



## ORIGINAL ARTICLE

# Equimolar mixture of oxygen and nitrous oxide as a method of conscious sedation in dentistry: a systematic literature review

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## ABSTRACT

**Background:** The equimolar mixture of oxygen and nitrous oxide (MEOPA) is widely used for conscious sedation in dentistry. It facilitates the management of anxious or uncooperative patients and represents an alternative to general anesthesia. **Objective:** To evaluate the effectiveness, safety, and clinical indications of MEOPA in improving the management of difficult patients and optimizing treatment outcomes. **Methods:** A systematic review was conducted in accordance with PRISMA 2020 guidelines. An electronic search was performed in the PubMed and Lissa databases, covering English- and French-language publications from 2004 to 2024. Studies were selected based on predefined inclusion and exclusion criteria following the screening of titles, abstracts, and full texts. **Results:** The search identified 31 articles, of which 9 were included in the final analysis. Findings indicate that MEOPA significantly improves patient cooperation, reduces anxiety, and facilitates dental care delivery. Its combination with midazolam further enhances its effectiveness. MEOPA is particularly beneficial for patients with intellectual disabilities and during tooth extractions. Adverse effects, such as vomiting, are rare (< 1%) and are generally associated with the duration or depth of sedation. The use of the Porter/Brown mask additionally reduces nitrous oxide emissions, promoting a more environmentally responsible practice. **Conclusions:** MEOPA is an effective and safe sedation technique in dentistry, optimizing the management of difficult patients and enhancing the overall dental care experience. However, the heterogeneity across the included studies underscores the need for further standardized research.

**Keywords:** MEOPA, Nitrous Oxide, Conscious Sedation, Dental Care, Dental Anxiety, Pediatric Dentistry.

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## 1. INTRODUCTION

Despite advancements in pain prevention and management, dental care still causes fear or anxiety in some adults, children, or individuals with disabilities. This fear can lead to difficult-to-control behaviors in the dental chair, hindering the delivery of care. Inhalation sedation using an equimolar mixture of oxygen and nitrous oxide (N<sub>2</sub>O O<sub>2</sub>, also known as nitrous oxide sedation) is a pharmacological approach that facilitates treatment options for patients who are minimally or non-cooperative. It induces conscious sedation: it depresses the central nervous system to allow patient relaxation while maintaining verbal communication. Its effects manifest quickly and wear off rapidly, making it a popular choice for short-term pain management.

The literature highlights a lack of standardized protocols for the use of nitrous oxide in dentistry. Few studies compare its effectiveness across different age groups or patient types. There is also insufficient data on its implementation in routine care, particularly in private dental practices. This article aims to present, through a systematic review of the literature, the benefits and advantages of this sedation technique in managing difficult patients in dentistry. By examining clinical and randomized studies, we will highlight how this approach can significantly improve patient experience and dental treatment outcomes.

## 2. MATERIALS AND METHODS

The review was conducted according to the guidelines, criteria, or principles of the Proposed Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009). This is a systematic review of the literature focusing on clinical and randomized experimental studies published from 2004 to 2024, evaluating the use of nitrous oxide-oxygen sedation (N<sub>2</sub>O-O<sub>2</sub>) in dentistry. This article aims to illustrate, through a systematic review of the literature, the relevance of this sedation technique in managing difficult patients in the field of dentistry.

Our review targets articles meeting the inclusion criteria : publication Year: 2004 to 2024 ; language: French or English; document Type: Original articles discussing N<sub>2</sub>O-O<sub>2</sub> sedation in dentistry; randomized clinical studies. Were excluded : articles published before 2004; articles published in languages other than French or English; theses, literature reviews, narrative reviews, and articles addressing the use of N<sub>2</sub>O-O<sub>2</sub> sedation in other medical specialties.

The search was conducted on two electronic databases: PubMed and LISSA (literature on health sciences).The MeSH terms used for literature search were related to the use of N<sub>2</sub>O-O<sub>2</sub> sedation in dentistry. We used keywords in French and their English equivalents (figure 1).

<b>Thèmes de recherches</b> mélange équimolaire d'oxygène et de protoxyde d'azote Dentisterie	<b>Equivalent</b> Equimolar mixture of oxygen and nitrous oxide Dentistry
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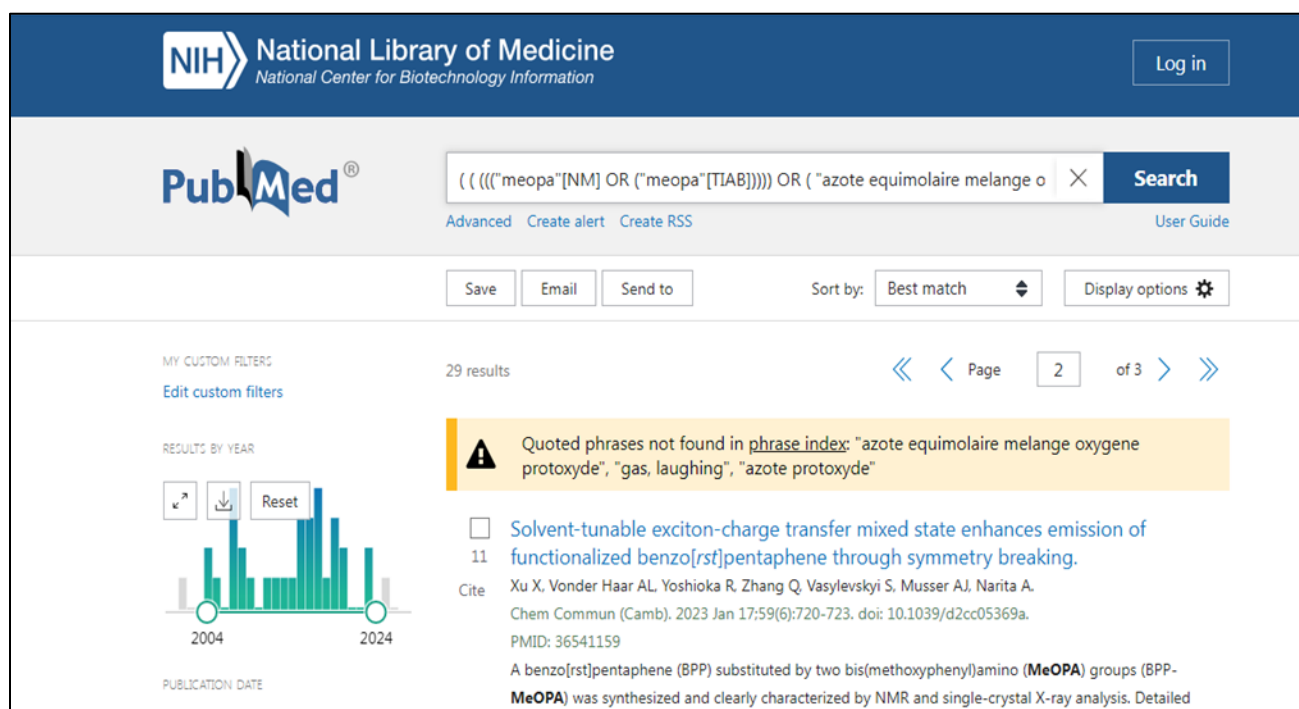


Figure 1. Screenshot of PubMed showing the search strategy on MEOPA in dentistry (2004-2024).

### Data Extraction Form:

After identifying the articles meeting our inclusion criteria, the studies were classified and analyzed, and the following data were extracted: article title, author, year of publication, language, document type, study type, study objective, population, age, and sample size.

### 3. RESULTS

#### Results from the Various Phases of Article Search for the Systematic Review:

During our search, we initially identified 32 articles. After removing duplicates, 31 articles remained eligible for further analysis. Next, a screening of titles and abstracts allowed us to exclude 15 articles that did not meet the inclusion criteria, for example: studies not addressing MEOPA or conscious sedation in dentistry, studies not involving the target population (children or patients with special needs) or experimental studies conducted outside the dental context (figure 2).

Among the remaining articles, 3 full texts could not be obtained and were therefore excluded. Thus, 12 articles were retained for full-text review, of which 9 were ultimately included in the final analysis. The 3 articles excluded at this stage were removed for reasons such as: the study did not correspond exactly to our target population, the sedation protocol was different or not relevant, insufficient results or incomplete data to address our research question.

This rigorous selection process ensures that the included articles are directly relevant to evaluating the effectiveness and safety of MEOPA in dentistry.

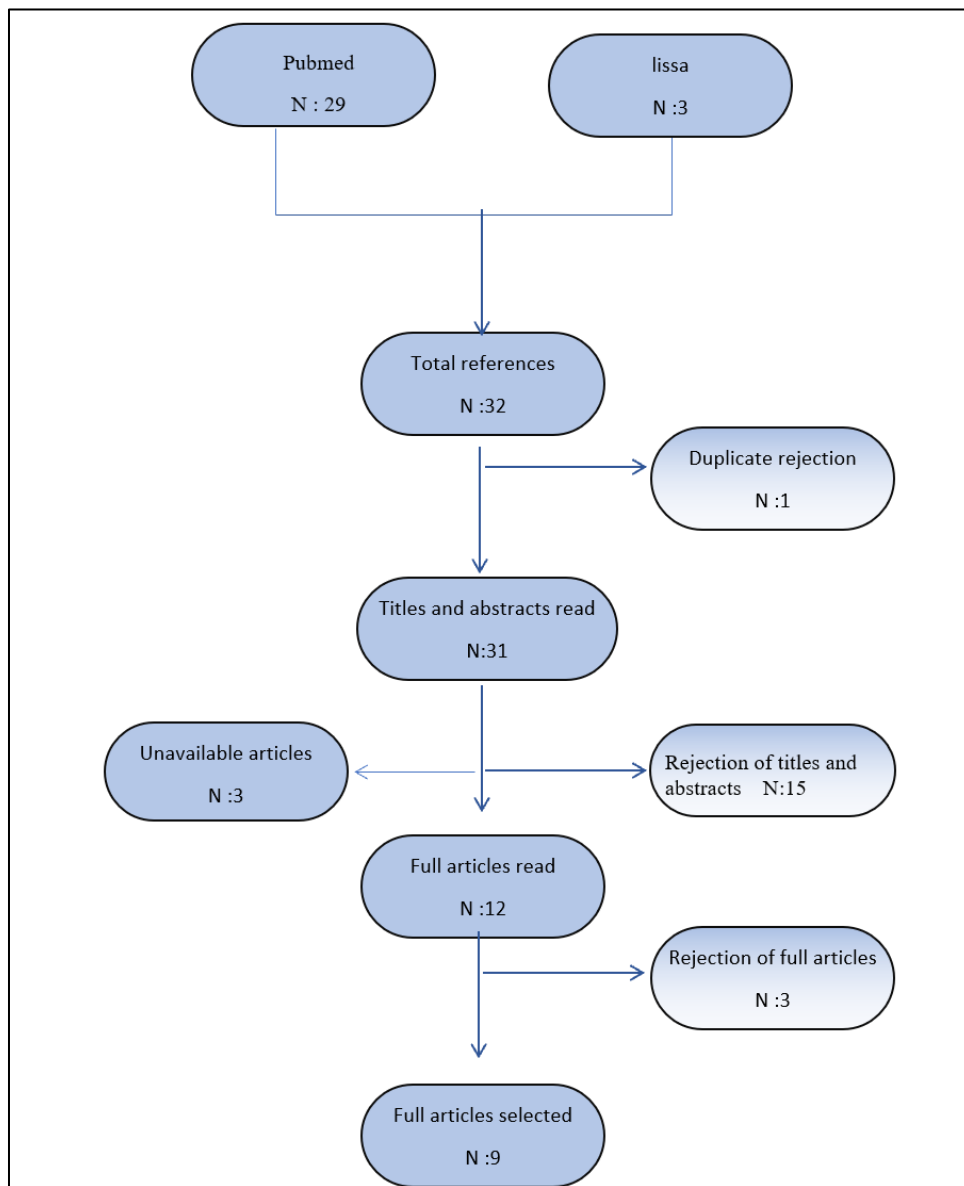


Figure 2. Flowchart of the Total Number of Selected Articles.

**Analysis of Included Articles (table 1).**

**Table 1.** Data Extraction Table.

Title	Author	Year of Publication	Language	Document Type	Study Type	Study Objective	Population	Age
An RCT pilot study to test the effects of intravenous midazolam as a conscious sedation technique for anxious children requiring dental treatment--an alternative to general anaesthesia	Averley PA, Lane I, Sykes J, Girdler NM, Steen N, Bond S	2004	Eng	British dental journal	Experimental	Compare three conscious sedation techniques, including the use of midazolam, as alternatives to general anesthesia for dental care in children	Children	/
Comparison of oral midazolam with a combination of oral midazolam and nitrous oxide-oxygen inhalation in the effectiveness of dental sedation for young children	Al-Zahrani AM, Wyne AH, Sheta SA	2009	Eng	Journal of the Indian Society of Pedodontics and Preventive Dentistry	Experimental	Compare the effectiveness of oral midazolam alone versus a combination of oral midazolam and nitrous oxide-oxygen inhalation sedation for non-cooperative children during dental care	Children	Mean age of 55.07 (+/- 9.29) months, ranging from 48 to 72 months
A randomized controlled trial of paediatric conscious sedation for dental treatment using intravenous midazolam combined with inhaled nitrous oxide or nitrous oxide/sevoflurane	Averley PA, Girdler NM, Bond S, Steen N, Steele J. A	2004	Eng	Journal Metrics: Anaesthesia	Experimental	Evaluate whether the combination of intravenous midazolam with inhalation agents (nitrous oxide alone or with sevoflurane) is more effective than midazolam alone and whether these techniques are a viable alternative to general anesthesia	Children	/
Premedication with melatonin vs midazolam in anxious children	Isik B, Baygin O, Bodur H.	2008	Eng	Journal of Paediatrics and Child Health	Experimental	Study melatonin premedication versus midazolam in children undergoing nitrous oxide/oxygen (N <sub>2</sub> O/O <sub>2</sub> ) sedation for dental treatment	Children	/
A prospective study of the use of nitrous oxide inhalation sedation for dental treatment in anxious children	Foley J	2005	Eng	European journal of paediatric dentistry	Experimental	Determine the baseline data related to the procedures undertaken during nitrous oxide inhalation sedation sessions in the dental department of the hospital.	Children Females: 169 Males: 143	The median age was 11.0 years (interquartile range 8.8, 12.7)
A comparison of inhalation sedation agents in the management of children receiving dental treatment: a randomized, controlled, cross-over pilot trial	Soldani F, Manton S, Stirrups DR, Cumming C, Foley J.	2010	Eng	International journal of paediatric dentistry	Experimental	Compare the effectiveness of two inhalation sedation techniques during dental extractions in children and determine the preferences of patients and their guardians between these techniques	Children and adolescents	6 to 15 years old
Effectiveness of two nitrous oxide scavenging nasal hoods during routine pediatric dental treatment	Chrysioulou A, Matheson P, Milles M, Shey Z, Houpt M	2006	Eng	American Journal Academy of Pedodontics	Experimental	Compare the effectiveness of Porter/Brown and Accutron nasal masks in reducing nitrous oxide waste during conscious sedation in pediatric dental care.	Children	3 to 8 years old.
Sedation with 50% nitrous oxide/oxygen for outpatient dental treatment in individuals with intellectual disability	Faulks D, Hennequin M, Albecker-Grappe S, Manière MC, Tardieu C	2007	Eng	Journal Metrics: Developmental Medicine & Child Neurology	Experimental	Assess the behavioral impact, effectiveness, and tolerance of sedation with N <sub>2</sub> O-O <sub>2</sub> in individuals with intellectual disabilities	Adults: Males: 192 Females: 157	Mean age: 22 years (range 3-81 years)
Fasting state and episodes of vomiting in children receiving nitrous oxide for dental treatment	Kupietzky A, Tal E, Shapira J, Ram D	2008	Eng	American journal Academy of Pediatric Dentistry	Experimental	Determine the frequency of vomiting during nitrous oxide and oxygen (N <sub>2</sub> O/O <sub>2</sub> ) analgesia and evaluate the relationship between fasting status and vomiting.	Children: Boys: 64 Girls: 49	Age range: 24 to 160 months

**Study Results:**

*Effectiveness of N<sub>2</sub>O-O<sub>2</sub> Sedation in Improving Patient Comfort:* We found 4 articles that evaluate the use of MIDAZOLAM.

**Table 2.** Results of N2O-O2 Sedation Effectiveness in Improving Patient Comfort.

Title	Author	Population	Age	Sample Size	Results	Conclusion
An RCT pilot study to test the effects of intravenous midazolam as a conscious sedation technique for anxious children requiring dental treatment--an alternative to general anaesthesia	Averley PA, Lane I, Sykes J, Girdler NM, Steen N, Bond S	children	/	65	The combination of intravenous midazolam promotes effective cooperation in children	The combination of intravenous midazolam for sedation was a safe and effective technique for dental care.
Comparison of oral midazolam with a combination of oral midazolam and nitrous oxide-oxygen inhalation in the effectiveness of dental sedation for young children	Al-Zahrani AM, Wyne AH, Sheta SA	Children	Mean age of 55.07 (+/- 9.29) months, ranging from 48 to 72 months.	30	Oral midazolam combined with nitrous oxide-oxygen provides optimal control of movements and crying during restorative procedures.	The combination of oral midazolam with nitrous oxide sedation improves comfort for both children and dentists during dental treatments.
A randomized controlled trial of pediatric conscious sedation for dental treatment using intravenous midazolam combined with inhaled nitrous oxide or nitrous oxide/sevoflurane	Averley PA, Girdler NM, Bond S, Steen N, Steele J. A	Children	/	697	The combination of intravenous midazolam for sedation has proven to be an effective technique for dental treatments.	Intravenous administration of midazolam, in conjunction with inhaled nitrous oxide or sevoflurane and nitrous oxide, is effective for dental care.
Premedication with melatonin vs midazolam in anxious children	Isik B, Baygin O, Bodur H.	Children	/	60	The group receiving oral midazolam in conjunction with N <sub>2</sub> O-O <sub>2</sub> sedation experienced better sedation, allowing for effective dental treatment.	Melatonin, compared to midazolam, was found to be ineffective for nitrous oxide/oxygen sedation in anxious children.

Two of the four articles found discuss the administration of intravenous midazolam. The study conducted by Averley PA and colleagues in 2004 involved 65 children to evaluate the use of intravenous midazolam in three sedation techniques involving nitrous oxide and oxygen for primary dental care. The study, published in the *Journal of Anaesthesia Metrics* in 2004, included 697 children and assessed the need for a combination of intravenous midazolam and inhalation agents (nitrous oxide alone or combined with sevoflurane) compared to the use of midazolam alone during dental treatments.

The remaining two articles discuss the administration of oral midazolam. Al-Zahrani conducted a study involving 30 children who received oral midazolam sedation at 0.6 mg/kg alone, and a combination of oral midazolam at 0.6 mg/kg and nitrous oxide-oxygen inhalation sedation. The experiment conducted by Isik B and colleagues in 2008 aimed to evaluate oral melatonin premedication compared to midazolam in 60 children divided into four groups under nitrous oxide/oxygen (N<sub>2</sub>O/O<sub>2</sub>) sedation for dental treatment. The authors of the four articles demonstrated that the use of midazolam, particularly in combination with an equimolar mixture of inhaled nitrous oxide and oxygen, was a safe and effective method for ensuring comfort for both non-cooperative children and dentists during dental procedures.

**Tooth Extraction Under N<sub>2</sub>O-O<sub>2</sub> Sedation:** We found two articles that evaluate tooth extraction under N<sub>2</sub>O-O<sub>2</sub> sedation (table 3).

The study by Foley J was conducted over a period of twelve months with 312 patients receiving dental treatments using nitrous oxide inhalation sedation. Another randomized clinical trial was carried out with thirty children, divided into two inhalation sedation groups: one using nitrous oxide and oxygen and the other using nitrous oxide, sevoflurane, and oxygen, for managing children undergoing dental extractions.

These two studies show no statistically significant difference between sedation using nitrous oxide and oxygen and sedation using a combination of nitrous oxide, sevoflurane, and oxygen for successful dental extractions.

**Table 3.** Results of Tooth Extraction Under N<sub>2</sub>O-O<sub>2</sub> Sedation.

Title	Authors	Population	Age	Sample Size	Results	Conclusion
A prospective study of the use of nitrous oxide inhalation sedation for dental treatment in anxious children	Foley J	Children Females: 169 Males: 143	Median age: 11.0 years (interquartile range 8.8, 12.7).	312	The majority of dental extractions within the pediatric dentistry department of the dental hospital are successful thanks to sedation with an equimolar mixture of nitrous oxide and oxygen	There is a need to train more specialists in pediatric dentistry to improve dental care under sedation within community dental services.
A comparison of inhalation sedation agents in the management of children receiving dental treatment: a randomized, controlled, cross-over pilot trial	Soldani F, Manton S, Stirrups DR, Cumming C, Foley J.	Children and adolescents: 6 to 15 years	: 6 to 15 years	30	There was no statistically significant difference between the success rates of dental extractions using the two sedation methods	A slight but significant preference among patients for nitrous oxide combined with sevoflurane and oxygen for dental extractions.

**Reduction of Nitrous Oxide Waste During Sedation:** We identified only one article discussing the reduction of nitrous oxide waste during dental treatments (table 4).

**Table 4.** Results of Nitrous Oxide Waste Reduction During Sedation.

Title	Authors	Population	Age	Sample Size	Results	Conclusion
Effectiveness of two nitrous oxide scavenging nasal hoods during routine pediatric dental treatment	Chrysiopoulou A, Matheson P, Milles M, Shey Z, Houpt M	Children	3 to 8 years	30	Nitrous oxide levels were significantly lower (P<.05) with the Porter/Brown system compared to the Accutron system.	The removal of residual nitrous oxide during dental treatments was more effective with the Porter/Brown device compared to the Accutron device.

Chrysiopoulou A and colleagues conducted a study on 30 children aged 3 to 8 years. Fifteen randomly selected children started with the Porter/Brown mask, which was then replaced by the Accutron mask, while the other 15 children used the masks in the reverse order. In this study, the Porter/Brown elimination system proved to be more effective than the Accutron system. However, the most significant finding was the remarkably high levels of nitrous oxide when the Accutron system was used. Nitrous oxide levels were high not only in the area where the dental treatment was performed but also throughout the entire dental operating room.

**Use of MEOPA sedation in individuals with intellectual disabilities:** We found 1 article addressing this topic (table 5).

**Table 5.** Results of the use of MEOPA sedation in individuals with intellectual disabilities.

Title	Authors	Population	Age	Sample Size	Results	Conclusion
Sedation with 50% nitrous oxide/oxygen for outpatient dental treatment in individuals with intellectual disability	Faulks D, Hennequin M, Albecker-Grappe S, Manière MC, Tardieu C	Adults Men: 192, Women: 157	Average age: 22 years, Range: 3-81 years	349	Among the 605 dental treatment sessions, 91.4% were considered successful. No serious adverse effects were observed.	The use of safe and effective conscious sedation can reduce the need for general anesthesia in individuals with intellectual disabilities.

This study was conducted with 349 adult patients recruited over a 12-month period across seven centers. Dental treatments were successfully completed. No serious adverse effects occurred, although minor adverse events, such as nausea, were observed.

**Frequency of Vomiting During Nitrous Oxide/Oxygen Analgesia:** We found only one article discussing the frequency of vomiting during MEOPA sedation (table 6). One hundred thirteen children participated in the study. At the initial examination, subjects were randomly assigned to be fasting at the first appointment and non-fasting at the second appointment, or vice versa. The average time interval between the meal and the treatment was 6 hours for fasting sessions and 1 hour for non-fasting sessions. The results of this study reveal that only one subject vomited immediately after the treatment was stopped.

**Table 6.** Results of the Frequency of Vomiting During MEOPA Analgesia.

Title	Authors	Population	Age	Sample Size	Results	Conclusion
Fasting state and episodes of vomiting in children receiving nitrous oxide for dental treatment	<i>Kupietzky A, Tal E, Shapira J, Ram D</i>	Children Boys: 64, Girls: 49	24 to 160 months	113	Only one subject vomited, resulting in a frequency of 1%, and no other differences were observed between fasting and non-fasting subjects.	The frequency of vomiting during sedation was found to be 0.5% when the dental treatment time was less than 35 minutes

#### 4. DISCUSSIONS AND STUDIES

##### Limitations of this literature review

This review has several limitations related to the heterogeneity of the included studies, particularly regarding the studied populations, sedation protocols, and evaluation criteria. Several studies also rely on small sample sizes, which may limit the generalizability of the findings. In addition, some studies present methodological limitations, such as the absence of a control group or the use of assessment tools not always suitable for all populations. Finally, the diversity of clinical settings (private practice, hospital environment, pediatric or adult patients) may influence the outcomes and make comparisons between studies more difficult.

##### Effectiveness of MEOPA for Improving Patient Comfort

The results from two randomized clinical trials using intravenous midazolam clearly demonstrate that a combination of inhalation sedation and intravenous midazolam is superior to using intravenous midazolam alone. This approach improves cooperation during the placement of a cannula and throughout the dental procedure, resulting in a higher rate of successful treatments. Additionally, it allows for a reduction in the dose of midazolam required while still providing good amnesia. Conducted in a primary care setting with anesthesiologist involvement, these techniques were found to be effective and seemingly safe [1-3]. However, it is recommended to avoid intravenous sedation in young children under 16 years in primary or community dental practice. It is also noted that conscious sedation is safer than general anesthesia [3].

Oral midazolam is the most commonly used premedication for pediatric patients [2]. The study conducted by Isik B reveals that melatonin premedication, compared to midazolam in children under nitrous oxide/oxygen (N<sub>2</sub>O-O<sub>2</sub>) for dental treatment, did not contribute to any sedation [2]. The combination of oral midazolam and nitrous oxide-oxygen showed better results compared to midazolam alone in terms of controlling movements and crying during local anesthesia administration and restorative procedures. This combination seems to offer more comfort to pediatric patients and operators during critical stages of dental treatment [2-4]. The combination of midazolam with MEOPA appears to improve comfort during dental procedures. However, these findings should be interpreted with caution due to the low level of evidence and study heterogeneity.

##### Tooth Extraction Under MEOPA Sedation:

The experimental study by Foley-J highlights the need for sedation within dental hospitals, as it reduces pain and anxiety and improves comfort for children during dental treatments [5]. The subsequent large-scale randomized clinical trial, mentioned in the Newcastle study, compared 40% N<sub>2</sub>O sedation with N<sub>2</sub>O + 0.1 to 0.3% sevoflurane sedation in two separate patient groups. Successful completion of treatment was reported for 52% and 89% of patients, respectively [5]. This result was consistent with the study conducted by Soldani in 2010. This seemed to be explained by the importance of this sedation mix in improving patient behavior and cooperation, as well as the ease of treatment [6]. It is worth noting that the main limitations of Soltani's study were the relatively small sample size and the use of a wide range of patient ages and types of extractions attempted, including both primary and/or permanent teeth extractions, which may have influenced the results [6]. Inhalation sedation with an equimolar nitrous oxide-oxygen mixture appears to improve patient management during dental extractions; however, these findings should be interpreted with caution due to the limited level of evidence.

### Reduction of Nitrous Oxide Waste During Sedation:

Nitrous oxide elimination devices are commonly used by pediatric dentists. Previous studies have shown that the Porter/Brown system is more effective than other systems, but none have compared its effectiveness with Accutron devices in a real pediatric dental treatment context [7]. The significant difference in efficiency between the nasal masks may be explained by their designs: the Porter/Brown mask has two separate chambers with negative suction around it, while the Accutron has an external scavenging cap located above the single nasal hood.

The clinical trial mentions that two patients vomited after nitrous oxide administration with the Accutron cap and one other with the Porter/Brown mask after switching from the Accutron. Dentists reported dizziness, lip numbness, and the smell of nitrous oxide only with the Accutron system [7]. In contrast, patients preferred the Accutron mask for its different flavors and colors, an advantage that the Porter/Brown system might consider adopting [7].

“Inhalation nasal scavenging devices appear to differ in their efficiency in eliminating residual nitrous oxide during pediatric conscious sedation. The Porter/Brown system may be more effective than the Accutron system. However, these findings should be interpreted with caution due to the limited number of available studies and their methodological limitations.

### Use of MEOPA Sedation in Individuals with Intellectual Disabilities

This study demonstrates the positive efficacy of using a premixed 50% N<sub>2</sub>O-O<sub>2</sub> mixture as the sole agent in the outpatient treatment of individuals with intellectual disabilities [8]. The main limitation was the absence of a randomized control group. The use of the modified Venham scale, designed to assess anxiety and behavior in children, may not be fully suited for adults with intellectual disabilities [8]. Despite the high prevalence of behavioral issues in these patients, treatment under inhalation sedation was successful in most cases (91.4%), showing a success rate similar to other studies. The study reveals that five percent of patients experienced vomiting, a slightly higher rate than reported in the literature for other patient groups. This increased prevalence in this population may be attributed to gastrointestinal issues, agitation, or heightened euphoria [8].

MEOPA appears to be a promising alternative for dental treatment in patients with intellectual disabilities and behavioral disorders, potentially reducing the need for general anesthesia. However, these findings should be interpreted with caution due to the limited number of studies and their methodological limitations.

### Frequency of Vomiting During Nitrous Oxide/Oxygen Analgesia

The study by Kupietzky and colleagues found that with a constant concentration of N<sub>2</sub>O and a treatment duration of less than 35 minutes, the frequency of vomiting was 0.5% [9]. An investigation by Ingebo et al. concluded that there is no advantage to requiring children to fast more than 2 hours before sedation, as it does not significantly alter gastric volume or pH [10]. British pediatric dentistry guidelines indicate that fasting is not required for children undergoing nitrous oxide inhalation sedation. However, dentists may recommend a light meal be consumed within two hours before the appointment [11] (table 7).

**Tableau 7.** Risk of Bias Assessment of Included Studies.

No	Reference	Study type	Risk of bias	Comment
1	Averley PA et al., 2004	Pilot RCT	moderate	Small sample, randomization present but limited blinding
2	Al-Zahrani AM et al., 2009	RCT	Moderate	Randomization described, non-blinded study, possible performance bias
3	Girdler NM et al 2004	RCT	Low to moderate	Randomization and standardized procedures, small sample size
4	Isik B et al., 2008	RCT	Moderate	Partial randomization, small sample, partial blinding
5	Foley J., 2005	Prospective observational study	High	No control group, non-randomized
6	Soldani F et al., 2010	Pilot cross-over RCT	Moderate	Cross-over improves comparison, small sample
7	Chrysiopoulou A et al., 2006	Experimental study	Moderate	Mask comparison, small sample, partial randomization
8	Faulks D et al., 2007	Observational study	High	No control group, measurement tool partially adapted for adults with intellectual disability
9	Kupietzky A et al., 2008	Observational study	High	Vomiting analysis, no randomization
10	Ingebo KR et al., 1997	Observational study	High	Small cohort, non-randomized
11	Hosey MT, 2002	Review / Guidelines	Moderate	Documentary synthesis, no original study, possible selection bias
12	Malamed SF, 2003	Book chapter	Moderate	Narrative review based on literature and experience, no original study

A study on pediatric sedation with chloral hydrate indicates that unfed children are often irritable, combative, and sometimes dehydrated. This can lead the dentist to use a higher concentration of N<sub>2</sub>O, resulting in oversedation and an increased risk of vomiting

[12]. Malamed suggested that nausea and vomiting are generally caused by oversedation, abrupt variations in N<sub>2</sub>O concentrations, and prolonged sedation duration. Another factor is middle ear pressure. Vomiting frequency under MEOPA appears low (<1%) for short procedures with rapid induction. No significant difference was observed between fasting and non-fasting patients. However, these findings should be interpreted with caution due to the low level of evidence.

## 5. CONCLUSION:

MEOPA is an effective and safe conscious sedation technique, ideal for dental interventions, particularly in anxious patients or those with intellectual disabilities. It provides a valuable alternative to general anesthesia due to its safety and rapid reversibility. The use of the Porter/Brown mask helps reduce nitrous oxide emissions, promoting a more environmentally friendly practice. However, it is essential to master its administration and adhere to contraindications while avoiding routine use of this inhalation sedation. Thus, MEOPA stands out as a valuable adjunct in medical practice, combining clinical effectiveness with environmental respect, requiring thoughtful and controlled use.

**Competing interests:** The authors declare that they have no competing interest.

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