

Inhalation conscious sedation with nitrous oxide/oxygen in pediatric dentistry

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■ INTRODUCTION

Conscious sedation is a technique in which one or more pharmacological agents are employed to produce a mild depression in the central nervous system, without loss of consciousness so that verbal contact can always be maintained with the patient; this allows for certain dental procedures to be performed. The technique is associated with a great margin of safety.^{1,2}

In Odontopediatrics, the sedative agents generally employed are nitrous oxide (N₂O) and benzodiazepines, amongst other agents with sedative properties.^{3,4,5,6}

The use of nitrous oxide/oxygen (N₂O) is becoming more frequent for general and pediatric procedures in dental medicine and has become common practice in many countries.^{6,7,8,9} It is also frequently used in general pediatric medicine^{10,11} for procedures ranging from minor surgery to more invasive diagnostic procedures.

Nitrous oxide, or protoxide of nitrogen (N₂O), is a colorless gas with a sweetish taste. It has an anxiolytic and sedative effect, and also promotes muscular relaxation and analgesia.⁷ N₂O 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.⁴

When N₂O is administrated in concentrations ranging between 20% and 50% (along with 80-50% O₂), the patient almost always stays awake, calm and capable of following spoken instructions. However, some patients may suffer episodes of unconsciousness when concentrations of N₂O are higher than 50%.^{4,6}

Sedatives such as N₂O are classified by their route of administration or by their impact on patients' conscience. Accordingly, N₂O-O₂ is an inhalation conscious sedation. Nevertheless, the 2007 Dentists' Guidelines for utilization of general anesthesia published by the American Dental Association (ADA) recommend a more specific classification, qualifying conscious sedation as minimal, moderate or deep⁷ and for this purpose N₂O-O₂ is classified as moderate.

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.^{10,12}

It is described as a "standard technique" for Pediatric Dentistry and as a successful procedure in 90% of adequately selected patients.²

This article's main goal is to lay out up-to-date guidelines on the operation of inhalation sedation with nitrous oxygen/oxygen (N₂O-O₂) for the management of child behavior during a Pediatric Dentistry appointment, highlighting aspects of this procedure which have been recently examined by international institutions such as the Council of European Dentists and the American Academy of Pediatric Dentistry.

■ SEDATION IN PEDIATRIC DENTISTRY

In contrast to adult sedation, in children the procedure has the objective of controlling behavior and achieving complete treatment in a safer and more efficient way. The child's cooperation and the Pediatric Dentist's power of control over the child both vary according to the child's age.^{10,13,14}

In numerous situations, moderate levels of sedation are required for behavior control of children under 6 years old and patients with developmental delays. However, this need must be assessed before the procedure.

Children under six are particularly vulnerable to the effects of sedation. Studies show that a patient may easily lapse into a non-intended deeper level of sedation. For older children, the use of other non-pharmacological techniques may reduce the need of this intervention.^{5,6,10,13,14,15}

Inhalation conscious sedation with N₂O-O₂ is used to achieve the following objectives: preserve patients' safety and well-being; minimize discomfort and physical pain; control anxiety, minimize psychological trauma and maximize amnesia; increase behavior and movement control so that dental treatment can be completed; provide patients with a safe condition without the need for medical supervision.^{3,10,16}

■ SPECIFIC TRAINING OF THE PEDIATRIC DENTIST

Regarding sedation with N₂O-O₂, a Pediatric Dentist's training routine must include theoretical and practical elements.^{2,4} The Council of European Dentists² has recently recommended a two-day theoretical course (10-14 hours) that covers knowledge of anxiety behavior control, technical aspects of different forms of sedation, psychological and biological features of N₂O usage, and basic support for life

and emergencies. In order to complement theory, practical knowledge on educational patterns must be covered. Furthermore, the training must include a supervisor's evaluation of the student's performance in five cases of observation and five cases of treatment. It is important that at the endpoint of any such courses the student becomes eligible to obtain a certificate and understands that practice and experience must be regularly updated.²

■ PATIENT SELECTION

The selection of the patient is based on a careful clinical examination and a well-documented medical and dental history elaborated by the Pediatric Dentist. Determination of risk factors and a better understanding of the patient's profile are mandatory. If a single risk factor is found, an anesthetist must be consulted in order to decide whether the patient can be submitted to the sedative procedure.⁴

Patients must be classified according to the American Society of Anesthesiologists (ASA) classifying system as shown in Table 1.¹⁷

Sedation with N₂O-O₂ can be performed in ASA III and ASA IV patients, provided its use is restricted to hospitals and under the supervision of a responsible anesthesiologist.

■ ESSENTIALS OF NITROUS OXIDE/OXYGEN ADMINISTRATION TECHNIQUES

Both the professional and the team responsible for the patient's treatment must be trained as described above and be familiar with the appropriate techniques to employ in any emergency situation.^{10,17,18,19} The following sequence must be observed: (a) adequate mask selection; (b) O₂ (100%) inhalation (one to two minutes); (c) N₂O (5 to 10%) inhalation with pauses of one to two minutes at each fraction; (d) a maximum of 50% of N₂O not to be exceeded, while maintaining verbal contact and using basic behavior control techniques; (e) monitoring of breathing and of the patient's conscience level; (f) gradual reduction of N₂O to end treatment, and 100% O₂ given for five minutes.²

■ INDICATIONS

The most common indications are discussed:^{3,10,16}

- (a) Patients showing low to moderate apprehensive behavior, capable of understanding and following simple instructions;^{7,10,19}
- (b) Patients aged four or over,⁴ although there is support for a minimum age of six¹⁹ or eight,²⁰ depending on how

well the child cooperates with the basic behavior techniques;

- (c) Patients with a severe vomiting reflex that makes the dental treatment otherwise impossible;⁴
- (d) Special patients who present physical or mental disorders;^{4,17,19}
- (e) Patients who require more sitting time because of complex or multiple treatments;⁷
- (f) Invasive medical diagnoses and minor surgeries.

■ CONTRAINDICATIONS

- (a) Non-cooperative patients who exhibit a highly anxious and apprehensive profile;^{4,7}
- (b) Hysterical, stubborn or defiant patients who refuse the mask due to age, maturity, behavior or personality disorder;^{7,19,21,22}
- (c) Psychotic⁴ or drug addicted patients, due to the influence of severe emotional disorder;¹⁷
- (d) Patients with severe pain,⁷ upper respiratory tract infection, chronic obstructive pulmonary disease (COPD), acute otitis,^{7,17} sinusitis or a recent (less than two weeks) ear, nose or throat operation,⁴ under chemotherapy with bleomycin⁴ or with porphyria;⁴
- (e) Patients during the first trimester of pregnancy;¹⁹

■ RISKS FACTORS AND CONNECTION WITH OTHER MEDICINES

Sedation in pediatric patients may be associated with serious risks, such as hypoventilation, apnea, respiratory obstruction, laryngospasm and cardiopulmonary alterations. These adverse effects may appear during and after the sedation procedure; the risk can be minimized, but not completely eliminated, by a preliminary analysis of the patient's medical conditions. But it is important to remember that foresight of its influence cannot be 100% guaranteed.¹⁰

■ NITROUS OXIDE USAGE, WORLDWIDE

Pediatric Dentists members of IAPD (International Association of Pediatric Dentistry) and EAPD (European Academy of Pediatric Dentistry) use a number of behavior conduct techniques, including pharmacological ones.

There is, nonetheless, an increasing interest about the continuous training in the field of sedation.² Pediatric Dentists can obtain specific sedation training in the technique through advanced courses, but evidence accumulated over recent years still shows that this varies widely according to each country's programs. There are various reasons for this variability.²

Rules and regulation of dental practice differ among countries and the most important contrasts emerge in dentists' rights regarding the use of sedation methods in different countries. Within the EAPD, the United Kingdom (UK) and Norway have developed guidelines for children's dental treatment.

In the UK, 99% of students specializing in Odontopediatrics state that they have knowledge of the sedation with N₂O-O₂ technique and believe that practicing it should be mandatory during specialization.²² Inhalation conscious sedation with N₂O-O₂ is referred as the first choice in 90% of cases among other techniques of conscious sedation.²³

Table 1 - American society of anesthesiologists (ASA) physical status classification evaluation

ASA Classification	
Class I	No organic, physiological, biochemical or psychiatric alterations
Class II	Moderate systemic alterations (diabetes, asthma)
Class III	Severe systemic alterations (acute diabetes, psychomotor retardation, severe pulmonary failure)
Class IV	Severe alterations that may endanger life (heart failure)
Class V	Moribund patient with no chances of surviving a surgery

In Portugal, the Dentists Association (Ordem dos Médicos Dentistas – OMD) considers the practice of conscious sedation (via nitrous oxide) to be an important component of curricular training, which contributes to the quality of certain dental treatments, the safety and well-being of patients and professional working conditions. In 2009, the Council of European Dentists unanimously adopted a resolution on “Necessary competences for the practice of dental medicine in the European Union.” This assumes that sedation must be practiced by professionals who have specific training and who should never neglect the importance of covering the risk of the activity through insurance adequate to the given situation.²⁴

The Dentists Association (Ordem dos Médicos Dentistas – OMD) harbors a working group dedicated to the study and regulation of conscious sedation regarding the professional dentist’s profile.

■ CONCLUSION

A patient with a non-collaborative profile in the pediatric dental office requires a specific approach for effective treatment and for the child’s safety. If psychological techniques are unproductive, inhalation conscious sedation should be considered as a viable option. Sedation with N₂O-O₂ is recommended in specific cases when it is supported by behavior control techniques that can provide more safety and comfort for children during the dental treatment.

Specific training in this area is fundamental for the professional medical team as well as a deep knowledge of the technique itself so that the country’s laws and regulation are applied without endangering the patient’s health.

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