NITROUS OXIDE/OXYGEN INHALATION SEDATION: AN EXCELLENT AGENT FOR PATIENT MANAGEMENT IN DENTAL PROCEDURES

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Abstract
Nitrous oxide/oxygen sedation has been used for over 160 years to assist in the management of pain and anxiety. It is commonly used in many dental specialties and other health disciplines have also benefitted.

In many instances, patients present to medical and dental offices with both pain and anxiety. It is necessary to manage both, since they are interrelated. Nitrous oxide and oxygen sedation can assist patients with their pain and anxiety, and can be employed safely and effectively with minimal concerns. Its use is currently enjoying tremendous growth worldwide.

HISTORY
Nitrous oxide (N₂O) is the most commonly used inhalation anesthetic agent in dentistry and indeed in all of medicine (1).

The history of N₂O use dates back to over 160 years, and represents the evolvement and innovation of the entire field of anesthesia. Nitrous oxide was first discovered by the Englishman Sir Joseph Priestley around 1773. In 1800, Sir Humphrey Davy published a book entitled “Researches Chemical and Philosophical; chiefly concerning Nitrous Oxide”. In this book, he first used the nickname “Laughing gas”, that is still commonly used today. He implied in this book that nitrous oxide may be useful to diminish pain during surgical procedures. He also stated that it could cause the “most voluptuous sensations” (2).

Unfortunately, for both Davy and the rest of the medical profession, the experiment to use nitrous oxide for surgery was delayed for over forty years. An American dentist named Horace Wells is credited with the discovery of the anesthesia, for having recognized the clinical benefits of nitrous oxide while having his own third molar removed. He is recognized as the Father of Anesthesia. (3) Nitrous oxide has been used continuously for the alleviation of pain and anxiety since that time. (4)

INTRODUCTION
Nitrous oxide is an excellent inhalation agent for most dental procedures. (5). It provides an unparalleled record of safety while creating a more relaxed and pain free experience for the dental patient. Local anesthesia is almost always used in combination with nitrous oxide administration but, when nitrous oxide is inhaled and allowed to provide physiologic effects, it not only provides sedation (anxiolysis) but a pain threshold elevation equal to approximately 15 mg of morphine. (6) Therefore, the pain of the needle upon injection with local anesthesia is greatly diminished. This effect provides the dental patient more accepting of any procedure ranging from restorative dentistry, periodontology to oral and maxillofacial surgery.

ADVANTAGES
It should be noted that nitrous oxide/oxygen sedation is highly effective in eliminating or at least minimizing severe gagging. Patients are titrated to their individual sedation point, and impressions, radiographs or other dental procedures can be completed. Often, the patient has to be placed in an upright posture for some or all of these procedures. However, this upright posture is not the preferred position. Upon completion of the short procedure, the patient is then placed into the preferred supine position for continuing dental therapy. (Figure I – supine position) (7).
The following is a list of potential clinical indications for the use of nitrous oxide/oxygen sedation:

- **Restorative dentistry**
- **Removal of provisional crowns and bridges** are usually done without local anesthesia, but may be uncomfortable.
- **Occlusal adjustment** rarely requires the use of local anesthesia, but may be uncomfortable and many patients are fearful of the sound of the handpiece.
- **Insertion of bands or wedges.** Matrix bands or wedges may be uncomfortable for some patients.
- **Periodontics or Dental Hygiene.** Initial periodontal exam- probing can be uncomfortable, especially in inflamed soft tissue and sensitive deep pockets.
- **Scaling, curettage and root planing** – while local anesthesia is sometimes administered, N₂O/O₂ offers a more pleasant way to achieve a level of comfort that is completely reversible.
- **Use of ultrasonic instruments**- These commonly used instruments, used for calculus debridement, may be uncomfortable without sedation.
- **Periodontal surgery.** The nature and length of this type of surgery often requires sedation; while intravenous sedation is common, nitrous oxide is often helpful.
- **Endodontics**- Rubber dam clamps- while not a problem with naked teeth, soft tissue clamping can be a problem that requires local anesthesia or nitrous oxide or both.
- **Gaining access into the pulp chamber**- until local anesthesia is directly placed into the intrapulpal tissue, nitrous oxide/oxygen sedation may be used to raise the pain reaction threshold.
- **Canal instrumentation**- after extirpation of the pulpal tissue following canal instrumentation, local anesthesia is not used because there should be no discomfort; however, some patients require pain control.
- **Removable Prosthodontics**- unlike fixed prosthodontics, where pain control is usually controlled with local anesthesia for preparation of abutment teeth. Removable Prosthodontics patients are often anxious or have tooth sensitivity. This is easily managed with N₂O/O₂ sedation.
- **Oral and Maxillofacial Surgery**- Lengthy procedures, such as draining of abscesses, suture removal, post operative complications are all possible indications for N₂O/O₂ sedation.
- **Pediatric Dentistry**- Inhalation sedation with N₂O/O₂ for children is an excellent modality for pain and anxiety control. Over 93 % of all pediatric dentists in the USA use N₂O/O₂ sedation in their everyday practice. It is the ideal agent for use in pediatric dentistry. It creates a co-operative, usually relaxed patient that seems to enjoy dentistry.

### TITRATION

The patient is given the nitrous oxide gas with a machine that is designed for that purpose only: the analgesia machine (Figure 2). This machine can give a maximum of 70% nitrous oxide and always a minimum of 30% oxygen. It is rarely necessary to use more than 50% nitrous oxide with any given patient. All modern machines provide more O₂ than in the ambient air and this is one reason that administration of the nitrous oxide/oxygen sedation is so safe. The agent to be given in incremental dosages until a specific clinical endpoint is reached. This prevents the patient from becoming oversedated and allows only the amount of drug needed by the patient to be given.
This easy to learn technique for administration of nitrous oxide sedation is part of the standard curriculum in all US dental schools.

POTENTIAL CONCERNS:

There are no absolute contraindications for the use of N₂O/O₂ administration. However, certain findings in the medical history may warrant the suspension of or the denial of N₂O/O₂ therapy.

They include mental illness, or antipsychotic therapy, middle ear disturbance or surgery, 1st trimester of pregnancy. In over 160 years of use, N₂O/O₂ has never caused an allergic reaction.

CONCLUSIONS

From the days of Horace Wells, “The Father of Anesthesia”, until today, nitrous oxide/oxygen therapy has proven to be inexpensive and an excellent way to manage dental patients in a variety of clinical applications. It has been used with an impeccable safety record that has withstood the test of time.

As the dental profession expands globally, there is an increasing need for inexpensive, safe and reliable means of pain control. Nitrous oxide is an excellent choice we have as a profession.

References