

Sedation Dentistry: Can You Really Relax in the Dentist's Chair?

Ambuj Chandna^{1*} Rohit Mittal² Yashpal³ Jazib Nazeer⁴ Surbhi Gupta⁵ Jyoti Singhal⁶

¹Senior Lecturer, Department of Orthodontics, D J College of Dental Sciences and Research, Modinagar, Uttar Pradesh, India.

²Senior Lecturer, Department of Prosthodontics, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab, India.

³Consultant Dental Surgeon, PHC Uplana, Karnal, Haryana, India.

⁴Lecturer, Department of Oral Pathology, Patna Dental College and Hospital, Patna, Bihar, India.

⁵PG Student, Department of Prosthodontics, D J College of Dental Sciences and Research, Modinagar, Uttar Pradesh, India.

⁶PG Student, Department of Orthodontics, D J College of Dental Sciences and Research, Modinagar, Uttar Pradesh, India.

ABSTRACT

Background: Consistent performance of pain free dental practice is the masterpiece of a pedodontist. Providing comprehensive oral health care to children is a unique challenge. Child behavior can never become an alibi for a sub-standard work in the mouth. However, in spite of all its technical and materialistic advances, behaviour science still seems to provide limited options for its uncooperative young children.

Keywords: Nitrous Oxide , Sedation , Behavior Management.

INTRODUCTION

Behavior modification using behavior management technique has been a key to success. Non pharmacological behavior management by using tell- show- do, desensitization, HOME, etc. techniques have shown wonderful efficient treatment delivery too your field. But at times they cannot be applied in case of very young or intellectually disabled children. In case of overly pampered, stubborn, and highly uncooperative children these techniques are ineffective¹. Therefore, pharmacological intervention becomes an important alternative for the dentist to adopt and manage dental anxiety, stress and fear related to dental procedure and avoid unpleasant and unproductive confrontation with the child. Consistent performance of pain free dental practice is the masterpiece of a pedodontist.

DEFINITION

The most accepted definition and as latest quoted by Intercollegiate Advisory Committee for Sedation in Dentistry in 2015² defined conscious

sedation as: “... 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 loss of consciousness unlikely”.

European Academy of Paediatric Dentistry in its Guidelines² on Sedation in Paediatric Dentistry defined conscious sedation as: “A medically controlled state of depressed consciousness that allows protective reflexes to be maintained, retains the patient's ability to maintain a patent airway independently and continuously, and permits appropriate responses by the patient to physical stimulation or verbal command, e.g., open your mouth”.

HISTORY

Analgesics, sedatives, and anaesthetics have been sought for centuries to control pain

Received: Sept. 23, 2016: Accepted: Nov. 9, 2016

*Correspondence Dr. Ambuj Chandna.

D J College of Dental Sciences and Research, Modinagar, Uttar Pradesh, India.

Email: ambuj.chandna@hotmail.com

during surgical procedures and to relieve pain. The use of opium as an analgesic was recorded in Samaria almost four thousand years ago, while approximately two thousand years ago a wine and mandrake combination was used before amputations. In earlier days, English sailors were given rum to try to anesthetize them prior to limb amputation on board sailing vessels. During the late 17th century, two English scientists, **Sir Joseph Priestly** and **Sir**

Humphrey Davy, were credited respectively with discovering nitrous oxide. Priestly discovered that by heating ammonium nitrate with iron filings mixed in he could create a gas, detoxify it by passing it through water, and store it as "dephlogisticated nitrous oxide", which is now known as nitrous oxide. Later, Davy inhaled nitrous oxide and, after discovering some of its effects, introduced it to English society as a recreational drug, where it gained the name "**laughing gas**"³

Dr. Horace Wells was intrigued by another participant's (Samuel Cooley) non responsiveness to the pain of an injury that occurred to him during the demonstration, when he was euphorically jumping and hit his leg against a bench. The participant after the exhibition professed that he did not feel pain. Dr. Wells then requested supplies of nitrous oxide from Dr. Colton and experimented on himself. He inhaled the gas and asked one of his colleagues to extract his own tooth under the influence of the gas. Wells exclaimed "the greatest discovery ever made" and "new era in tooth pulling" has begun. In 1845, Dr. Wells thought of demonstrating the painless tooth pulling among his peers after his several successful experiments. But unfortunately participant jumped in his chair during the extraction leading observers to believe he was in pain. Dr. Wells was defamed and called as a "charlatan" and "Fake". But Dr. Wells was obsessed with proving the legitimacy of his technique and he continued to provide anaesthesia to few dentists who gave attention to the use of nitrous oxide and hinged on the success of painless tooth extraction but could not stand long.

Since then dentistry has witnessed an extensive use of nitrous oxide. But there were periods of inactivity due to unreliable equipment, failure to produce satisfactory results and lack of

knowledge of technique. In 1930, nitrous oxide was introduced to medical students at the teaching front.⁴In 1949, **Dr. Harry Langa**, an early proponent of nitrous oxide, began postgraduate dental education and trained 6000 dentists in nitrous oxide sedation. Since its discovery more than 160 years ago, nitrous oxide has been used to provide pain and anxiety relief for patients undergoing surgical procedures with a remarkable safety record. It was the bravery of early medical pioneers and their sacrifices during their experiments which led to the discovery of miraculous potentials of this gas.

DISCUSSION

Nitrous oxide is a small and simple inorganic chemical molecule having indisputable effects of analgesia (the inability to feel pain), anxiolysis (diminished anxiety), and anaesthesia (insensitivity to pain) that are of great clinical interest as an inhalation sedation agent. Techniques of inhalation sedation tend to vary in popularity. Alternative terminology of inhalation sedation included relative analgesia and inhalation psycho sedation. Inhalation sedation with nitrous oxide/oxygen mixture is the first choice for child patients who are unable to tolerate dental treatment with local anaesthesia alone and who have a sufficient ability to communicate. It is usually offered to children with mild to moderate anxiety to facilitate a treatment that is anticipated to be complex like comprehensive dental treatment that requires several visits or multiple extractions⁵.

Nitrous oxide sedation is used for office-based patients in dentistry as well as in medicine. More than 24 million surgical procedures have been performed each year in United States and a large number of them, nitrous oxide in combination with other drugs are used to facilitate general anaesthesia. Danish researcher cites 3 million cases in which nitrous oxide was in dental office with no adverse events. Gardner Quincy Colton, an itinerant professor documented 193000 cases with no adverse reactions. It has been noted for its impeccable safety record, which has withstood the test of time longer than any other drug.⁵

The dental profession has historically used nitrous oxide sedation. Nitrous oxide is a non irritating respiratory tract gas, which presents fast

action on induction as well as during recovery. It is virtually completely eliminated from the body when its use is discontinued. For the practitioner, the drug is easily titrated to the level required for the procedure while accommodating the patient's physiologic and psychologic needs. When used as mild analgesic and sedative, nitrous oxide is administered with oxygen from safe, modern equipment that allows no more than 70% nitrous oxide and no less than 30% oxygen to be delivered at any given point of time. The patient is mildly sedated and responds to verbal commands. Protective defences such as the cough and gag reflexes remain intact; clinical action and elimination are rapid.

It is utilized for procedures where the efficacy of local anaesthesia may be reduced and for potentially more painful procedures – these include oral surgery, periodontal therapy, and some endodontic procedures. Its use is routine in many dental offices during extraction of third molars. For these feared and potentially painful procedures, patients actively request sedation. It has been found to be efficacious, reliable, and more cost-effective than general anaesthesia⁶

ADVANTAGES OF INHALATION SEDATION

1. Analgesic property

Nitrous oxide does possess analgesic properties when given in the usual sedative concentrations. Certain procedures, such as those involving soft tissues (e.g. scaling), may be performed in many instances without using local anaesthesia. The analgesia produced by a 20% concentration of nitrous oxide is equivalent to that of 10 to 15 mg of morphine. However, the degree of analgesia is quite variable from patient to patient and therefore cannot be relied on to provide all of the pain control required for a procedure.

2. Anxiolysis

Nitrous oxide administration diminishes anxiety and reduces fear. Nitrous oxide causes central nervous system (CNS) depression⁷, as an adjunct to local anaesthetic.

3. Amnesia

Nitrous oxide generally make the user appear stuporous, dreamy and sedated, some people also "get the giggles" in a state of euphoria, and frequently erupt in laughter.

4. Onset of action

Nitrous oxide inhalation has rapid onset of action 30 seconds with peak effects within 5 Minutes⁸.

5. Titration

Nitrous oxide can be given in incremental amounts until a desired endpoint is reached. Till date there is no allergic case reported.

6. Drug overdose

Significant drug overdose will not develop in techniques in which titration is possible as long as the administrator does indeed titrate the drug.

7. Outpatient setting

In an outpatient setting, it is advantageous for the patient to be discharged from the office following a procedure with no prohibitions on activities.

8. Drug elimination

Because nitrous oxide is not metabolized by the body, the gas is rapidly and virtually completely eliminated from the body within 3 to 5 minutes. In all other techniques, the recovery from sedation is considerably slower.

9. Recovery

With inhalation sedation, recovery is almost always complete; patient usually may be discharged from office alone, with no cautions about activities.

10. Route of administration

Inhalation sedation is that no injections are required for the administration as in case of local anaesthesia.

11. Safety

Nitrous oxide is safe; very few side-effects are associated with its use. The drugs used in this

technique have no adverse effects on the liver, kidneys, brain, or cardiovascular and respiratory systems⁹.

DISADVANTAGES OF INHALATION SEDATION

1. Abuse Potential

Euphoric effect of nitrous oxide causes slight hallucinations which are reported to have abuse potential.

2. Difficulty in operating in maxillary anterior region

Nasal hood's position close to the operation site might interfere with some procedures like in injections in the upper anterior region.

3. Equipment investment

Initial investment is required for equipment purchasing.

4. Potential chronic toxicity

Chronic exposure to nitrous oxide is found to cause haematological abnormalities.

INDICATIONS FOR NITROUS OXIDE IN DENTISTRY

1. Fear and Anxiety

Anxiety and fear experienced by dental patients range from mild anxiety to phobic fear, and represent a barrier to care. The main factors related to fear or anxiety in dental treatment fear of pain, needles, and/or the noise and sensation induced by the use of hand pieces. Nitrous oxide inhalation sedation acts as an analgesic, anxiolytic and amnesic agent for pleasant dental treatment and patient cooperation.

2. Special Needs Patients

Functional and cognitive deficits can make dental treatment difficult for special need patients. Nitrous oxide/ oxygen sedation can be an effective method to enable treatment in patients with reduced mental development as well as other special needs patients with appropriate physicians' clearance.

3. Specific Procedures

Nitrous oxide/oxygen is utilized for procedures where the efficacy of local anaesthesia may be reduced and for potentially more painful procedures and so there is demand from patients—these include minor oral surgery, periodontal therapy, and some endodontic procedures.

4. Other Conditions/ Situations

Nitrous oxide sedation minimizes hyperactive gag reflexes in patients.

RELATIVE CONTRAINDICATIONS

There are a number of relative contraindications to the use of nitrous oxide, though no known absolute contraindications.

1. First trimester of pregnancy
2. Pneumothorax
3. Cystic fibrosis
4. Current upper respiratory tract infection
5. Psychological impairment
6. Middle ear disturbance/ surgery (i.e. grafting)
7. Bleomycin therapy
8. Congenital hernias
9. Patient Cooperation¹⁰

OTHER USES OF NITROUS OXIDE:

1. Food industry:

Nitrous oxide is used as a propellant for dairy products such as whipped cream and also to displace oxygen in potato chips as oxygen causes staleness in them.

2. Chemical industry:

Nitrous oxide is used in production of sodium azide, the explosive that inflates the airbag in automobiles.

3. Car racing industry:

Nitrous oxide is used to increase engine performance in racing vehicles

4. Silicon industry:

Nitrous oxide is used in silicon industry where it oxidizes chemicals to manufacture

computer chips

5. High power rocketry:

Nitrous oxide is used as an oxidizer in combination with fuel

CONCLUSION

Conscious sedation forms the basis of an effective clinical practice, promising a painless dental treatment. We as odonto pediatricians must exercise a pain free dentistry because we meet a dental patient in his/ her psychological developmental stage, where once a bad dental experience can lead ages of dental fear or ignorance. Although oral sedation stands the as the most commonly used sedation technique but it has certain inevitable disadvantages. The inaccessibility to control sedation is the prime disadvantage which is boon in nitrous oxide inhalation sedation.

Nitrous oxide has played a vital role during the development of anaesthesia as a speciality. The remarkable 150 years of safety record has offered patients the possibility of receiving dental care with a reduced level of fear and anxiety and reduced pain. Demand for nitrous oxide/oxygen sedation continues to increase and is gaining a lot of attention in many of the developing countries. The practical implication of nitrous oxide with sound knowledge to deliver pain free dentistry to the pediatric population is the utmost important goal of our professional field.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. American Dental Association. Guideline for the use of sedation and general anesthesia by dentists. 2007.
2. American Society of Anesthesiologists. Practice guidelines for sedation and analgesia by non anesthesiologists: An updated report by the American Society of Anesthesiologists task force on sedation and analgesia by non anesthesiologists. *Anesthesiology* 2002;96:1004-17.
3. Paterson SA, Tahmassebi JF. Pediatric dentistry in the new millennium: Use of inhalation sedation in pediatric dentistry. *Dent Update* 2003;30(7):350-6, 358.
4. Dock M, Creedon RL. Pharmacologic management of patient behavior. In: Dean JA, Avery DR, McDonald RE, eds. *McDonald and Avery's Dentistry for the Child and Adolescent*. 9th ed. Maryland Heights, Mo: Mosby; 2011:261-4.
5. Emmanouil DE, Quock RM. Advances in understanding the actions of nitrous oxide. *AnesthProg* 2007;54 (1):9-18.
6. Sanders RDB, Weimann J, Maze M. Biologic effects of nitrous oxide: A mechanistic and toxicologic review. *Anesthesiology* 2008;109(4):707-22.
7. Patel R, Lenczyk M, Hannallah RS, McGill WA. Age and onset of desaturation in apnoeic children. *Can J Anaesth* 1994;41(9):771-4.
8. Patel R, Norden J, Hannallah RS. Oxygen administration prevents hypoxemia during post-anesthesia transport in children. *Anesthesiology* 1988;69(4):616-8.
9. Duncan GH, Moore P. Nitrous oxide and the dental patient: A review of adverse reactions. *J Am Dent Assoc* 1984;108(2):213-9.
10. Clark MS. Contemporary issues surrounding nitrous oxide. In: Malamed SF, ed. *Sedation: A Guide to Patient Management*. 5th ed. St. Louis, Mo: Mosby Elsevier; 2010:256.
11. Rowland AS, Baird DD, Shore DL, Weinberg CR, Savitz DA, Wilcox AJ. Nitrous oxide and spontaneous abortion in female dental assistants. *Am J Epidemiol* 1995;141 (6):531-7.
12. Fleming P, Walker PO, Priest JR. Bleomycin therapy: A contraindication to the use of nitrous oxide-oxygen psychosedation in the dental office. *Pediatr Dent* 1988; 10(4):345-6