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## Evaluation of nitrous oxide inhalation sedation during inferior alveolar block administration in children aged 7-10 years

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### Abstract

**Background:** To evaluate the nitrous oxide- oxygen inhalation sedation during inferior alveolar block administration in children.

**Materials & Methods:** A total of 50 children of age 7-10 years, with a treatment plan of extraction of primary teeth were enrolled in the study. They were divided into 2 groups as N<sub>2</sub>O-O<sub>2</sub> and oxygen. Those who presented with clinical conditions contraindicating the use of N<sub>2</sub>O-O<sub>2</sub> or having known allergy to lignocaine were excluded from the study. Data was collected and result was analysed using SPSS software. The level of significance was at  $p \leq 0.05$ .

**Results:** A total of 50 children were enrolled, 25 in each group. There was a significantly lower pain reaction to local anesthetic administration in the N<sub>2</sub>O-O<sub>2</sub> group ( $p < 0.01$ ). Scoring was done. In O<sub>2</sub> administered patients, 84% were in deep sedation during and even after the procedure. In N<sub>2</sub>O-O<sub>2</sub>, 32% patients were in light sedation after the procedure whereas 20% were in light sedation during the procedure.

**Conclusion:** N<sub>2</sub>O-O<sub>2</sub> inhalation showed better results as vital signs were normal and treatment completed successfully.

**Keywords:** Sedation, children, nitrous oxide

### Introduction

Effective local anesthesia is a basic principle of dentistry. One of the most used local anesthetic techniques, the inferior alveolar nerve block (IANB), does not always result in successful pulpal anesthesia. Failure rates for pulpal anesthesia after an IANB have been reported to be between 10–39% in asymptomatic subjects [1]. Previous investigations have evaluated various approaches to help improve the success of pulpal anesthesia following an IANB, including increased anesthetic volumes, addition of buffering agents, and orally administered anxiolytics, all with limited success [2,3].

Use of nitrous oxide in combination with other inhalational agents provides an additive anesthetic action since the minimum alveolar concentration of nitrous oxide is directly additive to theirs. Nitrous oxide in 60%-70% concentration equals a minimum alveolar concentration value of around 0.55-0.65 [4]. It accelerates the time of anesthetic induction when used in conjunction with poorly soluble inhalational agents. Nitrous oxide as a component of anesthesia has shown to reduce the utilization of inhalational agents, propofol, and opioids [5]. During inhalational induction with mask in children, high concentration of nitrous oxide facilitates a faster loss of consciousness by concentration effect and second gas effect. The use of nitrous oxide during induction has proven to increase the mask acceptance in children and lower incidence of airway related complications. However, nitrous oxide favors the incidence of excitatory phenomena with sevoflurane during inhalational induction. It has been seen that adding up nitrous oxide to other inhalational anesthetic agents decreases the occurrence of hemodynamic suppression as compared to use of equipotent doses of volatile agents alone [6].

Nitrous oxide-oxygen sedation is the standard sedative technique recommended by the Council of European Dentists. Nitrous oxide exerts its analgesic and anxiolytic properties by causing depression in the central nervous system [7].

It has a rapid induction and recovery. However, it is a technique sensitive procedure, as it depends on the patient's acceptance of the mask. Continuous administration of the agent is required throughout the procedure making the treatment difficult in fearful children [8]. Hence, this study was conducted to evaluate the nitrous oxide- oxygen inhalation sedation during inferior alveolar block administration in children.

### Materials & Methods

A total of 50 children of age 7- 10 years, with a treatment plan of extraction of primary teeth were enrolled in the study. They were divided into 2 groups as N<sub>2</sub>O-O<sub>2</sub> and oxygen. Those who presented with clinical conditions contraindicating the use of N<sub>2</sub>O-O<sub>2</sub> or having known allergy to lignocaine were excluded from the study. Consent was taken from parents of the children. The baseline physiological signs such as pulse rate,

O<sub>2</sub> saturation, BP, respiratory rate, oral temperature, and anxiety were recorded. Data was collected and result was analysed using SPSS software. The level of significance was at  $p \leq 0.05$ .

### Results

A total of 50 children were enrolled, 25 in each group. There was a significantly lower pain reaction to local anesthetic administration in the N<sub>2</sub>O-O<sub>2</sub> group ( $p < 0.01$ ). Scoring was done. In O<sub>2</sub> administrated patients, 84% were in deep sedation during and even after the procedure. In N<sub>2</sub>O-O<sub>2</sub>, 32% patients were in light sedation after the procedure whereas 20% were in light sedation during the procedure. 64% of subjects after procedure were in moderate sedation with N<sub>2</sub>O-O<sub>2</sub>. Improvement in the behaviour of the children belonging to N<sub>2</sub>O-O<sub>2</sub> group during and after the procedure as compared to the O<sub>2</sub> group ( $p < 0.01$ ) was observed.

**Table 1:** Sedation scale

Score	Interpretation
1	Unconscious
2	Deep sedation
3	Moderate sedation
4	Light sedation
5	Alert

**Table 2:** local anesthesia and behaviour recording

Behaviour rating	N <sub>2</sub> O-O <sub>2</sub> (n=25)		Oxygen (n= 25)	
	During procedure	After procedure	During procedure	After procedure
Rating 2	2 (8%)	1 (4%)	21 (84%)	21 (84%)
Rating 3	18 (72%)	16 (64%)	4 (16%)	4 (16%)
Rating 4	5(20%)	8 (32%)	0 (0%)	0 (0%)

### Discussion

Nitrous oxide-oxygen (N<sub>2</sub>O-O<sub>2</sub>) inhalation sedation has been recognized as a safe and effective technique to reduce anxiety, produce analgesia, and enhance effective communication between a patient and a health-care provider [9]. It has gained reputation as the most popular mode of sedation over other modalities. N<sub>2</sub>O is a nonirritating, colorless, inert gas with a faint sweet smell and odor. It is an effective analgesic/anxiolytic agent which causes central nervous system depression and euphoria with little effect on the respiratory system [10, 11]. N<sub>2</sub>O-O<sub>2</sub> inhalation sedation is one of the most common pharmacological means of behavioral modification advocated in children and anxious adults owing to its unique properties such as high efficiency, potency, fast onset, rapid recovery, and least adverse effects [8]. Hence, this study was conducted to evaluate the nitrous oxide- oxygen inhalation sedation during inferior alveolar block administration in children.

In the present study, a total of 50 children were enrolled, 25 in each group. There was a significantly lower pain reaction to local anesthetic administration in the N<sub>2</sub>O-O<sub>2</sub> group ( $p < 0.01$ ). Scoring was done. In O<sub>2</sub> administrated patients, 84% were in deep sedation during and even after the procedure. In N<sub>2</sub>O-O<sub>2</sub>, 32% patients were in light sedation after the procedure whereas 20% were in light sedation during the procedure. A study by Takkar D *et al.* studied to use N<sub>2</sub>O-O<sub>2</sub> alone, to evaluate its effectiveness for pain control during inferior alveolar nerve block administration in children. There was a single-centered, simple randomized, double-blinded, placebo-controlled parallel-group study involving 40 children in the age group of 7-10 years divided into 2 groups: N<sub>2</sub>O-O<sub>2</sub>

sedation and oxygen. There was a significantly lower pain reaction to local anesthetic administration in the N<sub>2</sub>O-O<sub>2</sub> group ( $p < 0.01$ ). All the vital signs recorded were in the normal physiologic limits in both the groups. Pain experienced by children receiving N<sub>2</sub>O-O<sub>2</sub> sedation was significantly lower. N<sub>2</sub>O-O<sub>2</sub> inhalation sedation produces adequate sedation with vital signs within normal limits and treatments successfully completed [12].

In the present study, 64% of subjects after procedure were in moderate sedation with N<sub>2</sub>O-O<sub>2</sub>. Improvement in the behaviour of the children belonging to N<sub>2</sub>O-O<sub>2</sub> group during and after the procedure as compared to the O<sub>2</sub> group ( $p < 0.01$ ) was observed. Another study by Olsen A *et al.* 311 procedures were performed with nitrous oxide in 238 patients aged 4-17 years. Age, sex, type and duration of procedure, any supplementary medications, complications and whether the procedure would previously have required general anaesthesia, were recorded in a form. The child rated the effectiveness of nitrous oxide using a graded age-appropriate 10-point pain scale, and the nurse rated it as good, moderate or none. The children reported a median pain score of 2/10 (interquartile range 0-4), and nurses rated effectiveness as good in 247 of 304 (81%) cases. For 43% of procedures, the nurse felt that general anaesthesia would have been necessary had the department not had access to nitrous oxide. Adverse effects, most often dizziness, were reported in 110 of 311 procedures (35%). In 7 of 311 procedures (2%), the patient experienced adverse effects that resulted in stoppage of the procedure. The procedure was completed in 286 (92%) children [13].

**Conclusion**

N<sub>2</sub>O- O<sub>2</sub> inhalation showed better results as vital signs were normal and treatment completed successfully.

**Conflict of Interest**

Not available

**Financial Support**

Not available

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