

Conscious Sedation by Inhalation of the Equimolar Mixture of Oxygen and Nitrogen Protoxide (MEOPA); Interest in Pediatric Odontology: Review of the Literature

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Original Research Article

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Article History

Received: 14.02.2018

Accepted: 21.02.2018

Published: 28.02.2018

DOI:

10.21276/sjds.2018.5.2.11



Abstract: In pediatric dentistry, the practitioner is often confronted with the care of difficult children who do not cooperate with care, for whom the use of a severe sedation technique is essential. Conscious sedation by inhalation of the equimolar mixture of oxygen and nitrous oxide (MEOPA) in Pediatric Dentistry constitutes an excellent solution to reduce anxiety and to improve the cooperation, thus allowing the realization of dental care in the best conditions. The objective of this review of the literature is to present Equimolar Oxygen and Nitrogen Protoxide Mix (MEOPA), to raise the interest of its use in pediatric odontology. A documentary search strategy was carried out in databases such as PUBMED, EMBASE, COCHRANE, and HINARI. The articles provided by the electronic search at the different databases and by the manual search were reviewed. The data collected were analyzed after implementation of the inclusion criteria: Articles dealing with the presentation of MEOPA from 2003 to 2014, Studies in humans and / or animals written in English or French. The search strategy implemented found 102 articles but after the application of filters and inclusion criteria. Only 12 articles dealing with the interest of MEOPA in the treatment of patients in dentistry and more particularly in pediatric odontology were selected for the analysis of the literature.

Keywords: pediatric dentistry, nitrous oxide, oxygen, PUBMED, EMBASE, COCHRANE, HINARI.

INTRODUCTION

In pediatric dentistry, the practitioner is often confronted with the care of difficult children who do not cooperate with care, for whom the use of a severe sedation technique is essential.

The ideal sedative agent would be an effective drug combining rapidity of induction and elimination, easily administered, having little or no adverse effects and not inducing dependence.

Today, several techniques available to the practitioner allow the constant improvement of the means of care for these patients for quality care. These techniques include the use of the Equimolar Oxygen and Nitrogen Protoxide Mix (MEOPA) [1].

For several years, this method of sedation has been used in industrialized countries, in pediatric or emergency departments. She made her progress in Odontology and developed first in hospital-university structures and since then in the liberal structures

(Marketing Authorization in France since 2001) [2, 3]. It could be of great use in our hospitals in Africa.

Thus, the objective of this review of the literature is to present the Equimolar Oxygen and Nitrogen Protoxide Mix (MEOPA), to raise the interest of its use in pediatric odontology.

MATERIALS AND METHODS

A documentary search strategy was carried out in databases such as PUBMED, EMBASE, COCHRANE, and HINARI. The articles provided by the electronic search at the different databases and by the manual search were reviewed. Initially, the titles and abstracts of the articles found thanks to the search strategy were reviewed. Articles that were not relevant

for inclusion were discarded at this stage. The data collected were analyzed after implementation of the inclusion criteria:

- Articles dealing with the presentation of MEOPA from 2003 to 2014
- Studies in humans and / or animals written in English or French.

RESULTS

The search strategy implemented allowed to find 102 articles but after the application of the filters and criteria of inclusion, only 12 articles were retained for the analysis of the literature.

Several clinical and experimental studies have presented MEOPA as well as its interest in the management of patients in odontology and more particularly in pediatric odontology.



Fig-1: KALINOX ® bottle with inhalation accessories [3]



Fig-2: Pulse oximeter that records oxygen values and saturation [5]

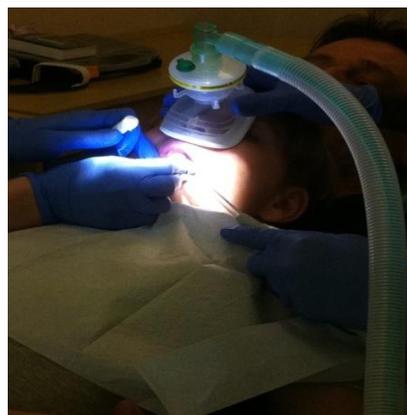


Fig-3: Induction of sedation (Department of Pediatric Dentistry and Dental Care for the Disabled at Saint Luc University Clinics in Brussels) (Photo A Niang)



Fig-4: The mask, connected to the hose through the filter, is applied on the nose, Releasing the mouth for the realization of the care (Photo Niang A)

Table-I: Evaluation scale of MEOPA conscious sedation [1]

Scale of VENHAM	
0	Relaxed
1	Uncomfortable
2	tense
3	Reluctant
4	Verydisturbed
5	Totallydisconnected

DISCUSSION

Presentation

Definition

MEOPA is a colorless, almost inodorous, tasteless gas composed of an equimolar mixture of oxygen (O₂) and nitrous oxide (N₂O) at equal and constant concentrations of 50%. Marketed as Kalinox® or Antonox®, it is used to reduce the perception of pain and anxiety associated with care.

It is presented in a pre-packed bottle with a fixed concentration of 5 to 20 liters, ie 1.5 m³ at 170

bar pressure. A trolley adapted to the bottle, equipped with a securing system in per-puts transport [1].

Pharmacology

MEOPA is a drug that when inhaled provides a short-lived conscious sedation. Anxiolysis associated with euphoria with intoxication is observed after two to three minutes of inhalation. The patient is calm, relaxed, detached with sometimes excessive laughter. Amnesia is often reported but of variable intensity. The state of consciousness is modified but the subject remains vigilant, able to react with the environment and to dialogue with the caregivers [2,4].

The 50% protoxide has no anesthetic effects despite the sedative effect. Both absorption and elimination of the product by the pulmonary route is very rapid (3 minutes), due to its low solubility in the blood and tissues [5].

This during very rare, minor and reversible side effects has, nevertheless, been noted. They disappear within a few minutes after stopping the gas administration. These include: nausea and vomiting, anxiety, excitement, too deep sedation, dizziness, excessive paresthesia, and headache [2, 6, 7, 8].

Therapeutic indications for oral care

The Method is intended for any patient whose cooperation in the vigilante state is insufficient to enable the diagnosis, prevention or treatment of oral pathologies, but who agrees to be helped to be treated: a minimum of cooperation is required at the start and throughout the duration of the care. MEOPA conscious sedation is particularly used for acute care not exceeding 30 minutes in:

- Anxious and pusillanimous children,
- Children with disabilities who often have a busy medical history responsible for fear and an attitude of opposition to care in general.
- Young children (from the age of four) with whom communication is difficult, phobic children and adolescents who often remember a past medical or dental experience.

The indication is perfectly appropriate for balanced diabetic patients, epileptic patients and stable asthmatic patients.

It is also indicated for the treatment of dental trauma emergencies and patients with an uncontrolled nausea reaction [4, 5, 9, 10, 11].

Contraindications

The contra indications related to the general state are rare but absolute:

- Intracranial hypertension, unexplored head trauma
- Pneumothorax, emphysema, diving accident
- Abdominal gas distention, abdominal occlusion

- Patient requiring pure oxygen ventilation
- Facial trauma impeding the application of the mask and incompatible with its tightness
- Alteration of non-assessed consciousness
- Pathology and recent operation of the middle ear [4, 5, 6, 9].

The counter indications related to the act

- Intervention time too long, or many teeth
- Inability to breathe through the nose (sinusitis, obstruction, bronchitis, colds ...)
- No acceptance of the mask
- Too much pain
- Repeated interventions within one week of each other
- Latex allergy [6].

Methods of administration and precautions

Like any medication, the administration of MEOPA requires a nominal and written prescription in the patient's file. It is done in ambulatory mode by a trained staff. The MEOPA, delivered by a bottle containing the fixed concentration mixture, thus avoiding any error of manipulation and accidental hypoxia. It is essential to explain the principle of inhalation to the child and his / her parents, to prevent different sensations, to show and try to mask the patient and to allow parents to ask questions.

Fasting is not obligatory but it is recommended to respect a light meal and a delay of approximately two hours before the intervention. All the same there is a risk of vomiting and nausea [6]. The administration of MEOPA requires the presence of at least two persons, one person who carries out the care, another who administers the gas and who must be totally available to do it during the totality of the care which must not exceed sixty minutes.

The premises must be well ventilated and equipped with an oxygen source and emergency equipment nearby. The practitioner must know the emergency gestures [5].

MATERIALS

The system is simple. It is composed of:

- A 5 liter to 170 bar MEOPA bottle with pressure regulator and integrated flowmeter adjustable from 0 to 15 l / min (Kalinox®) (figure 1)
- A kit MEOPA (an inflatable tank-deflectable tank with a capacity of 2 to 3 liters, a non-return valve, a hose) for a fortnight of use
- A nasal or bucco-nasal mask at the height of the child, connected to the bottle by the hose through which the gas passes
- An antibacterial and antiviral filter for single use, interposed between the mask and the administration circuit, to prevent any risk of nosocomial infection

- A blue pipe between the monomer and the balloon, for the removal of the exhaled gas. This disposal can be done passively (evacuation pipe directed outwards through the window) or better actively (air extractor system or controlled mechanical ventilation)
- A pulse oximeter: its use is only obligatory in the case of an associated administration of morphine or psychotropic, nevertheless it must be strongly recommended (figure 2) [2, 5, 9, 11].

Conduct of the treatment session

• Before the gesture

You have to check all the equipment (bottle, pipes, evacuation).

During a first session in particular and for the following ones if necessary, it is essential to build a relationship of trust with the child and to ensure the calm of the environment in which the inhalation takes place. The sequence of the different phases of the act of care must be described precisely with simple words. It is important to remind the patient that he is not going to sleep but that "the magic air" will cause his fear to go away (it can be evacuated through pipes for example). Do not promise him that he will not hurt [2, 6].

During the gesture

Once the material is checked, set up and the patient is installed, sedation can begin. Never apply the mask with force.

Induction

This is the first phase of inhalation sedation of the equimolar mixture of oxygen and nitrous oxide. This is to "get" the patient into sedation. Verbal support by caregivers is necessary (Figure 3).

The different steps are as follows:

- Setting up the pulse oximeter
- Opening the bottle
- The flowmeter is open and adjusted according to the physiological parameters of the patient
- The mask is placed tightly and the patient is breathing normally [2].

Flow is a function of age and respiratory rate. This is usually 4l / min for young children and 6 to 12l / min for older children. The flow rate is modulated according to the filling of the tank-tank. In case of severe stress, patient ventilation increases and MEOPA flow must be increased. The reference is the balloon that inflates and deflates regularly. The balloon should never be flattened at the end of an inspiration. Indeed it would mean that the inhaled volume is not enough. It is exceptional to go up to 15l / min.

Efficacy is reflected in an objective relaxation of the patient, the effects felt as tingling extremities, paresthesia perioral.

A nasal or nasobuccal mask can be used, depending on the patient's ventilation mode. The mask is held in place by an operative aid and without constraint. It must be said that the patient himself can hold the mask when he is able. Induction takes about three to five minutes [4, 6] (Figure 3).

Realization of the act

After three minutes of inhalation the patient is invited to open his mouth to begin the act of care itself. The act of care can be performed in a conventional manner (continuously) if a nasal mask is used and provided that the patient keeps a nasal breath. For intermittent periods (from thirty to sixty seconds) [4] when using a nasobuccal mask, the mask is then mounted on the nose and pinched to maintain a good seal (Figure 4) and the act of care must be periodically interrupted to replace the mask and allow the patient to inhale the gas correctly.

During the inhalation of the gas, it is important to maintain a verbal and visual contact with the patient to check his level of consciousness.

Moreover, for optimal monitoring of the patient, other elements must be taken into account

- Observation of the ventilator rhythm
- Maintaining physical contact
- The appearance and color of the skin
- Assessment of the state of sedation (the patient must not doze and must be able to respond to the request)
- General condition of the patient (pallor, heat ...)
- Occurrence of sweating or onset of nausea [1].
- Once the act is finished, the inhalation must be stopped. The bottle is closed after gradual decrease in flow, then the mask is removed (Figure 4).

After the gesture

At the end of the session we must make sure that the patient recovers his initial behavior, he must remain in a lying position or sitting on the chair for a few minutes so that the effects of the gas dissipate and that his behavior becomes normal again. It is important to evaluate the patient's saturation on a scale of value such as that of Venham (Table I), prompting the child to explain how he felt [11]. (Table I).

Interests in the use of sedation by inhalation of MEOPA in pediatric odontology

Our experience has allowed us to note the many benefits of MEOPA conscious sedation in pediatric odontology. The protocol is simple and easy to perform.

However, a qualifying training, regularly updated, is essential to the implementation of this technique. It allows effective analgesia in most cases, as confirmed by several studies [1, 5, 6]

It is beneficial for children whose cooperative survival is insufficient to enable diagnosis, prevention or dental treatment. Namely, young children, phobic or anxious children, children with disabilities such as autistic, trisomic 21, encephalopathic, mentally deficient, brain motor deficient, polyhandicaps in whom cognitive disorders and behavioral disorders encountered are often a problem. Hinders the smooth running of care.

The induction time is short with a return to the initial state immediately upon stopping the inhalation. During sedation, the patient is conscious, he is "awake"; verbal contact can and should be kept with him. This method leads to good patient cooperation.

Inhaling MEOPA can help manage anxiety, reduce the importance of nausea reflexes, and thus provide better care. Thus the realization of simple and punctual acts, conservative care, surgical gestures, intra-oral pictures and prostheses becomes possible. This will reduce the indications of interventions under general anesthesia. Its realization does not require in any way the presence of an anesthetist. This considerably reduces the cost of the related charges, contrary to the general anesthesia which requires hospitalization and operative supervision for the recovery of the patient. MEOPA conscious sedation simplifies the cumbersome management of patients under general anesthesia.

Inhalation can reduce the uncontrolled movements of the cerebral palsy; also help the child to overcome the difficult stage of local anesthesia through surface analgesia produced which reduces the painfulness of the injection.

Moreover, this sedation method makes it possible to reduce the risk of occurrence of seizures in the care of at-risk patients such as asthmatic, epileptic, anxio-phobic patients. An adapted treatment under MEOPA can thus allow the progressive return of these patients towards the realization of the care without sedation.

The mixture is also very useful for children without immediate dental experience in the event of dental trauma or infectious problems. Adverse effects are rare and reversible. They are minor in view of the importance of the benefits [1, 5, 9].

The use of MEOPA in university-hospital centers in Africa could be beneficial for the care of young children and children with disabilities, as their needs for oral health care are considerable and require

appropriate infrastructures such as than those related to the use of conscious sedation.

However, MEOPA inhalation sedation has a low success rate in children younger than three years because the minimum effective alveolar concentration is greater than that of older children; moreover, the immaturity of certain receptors does not make it possible to obtain the desired sedative effect. We can observe paradoxical effects as with some molecules used in premedication (Atarax® ...).

Many patients with disabilities are oral ventilators, so use nasal masks at home. Nevertheless, the acceptance of the mask may be an important limitation for this type of sedation in young patients, especially those with disabilities [7,12].

CONCLUSION

Conscious sedation by inhalation of an equimolar mixture of oxygen and nitrous oxide is a safe and effective technique that can bring appreciable help to the practitioner who implements it. It represents an interesting alternative to general anesthesia.

Because of its effectiveness, its ease of use, its rapidity of action, its rare or reversible contraindications, MEOPA must now be part of the therapeutic arsenal of our university-hospital centers, but on the condition of properly controlling its administration and to respect the usual contraindications. As a result, it will be of great interest to meet the need for important oral health care for young children, phobic or anxious children, children with disabilities and children at risk who are more easily educated to our hospital-university structures. Thus conscious sedation by MEOPA could help to advance pediatric odontology in Africa.

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