____ Time of discharge _____
 Student Signature _____ a.m./p.m.
 Faculty Signature _____

**Preparation ,planning and setting up for sedation procedures
 Soapme³**

- S**=size appropriate suction catheters and functioning suction apparatus
- O**=and its oxygen supply and functioning flow meters/other devices to allow its deliveryt.
- A**=Airway:size appropriateairway equipment(nasopharyngeal,oropharyngeal airways,laryngoscope blades(chcked for functioning),endotracheal tubes,stylets,face mask,bag-valve-mask or equivalent device(functioning).
- P**=Pharmacy:all basic drugs needed to support life during an emergency,including antagonist as indicated.
- M**=Monitor:functioning pulse oximeter with size-appropriate oximeter probes and other monitors as appropriate for procedure(eg,noninvasive blood pressure,end tidal carbon dioxide,ECG,stethoscope)
- E**=Special equipment or drugs for a particular case(eg,defibrillator)

A new method was discovered by Neerja singh et al to deliver supplemental oxygen via a saliva ejector during sedation which is found to be less irritating to children compared to conventional nasal cannula.⁴

After completion of treatment

Patient should be continuously observed in an appropriately equipped recovery area. Patient should remain under direct observation until respiratory and cardiovascular stability has been ensured and should not be discharged until pre-sedation levels of consciousness or a level as close as possible for that child has been achieved.⁵

Because some sedative medications are known to have a long half life and may delay a patient's complete return to baseline or pose the risk of re-sedation, some patients might benefit from a longer period of less-intense observation before discharge from medical supervision.⁶

Several scales to evaluate recovery have been devised and validated.⁷

A recently described and simple evaluation tool may be the ability of infant or child to remain awake for at least 20 minutes when placed in a quiet environment.⁸

Monitoring

Recommended monitoring for pediatric sedation includes the following:

- 1) Preoperative vital signs (if possible)
- 2) Vital signs periodically during treatment (recorded every 5 to 15 minutes)
 - a) Heart rate and rhythm, monitored continuously
 - b) Blood pressure, monitored every 5 minutes
- 1) Pretracheal stethoscope
- 2) Pulse oximetry

Optional monitoring for the pediatric patient includes the following:

- 1) End-tidal carbon dioxide (ETCO₂) monitoring
- 2) Electrocardiograph (ECG)

Assessing respiratory function by visual assessment, is not a reliable method, hearing breath sounds using a precordial stethoscope may be difficult due to noise of dental equipment, assessing by color and vital signs is a dangerous method of respiratory monitoring in children because these changes do not occur until late in the process of respiratory compromise. Monitoring should detect respiratory depression early to prevent hypoxemia from occurring.

Transcutaneous oxymetry and pulse oximetry are possible monitors of oxygenation and capnography for monitoring apnea, airway obstruction and developing hypoventilation.

The most promising technology for detection of apnea or airway obstruction appears to be capnography, which is continuous analysis of carbon dioxide content of respired gases.

Cassidy et al reported that transcutaneous oxygen monitoring in children to assess the respiratory effects of nitrous oxide sedation is a reliable modality of early detection of ventilation related complications.⁹

Vital Signs at various Ages			
	Heart Rate	Blood Pressure	Respiratory Rate
Age (yr)	(beats/min)	(mm Hg)	(breaths/min)
1 to 3	70 to 110	90 to 105/55 to 70	20 to 30
3 to 6	65 to 110	95 to 110/60 to 75	20 to 25
6 to 12	60 to 95	100 to 120/60 to 75	14 to 22
12	55 to 85	110 to 135/65 to 85	12 to 18

Monitor	Technique												General Anesthesia								
	Local Anesthesia			Oral			IM/SM			Inhalation			IV			Outpatient			Inpatient		
	Pr	In	Po	Pr	In	Po	Pr	In	Po	Pr	In	Po	Pr	In	Po	Pr	In	Po	Pr	In	Po
Heart rate ^a	**	0	*	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Blood pressure ^b	**	*	*	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Electrocardiograph (ECG) ^c	0	0	0	0	0	0	*	*	0	0	0	0	*	*	*	*	*	*	**	**	**
Respiration ^d	**	0	0	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Oximetry ^e	0	0	0	0	0	0	0	*	*	0	0	0	0	0	0	**	**	**	**	**	**
Temperature ^f	*	0	0	*	0	0	*	*	*	*	0	0	*	*	*	**	**	**	**	**	**

Discharge Criteria

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

The following should be completed when considering the discharge of a patient following parenteral sedation. The patient postsedation score must be approximately equal to the baseline (presedation) score.

Patient's name:	SSN:	Date:
Physical Signs	(Pretreatment)	Baseline/Discharge Comments
A. MOVEMENT 2—able to walk (when appropriate) 1—able to move extremities 0—unable to move any extremity		
B. RESPIRATIONS 2—able to breathe deeply and cough 1—limited respiratory effort 0—no spontaneous respiratory effort		
C. CIRCULATION 2—systolic BP \pm 20% baseline level 1—systolic BP \pm 40% baseline level 0—systolic BP $>$ \pm 40% baseline level		
D. CONSCIOUSNESS 2—full alertness seen in ability to answer questions appropriately 1—aroused when called by name 0—unresponsive to verbal stimulation		
E. COLOR 2—normal skin color and appearance 1—any alteration in skin color 0—frank cyanosis or extreme pale		
TOTAL SCORE: Dr's signature:		

Emergency Drugs That May Be Needed to Rescue a Sedated Patient (AAPD Guidelines)²

- 1) Oxygen
- 2) Hydrocortisone sodium phosphate 100 mg per vial-to be made up to 1 ml with physiological saline immediately before use, for intravenous injection;
- 3) Epinephrine (adrenaline) hydrochloride (1:1000, 1:10,000) 1 mg/ml (1000 p.g/ml), i.e. marked 1:1000 on a 1 ml ampoule for subcutaneous or intramuscular injection ,the IMS Min-I-Jet system is particularly quick and easy to use suitable needles and syringes should be available to enable drugs to be drawn up and administered parenterally;
- 4) Flumazenil (benzodiazepine antagonist) for reversing unexpected over sedation from an orally, intravenously, or rectally administered benzodiazepine.
- 5) Albuterol for inhalation
- 6) Ammonia spirits
- 7) Atropine
- 8) Diazepam
- 9) Diphenhydramine
- 10) Fosphenytoin
- 11) Glucose (25% or 50%)
- 12) Lidocaine

- 13) Lorazepam
- 14) Methylprednisolone
- 15) Naloxone
- 16) Racemic
- 17) Epinephrine
- 18) Rocuronium
- 19) Sodium bicarbonate
- 20) Succinylcholine

Drug most commonly investigated now a days is intranasal midazolam. Effective dosage of drug varies from 0.2 to 0.5 mg. Administering drug with atomizer would be less irritating when compared to other routes of administration. Till now few drugs have been proposed to be ideal but none of drugs have completely proved to be^{10,11,12}

II. Conclusion

Success of Moderate sedation lies in appropriate selection of case and determining dosage and route of administration of safe and effective drug or a proven combination of drugs, careful physiologic monitoring of child throughout the procedure and even post operatively and guidance of behavior should go hand in hand during the sedation session which constitutes the most important factor in pediatric moderate sedation. Moderate sedation with physical restraint does not affect the future dental behavior in a negative manner. In fact these children can develop into cooperative and even enthusiastic patients.¹³ On the other hand there is conflicting evidence that adolescents who had a history of moderate sedation in childhood has more anxiety or phobia than those who did not have sedation in childhood.¹⁴ So use of moderate sedation in pediatric dentistry should be done carefully, and only in appropriate situations, which in turn is left to the dentist's decision, knowledge and professional experiences and so also the consent from child's caregiver.

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