

Egyptian Clinical Practice Guidelines

Nitrous Oxide Sedation

2025

Clinical Practice Guidelines: Nitrous Oxide Sedation

Acknowledgement:

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Chair of the GDG: Randa ElSalawy, School of Dentistry, Newgiza University

Members of the Guideline Development Group (GDG):

Dr Randa Elsalawy Professor and Dean of school of dentistry New Giza University

Dr Karim Albattoty professor and Dean of school of dentistry Ain Shams University

Dr Ahmed Emad Fayyad, Professor at faculty of dentistry Cairo University

Dr Ahmed El Zohairy, Professor at faculty of dentistry Cairo University

Dr Osama Elshahawy, Professor at faculty of dentistry Cairo University

Dr Foad Sharaby, Professor at faculty of dentistry Cairo University

Dr Mohamed Khalifa Zayet, Professor at faculty of dentistry Cairo University

Dr Mohamed Ahmed Alsholkamy, Professor at Suiz Canal University

Dr Mohamed Tarek Alhalawany, Lecturer at Elalameen University

Dr Hussein Abdelhady, Lecturer at Minia University

Dr Ahmed Amin Musselhy, Associate professor at the Military Medical Academy

Dr Rafik Kamal Gerges Associate professor, at the Military Medical Academy

Dr Omar Shaalan, Associat professor, Faculty of Dentistry, Cairo University

Dr Marwa AbdelHafez, School of Dentistry, Newgiza University, Cairo

Dr Reham Ali Maher, MSc in pediatric dentistry, Cairo University

Abbreviations

ADA

American Dental Association

AAPD

American Academy of Pediatric Dentistry

WHO

World Health Organization

N2O

Nitrous oxide

ASA

American Society of Anesthesiologists physical status classification

Glossary

Minimal sedation is a drug-induced state where the patient is minimally depressed in consciousness but can still independently maintain an airway and respond to commands and touch. While cognitive function and coordination might be slightly impaired, breathing and heart function remain normal. The drugs used should be safe enough to make accidental loss of consciousness unlikely. ²

Moderate sedation is a drug-induced state of depressed consciousness where the patient can purposefully respond to verbal commands, sometimes needing light touch to do so. In this state, the patient does not require assistance to keep their airway open, breathes adequately on their own, and their heart function is generally stable. Responding only with reflex withdrawal to pain does not qualify as moderate sedation. ²

Executive Summary

This guideline provides evidence-based recommendations for the safe and effective use of nitrous oxide-oxygen sedation in dentistry in Egypt. Its aim is to improve patient access to quality dental care, particularly for children, anxious individuals, and patients with special healthcare needs, while ensuring safety, proper training, and alignment with international best practices. These recommendations are intended to support dental professionals in private practices, hospitals, and public dental clinics in making informed decisions regarding the use of nitrous oxide sedation.

Indications

- Use nitrous oxide-oxygen sedation for managing mild-to-moderate dental anxiety in children and cooperative adults. **(Strong recommendation)**
- Use nitrous oxide for patients with exaggerated gag reflex, minor surgical discomfort, and special healthcare needs. **(Strong recommendation)**

Contraindications

- Do not use nitrous oxide in patients with untreated respiratory illnesses, recent ear surgery, or first-trimester pregnancy. **(Strong recommendation)**
- Avoid use in uncooperative patients who cannot maintain nasal breathing or verbal contact. **(Strong recommendation)**

Equipment & Safety

- Use fail-safe systems that prevent delivery of 100% nitrous oxide without oxygen. **(Strong recommendation)**
- Ensure use of active scavenging systems to minimize occupational exposure. **(Strong recommendation)**

Preoperative Assessment

- Perform full medical and dental history with ASA classification before sedation. (**Strong recommendation**)
- Obtain informed written consent after explaining risks, benefits, and alternatives. (**Strong recommendation**)

Administration & Titration

- Begin with 100% oxygen for 1-2 minutes, then titrate nitrous oxide in 10% increments (typical range 30-50% N₂O). (**Strong recommendation**)
- Do not exceed 70% nitrous oxide concentration. (**Strong recommendation**)

Monitoring & Recovery

- Continuously monitor responsiveness; use pulse oximeter in moderate sedation and medically compromised patients. (**Strong recommendation**)
- Deliver 100% oxygen for 3-5 minutes post-op to prevent diffusion hypoxia. (**Strong recommendation**)

Documentation

- Record sedation details including nitrous oxide and oxygen doses, timing, vitals, and recovery outcomes. (**Strong recommendation**)

Training & Credentialing

- Practitioners must complete formal training (minimum 14-16 hours) and hold valid BLS certification. **(Good practice statement)**
- Engage in continuing education every 1-2 years to maintain competency. **(Good practice statement)**
- Ensure regular equipment maintenance, leakage checks, and use of scavenging systems. **(Good practice statement)**

Pediatric Dentistry and Special Needs Population

- Use behavior management techniques (Tell-Show-Do) and child-sized nasal hoods. **(Strong recommendation)**
- Do not use physical restraint; resistance may reflect inadequate sedation or distress. **(Strong recommendation)**

Occupational Health

- Monitor clinic N₂O levels and maintain <50 ppm over an 8-hour shift. **(Strong recommendation)**
- Ensure regular equipment maintenance, leakage checks, and use of scavenging systems. **(Good practice statement)**

Introduction

Dental anxiety is a significant challenge in pediatric dentistry, often leading to uncooperative behavior and untreated dental issues. Nitrous oxide (N₂O) is a well-established minimal sedation method that safely reduces anxiety, enhances patient cooperation, and ensures a more comfortable treatment experience particularly in children and individuals with special healthcare needs. Globally endorsed by organizations like the American Academy of Pediatric Dentistry (AAPD), the American Dental Association (ADA), and the World Health Organization (WHO), N₂O has proven to be a safe and effective tool for managing dental fear.^{1,2,3} Implementing regulated sedation techniques in Egypt will improve access to quality dental care while ensuring patient safety and adherence to international best practices.

Scope and Purpose

This document aims to establish standardized national guidelines for the safe and effective use of nitrous oxide-oxygen inhalation sedation in dental practices across Egypt.

- Ensure the safety and well-being of dental patients, particularly children and medically compromised individuals.
- Provide evidence-based clinical recommendations for dentists using nitrous oxide sedation.
- Support the legal, ethical, and practical implementation of sedation techniques in line with international standards.
- Guide dental schools, hospitals, private clinics, and regulatory bodies in training, equipping, and monitoring sedation services.
- Minimize the need for pharmacologic restraint or general anesthesia when appropriate.
- Support a more positive dental experience, thereby promoting long-term oral health care compliance

Target Audience

This guideline targets; healthcare professionals, policy makers, as well as non-governmental organizations (NGOs), special care dentistry practices and other stakeholders to improve access to quality dental care while ensuring patient safety and adherence to international best practices.

Methodology:

A comprehensive search for guidelines was undertaken to identify the most relevant guidelines to consider for adaptation.

Inclusion/ exclusion criteria followed in the search and retrieval of guidelines to be adapted:

- Selecting only evidence-based guidelines (guideline must include a report on systematic literature searches and explicit links between individual recommendations and their supporting evidence).
- Selecting only national and/or international guidelines.
- Specific range of dates for publication (using Guidelines published or updated in 2015 and later).
- Selecting peer reviewed publications only
- Selecting guidelines written in English language
- Excluding guidelines written by a single author, not on behalf of an organization to be valid and comprehensive, a guideline ideally requires multidisciplinary input.
- Excluding guidelines published without references as the panel needs to know whether a thorough literature review was conducted and whether current evidence was used in the preparation of the recommendations.

The following characteristics of the retrieved guidelines were summarized in:

- Developing organization/authors
- Date of publication, posting, and release
- Country/language of publication
- Date of posting and/or release
- Dates of the search used by the source guideline developers.

All retrieved Guidelines were screened and appraised using AGREE II instrument (www.agreetrust.org) by at least three members. The panel decided on a cut-off point or ranked the guidelines (any guideline scoring above 50% on the rigor dimension was retained). The GDG decided to adapt the American Dental Association (ADA) guidelines on the Use of Sedation and General Anesthesia by Dentists- 2016.²

Evidence assessment

According to WHO Handbook for Guidelines, we used the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) approach to assess the quality of a body of evidence, develop and report recommendations. GRADE methods are used by WHO because these represent internationally agreed standards for making transparent recommendations. Detailed GRADE information is available on the following site:

<https://www.gradeworkinggroup.org/>

Table 1 Quality and Significance of the four levels of evidence in GRADE:

Quality	Definition	Implications
High	The guideline development group is very confident that the true effect lies close to that of the estimate of the effect.	Further research is very unlikely to change confidence in the estimate of effect
Moderate	The guideline development group is moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different	Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate
Low	Confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the true effect	Further research is very likely to have an important impact on confidence in the estimate of effect and is unlikely to change the estimate

Very Low	The group has very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of the effect.	Any estimate of effect is very uncertain
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Table 2: Factors that determine How to upgrade or downgrade the quality of evidence:

Downgrade in presence of	Upgrade in presence of
Study limitations -1 Serious limitations -2 Very serious limitations Consistency -1 Important inconsistency Directness -1 Some uncertainty -2 Major uncertainty Precision -1 Imprecise data Reporting bias -1 High probability of reporting bias	Dose-response gradient +1 Evidence of a dose-response gradient Direction of plausible bias +1 All plausible confounders would have reduced the effect Magnitude of the effect +1 Strong, no plausible confounders, consistent and direct evidence +2 Very strong, no major threats to validity and direct evidence

The strength of recommendations:

The strength of a recommendation communicates the importance of adherence to the recommendation.

Strong recommendations

With strong recommendations, the guideline communicates the message that the desirable effects

of adherence to the recommendation outweigh the undesirable effects. This means that in most situations the recommendation can be adopted as policy.

Conditional recommendations

These are made when there is greater uncertainty about the four factors above or if local adaptation has to account for a greater variety in values and preferences, or when resource use makes the intervention suitable for some, but not for other locations. This means that there is a need for substantial debate and involvement of stakeholders before this recommendation can be adopted as policy.

Good practice recommendations:

Clinical opinion suggests this advice is well established or supported. No robust underpinning research evidence exists. Good practice points are primarily based on extrapolation from research on related topics and/or clinical consensus, expert opinion and precedent, and not on research appropriate for rating the certainty or quality of the evidence.

When not to make recommendations:

When there is lack of evidence on the effectiveness of an intervention, it may be appropriate not to make a recommendation.

Recommendations:

Indications

- - Use nitrous oxide-oxygen sedation for managing mild-to-moderate dental anxiety in children and cooperative adults. (**Strong recommendation, high certainty evidence¹⁻⁴**)

Evidence supports the efficacy of nitrous oxide-oxygen inhalation sedation in managing mild-to-moderate dental anxiety. Randomized controlled trials and systematic reviews demonstrate that N₂O effectively reduces anxiety, improves patient cooperation, and enhances the overall dental experience without compromising safety.¹¹⁻¹³ Studies also confirm that N₂O sedation results in fewer behavior management challenges in children compared to no sedation or oral sedation techniques.^{14,15}

- Use nitrous oxide for patients with exaggerated gag reflex, minor surgical discomfort, and special healthcare needs. (**Strong recommendation, moderate certainty evidence^{5,6}**)

Clinical evidence supports the use of nitrous oxide-oxygen inhalation sedation for suppressing exaggerated gag reflexes, easing minor surgical procedures, and improving cooperation in patients with special healthcare needs. Studies have shown that nitrous oxide raises the gag reflex threshold, facilitating procedures like impressions and intraoral radiographs.^{2,16} In individuals with developmental delays, autism, or sensory processing disorders, observational studies and expert consensus report improved tolerance and reduced need for physical restraint or general anesthesia.^{17,18}

Contraindications

- Do not use nitrous oxide in patients with untreated respiratory illnesses, recent ear surgery, or first-trimester pregnancy.

(Strong recommendation, high certainty evidence^{7,8})

- Avoid use in uncooperative patients who cannot maintain nasal breathing or verbal contact.

(Strong recommendation, moderate certainty evidence^{2,8})

Equipment & Safety

- Use fail-safe systems that prevent delivery of 100% nitrous oxide without oxygen.

(Strong recommendation, high certainty evidence^{2,8})

- Ensure use of active scavenging systems to minimize occupational exposure.

(Strong recommendation, high certainty evidence^{2,9})

Preoperative Assessment

- Perform full medical and dental history with ASA classification before sedation.

(Strong recommendation, high certainty evidence^{2,7})

Refer to appendix 1

- Obtain informed written consent after explaining risks, benefits, and alternatives.

(Strong recommendation, high certainty evidence^{2,4})

Administration & Titration

- Begin with 100% oxygen for 1-2 minutes, then titrate nitrous oxide in 10% increments (typical range 30-50% N₂O).

(Strong recommendation, high certainty evidence^{4,7})

- Do not exceed 70% nitrous oxide concentration.

(Strong recommendation, high certainty evidence²)

Monitoring & Recovery

- Continuously monitor responsiveness; use pulse oximeter in moderate sedation and medically compromised patients.

(Strong recommendation, moderate certainty evidence^{2,7})

- Deliver 100% oxygen for 3-5 minutes post-op to prevent diffusion hypoxia.

(Strong recommendation, high certainty evidence^{4,7})

Documentation

- Record sedation details including nitrous oxide and oxygen doses, timing, vitals, and recovery outcomes.

(Strong recommendation, high certainty evidence^{2,4})

Training & Credentialing

- Practitioners must complete formal training (minimum 14-16 hours) and hold valid BLS certification.

(Good practice statement)

- Engage in continuing education every 1-2 years to maintain competency.

(Good practice statement)

Pediatric Dentistry and Special Needs Population

- Use behavior management techniques (Tell-Show-Do) and child-sized nasal hoods.
(Strong recommendation, moderate certainty evidence^{1,6})

- Do not use physical restraint; resistance may reflect inadequate sedation or distress.

(Strong recommendation, moderate certainty evidence^{1,4})

Occupational Health

- Monitor clinic N₂O levels and maintain <50 ppm over an 8-hour shift.

(Strong recommendation, high certainty evidence^{9,10})

- Ensure regular equipment maintenance, leakage checks, and use of scavenging systems.

(Good practice statement)

Rationale:

Children with dental anxiety, mild behavioral challenges, or special healthcare needs may benefit most from nitrous oxide-oxygen sedation as a **reliable** behavior guidance technique. The use of nitrous oxide should be limited to **potentially** cooperative patients capable of nasal breathing and responsive communication. While most recommendations are supported by high-certainty evidence from pediatric populations, the panel acknowledges that data specific to certain special populations (e.g., children with syndromic conditions or cognitive impairments) are limited. Therefore, clinical decisions should be guided by the dentist's professional judgment, local infrastructure, patient characteristics, and parental preferences. Additionally, successful and safe sedation requires proper equipment, trained personnel, and adherence to safety protocols, including informed consent and post-operative monitoring.

Nitrous oxide-oxygen sedation provides a fast-acting, titratable, and reversible form of minimal sedation that reduces dental anxiety and facilitates cooperation, especially in pediatric and phobic adult patients. Its anxiolytic and mild analgesic effects help patients tolerate procedures that might otherwise be avoided due to fear or behavioral challenges. Inhaled via a nasal hood,

nitrous oxide allows for real-time adjustment of sedation depth while maintaining patient communication and protective reflexes. This makes it especially advantageous for short, non-invasive dental treatments where general anesthesia or deeper sedation is not indicated. The rapid recovery also allows for safe discharge without prolonged supervision, increasing efficiency and safety in both private and public dental settings ⁴.

Research needs:

Multiple well-designed, appropriately powered, placebo-controlled randomized trials that follow the Consolidated Standards of Reporting Trials (CONSORT) guidelines with standardized reporting according to patient age, ASA classification, dental treatment type, and sedation indication should be conducted in Egypt. Standardized methodologies for evaluating the safety, effectiveness, and patient-centered outcomes of nitrous oxide sedation should be developed for use in both academic and public health settings. Future studies should be registered in national or international clinical trial registries such as ClinicalTrials.gov. Specific areas of research recommendations are as follows:

- Evaluation of the safety, efficacy, and complication rates of nitrous oxide sedation in Egyptian pediatric and adult populations in both private and public clinics.
- Determination of the optimal sedation protocols (e.g., titration techniques, oxygen flush timing, duration) for different age groups and treatment settings.
- Comparative effectiveness of nitrous oxide versus other sedation techniques (e.g., oral midazolam, behavioral management alone) in managing anxiety and improving treatment completion in pediatric patients.
- Outcomes of nitrous oxide use in special populations, including children with autism spectrum disorder, intellectual disabilities, Down syndrome, cerebral palsy, and medically compromised patients (ASA II–III).
- Occupational exposure levels to nitrous oxide in Egyptian dental clinics and evaluation of effectiveness of scavenging and ventilation systems in reducing staff exposure.
- Assessment of parental and patient attitudes toward sedation in Egypt and identification of cultural or social barriers to acceptance of N₂O use in dental care.
- Long-term follow-up studies on repeated nitrous oxide use in children, including effects on neurodevelopment, behavior, and clinical outcomes.

- Economic evaluations comparing cost-effectiveness of nitrous oxide sedation versus referral for general anesthesia in uncooperative children.
- Evaluation of training programs and clinical competency of dental practitioners in safely administering and monitoring nitrous oxide sedation.
- Integration of sedation protocols into national oral health programs and assessment of their scalability and impact on access to care in underserved populations.

Monitoring and evaluating the impact of the guidelines:

Nitrous Oxide Sedation Utilization Rate:

Percentage of eligible dental patients (e.g., children with dental anxiety or special healthcare needs) receiving nitrous oxide-oxygen sedation during dental visits.

Sedation Safety Outcome Rate:

Percentage of sedation cases completed without adverse events or complications (e.g., oxygen desaturation, vomiting, unplanned treatment interruption).

Treatment Completion Rate Under Sedation:

Percentage of patients who successfully complete planned dental treatment under nitrous oxide sedation without the need for escalation to general anesthesia.

Parent/Patient Satisfaction Rate:

Percentage of parents or patients reporting high satisfaction with the sedation experience, as measured through post-treatment surveys.

Reduction in General Anesthesia Referrals:

Change in the number of referrals to hospital-based general anesthesia for behavioral management in pediatric dental patients after implementation of nitrous oxide sedation guidelines.

Clinician Compliance with Sedation Protocols:

Percentage of sedation procedures that comply with documentation, informed consent, monitoring, and oxygenation requirements as specified in the guidelines.

Occupational Exposure Monitoring Compliance:

Percentage of dental facilities with functioning scavenging systems and regular monitoring of nitrous oxide levels to ensure staff safety.

Training and Credentialing Compliance Rate:

Percentage of providers who have received certified training in nitrous oxide sedation and maintain valid Basic Life Support (BLS) certification.

Cost-Effectiveness of Nitrous Oxide Sedation:

Evaluation of financial feasibility and return on investment for implementing sedation infrastructure in private practice settings.

Updating the guidelines:

These guidelines will be updated whenever new evidence, international recommendations, or clinical safety data become available. Updates will follow systematic review of the literature and expert panel consultation to ensure continued alignment with best practices in patient safety and sedation efficacy.

Adapted from the American Dental Association (ADA) “Guidelines for the Use of Sedation and General Anesthesia by Dentists,” 2016.

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Appendix 1. American Society of Anesthesiologists Physical Status Classification System

ASA Physical Status Classif	Definition	Examples
ASA 1	A healthy patient	A fit, nonobese, nonsmoking patient with no underlying disease and good exercise
ASA 2	A patient with systemic disease that is mild	A patient with no functional limitations and a well-controlled disease, obesity with a BMI 30-40, frequent social
ASA 3	A patient with systemic disease that is severe but not life-threatening	A patient with some functional limitation due to poorly controlled moderate/severe disease(s), morbid obesity with BMI 40 or above, substance abuse, end-stage renal disease undergoing regular dialysis, implanted pacemaker, or
ASA 4	A patient with "severe systemic disease that is a constant threat to life"	A patient with substantial functional limitations due to severe, life-threatening diseases, such as coronary or intracerebral ischemic event within the past 3 months, severe end-organ
ASA 5	A comatose patient who is "not expected to survive without the operation"	Ruptured aneurysm, multisystem trauma, or extensive intracranial
ASA 6	A brain-dead patient whose organs are being procured for transplantation into another	