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RESEARCH ARTICLE

COMPARISON OF EFFICACY OF NITROUS OXIDE INHALATION SEDATION AND OXYGEN INHALATION SEDATION DURING ADMINISTRATION OF INFERIOR ALVEOLAR NERVE BLOCK IN PAEDIATRIC PATIENT AGED 7-10 YEARS: A RANDOMISED DOUBLE BLIND CONTROL STUDY

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ABSTRACT

Aim: The purpose of our study was to compare the efficacy of nitrous oxide and oxygen inhalation sedation for pain control during inferior alveolar nerve block administration in children.
Design: In this randomized, double-blinded, parallel-group study, 40 children in theage group of 7-10 years divided into 2 groups: GroupA (Nitrous oxide sedation) and Group B (oxygen). Pain perception for local anesthesia was assessed using face, legs, activity, cry, consolability scale. Children's behaviour was assessed using Frankl ratings, depth of sedationusing Observer's Assessment of Alertness/Sedationscale. The vital signs and oxygen saturation were recorded.
Results: There was a statistically significant lowerpain reaction in nitrous oxide group during administration of nerve block ($P < 0.01$). Improvement in thebehavior of the children belonging to nitrous oxide groupduring and after the procedure as compared to the oxygen group ($P < 0.01$) was also observed.
Conclusion: Nitrous oxide inhalation produces adequate sedation with vital signs within normal limits and treatments successfully completed.

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INTRODUCTION

Nonpharmacological behavior management techniques are routinely used to create an environment wherein the dentist can carry out dental procedures easily by winning the confidence of the child patient. However, in case of very fearful or anxious children, these techniques may not be sufficient. In such scenario conscious sedation may prove to be a helpful tool (Folayan *et al.,* 2002). Use of pharmacological behavior management techniques such as nitrous oxide (N_2O) consciousse dation coupled with local anesthesia when requiredthe foundation of the delivery of pain-free dentistry to children (Hosey, 2002). But the administration of local anesthesia itself is potentially the most anxious aspect of the dental procedure for the child (Roberts and Hosey, 2005). Administration of local anesthesia often leads to high anxiety and uncooperative behavior in children. Nerve Block anesthesia is known to be more painful andleast accepted by children. Dentists have always been on the lookout to make this difficult procedure more comfortable for the child. WAND (Gibson *et al.,* 2000), 30 gauge needles (Ram *et al.,* 2007), two stage injections (Fayle *et al.,* 2002) have all been attempts in this direction. It is a well-known fact that N_2O–O_2 sedation is an excellent adjunct to lessen anxiety and pain.A combination of nitrous oxide with oxygen (N_2O–O_2) has been successfully employed by the profession to manage anxious children. Nitrous oxide-oxygen (O_2) was frequently used incombination with many drugs such as chloral hydrate, hydroxyzine, midazolam (Lindsay, 1980). The purpose of our study was to use N_2O-O_2 to evaluate its effectiveness for pain control during inferior alveolar nerve block administration in children.

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MATERIALS AND METHODS

In this randomized, double-blinded, placebo-controlled parallel-group study, the sample size was calculated using the formula which yielded power of0.90 at 95% confidence level. Thirty children in the age group of 7-10 years were selected

after screening for the following inclusion and exclusion criteria:

Inclusion criteria

The inclusion criteria were as follows:

- Dental treatment to be done under inferior nerve block anesthesia
- Subjects who belong to Frankl 2 and 3 rating during examination process
- Subjects belong to American Society of Anesthesiologists 1 category
- Subjects' whose parents/ guardians were willing to give written informed consent

Exclusion criteria

Exclusion criteria were as follows:

- Clinical condition contraindicating the use of N_2O-O_2
- Subjects with known allergy to lignocaine.

Randomization

Subjects were randomly allocated into two Groups- A and B using the chit-pick box method. Group A (n =15) were given N_2O-O_2 sedation and Group B (n=15) only oxygen as placebo. This was a double blinded blinded study whose duration was six months.

METHODS

A thorough extra- and intra-oralphysical examination with special focus on airway was done. Before commencing the sedation process, child's behavior was again determined using Frankl scale (Wright, 1975). The vital signsand oxygen saturation were evaluated and noted prior to the dental treatment. The technique (Clark, 2010; Malamed and Clark, 2003) was described to the patient as perthe child's level of understanding using euphemisms. Sedation was carried out by Specialist and Experienced physician. During sedation, constant communication with the child including physical, visual and verbal contact was maintained. Once the objective signs of sedation were observed the child was questioned as to how he or she was feeling. Depending on child's response, it was concluded if the ideal level of clinical sedationwas achieved or not. Following successful sedation, inferior alveolar nerve block was administered. Post administration of local anesthesia, child's behaviour was assessed using face, legs, activity, cry, consolability (FLACC) (Merkel *et al.,* 1997) scale. The depth ofsedation was assessed using Observer's Assessment ofAlertness/Sedation (OAA/S) scale (Chernik *et al.,* 1990). The obtained data were compiled systematically and analyzed using SPSS for Windows release 19.0.The level of significance waskept at $P < 0.05$.

RESULTS

Of 30 children involved in study, 18 (60%) were females, 12 (40%) were males. The duration of local anesthesia administration of ranged from 9 to 15 min dependingon the behavior management and requirement of sedation for each child. Behavior recording, OAA/S, FLACC scale during the procedure is given in Table 1.

Table 1. Behavior recording, OAA/S, FLACC scale during the procedure

Parameters observed	Group A	Group B
FLACC Scale Scoring		
Score O	5	1
Score 1-3	7	3
Score 4-6	1	9
Score 7-10	2	2
OAA/S Scale Scoring		
Score 5	2	11
Score 4	8	2
Score 3	4	1
Score 2	1	1
Score 1		

DISCUSSION

The present study examined the effect of N2O-O2on the behavior pattern, level of sedation attained and pain experienced by children during dental procedures. Children between 7 and 10 years of agewere chosen for the study because at this age they can understand the verbal explanation given to them regarding enrollment to the study. Total of 12 malesand 18 females subjects were part of the study. Gender is not known to influence subjective response to N_2O sedation (Zacny and Jun, 2010). Many studies in literature on N_2O–O_2 sedation have used various visual analogue scales in which children rate their pain at the end of the procedure (Blain, 1998; Crawford, 1990). But, this can be unreliable and inconsistent in children especially after an episode of sedation. In this study an FLACC scale was used to observe the children's behaviour by an independent observer to eliminate this bias. Though the relaxed behaviour of the children in group A can easily be attributed to the anti-anxiety and analgesic properties of Nitrous oxide (Holroyd and Roberts, 2000), the important clinical implication of the study is that, inhalation sedation with N_2O–O_2 could be ideally used in children during the stressful episode of local anasthetic administration to prevent their potential deterioration of behaviour instead of using it as an advanced behaviour management tool in combination with other sedative agents to correct already deteriorated behaviour. No adverse events occurred in our study. The safety of this technique lies in the ability to titrate N_2O to the desired concentration.Many studies focus on the use of N_2O-O_2 in combination with other agents justifying that theoutcome is better. A study by (Fukuta *et al*., 1994) found better patient compliance to wear the nasal hoodin children who were given N_2O⁄O_2 subsequent to intranasal administration of midazolam. But in the present study, all the children accepted the hoodafter appropriate non-pharmacological behaviour management technique.

Conclusion

Reaction of the children receiving nitrous oxide sedation was significantly lower than children who received oxygen alone during the administration of the Inferior Alveolar Nerve Block.

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