# Managing Anxious Children- The use of Conscious Sedation in Pediatric Dentistry : Review Article (Conscious Sedation In Pediatric Dentistry)

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## Introduction

All children should be able to expect painless, high quality dental care. The following guideline is intended to assist dentists in the management of healthy anxious children; discussion of the sedation of medically compromised children or those with a learning disability is not included.

Behavioural management and prevention, coupled with local anaesthesia when required, form the foundation of the delivery of pain-free dentistry to children.

Although behavioural management may need to be augmented with conscious sedation for some anxious children, pharmacological agents are not substitutes for effective communication and the persuasive ability of the operator. There is certainly no place for invasive and high-risk sedative techniques such as deep sedation or polypharmacy in the dental management of anxious children within paediatric dental care in the UK. Indeed, even in parts of the world where deep sedation techniques are more common, their use is often limited to hospitals[1].

Nitrous oxide inhalation sedation remains the preferred technique for the pharmacological management of anxious paediatric dental patients.

It is hoped that this guideline will be an adjunct to clinical judgement and careful treatment planning within both primary dental care and specialist paediatric dentistry practice. It is therefore generally assumed that the dentist is also the sedationist. Restraining devices (such as the papoose board) and deep sedation techniques (where the patient is more deeply sedated than the General Dental Council definition of conscious sedation [2] are not acceptable in UK dental practice. Where there is evidence or a substantive body of opinion relating to a specific drug or route indicating that deep sedation might occur, or where research is meagre, referral to a hospital-based paediatric dental service and, where appropriate, the assistance of a qualified anaesthetist has been recommended. As such, not all drugs reported in this guideline are recommended for use in primary care dentistry in the UK, but are included because the author is aware that the diversity of published literature might lead some dental practitioners to consider using them in an effort to find an alternative to general anaesthesia.

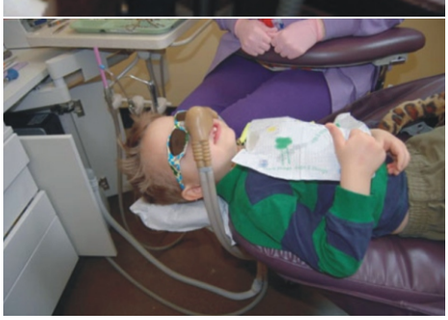
This guideline is based on the evidence currently available but even although the paediatric dental sedation literature is extensive, there are relatively few randomised controlled trials. Furthermore, the evaluation of the efficacy of an individual drug is often confounded by the use of polypharmacy, restraining devices and diverse methodology. The Poswillo Report[3]. clearly stated that conscious sedation should involve the administration of a single drug.

Conscious sedation is used in pediatric dentistry as elsewhere to reduce fear and anxiety in pediatric patients and so promote favorable treatment outcomes. This can help to develop a long-term positive psychological response to necessary dental procedures.

The publication of 'A Conscious Decision' in 2000[4] resulted in the cessation of general anesthesia for dentistry in the primary care setting. Up to this date, there had been an increased emphasis on the safe provision of conscious sedation for management of pain and anxiety in child and adult patients and this has continued following the removal of general anesthesia in the primary care.

Several recent guidelines have sought to provide advice to general dental practitioners, community dentists and those in the hospital setting on the use of conscious sedation for both children and adults.

The British Society of Paediatric Dentistry (BSPD) produced the UK Clinical Guidelines in pediatric dentistry for conscious sedation in children in 2002[5] and in combination with the Scottish Intercollegiate Guidelines Network (SIGN), which published the Safe Sedation for Children guideline in the same year[6].



Practitioners were able to understand the evidence base behind various techniques. The UK Department of Health sponsored an independent working party the Standing Dental Advisory Committee (SDAC) to develop further guidelines, which were published in 2003[7]. These guidelines were endorsed by the General Dental Council (GDC) and dental professionals are expected to follow it. Therefore, the SDAC report is now considered as professional regulation in combination with the GDC's own Standards guidance of 2005[8]. This year has also seen the

publication of the Scottish Dental Clinical Effectiveness Programme's [SDCEP is an initiative of the National Dental Advisory Committee (NDAC)]. Conscious sedation in dentistry seeks to update and extend the SDAC guidance[9].

Currently, different forms of sedation, for example, oral, intravenous (i.v.), inhalation, intranasal and combinations of treatments are used for pediatric dental patients worldwide. Some of these techniques do not comply with the UK definition of conscious or moderate sedation[6], where the patient remains in verbal contact throughout treatment and the margin of safety is wide enough to render the loss of consciousness unlikely [NDAC, GDC, SDAC, Dental Sedation Teachers Group (DSTG)].

## Conscious Sedation

**General Dental Council definition :** 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 to respond to verbal commands[2].

Goals of pediatric conscious sedation are to

1. Promote patient welfare and safety.
2. Facilitate the provision of quality care.
3. Minimize the extremes of disruptive behaviour.
4. Promote a positive psychological response to treatment.
5. Return the child to a physiological state in which safe discharge is possible (19).

## Inhalation Sedation with Nitrous Oxide

The inhalation sedation technique that is commonly used in dentistry refers to the administration of a titrated dose of nitrous oxide in oxygen. In this respect, the technique is different from the Entonox (50 : 50 oxygen and nitrous oxide mixture) that is administered in maternity or medical A & E units. Only dedicated dental nitrous oxide inhalation sedation delivery systems must be used. The standard delivery system is designed to prevent administration of nitrous oxide gas concentrations in excess of 70%, i.e. there is an assured minimum oxygen concentration of 30%. There should be a fail-safe device which shuts down nitrous oxide delivery should the oxygen supply fail. The dentist sets the flow depending on the calculated tidal volume of the patient and then uses a single valve to vary the percentage delivery of nitrous oxide against oxygen.

Meanwhile, the dentist should encourage relaxation through semihypnotic suggestion and reassurance as the psychological preparation by the operator exerts a beneficial influence on the analgesic effect of the gas[20].

Inhalation sedation with nitrous oxide has been established as a method for conscious sedation for many years. The technique uses subanesthetic concentrations of nitrous oxide delivered with oxygen in a titratable dose from dedicated machinery via a nasal mask.

Nitrous oxide is poorly soluble with a high minimum alveolar concentration (MAC value), rapid onset of action is therefore coupled with a rapid recovery period; the duration of the sedation is controlled and the patient can quickly return to normal activities. Patients do not need to be fasted and adults (over 16 years) do not need to be accompanied for treatment after their first visit[9]. It is not used in isolation from the support given by the dentist but has been shown to be very successful in facilitating treatment for children with mild to moderate anxiety[5]. It is a viable and cost-effective alternative to general anesthesia for children requiring extractions, especially orthodontic extractions, with the exception of very young children requiring multiple extractions and irregular attenders[10,11].

There are few disadvantages to the technique although precooperative children and those who cannot accept a nasal mask or breathe adequately through the nose may be unable to tolerate this form of sedation. There have been no recorded fatalities or cases of serious morbidity associated with the technique when it has been used alone and in concentrations appropriate for conscious sedation[12,13]. Nitrous oxide has no excretion products being eliminated unchanged through the lungs and is therefore useful in patients who have kidney or liver disorders. Patients with cardiovascular or cerebrovascular disease especially those at risk of ischemic episodes can benefit from the technique from both the anxiolysis effects and the enriched oxygen given as part of the technique. Nitrous oxide sedation is suitable for patients with sickle cell trait or the full disease, asthmatics, epileptics, where the onset of seizures is reduced, and diabetics[14]. This technique has been shown to be effective as an alternative to general anesthesia for dental extractions, which is significant for these medically compromised patients.

Caution should, however, be used in those patients with chronic obstructive pulmonary disease (because of the enriched oxygen), pregnancy, severe asthma, and psychiatric disorders. Nitrous oxide has a solubility 15 times that of nitrogen. High doses can therefore cause gaseous expansion and rupture of enclosed air spaces and it should not be used when treating patients with middle ear disease, including infections or those with intestinal obstruction[12,14].

## Occupational Exposure of Anaesthetics Nitrous Oxide Pollution

Practitioners should be aware of the deleterious effects from chronic occupational exposure and comply with health and safety requirements in respect of nitrous oxide pollution and gas safety[15]. Nitrous oxide inhibits vitamin B12 metabolism and can cause liver, kidney, and neurological disease. It is also a greenhouse gas and these problems have led to research using other agents such as sevoflurane.

To limit the pollution effects The Health and Safety Executive in the UK and similar bodies around the world have established exposure guidelines and recommendations for adequate ventilation of dental surgeries and the use of a form of active scavenging to remove expired nitrous oxide. There are also guidelines on the storage of gas cylinders and the design of the equipment used to deliver the nitrous oxide. Training in the technique should reinforce the need to remind patients to breathe through the nose and not mouth breathe (a common feature of very young patients) both to allow nitrous oxide to be actually inhaled and to reduce pollution to the operator and assistant. The use of rubber dam for routine restorative procedures can significantly reduce pollution through mouth breathing. In following these recommendations, it is possible to keep exposure within the recommended limits[15,16].

## Nitrous Oxide Administration

### Training

The technique for administration of nitrous oxide sedation is straightforward but requires formal training at the undergraduate or postgraduate level; training standards have recently been outlined by the DSTG[17]. Training should include supervised clinical practice for the whole dental team.

The importance of suitable behavior management techniques and the use of semihypnotic suggestion should not be underestimated and requires practice by the operator. The machines currently available commercially must comply with the guidelines described and all feature a 70%nitrous oxide limiter, automatic nitrous oxide cut out in the event of oxygen failure, emergency oxygen override, proportional nitrous oxide / oxygen delivery and color-coded cylinders with a pin index loading system.

### Technique

Following a full assessment of the patient's dental and medical history and written consent for the procedure, the patient is settled in the chair. An incremental introduction of nitrous oxide delivered through a simple nasal mask allows the patient's response to be carefully monitored, particularly if the operator is also inexperienced in the use of the technique. Generally between 20% and 40% nitrous oxide (with 8060% oxygen) results in an adequate level of sedation for dental treatment. The patient is awake, relaxed, comfortable, and able to maintain an open mouth for treatment, but there is a reduction in spontaneous movements. Pulse, blood

pressure, and the respiratory rate are normal with the pupils normal and responsive to light. The laryngeal reflex remains intact[18]. The patient may feel a range of subjective symptoms: mild intoxication and euphoria, paresthesia of the extremities, a sense of detachment and a lessened response to pain. Increasing the flow of nitrous oxide from 50% to 70% results in an increased sense of detachment, dizziness, nausea and disorientation for the patient, coupled with a reduction in the pharyngeal and laryngeal reflexes.

The patient may not be able to maintain an open mouth and verbal contact may be lost. It is therefore important that the operator appreciates that increasing the level of nitrous oxide given will result in less successful treatment, and mouth props should never be used as the ability to open the mouth for treatment is an important clinical indicator of the level of sedation.

For all but the simplest of treatments local anesthesia in the dose appropriate for the age of the patient and procedure planned, is still required as the analgesic effects of nitrous oxide are too weak for most dental procedures. If the patient appears too heavily sedated (very drowsy or unable to maintain an open mouth) the nitrous oxide level should be reduced.

The patient is recovered with 100% oxygen to prevent a possible diffusion hypoxia as nitrous oxide is expired through the lungs, and postoperatively given advice to avoid demanding physical activity.

Unlike i.v. or oral agents, adult patients are not restricted to drive or operate machinery postoperatively[9]. Suitable techniques for conscious sedation of pediatric dental patients continue to be the object of discussion and research and continued expansion of a sound evidence base is welcomed by this author.

## Monitoring

Although the principal functions monitored are the central nervous, cardiovascular and respiratory systems, hypoxaemia is the major complication in the sedation of paediatric dental patients.

Hypoxaemia is defined as a low partial pressure of oxygen in the blood, which may be caused by conditions such as failure of oxygen supply, pulmonary disease, cardiovascular collapse, hyperventilation, apnoea or airway obstruction.

Traditional methods of monitoring sedated paediatric patients include visual observation of skin colour, depth and rate of respiration, measuring pulse and blood pressure and listening to heart and breath sounds using a pre-cordial stethoscope. Moore et al. (1984) described a method of determining the level of consciousness in a sedated child in which the head was allowed to drop forward onto the chest while an observer listened for breath sounds[21].

Trained personnel skilled in conscious sedation are vital to monitor the safety and well-being of the sedated child dental patient. However, hypoxaemia can occur before changes in vital signs or skin and mucosal colour are detectable and symptoms may not become clinically evident until dangerously low levels of oxygen tension develop[22].

## Pulse oximetry

Pulse oximetry has revolutionized modern monitoring procedures. It is a noninvasive method of measuring arterial oxygen saturation using a sensor probe, placed on the patient's finger or ear-lobe, which has a red light source to detect the relative difference in the absorption of light between saturated and desaturated haemoglobin during arterial pulsation. Adequate oxygenation of the tissues occurs above 95%, whereas oxygen saturations lower than this are considered to be hypoxaemic. Under normal circumstances, a child's oxygen saturation (SaO2) is 97100%.

The probe is sensitive to patient movement, relative hypothermia, ambient light and abnormal haemoglobinaemias, which means that false readings can occur. Indeed, the role of carbon dioxide monitoring (capnography), as an adjunct to pulse oximetry and alert clinical observation, is under increasing scrutiny[23,24].

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