

Conscious Sedation in Pediatric Dentistry: A Review

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ABSTRACT

Fear and avoidance of dental treatment are considered to be major barriers to oral health. Most of child dental patients can be treated efficiently and with little or no discomfort or fear by the use of adequate local analgesia, modern equipment, careful patient management and good technical skill. However, dental treatment often includes painful procedures that may precipitate fear and anxiety in patients. Also, there is a considerable group of children with special health care needs that pose a problem to the effortless delivery of dental treatment. Methods to manage anxiety and behaviour are therefore required to meet this need. Nitrous oxide-oxygen sedation meets almost all of these requirements and has, therefore, been propagated and used for years in many countries. Inhalation sedation utilizing nitrous oxide-oxygen has been a primary technique in the management of dental fears and. The technique has an extremely high success rate coupled with a very low rate of adverse effects and complications. However, there is a need for effective training in this technique and more acceptance by the dental professionals in our country.

Keywords: Nitrous-oxide sedation, Conscious Sedation, Anxiety, Dental Fear, Moderate Sedation

INTRODUCTION

Reasons for not seeking dental treatment may be various, including cost concerns or anxiety due to anticipation of pain. Malamed¹ claims that fear, anxiety and pain have long been associated with the practice of dentistry, although he goes on to explain that image of the dentist as an instrument of pain is not justified. Pain is an unpleasant emotional experience usually initiated by a noxious stimulus, mediated over a specialized neural network to cortical and subcortical centers where it is interpreted as such.² Dental anxiety can be managed either by non-pharmacological methods like behavior therapy, desensitization or by pharmacological means that include conscious sedation techniques using inhalation sedation (nitrous oxide/oxygen mixture), oral or intranasal sedation (midazolam), intravenous sedation (midazolam) and general anaesthesia. The goal of conscious sedation is to alleviate fear and anxiety in order to facilitate treatment and it serves only as an adjunct to behavioural shaping techniques, and not a replacement.

DEFINITION AND CONCEPT

The Joint commission on Accreditation of Health Care Organizations (Chicago, Jan1, 2001)³ has defined four levels of sedation (Table-1).

We must first describe the word 'conscious' before defining Conscious Sedation. According to a definition by the American Dental Society of Anesthesiology, a patient is said to be conscious if he is capable of rational response to command and has all protective reflexes intact, including the ability to clear and maintain his airway in a patent state.

The UK Department of Health⁴ (2003); National Dental Advisory Committee, (2006) General Dental Council and the

Dental Sedation Teachers Group⁵ (2005) accept the following definition of conscious sedation,

"A technique in which the use of a drug or drugs produces a state of depression of the central nervous system enabling treatment to be carried out, but during which verbal contact with the patient is maintained throughout the period of sedation. The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render unintended loss of consciousness unlikely. The level of sedation must be such that the patient remains conscious, retains protective reflexes and is able to understand and respond to verbal commands."

Patient selection is of utmost importance in administering conscious sedation in pediatric dentistry. The American Society of Anesthesiologists (ASA) scale of Physical Fitness (Craig and Skelly, 2004)⁶ may be useful to classify patients when risk is anticipated,

ASA 1: Normal healthy patient

ASA 2: Patient with mild systemic disease.

ASA 3: Patient with severe systemic disease (limits activity).

ASA 4: Patient with severe incapacitating systemic disease.

ASA 5: Moribund patient with poor prognosis (<24 hours).

ASA 1 and 2 patients are generally considered suitable for treatment in a primary care setting. Those falling into categories 3 and 4 should be referred for specialist management, probably in a hospital setting.

OBJECTIVES OF CONSCIOUS SEDATION²

Conscious sedation techniques possess several characteristics that differentiate them from unconscious modalities. In general, conscious techniques:

1. It should alter the patient's mood, thus making him psychologically receptive to dental treatment.
2. It must allow the maintenance of consciousness throughout the procedure.
3. It must result in patient cooperation. Numerous studies carried out at the University of Pittsburgh have shown that chair side productivity is increased by a minimum of 30% when conscious sedation is utilized for dental procedures (Bennett, in preparation).
4. It should raise the pain threshold that is usually beneficial particularly when long appointments are contemplated.

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5. It must allow protective reflexes to remain intact. Studies have shown that maintenance of consciousness is the key to retaining protective reflex function. The production of unconsciousness, even for brief periods, results in dramatic alteration of respiratory and cardiovascular system function.
6. It should produce only small variation in vital signs.
7. It should not require continual monitoring of the patient as needed when carrying out general anesthesia. But still, the patient should be observed for the presence of consciousness and oxygen saturation throughout the procedure.
8. It may produce a variable degree of amnesia.

INDICATIONS FOR CONSCIOUS SEDATION IN PEDIATRIC DENTISTRY

Dental Anxiety

Anxiety is a generalized unpleasant emotion which can occur without the presence of the trigger object or situation, e.g. dental local anesthetic, high speed drill.

Dental anxiety can be measured using psychometric testing with self-report measures such as State- Trait Anxiety Inventory for Children (STAIC, a general anxiety scale)⁷ and the Child Fear Survey Schedule- Dental subscale (CFSS-DS, a dental- specific fear scale)⁷

Fear of specific procedures

Sometimes cooperative children get scared of specific procedures like taking local anesthesia or the sound of air-rotor etc. Nitrous oxide can be of great help owing to its anxiolytic and analgesic properties, in accomplishing these procedures. In a survey by Chanpong B et al⁸ in 2005, the demand for sedation was found to vary from 2% for prophylaxis to 68% for periodontal surgery.

Mentally/ physically disabled or medically compromised patients

Children with special health care needs exhibit severe anxiety when visiting a dental office. It may be caused due to a number of factors including fear of the unknown, inability to communicate one's feelings and reactions to sensory stimuli. The effectiveness of nitrous oxide varies according to the extent and severity of the disability and it should be considered as an option before thinking about deep sedation or general anaesthesia.

Involuntary movement conditions

Various medical conditions, such as Parkinson's disease, Multiple Sclerosis and Cerebral Palsy, affect the child's ability to maintain an open mouth during dental treatment. Conscious sedation often helps in reducing these involuntary movements through muscle relaxation and anxiety reduction.

Routes of administration

Oral

Midazolam is the most commonly used oral agent. It produces earlier sedation, more complete amnesia and improved awakening when compared with diazepam. The onset is 60-90 seconds and the duration of action for small doses is 10-15 minutes.

Oral sedation is easy to administer and monitor, and it costs less. But the level of sedation cannot be easily changed and there is no analgesic effect.⁹

Inhalation

It is a dependable and simple route of drug administration. As a general rule, the drugs delivered through this route have a very rapid onset and short recovery period. Their effect may be rapidly reversed by lowering the concentration of the agent or discontinuing it entirely and administering only oxygen or room air.¹⁰ Nitrous oxide is the most popular agent used through this route. But it has an inherent disadvantage of being the weakest agent available today. Nitrous oxide administration requires special equipment and training. Although it has a wide safety margin, it could prove dangerous and sometimes even fatal at the hands of an untrained individual. Figure-1 shows equipment for inhalation sedation.

Parenteral administration

Intravenous sedation

The standard technique is the use of titrated dose of a single benzodiazepine or opioid, like fentanyl, etomidate and propofol.⁹ The actions can be reversed by using agents like naloxone, a competitive antagonist of opioid receptors and flumazenil, a pure benzodiazepine antagonist.

Other routes include intramuscular and subcutaneous administration. But they are not commonly practiced.

RECOMMENDATIONS

Patient selection

As discussed earlier, the indications for use of nitrous oxide/oxygen analgesia/ anxiolysis include¹¹:

- A child mature enough to understand the procedure, usually older than 7-8 years;
- A fearful or anxious patient;
- Children with special health care needs;
- Child whose gag reflex interferes dental care;
- A patient for whom profound local anesthesia cannot be obtained;
- Lengthy dental procedures.

Review of patient's medical history should be assessed and should include:

	Minimal Sedation (Anxiolysis)	Moderate Sedation/ Analgesia (Conscious Sedation)	Deep Sedation/ Analgesia	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response after repeated or painful stimulation	Unarousable even with painful stimulus.
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

Table-1: Levels of Sedation



Figure-1: Portable Nitrous oxide- oxygen sedation machine with gas tanks. (Welbury R, Dugal MS, Hosey MT. Pediatric Dentistry. 4th edition, Oxford University Press, 2012)



Figure-2: Scavenging nose piece. (Welbury R, Dugal MS, Hosey MT. Pediatric Dentistry. 4th edition, Oxford University Press, 2012)

- History of previous allergic or adverse drug reactions;
- Medications including dose, time, route and site of administration;
- Systemic disorders;
- Previous hospitalization to include the date and purpose.

Contraindications may include:

- Some chronic obstructive pulmonary diseases;
- Drug-related dependencies¹¹;
- First trimester of pregnancy¹²;
- Treatment with bleomycin sulfate¹³;
- Methylenetetrahydrofolate reductase deficiency.¹⁴

Technique

Nitrous oxide/ oxygen should be administered by appropriately trained individuals, or under the direct supervision thereof. Nasal hood of appropriate size should be selected. A flow rate of 5-6 L/min generally is acceptable to most patients. The treatment should be started by administering 100% oxygen for 1-2 minutes should be started followed by titration of nitrous oxide in 10% intervals. And even when nitrous oxide flow is

terminated, 100% oxygen should be delivered for 3-5 minutes.¹⁵

Monitoring

Patient should be clinically observed for responsiveness, colour and respiratory rate and rhythm. Verbal responses provide an indication that the patient is breathing.¹⁶

Documentation

Well drafted informed consent must be taken from the parent or legal guardian and documented prior to administration of nitrous oxide/ oxygen.

Facilities/ personnel/ equipment

Facilities for delivering nitrous oxide/ oxygen must ensure proper gas delivery, fail-safe function and scavenging system prior to use. Inhalation equipment must have a fail-safe system that is checked and monitored regularly according to the latest guidelines and regulations.¹⁷

An emergency cart (kit) must be readily accessible and must be able to accommodate children of all ages and sizes

Occupational safety

The American Association of Pediatric Dentistry recommends minimal exposure to ambient nitrous oxide through the use of effective scavenging systems and periodic monitoring and maintenance of the delivery and scavenging systems.^{18,19}

CONSCIOUS SEDATION GUIDELINES

The American Academy of Pediatric Dentistry adopted a set of clinical guidelines in 2005 (revised in 2009)²⁰ to assist the dental profession in the use of nitrous oxide/ oxygen analgesia/ anxiolysis for pediatric patients.

Nitrous oxide acts as an adequate analgesic and anxiolytic agent causing central nervous system depression and euphoria with minimal effect on the respiratory system. The anxiolytic effect involves activation of GABA receptor either directly or indirectly through the benzodiazepine binding site.²⁰

CONCLUSION

Sedation should be considered as part of management of pain and dental anxiety, to make the treatment a pleasant learning experience. Conscious sedation is a safe method with a wide safety margin that can be used effectively in managing dental fear and anxiety and can reduce the need for general anesthesia. Inhalation sedation using nitrous oxide is the recommended choice for conscious sedation in children. Intravenous sedation should be prescribed carefully and used only in adolescents over the age of 12 years.

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