

# Nitrous Oxide Inhalation Sedation in Present Scenario: A Review Article

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### Abstract

Joseph Priestley's discovered of nitrous oxide (N<sub>2</sub>O) in 1772. Nitrous oxide is the first modern anesthetics, was first manufactured in by this English chemist. Sir Humphrey Davy (1800) experimented with the physiological properties; he coined the term "laughing gas". Dr. Horace Wells (1844)- Nitrous oxide was used for the first time as a dental anesthetic drug. Provision of General Anaesthesia is now limited and restricted to the hospital setting. Sedation for paediatric patients is an essential tool in anxiety management and is used as an adjunct to behaviour management. Inhalation sedation with nitrous oxide/oxygen sedation to reach a plane of relative analgesia may be administered easily and safely in children for general dental practice and is a potential alternative to general anaesthesia.

**Keywords:** Paediatric Patients, behaviour management, Inhalation sedation, nitrous oxide/oxygen sedation

### INTRODUCTION

Many patients experience dental fear and anxiety (DFA), which imposes a significant level of stress in dentists who must treat such patients<sup>[1-3]</sup>. While there are various non-harmacological methods for dealing with DFA, these methods may not be effective in patients with severe DFA; therefore, pharmacological approaches including sedation and general anaesthesia (GA) may be unavoidable in treating some patients<sup>[4]</sup>. Although there is very little difference in the prevalence of DFA between adults and children<sup>[1,2]</sup>, adults are able to avoid their DFA by cancelling or delaying their own dental appointments, whereas children often do not have such options.

Moreover, children are often unable to repress their expression of fear, which may manifest as excessive crying and/or physical struggle. These reasons led to the early adoption of sedation in pediatric dentistry. According to a survey of the members of International Association of Paediatric Dentistry (IAPD) and European Academy of Paediatric Dentistry (EAPD), the pharmacological method most often used for behavioral control was GA (52%), followed by N<sub>2</sub>O-only sedation (46%) and oral sedation (44%)<sup>[4]</sup>. The objective of this review was to investigate the properties of N<sub>2</sub>O as a PSA agent and identify the adverse events (AEs) associated with N<sub>2</sub>O.

Nitrous oxide, or protoxide of nitrogen (N<sub>2</sub>O), is a colourless gas with a sweetish taste. It has an anxiolytic and sedative effect, and also promotes muscular relaxation and analgesia.<sup>[5]</sup> N<sub>2</sub>O is non-irritant for the respiratory tract, with minimal alveolar concentration and low solubility in tissues. It acts with a quick onset and a rapid recovery, the entire procedure only lasting for a few minutes.<sup>[6]</sup>

When N<sub>2</sub>O is administered in concentrations ranging between 20% and 50% (along with 80-50% O<sub>2</sub>), the patient most always stays awake, calm and capable of following spoken instructions. However, some patients may suffer episodes of unconsciousness when concentrations of N<sub>2</sub>O are higher than 50%.<sup>[6,7]</sup>

Sedatives such as N<sub>2</sub>O are classified by their route of administration or by their impact on patients' conscience. Accordingly, N<sub>2</sub>O-O<sub>2</sub> is an inhalation conscious sedation. Nevertheless, the 2007 Dentists' Guidelines for utilization of general anaesthesia published by the American Dental Association (ADA) recommend a more specific classification,

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qualifying conscious sedation as minimal, moderate or deep<sup>[5]</sup> and for this purpose N<sub>2</sub>O-O<sub>2</sub> is classified as moderate.[Figure1]



Figure 1. Nitrous oxide Inhalation sedation equipment

The American Academy of Pediatric Dentistry Guidelines consider it a safe and effective basic control technique that allows the reduction of the child's anxiety and promotes improvements in the communication between the Pediatric Dentist and the child.<sup>[8,9]</sup> It is described as a “standard technique” for Pediatric Dentistry and as a successful procedure in 90% of adequately selected patients.<sup>[10]</sup>

## DISCUSSION

Health is directly related to general health and well being of pediatric patients, especially those with disabilities and those with behavioral management problems, because they have greater oral health needs. Although it can be a challenge, all pediatric patients should be able to expect painless, high quality dental care, maximizing comfort and cooperation.[Figure 2]



Figure 2: Nitrous oxide administration

In dentistry, use of minimal and moderate sedation is usually more beneficial because of its minimal pre-operative preparation and acceptable comfort level of patients post-operatively as they<sup>[11]</sup> require no or minimal hospitalization. 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. 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<sup>[12]</sup> reduction.

### Goals of conscious sedation in children

An ideal sedative agent for children should be easy to administer, have a rapid onset and offset, produce no residual symptoms, have minimal side effects, and should be cost<sup>[13]</sup> effective. According to the Guidelines developed by American Academy of Pediatrics and the American Academy of Pediatric Dentistry in 2011 for Monitoring and Management of Pediatric Patients During and after Sedation<sup>[14]</sup> for Diagnostic and Therapeutic Procedures, the goals of sedation in the pediatric patient for diagnostic and therapeutic procedures are [Figure3]



Figure 3. Patient signalling during inhalation sedation

1. To guard the patient's safety and welfare,
2. To minimize physical discomfort and pain,
3. To control anxiety, minimize psychological trauma, and maximize the potential for amnesia,
4. To control behavior and/or movement so as to allow the safe completion of the procedure, and

5. To return the patient to a state in which safe discharge from medical supervision, as determined by recognized criteria, is possible.

### Indications for Inhalation Sedation

Inhalation sedation is primarily indicated for the management of dental anxiety, especially in children. It should be viewed as part of an overall behavior management strategy.<sup>[15]</sup> Indications for use of inhalation sedation are:<sup>[16]</sup>

- Fear or anxiety
- Needle phobia
- Where profound local anaesthesia can not be obtained, e.g., acute pulpitis
- Gag reflex
- Hypoplastic teeth, to decrease sensitivity
- Prolonged or unpleasant treatment, e.g., surgical extractions
- Persistent fainting
- An alternative to GA for some special needs/medically compromised patients
- Cardiovascular disorders; it reduces anxiety, elevates the pain threshold and provides increased levels of oxygen

### The contraindications are:<sup>[18-19]</sup>

- Inability to communicate
- Very young children, some authors suggest not less than 6 years of age, but each case should be assessed on its own merit;
- Fear of the mask
- Mouth breathing
- Unwilling/unable to nose breathe
- Cold/rhinitis
- Chronic obstructive airways disease, e.g., emphysema, chronic bronchitis because the lowered blood oxygen level is the stimulus for breathing
- Otitis media; because N<sub>2</sub>O causes pressure volume effects on the ear
- Severe muscular depression activity, e.g., Multiple Sclerosis
- Severe psychiatric disorders
- Behavioral / personality problems
- Learning difficulties
- Psychological 'loss of control'

### CONCLUSION

Nitrous oxide can be easily and safely administered to paediatric patients in general practice. Sedation skills are an essential part of anxiety management. Successful sedation can also reduce stress for the dental team, as well as the patient, and becomes a practice builder.

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