

Conscious Sedation: Uses in Medicine and Dental Practice

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Abstract

Dental fear is common among children as well as adults due to the high intensity of pain. Provision to control adequate anxiety and pain has been an integral part of medical and dental treatment and practice. The level of sedation must be such that the patient remains conscious and able to understand as well as respond to verbal commands. The level required for sedation should be adjusted to achieve a proper balance between the need of the patient, the surgical procedure, and the safety of the patient. Various sedation techniques using many different anesthetic agents have become popular over the past few years. These techniques have a high success rate with low adverse effects, but effective training of these techniques is required. This article summarizes the history, principles, applications, indications, contraindications, the need for conscious sedation, various agents used, and route of administration of these agents in the field of medicine and dentistry.

Keywords: Medical and dental fear, Anxiety, Sedation, Verbal Commands.

Introduction

Anesthesia word is derived from the Greek word 'Anaesthesia' which literally means 'no sensation'. It is the reversible loss of response to any noxious stimuli. General anesthesia is defined as the administration of drugs that produce a reversible loss of all sensation and consciousness whereas local anesthesia are the drugs in which consciousness of the patient is maintained during whole procedure.¹ Before giving anesthesia, pre-anesthetic medication is given to make the use of drugs more safe and pleasant. They tend to relieve anxiety and apprehension preoperatively to facilitate its smooth induction.

Stages of Anesthesia

Various important changes in different stages of anesthesia are as follow:

1. Stage of Analgesia: from beginning to loss of consciousness
2. Stage of Delirium: regular respiration, jerky breathing, excitement, struggling. No procedure can be carried out in this stage.
3. Stage of Surgical anesthesia
 - Plane 1- roving movements of eyeballs
 - Plane 2- progressive loss of corneal reflex
 - Plane 3- pupils start dilating, muscle relaxation
 - Plane 4- only abdominal respiration, fully dilated pupils

4. Stage of Medullary Paralysis: from the cessation of breathing to the failure of circulation and ultimately death of the patient².

Conscious Sedation

According to the American Dental Society of Anesthesiology, a patient is said to be conscious, if capable of rotational response to the command and has all protective reflexes intact thus has the ability to maintain his airway in a patent state. Sedation is defined as the reduction in irritability/agitation by the administration of drugs, generally to facilitate a patient for a diagnostic, interventional, medical, or surgical procedure for the purpose of producing a degree of impaired response (Starship Children's Health Guidelines)³. This has been used in the field of medicine for a long time to carry out the various procedure. Children sedation more frequently than adults. To meet the necessary goal, sedation usually given in children should be deeper than given to adults. However, children are at higher risk for respiratory depression and life-threatening hypoxia.

Conscious sedation also known as Moderate sedation, is defined as a technique in which pharmaceutical agents are used to produce a state of CNS depression (but not unconsciousness) enabling the surgical procedure to be carried out while maintaining communication with the patient who is able to respond to commands and maintain a patent airway throughout¹. In place of general anesthesia, 'conscious sedation' (a monitored state of altered consciousness) can be employed, supplemented with local anesthesia, to carry out any dental procedure/ surgery in apprehensive children or adults and in medically compromised patients. It allows operative procedure to be carried out with minimal physiologic and psychologic stress.

The table below is showing various types of sedation along with their effects on respective functions⁴:

	Minimal Sedation	Moderate Sedation	Deep Sedation	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal stimulation	Purposeful response after repeated stimulation	Unarousable even with painful stimulation
Airway	Unaffected	No intervention required	Intervention may be required	intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

The difference between general anesthesia and conscious sedation is one of the degrees. The protective airway and other reflexes are not lost during conscious sedation and therefore it is safer. However, by itself conscious sedation is not able to suppress the pain of the dental and medical procedure, so local anesthesia must be injected in addition.

Patient Selection for Conscious Sedation

Patient selection is the utmost important thing for administering conscious sedation. American Society of Anesthesiologists (ASA) has classified patients by using a scale of Physical Fitness:⁵

Status	Disease state	Examples
ASA 1	Normal Healthy patient	

ASA 2	Patient with mild systemic disease	Controlled asthma, controlled diabetes
ASA 3	Patient with limited activity and have severe systemic disease	Diabetes mellitus with complications, heart disease that limits activity
ASA 4	Patient with severe incapacitating disease	Sepsis, severe BPD, Status asthmaticus
ASA 5	Moribund patient with poor prognosis	Cerebral trauma, septic shock

Patients under category ASA 1 and ASA 2 are considered for the dental procedure whereas ASA 3 and ASA 4 are considered for the hospital setting.

Principles

- 1) Good sedation practice requires practitioners to consider the range of non-pharmacological and pharmacological methods for the management of anxiety in the treatment planning of the patient.
- 2) It is essential that conscious sedation is provided to the highest standards, respecting the rights of the patients as an individual.
- 3) The provision of safe and effective conscious sedation requires both regulation and more importantly, education of both the patient as well as the professional.
- 4) Children should not receive any medication without the supervision of the trained professional.
- 5) Formulate a reasonable plan for sedation.

Need of Conscious Sedation

Conscious sedation is a combination of medicines given to the patient that is

1. Used to relax and block the pain during medical or any dental procedures.
2. Used to relieve anxiety and depress the level of consciousness
3. Improves Patient Corporation.

Indications of Conscious Sedation

According to the Scottish and British Dental Board Guidelines⁶:

- 1) Phobic patients usually children and people with high fear susceptibility.
- 2) For patients with a severe gag reflex.
- 3) Medically conditions potentially aggravated by stress.
- 4) Medically conditions affecting the patient's ability to cooperate.
- 5) Those patients with movement disorders with Physical/Medical defects unlikely to allow safe completion of treatment.
- 6) Special needs
- 7) To enable the prolonged unpleasant procedure to be carried out without any stress.
- 8) To avoid general anesthesia and its related risk.
- 9) Traumatic and long dental procedures
- 10) Patients with involuntary movement conditions such as Epilepsy, Parkinson's disease.
- 11) Patient in whom local anesthesia not effective due to any reason.
- 12) Pediatric patient with Down syndrome, Cerebral Palsy, Autism.
- 13) Indicated in pediatric tooth extraction.

Contraindications of Conscious Sedation

- 1) Patient with Obstructive Sleep Apnea
- 2) Severe obesity patient
- 3) A child suffering from Congenital Heart Disease associated with CHF or cyanosis, chronic obstructive pulmonary diseases.
- 4) Patient with Raised Intracranial Pressure
- 5) Neurological impairment with poor pharyngeal coordination.
- 6) Uncooperative and unwilling patient.
- 7) Lack of equipment or inadequate personnel.

- 8) The first trimester of Pregnancy⁷
- 9) Treatment with bleomycin sulfate⁸
- 10) In the patient with Methylenetetrahydrofolate reductase deficiency⁹

Advantages of Conscious Sedation

- 1) Produces small variation in vital signs.
- 2) Avoid the need for continuous monitoring of the patient.
- 3) Alter the patient's mood making him psychologically receptive to dental treatment.
- 4) Maintain consciousness of the patient throughout the procedure.
- 5) Improves pain threshold particularly for longer procedures.
- 6) Allow reflexes to remain intact.
- 7) Promotes patient welfare and safety.
- 8) Facilitating provision of quality care^{10,11}.

Disadvantages of Conscious Sedation

- 1) Conscious sedation may cause amnesia to the patient.
- 2) Not cost effective
- 3) Special instruments and training are required.

Patient Preparation for Conscious Sedation

The patient should be assessed and assessment includes:

1. Detail medical and dental history of the patient before the initiation of the treatment so as to classify him according to the American Society of Anesthesiologists classification. Patient with ASA 1 and ASA 2 are considered for sedation in the dental procedure outside hospital¹².
2. If the patient has some serious medically compromised condition, then anesthetist should monitor the patient during the procedure.
3. Informed consent of the patient for the course of treatment under conscious sedation and various documentation of the patient which include:
 - A. Name and signature of the operator and assistants.
 - B. A clear treatment plan, completed medical history, appropriate radiograph along with the reason for the need for the sedation.
 - C. Mentioning about the age, weight and height of the patient.
 - D. Mentioning about the name of drugs, concentration, route, duration and dosage of the sedation.
 - E. Include time-based record¹³.
 - F. In case the patient is a child, then the consent should be signed by his legal guardian.
 - G. Briefly explain about the sedation technique to the patient.
 - H. Explain and written pre-operative and post-operative instructions given to the patient's family or guardian.
 - I. Fasting instructions: The patient should be advised to have a light meal at least four-six hours before prior to the appointment. The patient should be advised to avoid alcoholic drinks and heavy meals.

Table below is showing American Society of Anesthesiologists recommendations for fasting before elective procedures⁵:

Ingested material	Minimum fasting time
Clear fluids (water, fruit juices, clear tea, black coffee)	2 hours
Infant formula	6 hours
Milk	6 hours

Light meal	6 hours
Fatty meal	8 hours

Operation Set Up

Every procedure should be carried out after ensuring availability of proper size suction catheter, airway equipment, crash cart along with other resuscitation equipment should be available to resuscitate the patient. Most important is personnel skill in advanced life support.

Table below is showing basic requisites of operation set up:-

1.	Suction	Functioning suction apparatus
2.	Oxygen	Adequate oxygen supply and flowmeter to allow its supply
3.	Airway	Appropriate airways (Endotracheal tube, Face mask, Laryngoscope blades.) ¹⁴
4.	Pharmacy	All basic drugs needed to support life during an emergency
5.	Monitor	Functioning Pulse oximeter, ECG, end tidal carbon dioxide, NIBP, BP monitor, cardiac monitor
6.	Equipment	Special equipment for a specific case such as E.G defibrillator, temperature monitor, intra-venous access.

Agents used for Conscious Sedation

1. Nitrous oxide

It is a colourless gas with a sweet taste and is used as a sedative. The analgesic agent causes CNS depression and various degrees of muscle relaxation and euphoria without any effect on the respiratory system¹⁵.

Mechanism of Action

Its analgesic effects are initiated by the neuronal release of endogenous opioid peptides with activation of opioid receptors and descending gamma-aminobutyric acid (GABA) and noradrenergic pathways that modulate nociceptive processing at the spinal level.

It has four phases of administration:

- i. Induction Phase
- ii. Injection Phase
- iii. Maintenance Phase
- iv. Withdrawal Phase

Technique

- 1) It should be given under direct supervision or by trained individuals.
- 2) The nasal hood selected should be of appropriate size and place it on the nose.
- 3) Normally, a flow rate of about 5-6 liters is generally accepted for all the patients.
- 4) First of all 100% oxygen is administered to all the patients for the time interval of 1-2 minutes.
- 5) Followed by titration of nitrous oxide in 10% intervals.
- 6) Encourage the patient to breathe through.
- 7) Explain the sensation to be felt- floating, giddy, tingling.

- 8) Carry out the procedure with careful monitoring, nitrous oxide flow is terminated, 100% oxygen should be delivered for about 5 minutes.
- 9) Patient should be monitored for colour, responsiveness, respiratory rate, and rhythm.
- 10) Allow the patient to rest
- 11) Ensure adequate pain management as effects of sedation tends to wear off.

Uses

1. Children with mild to moderate anxiety to enable them to accept dental treatment better and to facilitate coping across sequential visits.
2. Can be used for dental extraction in children.
3. Used in children undergoing elective orthodontic extractions.

Advantages

1. The patient can be discharge alone.
2. Rapid onset of action and recovery
3. Ability to titrate and to reverse
4. It increases the patient's pain threshold.

Drawbacks

1. Weakest agent available
2. Require special equipment and training.
3. Not indicated in conditions that require multiple extractions.
4. Contraindicated in pregnant women
5. Not recommended in a patient who have a common cold, nasal blockage, tonsillitis, acute asthma.
6. Expensive equipment required
7. Not always effective
8. Patient acceptance not universal
9. Toxicity inhibits vitamin B₁₂ dependent enzymes resulting in Pernicious anaemia¹⁶.

2. Benzodiazepines

These include diazepam and midazolam.

They are safe and effective for intravenous conscious sedation. They have anticonvulsant, skeletal muscle relaxant, anxiolytic, and amnesia effects. They are added to nitrous oxide for conscious sedation. Midazolam has first pass metabolism and hence, has a short duration of action but is two times more powerful than diazepam.

Mechanism of Action

They have a rapid onset of action due to high lipid solubility and they act through GABA-mediated opening of chloride channels.

	Application	Drawback
Diazepam	Used to relax an anxious patient before the dental procedure but results are unpredictable in children.	Intravenous diazepam is not recommended in the paediatric patients. Ataxia respiratory depression in high doses.
Midazolam	The onset of action is 60-90 seconds. Its duration of action is about 10-15 minutes. Used as a premedication and sedative agent. The high margin for safety and reversal agent available.	Not recommended for use without hospital environment. Apnea Prolonged CNS effects Rebound effect

Dosage¹⁶

	Intravenous	Intramuscular
Adults	0.05-0.1 mg/kg	----
Children	0.05-0.1 mg/kg	0.2-0.3mg/kg

3. Ketamine

It is a drug that gives complete anesthesia and analgesia with the preservation of vital brain stem functions.

Disadvantages

1. Vomiting
2. Increases salivary and tracheobronchial mucus gland secretions
3. It shows the emergence phenomenon in about 5%-50% of adults and 0%-5% of children.
4. Some patients (0.4%) also reported cases of Laryngospasm with asthma which are resolved with positive pressure ventilation with 100% oxygen
5. Not recommended for children less than 3 months.
6. Gastric distress
7. Apnea

Dosage¹⁶

	Intravenous	Intramuscular
Adults	0.5-1 mg/kg	4-5 mg/kg
Children (age more than 3 months)	1-2 mg/kg Additional dose 0.5 mg/kg	4-5mg/kg

4. Opioids: (Fentanyl)

It is a potent analgesic, who has a rapid onset of analgesia and sedation. Its duration of action is about 30-60 minutes and is about 80 times more potent than morphine. The onset of action occurs within 7-15 minutes.

Mechanism of Action

They have a lollipop delivery system, which is more acceptable to the children. The drug being lipophilic is readily absorbed from buccal mucosa, metabolized in the liver, and then secreted in the urine.

Routes: Drug can be given through various routes:

1. Parenteral
2. Transdermal
3. Nasal
4. Oral

Disadvantages

1. Constipation
2. Nausea and Vomiting
3. Dose-dependent respiratory depression
4. Occasionally bradycardia and chest wall rigidity
5. Repeated administration carries the risk of carcinogenesis.
6. Required highly trained professional for giving opioids.
7. Effects can be unpredictable in children.

Dosage

For Adults (Intravenous Administration) - 1µg/kg which can be repeated by 1µg/kg in increments, if required.

5. Propofol

It is a fat-soluble agent used for intravenous delivery. On exposure to air for about 6 hours, it turns from white to yellow as it is oxidized to quinone.

Mechanism of Action

It acts by activation of the central inhibitory neurotransmitter GABA. It is lipophilic in nature which causes rapid distribution from central to the peripheral brain and hence has a rapid onset of action.

Disadvantages

1. It causes a decrease in arterial blood pressure and heart rate.
2. The patient experience pain on injection when a large dose is given.
3. Cause risk of apnea, hypoventilation
4. Hypotension
5. A rapid change in sedative depth.

It is preferred to use a combination of Ketamine and Propofol.

Dosage¹⁶

	Intravenous
Adults	0.5-1 mg/kg Additional dose 0.5 mg/kg
Children	1 mg/kg Additional dose 0.5 mg/kg

6. Sevoflurane

It is an ether anesthetic agent. Used in an inhaled concentration of 2-4%.

Advantages

1. Non-irritating
2. Does not produce tachycardia
3. No signs of hepatotoxicity
4. Low Pungency

Disadvantages

1. Hypotension
2. Renal impairment
3. Concentration dependent increase respiratory rate.

Table below is showing various Routes of Administration¹⁷:

Route	Features
Inhalation	<ul style="list-style-type: none"> • Nitrous oxide is most commonly used. • Rapid onset and short recovery time. • Indicated in paediatric patients • Nasal hood use should be of close-fitting • Less effective when a patient feels difficulty in breathing through the nose.
Oral	<ul style="list-style-type: none"> • Midazolam is mostly commonly used oral agent. • Cost effective and easy to administer. • Given to the children or adult. • After given, it is preferred to ask the children in a quiet room with their guardian • Children given sedation should be monitored clinically as well as electronically. • Limited success in young patients.
Intravenous	<ul style="list-style-type: none"> • Opioids such as fentanyl is mostly used¹⁸ • Mostly recommended in an un-cooperative patient. • Single dose of the drug is given to a patient who is emotionally and psychologically stable. • Given by highly trained professional. • Periodic check and use pulse oximeter.
Intramuscular	<ul style="list-style-type: none"> • Not recommended • Only preferred when general anesthesia carry risk to the patient.
Rectal	<ul style="list-style-type: none"> • Not accepted socially

Uses of Conscious Sedation in Medical Field

Conscious sedation is used while performing a various procedure such as:

1. Colonoscopy¹⁹
2. Endoscopy procedures- gastroscopy, laparoscopy
3. Cataract surgery²⁰
4. Breast Biopsy
5. Treatment of minor bone fracture repair
6. For removal of abdominal fluid known as abdominal paracentesis

Uses of Conscious Sedation in Dentistry

Dr. Horace Wells, a dentist firstly uses Nitrous oxide to sedate a patient undergoing tooth extraction in the early nineteenth century. In 1864, Dr. William T.G. Morton uses ether during Tooth extraction. Dr. Wells is considered as the father of anesthesia for the introduction of Nitrous oxide. Andrews in 1869 uses a mixture of nitrous oxide and oxygen. In 1930, Barbiturates were used as sedation in the dental practice. The technique of administering multiple drugs was introduced by Niels Bjorn Jorgensen in 1945 and is known as the father of intravenous sedation in dentistry. This technique is also referred to as Jorgensen technique. In 1970, intravenous diazepam, in 1988, intravenous flumazenil, and in 1990, intravenous propofol were used.

Use in patients who feel panic or anxious in dental procedures such as:

1. For pediatric patients who fear dental procedures
2. Minor surgical procedures such as apicoectomy.
3. A root canal and routine cleaning
4. Routine cleaning
5. Minor Periodontal procedures- bone grafting
6. Dis-impaction (wisdom tooth removal)²¹
7. Full mouth dental implant placement
8. Dental prosthetic or reconstructive surgery
9. It improves behaviour of the child during subsequent recall appointments and hence, helps in behaviour management of the child²².

Complications

- 1) Diffusion Hypoxia
- 2) Nausea and vomiting
- 3) Inadvertent general anesthesia
- 4) Patient with acute otitis media can complain of pain due to an increase in middle ear pressure.
- 5) The greatest concern regarding toxicity centres on the exposure of dental personnel to high ambient air levels of the gas during its use for patient sedation²³.

Diffuse hypoxia being the most common complication. This can be monitored by various methods such as: visual observation of skin colour, depth and rate of respiration, listening to heart sounds using a precordial stethoscope. Oxygen administration reduces hypoxia.

Futuristic Approach

Conscious sedation can be considered as a successful mode of treatment for medical and dental phobic patients. However, the risk associated with it can be troublesome. The future of conscious sedation relies on collecting and sharing proper data by conducting various studies that to on a larger scale among different specialties and countries so as to improve sedation practice and its outcome. As sedation become safer, the cases of incidence will minimize. However, a detailed dental and medical history is a keynote for its success. Proper guidelines related to sedation between specialties, countries need to be lead down. Understanding about various risk factors, and an effort to overcome them can help us to reach the goal. Patients and parent experience and their level of satisfaction are equally important for future better sedation practice²⁴.

Conclusion

Conscious sedation can be considered as an important part for the management of pain and anxiety in medical and dental field. It is a safe method which reduces the need for general anesthesia. When given to pediatric patients, more concern should be taken. Not all techniques are recommended for each and every patient and procedure. So, proper knowledge, skills and continuing experience is the key to increase the safety of the patient.

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