

Review Article

Challenges, difficulties and evolution of conscious sedation in pediatric dentistry: A review

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ABSTRACT:

Children differ from adults in their emotional, physical and psychological state. Many of the pediatric patients coming to the dental clinic are usually relaxed and even relatively cooperative; however some presents with undesirable tantrums which may raise the hardship of the clinician in giving safe and adequate treatment. Pharmacological behavior management in pediatric dentistry incorporates measures including anxiolysis to negligible sedation to even acceptance of general anesthesia. It can be utilized securely with extraordinary impact in patients who can't get treatment for different reasons, for example mentally and physically compromised and young age. Utilization of minimal to moderate sedation is typically advantageous as a result of its insignificant pre-operative preparation and acceptable solace level of patients post-operatively as they further require minimal or even no hospitalization. Accordingly, the primary aim of our article is to give general information to dental specialists about the utilization, pharmacology, route of administration and general indication on the practice of conscious sedation.

Keywords: Anxiety, Conscious-Sedation, Fear, Inhalation, Management, Nitous-Oxide

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INTRODUCTION

Any developing child frequently lacks the adapting abilities important to explore the dental experience, making arrangements of valuable dental consideration to children exacting. While unrestored tooth might add to the torment, insomniac child, troublesome learning and unfortunately poor growth in kids, causing psychological harm due to any uneventful dental experience.¹ Anxiety and dental fear turns out to be the most common problems encountered in pediatric children. Many children show calm and composed nature during the dental treatments, but still some display unnecessary flared-up nature, causing great difficulties in providing a standard treatment plan.²

There are an impressive number of variations in methods followed to manage such patients. Preferably, numerous non-pharmacological behavioral management techniques are used to implement successful treatment plan and to further guide them to

adopt a positive behavior for further treatments.³ Even if, a child turn outs to be reluctant and unacceptable to treatment only then pharmacological procedures including anesthesia and sedation for behavior management proves to be a valuable tool by the clinician in such patients. Innumerable sedation techniques using divergent anesthetic agents have gained a substantial acceptance over the past many years.⁴

Conscious sedation can be explained as the method where the utilization of medication or medications creates a state of depression in the central nervous system empowering any treatment to be carried out, during which the verbal contact is maintained throughout the period of sedation⁵ and/or a medically supervised state of depressed consciousness that allows maintenance of protective reflexes, retaining patients patent airway continuously and independently and permissible response to verbal and physical commands.

In the year 1992, it was stated that a patient under conscious sedation can readily progress from one to another level of sedation without even any notice, making increase vigilance and monitoring a prime factor.⁵

MAIN OBJECTIVES OF CONSCIOUS SEDATION

An ideal sedative agent should be easy to administer with rapid offset and beginning, producing no lingering side effects, having in-significant after effects and in fact cost effective.⁷ American Academy of Pediatric dentistry and Pediatrics in the year 2011 developed specific guidelines for management and monitoring of pediatric patients after administration of sedative for therapeutic and diagnostic purpose. The objective being⁴:

- Minimizing or raising pain threshold specifically for long appointments.
- Minimizing psychological trauma and anxiety followed by maximizing potential for amnesia.
- Guarding patient's welfare and safety.
- Controlling behavior and any movement so as to allow the safe and effective completion of the procedure.
- Return of patient to a state where a safe discharge from medical supervision is possible.
- Should produce minimal or no variations in vital signs.

APPLICATIONS IN PEDIATRIC DENTISTRY⁸

Sedation in case of dental surgery conveys high risk both in case of patient and anesthesiologists. The sedation procedure offers option for patients where utilization of general sedation is unavoidable.⁹ Oversedation or undersedation is absurd or inadmissible in certain conditions. All together to decrease reliance of the patient to sedation other psychological methods can be utilized.¹⁰ Indication for conscious sedation in pediatric dentistry is as follows:

- **Fear and dental anxiety:** many of the times cooperative child usually gets scared of dental procedures such as sound of high speed drilling machine, local anesthesia, and in-fact instruments. The sedatives help to calm and make patients much co-operative for any further treatment.
- **Patients with involuntary movement:** number of diseases like Multiple Sclerosis, Cerebral Palsy, Parkinson diseases is known for affecting child's ability in maintaining an open mouth during the dental treatment. Conscious sedation helps in reducing involuntary movements through relaxation of muscle and reduction in anxiety.
- **Physically and mentally compromised patients:** children exhibiting severe anxiety disorder need

special health care need whenever visiting a dental office. Fear of unknown, inability to communicate and express their feeling cause an increase in the anxiety and exaggerated response to minute dental trauma. The effectiveness of sedatives usually varies according to the severity and extent of the disability and should be considered as one of the options before even thinking about general and deep sedation.

SELECTION OF SEDATIVES IN CHILDREN UNDERGOING DENTAL TREATMENT

The medications used in pediatric dental sedation include benzodiazepines, inhalational agent, oral sedatives, and laughing gas.

1. **BENZODIAZEPINES:** work through gamma amino butyric acid mediated chloride channel opening. Benzodiazepines have an extensive margin of safety between the toxic and therapeutic dose with a rapid onset of action and high lipid solubility. They are known for providing skeletal muscle relaxation, hypnosis, anxiolysis, anterograde amnesia, respiratory depression and even anti-convulsant effect without any analgesic effect.¹¹ When combined with nitrous-oxide and oxygen are determined to produce analgesic effects. The most commonly used medication of choice is midazolam with shorter duration of action and one of the most important choice for conscious sedation in pediatric treatment.¹²

DOSAGE: sweetened syrup either via a glass or drawn in a syringe without the needle. It can be given 20-30 minutes before the procedure. Oral tablets 60 minutes before the procedure. If given rectally, it should be preferred 10 minutes before the surgery. It can also be administered via IM, intranasal and IV routes also.¹³

MIDAZOLAM: it is one of the newer generation benzodiazepine with outspread safety of margin with wide therapeutic and toxic ratio. It doesn't bring out a prolonged sedation associated with other medications of the group including diazepam. It has shown to produce antero grade amnesia when used preoperatively. Midazolam rapidly absorbs via gastrointestinal tract when taken orally and produces its peak effect in relatively shorter period of time i.e. 30 minutes and short half life about 1.75 hours. Its clinical use is mainly reserved for premedication though with excellent anti-convulsant and muscle relaxant properties.¹⁴ Its shorter length of action becomes one of its limiting factors and can be used effectively and efficiently in patients for mildly painful, short and minimally invasive procedure.

DOSAGE: midazolam has been widely used orally between the dosages of 0.2-1 mg/kg with onset of action of 20.-30 minutes. Literature suggests an optimum dose of 0.5 mg/kg for pre-medication for

children with ASA I category during short dental procedure.¹⁵

2. PROPOFOL: used in cases to avoid the struggle to get an IV access in children, propofol is a powerful volatile anesthetic agent. Being water immiscible oil formulated as an emulsion with soya oil base is facilitated to injections. Propofol rapidly distributes into the peripheral tissues and its effect, wears off considerably within half an hour of injection.¹⁶ The duration of clinical effect along with the moderate amnesia, propofol makes an ideal drug in cases of IV sedation. The elimination half life of propofol is around 2-24 hours.¹⁷

DOSAGE: With sevoflurane, propofol is used with the initial loading dose of usually 1 mg/kg body weight while the maintenance dosage needs to be adjusted for satisfactory sedation ranging between 0.3-4 mg/kg/hr.¹⁸

3. SEVOFLURANE: an effective and potent anesthetic which is volatile in nature with rapid onset and offset possessing low blood gas solubility. This property of sevoflurane makes it an ideal for induction before infiltration of other anesthetic for maintenance of sedation.¹⁹

DOSAGE: Inhaled concentration should be 2-4%.

4. CHLORAL HYDRATE: it is a psychosedative and a weak analgesic with a half life of about 8 hours. When used in small doses, it produces mild sedation while natural sleep is produced with intermediate doses. It is a chlorinated derivative of ethyl alcohol, which acts as an anesthetic whenever administered at a higher dose. Chloral hydrate is contraindicated in cases of children with heart, renal or hepatic impairment. It depresses respiratory rate, blood pressure, causes oxygen desaturation and even prolong drowsiness.²⁰ More recently, a concern of increased risk of carcinogenesis, specifically when used repeatedly. Though used for many years, further discovery of newer and more effective agents have largely replaced the drug and is at the verge of becoming obsolete.²¹

DOSAGE: a general recommendation of 50-100 mg/kg and 75 mg/kg is viewed as standard dosage.²²

5. NITROUS OXIDE: one of the first modern anesthetic manufactured by an English chemist Joseph Priestly in 1772. In 1800 Sir Humphrey Davy coined the term laughing gas by doing experimentation with the physical properties of the gas. It was used as a dental anesthetic for the first time by Dr. Horace Wells in the year 1844.³ Nitrous oxide affects both N-methyl-D-Aspartate and gamma amino butyric acid receptors producing varying degree of analgesia and muscle relaxation.²³ Deep sedation can be easily produced in cases when used in addition with other sedatives, though has a long history of effective use in

providing moderate sedation in moderately painful procedures. When a child patient is unable to tolerate local anesthetics, nitrous oxide becomes the first choice of the clinician with sufficient acceptance of the procedure. Nitrous oxide is among the safest anesthesia used which enables the child to remain awake, breathes of its own and are mentally and physically responsive. Fast recovery, rapid onset of action and poor anesthetic effect of nitrous oxide is due to its non-irritant nature, minimal alveolar concentration and low tissue solubility property. Nitrous oxide should be administered by a trained individual under the direct supervision of the consultant.²⁴ Though nitrous oxide can be used in all of the patients with minimal exception of nasal blockage, tonsillitis, common cold, patients with porphyria and psychotic patients.²⁵ Machines which are specially designed for inhalation sedation in dentistry should be used and they should be capable enough for the administering nitrous oxide to limit of 70% with not less than 30% of oxygen in volume. In majority of the cases adequate analgesia is achieved with 50% concentration of nitrous oxide in volume.²⁶

DOSAGE: Nasal hood with a flow rate of 5-6 L of nitrous oxide and oxygen per minute is generally accepted by many patients. The phase of sedation should be started with the administration of 100% oxygen for 1-2 minutes followed by titration of nitrous oxide in 10% interval. While termination 100% oxygen should be delivered for a period of 3-5 minutes.²⁷

6. KETAMINE: one of the drugs which has advantages over other drugs in its relative cardiovascular and respiratory effect. Ketamine is a dissociative agent, with the state of catalepsy that gives control of pain, amnesia and sedation. It is NDMA antagonist with the recovery period of 30-120 minutes. It increases tracheobronchial and salivary mucus gland secretion making an effective antisialogog which is usually recommended with general anesthesia. Emesis was found in around 10% of the children and was generally associated with dental procedures.²⁸

DOSAGE: it can be administered IM at 3-4 mg/kg or IV at 1-2 mg/kg. Ketamine can also be given along with nitrous oxide/oxygen in doses of 2.5 mg/kg, promethazine, diazepam and atropine.²⁹ An induction dose of 0.6 mg/kg and a maintenance dosage of 0.4 mg/kg every 10 minutes were recommended.³⁰

Apart from these many more sedatives including sufentanil, opioids with lollipop delivery system, dexmedetomidine, hydroxyzine and promethazine which are psychosedatives with antiemetic, antispasmodic and even antihistaminic effects are also well known.

ADVANCEMENT OF RULES FOR SEDATION IN DENTISTRY³¹

Many years after the publication of the report by Poswillla (2000), Department of Health issued a document with the title of “A Conscious Decision” where poor resuscitation and monitoring standards while administration of general anesthesia in a dental setup under the supervision of a dentist were discussed. This major discussion was based on the eight deaths reported in dentistry from the year 1966 to 1999. Due to which the general anesthesia practice was ceased in a dental clinics specifically in UK, and was limited to hospitals leading to audit in dentistry. Perceiving the need for safe sedation in dentistry, the first set of UK dental sedation guidelines were circulated in the year 2002. Scottish Intercollegiate Guideline Network set few guidelines in the same year with a separate section for dental sedation at dispense of first evidence based explanation regarding the same. Similarly few more guidelines were set up later such as General Dentist Council Guideline in 2005 and National Dental Advisory in 2006 for authenticating the use of sedation in dental practice. American Academy of Pediatric Dentistry laid a number of guidelines to be followed in association with American Academy of Pediatrics (2006) which lay emphasis on the monitoring, risk assessment and proper armamentarium.

FUTURE VIEWPOINT

Recent literature updated by Cochrane review emphasized on the need for standard researches for collection of enough evidence for the efficacy of use of sedatives in pediatric dentistry. A number of research's are available in support of oral midazolam and nitrous oxide sedation efficacy. There is still a need to improve research in pediatric dental sedation where new. Apart from building evidence, there is still a need to stimulate literature in insufficient areas including the role and effect of fasting and restrain from sedation, feasibility of target controlled anesthesia, and development of tools for assessing indications for treatment under sedation.³²

CONCLUSION

Sedation ought to be considered as a component of the management of dental anxiety and pain, to make the treatment a pleasant learning experience. Conscious sedation is a protected strategy with a wide safety margin that can be utilized effectively in overseeing dental fear and uneasiness and can diminish the requirement for general sedation. Inhalation sedation utilizing nitrous oxide is the suggested choice for conscious sedation in youngsters. Intravenous sedation ought to be endorsed cautiously and utilized uniquely in adolescents over the age of 12 years.

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