Conscious sedation in dentistry: narrative review

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Abstract

Purpose. The purpose of this narrative review is to demonstrate that conscious sedation is an anesthesiologic technique that, when appropriately performed, proves to be safe and valuable for the treatment of many cases that require its application such as: dental phobia patients, special needs patients, or simply to increase patient compliance in the case of investigative or very lengthy procedures.
Methods. All articles dealing with the topic of management of conscious sedation in dentistry were searched on the online platform of scientific reading sites such as Pubmed and Medline, selecting the most current ones up to January 2022, including all languages. Considering the keyword "Sedation," " Dentistry," " Special needs," " Dentophobia," randomized controlled trials, prospective studies, observational studies, reviews, and retrospective studies were considered. Textbooks relevant to the topic were then reviewed, and citations of each retrieved article and those of expert opinions were examined to include as much information as possible.
Results. From the analysis of data found in the literature, it is possible to state that sedation is a special form of anesthesia that reduces pain sensitivity and induces myorelaxation, without impairing the patient's consciousness. Moreover, it, which can be obtained by inhalation or pharmacological means, allows the patient to maintain autonomous breathing and to respond to physical and verbal stimuli.
Conclusion. Sedation in dentistry allows many patients to cope with dental sessions, reducing anxiety and emotional stress by eliminating the pain component. With conscious sedation, it is possible to bring the patient into a more relaxed situation by reducing stress and increasing compliance.

Introduction

Conscious sedation is a well-established practice in dentistry that involves inducing a state in which patients remain alert and able to respond to stimuli while being free of anxiety and tension caused by the procedure. Managing anxiety, pain, and discomfort is indeed a primary goal of conscious sedation. According to the World Health Organization (WHO), dental phobia has been defined as a real disease, so it is important for the clinician to manage it as effectively as possible (Seligman LD et al). Following several studies, it has been found that in the general population, the prevalence of dental phobia is around 10% (Gatchel RJ et al). It is possible to classify three different classes of dental phobia: mild, moderate, and severe. To properly manage the patient, it is crucial to recognize and classify their level of phobia. While dental procedures are generally performed with the use of local anesthesia, in selected cases, the addition of conscious sedation can reduce anxiety and increase patient compliance (Fiorillo L. et al). This procedure requires

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a careful preoperative evaluation of the patient, including checking for any tonsillar hypertrophy and the presence of airway abnormalities—features that would not allow the appropriate maintenance of autonomous breathing (Attri JP et al). Airway patency can be assessed by Mallampati's classification (Mallampati SR. et al), which distinguishes four classes: • Class I: complete visualization of the uvula, tonsillar pillars, and soft palate; • Class II: partial visualization of the uvula and complete visualization of the soft palate; • Class III: visualization of the soft palate only; • Class IV: visualization of the hard palate only. In addition to the preoperative evaluation, it is essential to provide all preoperative instructions to the patient in writing, and the patient should sign the informed consent. The presence of an anesthesiologist is crucial for the administration of conscious sedation, as, according to legislation, the concept of sedation is inseparable from anesthesia (Zajtsev AY et al). Indeed, it is necessary to set up a room in which monitoring and rescue equipment, such as a noninvasive sphygmomanometer, pulse oximeter, electrocardiograph, stethoscope, and capnograph, are present (Abdallah C. et al). According to the American Society of Anesthesiologists (ASA), facilities where conscious sedation takes place, although not as comprehensive as those in hospitals, should comply with all federal, state, and local rules and regulations (FukayamaH et al). The objective of this narrative review is to emphasize that conscious sedation represents an anesthesiological modality that, when executed with due diligence, demonstrates its safety and efficacy in managing various clinical scenarios requiring its use. These scenarios include, but are not limited to, patients with dental phobia, individuals with special needs, or situations demanding increased patient compliance, especially in prolonged or investigative dental procedures.

Materials and methods

All articles dealing with the topic of management of conscious sedation in dentistry were searched on the online platform of scientific reading sites such as Pubmed and Medline, selecting the most current ones up to January 2022, including all languages. Considering the keyword "Sedation," " Dentistry," " Special needs," " Dentophobia," randomized controlled trials, prospective studies, observational studies, reviews, and retrospective studies were considered. Textbooks relevant to the topic were then reviewed, and citations of each retrieved article and those of expert opinions were examined to include as much information as possible.

Conscious sedation in dentistry: benefits and contraindications

Conscious sedation in dentistry serves as a cornerstone in managing patients with dental anxiety or those in need of extensive dental procedures. It entails administering sedative medications to induce relaxation, diminish anxiety, and enhance patient cooperation while maintaining consciousness to respond to verbal commands and protective reflexes. This strategy aims to establish a comfortable, stress-free environment for patients and dental practitioners, facilitating the delivery of quality dental care. The indications for conscious sedation in dentistry encompass various scenarios where traditional local anesthesia or patient management techniques may prove insufficient:

1. Dental Anxiety/Phobia: Dental anxiety is a prevalent issue affecting patients' willingness to seek and undergo dental treatment. Conscious sedation provides a solution by alleviating anxiety and fear, enabling patients to undergo necessary procedures with reduced distress (Pourabbas R. et al.) (De Stefano et al.).
2. Behavioral Management: Pediatric patients and individuals with developmental or cognitive impairments may present challenges in behavior management and cooperation during dental treatment. Conscious sedation helps calm these patients and enhances compliance, ensuring successful completion of necessary procedures (Stern et al.).
3. Invasive Procedures: Certain dental treatments, like complex restorative work, extractions, or periodontal surgeries, may induce discomfort or anxiety. Conscious sedation can alleviate these concerns by promoting relaxation and reducing pain perception, thereby enhancing patient comfort and cooperation during the procedure (Melini M. et al.).

While conscious sedation offers significant benefits, it is vital to thoroughly assess patients for any contraindications or potential risks:

1. Allergy or Hypersensitivity: Patients with known allergies or hypersensitivity to sedative medications should be identified, as the administration of these drugs may result in adverse reactions or complications (Melloni et al.).
2. Respiratory Compromise: Individuals with pre-existing respiratory conditions, such as severe obstructive sleep apnea or chronic obstructive pulmonary disease (COPD), may face an elevated risk of respiratory depression or airway compromise during sedation (Pozin et al.) (Leiten et al.).
3. Pregnancy: The use of sedative medications during pregnancy, particularly in specific trimesters, may pose risks to the developing fetus and should be avoided unless absolutely necessary and deemed safe by a healthcare professional (McPherson et al.).
4. Uncontrolled Medical Conditions: Patients with uncontrolled hypertension, cardiovascular disease, or compromised airways may encounter heightened risks during sedation and necessitate careful evaluation to determine the suitability of conscious sedation (Araújo et al.).

The benefits of conscious sedation in dentistry are manifold and significantly enhance the overall quality of patient care:

- Anxiety Reduction: Conscious sedation plays a pivotal role in alleviating dental anxiety and fear, which often serve as barriers to seeking and receiving dental care. The fear of dental procedures can be overwhelming for many individuals, hindering them from seeking necessary treatments and resulting in oral health issues and compromised overall well-being. By inducing relaxation and calmness, conscious sedation helps patients feel more at ease and lessens the psychological distress associated with dental visits. This not only improves the patient experience but also fosters a positive relationship between the patient and the dental practitioner, ultimately promoting better oral health outcomes (Hoffmann B. et al.).
- Improved Cooperation: Patients experiencing anxiety

or fear may exhibit heightened stress levels during dental procedures, making it difficult for them to cooperate fully. This can lead to challenges such as involuntary movements, gagging reflexes, or an inability to remain still, which can hinder the dentist's ability to perform procedures effectively. Conscious sedation mitigates these issues by inducing a relaxed state in patients, making them more compliant and cooperative throughout the treatment process. Enhanced patient cooperation facilitates smoother and more efficient delivery of dental care, reducing the likelihood of procedural delays or complications and improving overall treatment outcomes (Aartman et al.).

- Enhanced Pain Management: Effective pain management is crucial in dental care, as procedures can often cause discomfort or pain. Sedative medications utilized in conscious sedation not only induce relaxation but also possess analgesic properties, making them effective in managing dental pain. By enhancing pain control, conscious sedation ensures that patients experience minimal discomfort during dental procedures, contributing to a more positive treatment experience. This is particularly beneficial for individuals undergoing invasive or lengthy procedures, allowing them to undergo treatment without undue discomfort or distress.
- Time Efficiency: In a busy dental practice, optimizing time management is essential to ensure the efficient delivery of care to patients. Conscious sedation significantly contributes to time efficiency by promoting patient comfort and cooperation during procedures. Patients under conscious sedation are typically more relaxed and less prone to anxiety-induced behaviors that may prolong treatment times. Additionally, the sedative effects of conscious sedation help minimize discomfort and pain during procedures, reducing the likelihood of interruptions or pauses due to patient discomfort. As a result, dental practitioners can complete treatments more efficiently, leading to improved workflow efficiency and the ability to accommodate more patients within a given time frame (Rudner et al.).

Despite its numerous benefits, conscious sedation in dentistry carries risks (Schwamburger et al.), and it's crucial to consider potential disadvantages:

- Risk of Oversedation: Excessive sedation poses significant risks to patient safety, including respiratory depression, cardiovascular compromise, and other adverse events. Oversedation occurs when the dosage of sedative medications surpasses the patient's tolerance level, resulting in a deeper sedation state than intended. This can lead to decreased respiratory rate, shallow breathing, hypoxia, or even respiratory arrest. To mitigate this risk, careful titration and monitoring of sedative medications are essential. Dental practitioners must adhere to established dosing guidelines and continuously assess the patient's sedation level throughout the procedure. Close monitoring enables prompt detection of signs of oversedation, facilitating timely intervention to prevent adverse outcomes (Koniaris et al.).
- Patient Monitoring: Conscious sedation requires vigilant monitoring of various parameters to ensure patient safety and promptly detect any signs of adverse reactions or complications. Essential aspects of patient monitoring during conscious sedation include continuous assessment of vital signs such as blood pressure, heart rate, respiratory rate, and oxygen saturation. Additionally, dental practitioners should regularly evaluate the patient's level of consciousness and responsiveness to verbal stimuli. Monitoring equipment such as pulse oximeters, blood pressure monitors, and electrocardiograms may be utilized to facilitate real-time assessment of the patient's physiological status. Rigorous and systematic monitoring enables dental practitioners to identify and manage any deviations from the expected clinical course promptly, minimizing the risk of adverse outcomes (Sheahan et al.).
- Potential for Complications: Sedative medications used in conscious sedation can interact with other drugs or exacerbate underlying medical conditions, leading to complications. Therefore, a comprehensive pre-sedation assessment is crucial to identify any contraindications, drug allergies, or medical conditions that may increase the risk of complications. Dental practitioners should obtain a detailed medical history from the patient, including information about current medications, allergies, and past medical/surgical history. Based on this assessment, appropriate risk stratification can be performed to determine the suitability of conscious sedation for the patient. In cases where significant medical concerns exist, consultation with a physician or anesthesiologist may be necessary to ensure safe sedation practices and minimize the likelihood of complications (Conway et al.).
- Post-Sedation Effects: Following the dental procedure, patients may experience residual effects of sedative medications, such as drowsiness, lethargy, or temporary memory impairment. These post-sedation effects can impact the patient's ability to resume normal activities immediately after the procedure and may require a period of observation and recovery. Dental practitioners should provide appropriate post-operative instructions to patients and their caregivers, including guidance on activities to avoid, dietary restrictions, and the need for transportation assistance. Patients should be advised to refrain from driving or operating heavy machinery until the effects of the sedative medications have fully dissipated. Additionally, dental practices should implement protocols for post-operative follow-up to monitor patients' recovery and address any concerns or complications that may arise during the post-sedation period (Arnal Velasco et al.).

Nitrous oxide

Nitrous oxide (N2O), commonly known as laughing gas, has a long history of use in dentistry due to its analgesic, anxiolytic, and sedative properties. This gas is particularly valued in the treatment of pediatric patients, as it can help overcome resistance to dental procedures due to anxiety or fear. N2O sedation is widely considered a safe and effective method to facilitate a wide range of dental treatments, especially those involving minimally invasive procedures or generating mild to moderate patient apprehension (Mennerick S. et al).

The administration of N2O-O2 sedation involves controlled mixing of nitrous oxide and oxygen, with higher concentrations of oxygen compared to N2O, to ensure patient safety and comfort. In dental practice, inhaled

N2O concentrations typically range from 25% to 45%, with the remainder being oxygen.
One of the key advantages of N2O sedation is its rapid onset of action, facilitated by its rapid diffusion across the alveolar-capillary membrane and into the bloodstream. This allows for a quick attainment of sedation state, enabling dental procedures to commence promptly and minimizing patient anxiety and discomfort. Similarly, the effects of N2O dissipate rapidly following cessation of administration, facilitating a smooth and swift recovery process (Fleming P. et al).
The pharmacological effects of N2O are mediated in part by its interaction with neurotransmitter receptors in the central nervous system. Specifically, N2O enhances the activity of gamma-aminobutyric acid type A (GABA A) receptors, involved in anxiety reduction and sedation. Additionally, N2O acts as an antagonist of N-methyl-D-aspartate (NMDA) receptors, further contributing to its analgesic properties and reducing musculoskeletal activity during sedation (Mennerick S. et al).
Following the completion of the dental procedure, it is essential to mitigate the risk of diffusion hypoxia, a potential complication associated with the rapid elimination of N2O from the body. To this end, patients are typically instructed to inhale pure oxygen for a period of approximately 5 minutes post-procedure, ensuring adequate tissue oxygenation and minimizing the risk of hypoxemia.
Despite its potent effects, N2O sedation is generally well tolerated b. y patients and is associated with a rapid return to normal functionality after the dental visit. Typically, patients can be discharged on the same day as the procedure, provided that their vital signs and overall condition remain stable during the immediate postoperative period. However, close monitoring and appropriate follow-up are important to ensure optimal outcomes and patient safety.
Prior to administering nitrous oxide sedation in dentistry, patients undergo a comprehensive preoperative evaluation, which includes an assessment of their medical and dental history, as well as their ASA physical status, to identify any contraindications or risk factors. Informed consent is obtained from the patient after providing detailed information regarding the procedure's risks, benefits, and alternatives (Khinda et al.).
Nitrous oxide is delivered using a specialized administration system comprising a blending tank, flow control valves, a delivery apparatus, and a nasal mask. The concentration of nitrous oxide is precisely regulated by adding medical-grade oxygen to achieve the desired mixture, typically ranging between 30% and 50%. Continuous monitoring and control of the gas mixture are maintained throughout the procedure to ensure its stability and safety (Samir et al.).
During sedation, patients' vital signs are continuously monitored, including heart rate, non-invasive blood pressure, oxygen saturation via pulse oximetry, and, if available, capnography to assess expired CO2 levels. This allows for real-time assessment of the patient's physiological response and prompt detection of any signs of cardiorespiratory compromise.
The duration of nitrous oxide sedation may vary depending on the complexity and duration of the dental procedure, as well as the individual patient's response. The concentration of nitrous oxide can be adjusted as needed during the procedure to optimize sedation levels and ensure patient comfort (Samur Ergüven et al.).
Dental personnel are trained in managing sedation-related emergencies, such as airway obstruction or respiratory depression, and are equipped to provide appropriate interventions, including advanced airway management and administration of reversal agents if necessary (González-Lemonnier et al.).
Following the conclusion of the dental procedure, patients are monitored during the post-sedation recovery period until they return to full consciousness and cardiorespiratory stability. During this time, patients continue to breathe pure oxygen to facilitate the elimination of residual nitrous oxide from their system.
All details related to the sedation procedure, including dosages administered, vital signs monitored, and any complications encountered, are accurately documented in the patient's medical record. Adequate post-treatment follow-up is essential to assess the patient's health status and address any potential complications that may arise.

Benzodiazepines
Benzodiazepines constitute a versatile class of psychoactive drugs, widely employed in the treatment of various psychiatric disorders and medical conditions. Their primary action is to enhance the activity of the neurotransmitter gamma-aminobutyric acid (GABA) in the central nervous system. GABA is the main inhibitory neurotransmitter, and increased activity leads to calming and sedative effects (Pieri L. et al).
These drugs are commonly prescribed for anxiety disorders, insomnia, mood disorders like depression, panic attacks, epilepsy, and post-traumatic stress disorder. They are available in various formulations, including oral tablets, sublingual tablets, intravenous injections, and intramuscular injections, allowing flexibility in administration based on patient needs and medical requirements (Averley PA et al).
In conscious sedation, benzodiazepines play a crucial role by inducing relaxation and sedation while preserving the patient's consciousness and ability to respond to verbal cues. This is particularly valuable in medical procedures such as endoscopy, dental procedures, and minor surgeries, where patient cooperation and comfort are essential.
Common benzodiazepines used for conscious sedation include midazolam, diazepam, and lorazepam (Table 1). These drugs are chosen for their rapid onset of action, relatively short duration of effect, and predictable sedative properties, making them well-suited for procedures requiring conscious sedation. Additionally, their ability to induce anterograde amnesia further enhances patient comfort and cooperation during medical interventions.
Each benzodiazepine has its unique pharmacokinetic profile and clinical considerations, necessitating individualized selection based on patient characteristics and procedural requirements. Close monitoring of vital signs, level of sedation, and adverse effects is crucial throughout the sedation process to ensure patient safety and procedural success. Additionally, appropriate pre-procedural assessment and post-procedural care are essential components of a comprehensive sedation protocol.
Midazolam is indeed the benzodiazepine most frequently utilized in dentistry, particularly in pediatric settings, due to its rapid onset of action and ease of administration. It can be administered orally (by mouth) or rectally, offering flexibility in dosing and route of administration to suit the needs of different patients and clinical scenarios.

Table 1. Overview of the onset and duration of action, as well as special considerations for each benzodiazepine applied for conscious sedation.

Benzodiazepine	Onset of Action	Duration of Action	Special Considerations
Midazolam	Rapid (1-5 min)	Short (1-2 hours)	High potency, potential for respiratory depression anterograde amnesia
Diazepam	Rapid (1-5 mi)	Intermediate (2-4 hours)	Active metabolites, prolonged sedation, accumulation in elderly
Lorazepam	Intermediate (15-30 min)	Intermediate (6-8 hours)	Less amnestic effect, lower risk of respiratory depression
Alprazolam	Rapid (15-30 min)	Short (6-12 hours)	Potential for dependence, less commonly used for sedation
Clonazepam	Intermediate (20-60 min)	Long (8-12 hours)	Antiepileptic properties, long duration of action
Temazepam	Rapid (30-60 min)	Intermediate (6-10 hours)	Indicated for insomnia, sustained anxiolytic effect
Oxazepam	Intermediate (30-60 min)	Intermediate (4-15 hours)	Slower onset, suitable for outpatient settings
Triazolam	Rapid (15-30 min)	Short (2-4 hours)	High potency, potential for anterograde amnesia, residual sedation

When administered orally, the recommended dosage for pediatric patients weighing less than 25 kg typically ranges from 0.3 to 0.5 mg/kg. This dosing regimen ensures effective sedation while minimizing the risk of adverse effects.

It's noteworthy that the administration of midazolam, especially in pediatric patients, should be conducted under appropriate medical supervision and in a controlled environment such as a hospital setting. This ensures that trained healthcare professionals can monitor the patient's response to the medication and manage any potential complications that may arise during or after the administration (Erlandsson AL et al.).

Conscious sedation in special needs patients

In dentistry, the term "special needs" encompasses a diverse array of individuals necessitating heightened levels of care and attention due to various factors such as physical or cognitive disabilities, profound dental anxiety, or challenges with cooperation during dental procedures. Clinicians are tasked with modifying standard diagnostic and treatment protocols to accommodate these patients' unique needs and circumstances, ensuring their comfort and safety throughout dental care (Lollar DJ et al.).

Within this demographic, a spectrum of conditions and challenges may impact the delivery and efficacy of dental care. Patients with disabilities may have mobility, communication, or cognitive function limitations, requiring tailored approaches to treatment planning and execution. Similarly, individuals with severe dental phobia may experience heightened distress and apprehension, necessitating strategies such as behavioral management techniques or pharmacological interventions to facilitate successful treatment outcomes (Yagiela JA et al.).

Conscious sedation and general anesthesia represent valuable tools in the armamentarium of dental practitioners when managing patients with special needs. These modalities can help alleviate anxiety, mitigate discomfort, and enhance cooperation, enabling clinicians to perform necessary diagnostic assessments and dental procedures more easily and efficiently. However, the decision to utilize sedation must be carefully considered, taking into account factors such as the patient's medical history, treatment requirements, and the availability of appropriate facilities and personnel (Yagiela JA et al.).

The Special Care Dentistry Association (SCDA) serves as a dedicated resource for dental professionals involved in caring for individuals with special needs. Through advocacy, education, and research initiatives, the SCDA seeks to promote the highest standards of oral health and quality of life for this patient population. Recognizing the unique challenges individuals with special needs face, the SCDA advocates for inclusive and patient-centered approaches to dental care, fostering a collaborative and supportive environment within the dental community (Glassman P. et al.).

In conclusion, providing dental care for individuals with special needs requires a multifaceted approach that encompasses clinical expertise, compassion, and interdisciplinary collaboration. By tailoring treatment strategies to address each patient's specific needs and challenges, dental professionals can play a pivotal role in improving oral health outcomes and enhancing the overall quality of life for this vulnerable population.

Conclusion

Conscious sedation has proven over the years to be an effective and safe method of treating patients who are difficult for the clinician to manage. The absence of anxiety and pain, accompanied by a state of muscle relaxation and increased compliance, allow the clinician to perform more complex treatments in maximum comfort. In addition, regardless of the extent of treatment, conscious sedation turns out to be an excellent additional anesthesia practice for special needs patients.

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