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CONSCIOUS SEDATION IN DENTAL PRACTICE: CLINICAL PHARMACOLOGICAL PERSPECTIVES

SEDAÇÃO CONSCIENTE NA PRÁTICA ODONTOLOGICA:PERSPECTIVAS CLÍNICAS FARMACOLOGICAS

SEDACIÓN CONSCIENTE EN LA PRÁCTICA DENTAL: PERSPECTIVAS CLÍNICAS FARMACOLÓGICAS

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Maria Josilaine das Neves de Carvalho[1], Marcos Gustavo Oliveira da Silva[2], Rafael Bruno Santiago Monteiro[3], Ana Elizabete Jacob Pedrosa[4], Jeyse Anne Vasconcelos da Silva[5], Thalita Augusta Amorim Santos[6], Édila Figuerêdo Feitosa Cavalcanti[7], Josie Meneses Aguiar[8]

ABSTRACT

Conscious sedation is widely used in contemporary dentistry to manage anxiety and fear, ensuring greater comfort and safety during clinical care. This study aims to review recent literature on the clinical and pharmacological perspectives of conscious sedation, with an emphasis on pharmacological agents, routes of administration, indications, and safety protocols. This integrative review was conducted in the PubMed, SciELO, and BVS databases, covering publications published between 2020 and 2025. The results show that nitrous oxide and midazolam remain the most commonly used drugs, standing out for their efficacy and safety profile when administered by qualified professionals. Technological and pharmacological advances have allowed greater control of sedation levels and reduced adverse effects, consolidating conscious sedation as an essential resource in modern dental practice.

Keywords: Conscious Sedation. Dentistry. Pharmacology. Nitrous Oxide. Midazolam.

[1] Undergraduate student in Dentistry. Centro Universitário Maurício de Nassau. Pernambuco, Brazil. E-mail: Josilaine.carvalho.odontologia@gmail.com
[2] Master in Family Health. Centro de pesquisa Aggeu Magalhães (CPqAM- FIOCRUZ). Pernambuco, Brazil. E-mail: marcos.osilva@hotmail.com
[3] Undergraduate student in Dentistry. Centro Universitário Maurício de Nassau. Pernambuco, Brazil. E-mail: afaelbrunosantiago13@gmail.com
[4] Master in Child and Adolescent Health. Universidade Federal de Pernambuco (UFPE). E-mail: jacobpedrosa.ae@gmail.com
[5] Undergraduate student in Dentistry. Centro Universitário Maurício de Nassau. Pernambuco, Brazil. E-mail: Centro Universitário Maurício de Nassau. Pernambuco, Brazil. E-mail: afaelbrunosantiago13@gmail.com
[6] Specialist in Hospital Dentistry. Faculdade Unyleya. Pernambuco, Brazil. E-mail: amorimthalita09@gmail.com
[7] Dr. in Sciences. Universidade Federal do Rio de Janeiro (UFRJ). Pernambuco, Brazil. E-mail: edilaff@yahoo.com.br
[8] Dental Surgeon. Universidade Federal do Ceará (UFC). Ceará, Brazil. E-mail: josiemenesesaguiar@gmail.com

RESUMO
A sedação consciente é amplamente utilizada na odontologia contemporânea para o manejo da ansiedade e do medo, garantindo maior conforto e segurança durante o atendimento clínico. Este estudo tem como objetivo revisar a literatura recente acerca das perspectivas clínicas e farmacológicas da sedação consciente, com ênfase nos agentes farmacológicos, vias de administração, indicações e protocolos de segurança. Trata-se de uma revisão integrativa conduzida nas bases de dados PubMed, SciELO e BVS, abrangendo publicações entre 2020 e 2025. Os resultados evidenciam que o óxido nitroso e o midazolam permanecem como os fármacos mais empregados, destacando-se por sua eficácia e perfil de segurança quando administrados por profissionais habilitados. Avanços tecnológicos e farmacológicos têm permitido maior controle dos níveis de sedação e redução de efeitos adversos, consolidando a sedação consciente como recurso essencial na prática odontológica moderna.

Palavras-chave: Sedação Consciente. Odontologia. Farmacologia. Óxido Nitroso. Midazolam.

RESUMEN
La sedación consciente se utiliza ampliamente en la odontología contemporánea para controlar la ansiedad y el miedo, garantizando mayor comodidad y seguridad durante la atención clínica. Este estudio tiene como objetivo revisar la literatura reciente sobre las perspectivas clínicas y farmacológicas de la sedación consciente, con énfasis en los agentes farmacológicos, las vías de administración, las indicaciones y los protocolos de seguridad. Esta revisión integrativa se realizó en las bases de datos PubMed, SciELO y BVS, abarcando publicaciones publicadas entre 2020 y 2025. Los resultados muestran que el óxido nitroso y el midazolam siguen siendo los fármacos más utilizados, destacando por su eficacia y perfil de seguridad cuando son administrados por profesionales cualificados. Los avances tecnológicos y farmacológicos han permitido un mayor control de los niveles de sedación y la reducción de los efectos adversos, consolidando la sedación consciente como un recurso esencial en la práctica odontológica moderna.

Palabras clave: Sedación Consciente. Odontología. Farmacología. Óxido Nitroso. Midazolam.

1 INTRODUCTION

Anxiety and fear related to dental treatment are factors frequently observed in clinical practice, which can compromise patient adherence, hinder management during care, and increase the risk of therapeutic failures (STATPEARLS, 2024). Given this reality, conscious sedation has been consolidated as an effective alternative for controlling fear and anxiety, providing greater comfort and safety during dental procedures, without the need for general anesthesia (STATPEARLS, 2024).

Conscious sedation is defined as the use of pharmacological agents capable of promoting minimal depression of the central nervous system, preserving protective reflexes and allowing the patient to maintain a response to mild verbal or tactile stimuli (FRONTIERS, 2023). This modality is indicated in different clinical contexts, from pediatric dental procedures to minor oral surgeries in anxious adults (FRONTIERS, 2023).

Among the main agents used, nitrous oxide associated with oxygen (N_2O/O_2) stands out for its rapid onset of action, safe therapeutic margin, and rapid postoperative recovery (PMC, 2023). The use of nitrous oxide in concentrations of up to 50% has shown success rates of more than 90% in reducing anxiety and promoting cooperation during dental treatment (FRONTIERS, 2023). Recent clinical studies point to significant efficacy of inhalational sedation, with a low incidence of adverse effects when correctly administered (PMC, 2023).

Another widely used drug is midazolam, which belongs to the benzodiazepine class, with anxiolytic, amnesic, and sedative properties (STATPEARLS, 2024). Midazolam can be administered orally, sublingually, or intravenously, with predictable effects and adequate control of sedative depth (JOURNAL OF DENTAL ANESTHESIA AND PAIN MEDICINE, 2025). Comparatively, studies show that nitrous oxide has a faster recovery, while midazolam confers greater anxiolytic stability, and the choice should be individualized according to the clinical and psychological profile of the patient (JOURNAL OF DENTAL ANESTHESIA AND PAIN MEDICINE, 2025).

To ensure the safety of the procedure, it is recommended to carry out a detailed prior evaluation, including medical history, ASA classification, and identification of risk factors, in addition to continuous monitoring of physiological parameters, such as heart rate, ventilation, and oxygen saturation (FRONTIERS, 2023). In the case of nitrous oxide,

the use of exhaust systems (scavenging) and adequate ventilation is essential to avoid occupational exposure (AMERICAN DENTAL ASSOCIATION, 2023).

In recent years, pharmacological and technological advances have expanded the therapeutic possibilities of conscious sedation, with the introduction of agents such as dexmedetomidine, which offers better hemodynamic stability and less respiratory depression (SCIENTIFIC DIRECT, 2023). In addition, recent research demonstrates that repeated use of nitrous oxide sedation in pediatric patients contributes to positive conditioning and increased collaboration at future visits (MDPI, 2022).

In view of this scenario, this article aims to review the recent literature (2020-2025) on the clinical and pharmacological perspectives of conscious sedation in dental practice, with emphasis on the agents used, routes of administration, clinical indications, and safety protocols. The proposal aims to contribute to the improvement of evidence-based dental practices, reinforcing the role of conscious sedation as an essential tool in contemporary dentistry.

2 METHODOLOGY

This is an integrative literature review, elaborated with the objective of gathering and analyzing recent scientific evidence on the clinical and pharmacological perspectives of conscious sedation in dental practice. This type of study allows the synthesis of empirical and theoretical research results, enabling a broad and up-to-date understanding of the subject (SOUZA; SILVA; CARVALHO, 2021).

The elaboration followed the six steps proposed by MENDES; SCOTT; GALVÃO (2008): identification of the theme and definition of the research question; establishment of inclusion and exclusion criteria; definition of information sources; data collection; analysis and interpretation of results; and presentation of the review.

The guiding question was formulated according to the PICO (Population, Intervention, Comparison and Outcome) strategy, defined as: *"What are the current clinical and pharmacological perspectives of conscious sedation used in dental practice between the years 2020 and 2025?"*

The search for studies was carried out between July and September 2025 in the PubMed/MEDLINE, SciELO, and Virtual Health Library (VHL) databases. The controlled descriptors of the Health Sciences Descriptors (DeCS) and equivalent terms in the Medical Subject Headings (MeSH) were used, combined with the Boolean operators

"AND" and "OR". The descriptors used were: *"conscious sedation", "dentistry", "nitrous oxide", "midazolam*", *"pharmacology"* and *"anxiety management".*

Articles published between 2020 and 2025, available in Portuguese, English, and Spanish, that addressed clinical, pharmacological, or safety aspects of conscious sedation in dentistry were included. Narrative reviews, duplicate studies, letters to the editor, dissertations, theses, and articles that did not have direct relevance to the research objective were excluded.

The selection of articles was carried out in three stages: reading of the titles, analysis of the abstracts and full reading of the selected texts. Data extraction included information on the year of publication, country of origin, type of study, drugs used, route of administration, main results, and conclusions.

The collected data were organized in a comparative spreadsheet and analyzed in a descriptive and interpretative way, allowing the identification of the most recent evidence on the use of conscious sedation, as well as emerging clinical and pharmacological trends in the dental context.

This review was conducted in an ethical and transparent manner, respecting the principles of scientific integrity and responsible use of information sources.

3 FINDINGS

The analysis of recent scientific literature reveals that the most commonly used agents in conscious dental sedation are nitrous oxide (N_2O/O_2) and midazolam, with emphasis on remimazolam as an emerging alternative. The efficacy and safety of these drugs have been widely studied, evidencing their crucial role in the management of anxiety and patient comfort during dental procedures.

Nitrous Oxide (N_2O/O_2)

Nitrous oxide, administered in concentrations of up to 50%, has been shown to be highly effective in reducing anxiety and promoting patient cooperation during dental treatments. Studies indicate that sedation with N_2O/O_2 has success rates greater than 90%, with a low incidence of adverse effects, such as nausea and residual sleepiness (LI et al., 2023). In addition, rapid recovery after the procedure and precise control of the depth of sedation are characteristics that make N_2O/O_2 a preferred choice in various clinical contexts (PICCIALLI et al., 2025).

Midazolam

Midazolam, a benzodiazepine with anxiolytic and amnesic properties, is widely used in dental conscious sedation, especially in pediatric and anxious patients. Its administration can be performed orally, sublingually or intravenously, with rapid onset of action and favorable safety profile. Comparative studies between midazolam and N_2O/O_2 indicate that both agents are effective in reducing anxiety, although N_2O/O_2 has a lower incidence of adverse effects and faster recovery (KHAN et al., 2025).

Remimazolam

Remimazolam, a derivative of midazolam, has emerged as a promising alternative in conscious dental sedation. Recent studies have shown that remimazolam offers a 100% success rate in sedation of dental procedures, with minimal cardiovascular and respiratory depression, as well as rapid postoperative recovery (GROSSI et al., 2025). These attributes make remimazolam a viable option, especially in patients at high risk or with comorbidities.

Pharmacological and Technological Advances

In addition to traditional agents, pharmacological and technological advances have expanded the possibilities of conscious sedation in dentistry. The introduction of drugs such as dexmedetomidine has shown benefits in terms of hemodynamic stability and lower incidence of respiratory adverse effects (GAO et al., 2023). The combination of different sedative agents, such as midazolam and dexmedetomidine, has been explored to optimize sedation, providing a balance between efficacy and safety (PICCIALLI et al., 2025).

Clinical Considerations and Safety Protocols

The choice of sedative agent should be individualized, considering factors such as age, comorbidities, level of anxiety, and type of dental procedure. Continuous monitoring of vital parameters such as heart rate, oxygen saturation, and blood pressure is essential to ensure patient safety during conscious sedation. Safety protocols, including detailed preoperative evaluation and the presence of emergency equipment, are essential to prevent and manage possible complications (GAO et al., 2023).

4 DISCUSSION

Conscious sedation has been consolidated as an essential tool in contemporary dentistry, especially in the management of anxiety and fear, factors that directly impact

patient cooperation and the success of clinical procedures (STATPEARLS, 2024). The analysis of recent studies shows that nitrous oxide (N_2O/O_2) and midazolam remain the most widely used agents, with robust evidence of efficacy and safety, while new drugs such as remimazolam and dexmedetomidine emerge as promising alternatives, offering specific advantages in terms of hemodynamic stability, recovery profile and lower incidence of serious adverse effects (GROSSI et al., 2025; GAO et al., 2023).

4.1 EFFICACY AND ADVERSE EFFECTS OF AGENTS

Nitrous oxide is valued for its rapid onset of action, precise control of the depth of sedation, and immediate recovery, allowing patients to remain responsive and safe during dental procedures (PICCIALLI et al., 2025). The most frequent adverse effects include mild nausea, vomiting, transient drowsiness, and dizziness, with a low occurrence of serious events, as long as it is administered correctly (LI et al., 2023).

Midazolam confers a greater anxiolytic and amnesic effect, and is indicated especially for pediatric or adult patients with intense anxiety (KHAN et al., 2025). Among its adverse effects, mild to moderate respiratory depression, prolonged sedation, excessive amnesia, and in rare cases bradycardia stand out. Despite this, their adequate prophylaxis and continuous monitoring significantly reduce clinical risks.

Remimazolam, derived from midazolam, has a favorable pharmacokinetic profile, with effective sedation, minimal cardiovascular and respiratory depression, and rapid post-procedural recovery (GROSSI et al., 2025). Reported adverse effects are rare and include mild hypotension, dizziness, and transient headache, and are considered a safe agent even in high-risk patients.

Dexmedetomidine, used alone or in combination protocols, offers deep sedation with hemodynamic stability (GAO et al., 2023). Its adverse effects include hypotension, bradycardia, dry mouth, and prolonged drowsiness. Slow administration protocols and close monitoring minimize the occurrence of significant adverse events.

Table 1

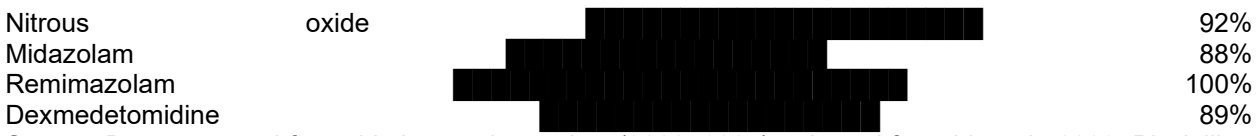
Pharmacological characteristics, routes of administration, effects and recovery of the main agents used in dental conscious sedation

Agent	Route of administration	Initiation of action	Duration	Main effects	Recovery	Most common adverse effects
Nitrous oxide	Inhalation	2–5 min	Short	↓ Anxiety, relaxation	Rapid	Mild nausea, vomiting, somnolence, dizziness
Midazolam	Oral, sublingual, IV	15–30 min	Moderate	Anxiety ↓, amnesia	Moderate	Prolonged sedation, mild respiratory depression, bradycardia
Remimazolam	IV	1–2 min	Short	Anxiety ↓, amnesia	Very fast	Mild hypotension, dizziness, transient headache
Dexmedetomidine	IV	10–15 min	Moderate	Sedation, analgesia	Moderate	Hypotension, bradycardia, dry mouth, prolonged somnolence

Source: adapted from LI et al., 2023; PICCIALLI et al., 2025; GROSSI et al., 2025; GAO et al., 2023.

Figure 1

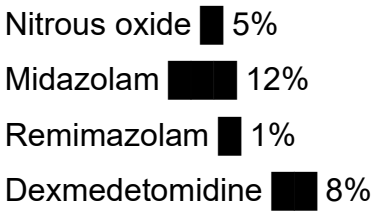
Clinical success rate (%)



Source: Data extracted from this integrative review (2020–2025), adapted from Li et al., 2023; Piccialli et al., 2025; Grossi et al., 2025; Gao et al., 2023.

Figure 2

Incidence of adverse effects (%)



Source: Data extracted from this integrative review (2020–2025), adapted from Li et al., 2023; Piccialli et al., 2025; Grossi et al., 2025; Gao et al., 2023.

Conscious sedation is effective, safe and flexible, as long as it is applied with strict clinical protocols and adequate monitoring. The inclusion of the adverse effects of each agent allows for safer and more individualized clinical decisions, balancing efficacy and safety. Pharmacological and technological advances allow for the customization of sedation, rapid post-procedure recovery, and reduction of adverse events, consolidating conscious sedation as an indispensable practice in modern dentistry.

5 CONCLUSION

The integrative review showed that conscious sedation is an effective and safe strategy for the management of anxiety and fear in dental procedures, and is indicated for both pediatric patients and anxious adults. Among the pharmacological agents analyzed, nitrous oxide (N_2O/O_2) and midazolam remain the most widely used, with high efficacy and a favorable safety profile when administered by trained professionals.

New agents, such as remimazolam and dexmedetomidine, have stood out as promising alternatives, offering rapid recovery, minimal cardiovascular and respiratory depression, and a manageable adverse effect profile. The analysis of the adverse effects of each drug shows that, although events such as nausea, somnolence, and hypotension are possible, adequate monitoring and the application of standardized protocols minimize clinical risks, allowing safe and predictable sedation.

The study also shows that technological advances, including systems for continuous monitoring of vital parameters and integrated clinical software, enhance the safety and personalization of sedation, allowing individual adjustments according to the patient's clinical profile. Combined sedative protocols have been shown to be effective in optimizing sedation depth, reducing adverse effects, and increasing patient compliance, especially in more complex or prolonged procedures.

In this way, conscious sedation is consolidated as an indispensable resource in contemporary dentistry, contributing to greater comfort, safety and adherence to treatment. Understanding pharmacological characteristics, adverse effects, and monitoring strategies is critical for professionals seeking clinical excellence and safe management of dental anxiety.

Finally, it is recommended that future research explore the combined use of sedative agents, new pharmacological formulations, and advanced monitoring

technologies, in order to further enhance the efficacy, safety, and applicability of conscious sedation in dental practice.

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