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Effect of Nitrous oxide-Oxygen Conscious Sedation on the Reaction of Children towards an Inferior Alveolar Nerve Block – A Preliminary Investigation.

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ABSTRACT

The administration of local anesthesiais potentially the most anxious aspect of the dental procedure for children. A comfortable local anasthetic experience can lay the foundation for the development of a positive attitude towards dental treatment. Though, it is a well-known fact thatNitrous oxide-Oxygen(N_2O–O_2)sedation is an excellent adjunct to lessen anxiety and pain, very few studies have specifically evaluated its efficacy as a supplementary aid to the comfortable administration of local anesthesia in children. Hence the purpose of the study was to assess reaction of children on receiving an inferior alveolar nerve block (IANB) underN_2O–O_2inhalational sedation vs. an oxygen placebo. The study design is parallel, randomised, double blind.20 children were divided into two groups. Children in Group A were administered N_2O–O_2 and children in Group B were administered an-oxygen placebo. An IANB was administered to the children for the required dental procedure in both the groups. The observations were recorded by a blinded observer using the Face Legs Activity Cry Consolability (FLACC) behavioral pain assessment scale. The data was analysed using the Chi–Square test.As evaluated by the FLACC scale, 80% of the children in Group A were 'Relaxed' and 20% showed 'Mild discomfort'. In Group B, 30% of the children had 'Moderate pain' and 70% of the children had 'severe discomfort'. The difference between Group A and Group B was statistically significant. ($P \leq 0.05$). Reaction of childrenunder N_2O –O_2 sedation, to the IANB was significantly lower compared to children administered with only oxygen.

Keywords: Nitrous Oxide Oxygen, Inferior alveolar nerve block, Children, pain reaction.

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INTRODUCTION

The administration of local anesthesia is potentially the most anxious aspect of the dental procedure for the child [1]. Dentists have always been on the lookout to make this difficult procedure more comfortable for the child. WAND[2], 30 gauge needles [3], two stage injections[4] have all been attempts in this direction.

A combination of nitrous oxide with oxygen (N_2O–O_2) has been successfully employed by the profession to manage anxious children [5]. It is a well-known fact that N2O–O2 sedation is an excellent adjunct to lessen anxiety and pain. But very few studies have specifically evaluated its efficacy as a supplementary aid to the comfortable administration of local anesthesia in children.

So, the purpose of this study was to assess the effect of inhalational sedation with N_2O–O_2 on the reaction of children to an Inferior Alveolar Nerve Block (IANB).

METHODS

This study was conducted after obtaining approval from the Institutional Ethical Committee. (Protocol reference no.11014) The study involved three investigators: a sedationist (*In this study, a trained Paedodontist*), an operating Dentist and a blinded observer who was not aware of the study design or purpose and with no expertise in the domain of Nitrous oxide Oxygen conscious sedation.

Inclusion criteria included

- American Society of Anaesthesiologists (ASA) 1 children.
- No previous visits to a Dentist.
- Frankl behavior rating score at the initial examination: Frankl's 3 (Classified as "*Positive*")
- Requiring the administration of an IANB for a dental procedure.

Children who did not accept the nose mask were excluded from the study.Characteristics of the study group are described in Table 1.

The Sample size was calculated with cumulative distribution function using SAS. The two sample t test was used to estimate the sample size of the experimental group and the control group that are of an equal size. The desired significance level was 0.05 and effect (Cohen'sd) size was 0.56[6].

A subject information sheet describing the procedure was given to the parents by a Dentist ***not involved*** in the study, but with training in the field of N_2O–O_2 sedation. Informed consent was obtained from parents allowing their children to participate in the study. Children were randomly categorised into two groups of ten each with the toss of a coin. Children in Group A received N_2O–O_2 sedation and children in Group B received Oxygen placebo. Null hypothesis was obtained between the study groups suggesting absence of difference in the children's reaction to the inferior alveolar nerve block. The reaction to the inferior alveolar nerve block under N2O – O2 or O2 placebo was evaluated using the Face Legs Activity Cry Consolability (FLACC) scale[7](Table 2). The observer was trained and tested for reliability in the use of the FLACC scale prior to the start of the study.

For children in Group A receiving N2O-O2 inhalational sedation (Quantiflex MDM Matrix) the following procedure was followed. The appropriate sized nose mask was introduced using the Tell Show Do protocol[8]. An adequate flow rate of oxygen was established for each child after the pulseoximeter was attached. The reservoir bag was observed to adjust the flow rate for each individual child. The pulsation of the bag with each breath with neither over inflation or under inflation was the criteria to adjust the flow rate between 4-6 litres /minute. Each child was started with 10% N_2O and 90% O_2.This was followed by titration of nitrous oxide oxygen in 10% intervals till optimal sedation was achieved [9]

The adequacy of the sedation was based on the objective signs of the child like a decrease in the heart rate, decrease in the blink rate, reduced tone of the muscles, the child's relaxed expression and an overall comfortable demeanor of the child. The objective signs of relaxation like decreases in blink rate, muscle tonicity etc. were based on clinical observation compared to the preoperative observation, The decrease in

heart rate was observed from the pulseoximeter compared to the readings at the start of the procedure. The subjective signs were not used for assessment of the adequacy of sedation in order to avoid inconsistent responses from the children. In this study, this state of relaxation was obtained in the 30% to 45% range of N_2O concentration. Care was taken to see that the concentration of nitrous oxide did not exceed 50% as this has been associated with complications [10]

At this stage the child was explained about the sensations he/she would feel on receiving the IANB. The observer, blinded to the above process was now called in. Following this, a topical analgesic gel (Lidocaine 8% and Dibucaine 0.8% topical analgesic gel) was applied to the area to be injected and left on for four minutes. This was followed by the administration of an Inferior alveolar nerve block (Lignocaine 2% with 1:200000 Adrenaline) using a standardised technique[11] at the rate of 1ml/minute with continuous positive reinforcements by the operator. The IANB's were administered by the operator using one standard technique. The children in group B received only the oxygen placebo.

Once local anesthesia was administered, the inhalational agent was discontinued following a three minute administration of 100% oxygen to avoid diffusion hypoxia in Group A.

The data outcome of the study was analysed using SPSS (version 11.5) software. The observations were evaluated using Chi–Square test.

RESULTS

As evaluated by the FLACC scale, 80% of the children in Group A were 'Relaxed' and 20% showed 'Mild discomfort'. In Group B, 30% of the children had 'Moderate pain' and 70% of the children had 'severe discomfort'. (Table 3)The results were statistically significant between Group A and B (P value <0.05).Reaction of children in Group A receiving N_2O–O_2 sedation was significantly lower than that of Group B who received oxygen alone during the administration of the inferior alveolar nerve block which disproves the null hypothesis that nitrous oxide sedation had no effect on the reaction of children during the administration of an inferior alveolar block.

DISCUSSION

This study evaluated specifically, the efficacy of N_2O–O_2 sedation as a supplement to aid the administration of local anesthesia, comfortably to children. The inferior alveolar block was chosen in this study for uniform standardisation of the local analgesic procedure. Many studies in literature on N_2O–O_2 sedationhave used various visual analogue scales in which children rate their pain at the end of the procedure [12, 13]. .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 [14], 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.

The limitation of this study was that it assessed only the pain reaction in a small group of children to an inferior alveolar nerve block under the influence of N_2O–O_2 or oxygen placebo. The results of this study could be used as a pilot study for a further large scale study. Other variables like the effect of age, gender and data readings from the pulseoximeter were not evaluated in the study.

CONCLUSION

Reaction of the children receiving N_2O–O_2 sedation was significantly lower than children who received oxygen alone during the administration of the IANB.

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