

NITROUS OXIDE/OXYGEN CONSCIOUS SEDATION IN ASA CLASS II DENTAL PATIENTS – PART 1

Liviu Ioan Tuturici¹, Octavian Dincă², Cristina Pădurariu², Tiberiu Niță², Cristian Vlădan², Alexandru Bucur³

1 PhD student "Carol Davila" U.M.Ph. - București, Romania, Department of OMF Surgery

2 "Carol Davila" U.M.Ph. - București, Romania, Department of OMF Surgery

3 "Carol Davila" U.M.Ph. - București, Romania, Faculty of Dentistry, Head of Department of OMF Surgery

Corresponding author: alexandru.bucur@umfcd.ro

ABSTRACT

Aim of the study

The use of nitrous oxide/oxygen conscious sedation in American Society of Anesthesiologists (ASA) II dental patients has been regarded as controversial. The aim of this study was to investigate cardiovascular effects of nitrous oxide-oxygen mixture conscious sedation in ASA II patients undergoing tooth extraction.

Material and methods

The purpose of this study was to determine differences in heart rate (HR) and blood pressure (BP), comparing nitrous oxide/oxygen with no sedation in a sample of ASA II patients. Physiologic parameters measured were heart and respiratory rate, systolic and diastolic blood pressure and oxygen saturation. Categorical data are summarized as percentages, and differences between groups were tested using Stata/IC 16 software (StataCorp). Ethical approval from the local institutional ethics committee was obtained for this study.

Results Results did not indicate differences for any physiologic parameters, including heart rate and diastolic blood pressure. Significant differences across procedures were found for systolic blood pressure.

Conclusions Although the effects of nitrous oxide/oxygen may not be statistically significant, generally it produces an attenuation in physiological responses as measured under the conditions of this study in ASA II patients.

Keywords: Nitrous oxide. Conscious sedation. ASA II

INTRODUCTION

Conscious sedation is a technique in which the use of a drug produces a state of depression of the central nervous system enabling dental treatment to be carried out, but during which communication with the patient is maintained throughout the period of procedure. The level of sedation must be such that the patient remains conscious, retains protective reflexes, and is able to respond to verbal commands [1].

Previous data evaluating the use of nitrous oxide in dental patients is relatively sparse.

The efficacy of conscious sedation with nitrous oxide/oxygen in dental treatment has been studied only on ASA Class II [2] groups of children and adults and not solely adult subjects or disabled patients [3,4].

Tus, the aim of this study was to investigate the effectiveness and the tolerability of the nitrous oxide/oxygen sedation during tooth extraction on a large ASA Class II sample constituting adult patients with low pain tolerance and/or dental phobia as a method for providing high quality treatment.

MATERIAL AND METHODS

This was a 6-month prospective study, which included a total of 114 consecutive adult ASA II patients referred by general dentists for tooth extraction at the Clinic of Oral and Maxillofacial Surgery, Carol Davila University Bucharest - Hospital of Oral and Maxillofacial Surgery.

All patients in the study had no previous operative dental experience under conscious sedation. Also, all subjects met the requirements of the ASA Class II anesthesia risk. Exclusion criteria were severe pulmonary disease and severe emotional disturbances.

All 114 patients accepted the assessment for inclusion in the study. Fifty-four patients were included in the Study group that choosed to receive nitrous oxide/oxygen inhalation sedation; the Control group consisted of the 60 patients unwilling to be sedated.

All subjects received plexal anesthesia using two shots of 1.8 mL of 4% articaine HCl with 1:200.000 epinephrine.

For the first group, at the start of procedure, 100% oxygen was delivered via a flavored nasal mask for 2 to 3 minutes and then nitrous oxide, from a concentration of 20%, was titrated in 5–10% increments to the maximum desired level for each patient by an appropriately trained dentist trained in sedation techniques and holding the "Certificate of complementary studies in Inhalosedation by inhalation mixture with nitrous oxide and oxygen in Dental Medicine", with the aid of of an Intensive Care specialist, until adequate sedation was achieved. A flow rate of 6 L/min was generally used.

Nitrous oxide/oxygen sedation was administered using a relative analgesia machine, which is subject to periodical calibration and servicing.

Once the maximum desired level of nitrous oxide had been reached, it was continued

throughout the subsequent dental treatment. When the treatment was complete, the nitrous oxide flow was switched off and oxygen 100% administered for 3-5 min.

At the completion of the dental treatment, the patient was transferred to recovery room where monitoring continued; they were supervised by an Intensive Care nurse. The patient remained in recovery for 20 min.

The following physiologic parameters and outcome measures were used: baseline weight, blood pressure, pulse, ventilatory frequency, and oxygen saturation were recorded immediately before the administration of Nitrous oxide/oxygen sedation (first group) or oxygen only (second group). The blood pressure, pulse rate, ventilatory frequency and oxygen saturation were monitored continuously throughout treatment and the data recorded every 5 min intervals. The sedation level was also recorded every 5 min.

Data were entered onto an Worksheet file and analysed using using Stata/IC 16 software (StataCorp). Statistical significance was defined by a 2-sided $p \leq 0.05$. The study was approved by the Committee of the Ethics of the Hospital of Oral and Maxillofacial Surgery, Bucharest. Informed consent was obtained from each patient.

RESULTS AND DISCUSSIONS

The Study group consisted of 54 patients, of which 30 (55.56%) were men. The mean age was 65.02 years (+/- 15.97; range 20-89). The average waist was 167.54 cm (+/- 10.28; range 145-191), and the average body mass was 78.89 kg (+/- 15.19; interval 50-109).

The Control group consisted of 60 patients, of which 28 (46.67%) were men. The mean age was 65.43 years (+/- 13.45; range 27-86).

The average height was 164.32 cm (+/- 9.43; range 137-185), and the average body mass was 73.6 kg (+/- 16.3; range 40-110). There were no statistically significant differences between the two groups and for demographic characteristics and physical assessments ($p \geq 0.05$).

In the Study group, significant differences were observed on the decreasing heart rate following Nitrous oxide/oxygen sedation ($p < 0.0001$; t-test for 2 dependent samples) (Table I).

Table I. Variations in Heart rate, Systolic blood pressure and Diastolic blood pressure in the Study group

Variable	Mean	Standard Deviation	Interval
Heart rate pre-operative	75.68	9.01	64-98
Heart rate post-operative	70.28	7.31	60-90
Systolic blood pressure pre-operative	153.29	15.76	121-191
Systolic blood pressure post-operative	140.75	12.86	114-180
Diastolic blood pressure pre-operative	87.79	8.79	61-102
Diastolic blood pressure post-operative	84.95	7.81	65-98

There was a significant difference for decreasing of the value of both Systolic blood pressure ($p < 0.001$; t-test for 2 dependent samples) and Diastolic blood pressure ($p = 0.001$; t-test for 2 dependent samples) (Table I).

In the Control group, significant differences were observed on the decreasing heart rate following Nitrous oxide/oxygen sedation ($p < 0.0001$; t-test for 2 dependent samples) (Table II).

Table II. Variations in Heart rate, Systolic blood pressure and Diastolic blood pressure in the Control group

Variable	Mean	Standard Deviation	Interval
Heart rate pre-operative	75.3	7.63	62-98
Heart rate post-operative	71.6	7.58	58-90

Systolic pressure operator	blood pre-	140.03	13.61	110-182
Systolic pressure operator	blood post-	134.47	10.43	106-156
Diastolic pressure operator	blood pre-	85.17	8.65	63-108
Diastolic pressure operator	blood post-	84.08	8.38	60-97

In the same group, there was a significant difference for decreasing of the value of the Systolic blood pressure ($p < 0.001$; t-test for 2 dependent samples) (Table II).

No significant difference in the Diastolic blood pressure decreasing was observed ($p = 0.05$; t-test for 2 dependent samples) (Table II).

Most studies on the cardiovascular effects of nitrous oxide alone would suggest that it exhibits a sympathomimetic action [5,6]. In our study, the decrease of heart rate following Nitrous oxide/oxygen sedation was higher than in the control group. Also, both Systolic and Diastolic blood pressure showed a similar tendency; it has been demonstrated that nitrous oxide reduces the decline in arterial pressure in healthy young adults [7]. However, the use of 100% oxygen in the control group may have contributed to cardiovascular changes, although oxygen alone has been shown to increase blood pressure [8].

As a sole agent, nitrous oxide has been shown to exert a peripheral vasoconstricting effect in healthy adults and animals [9-11]. Our results adds to the existing literature by demonstrating that nitrous oxide is unlikely to increase the risk major cardiovascular

complications in ASA Class II patients undergoing dental treatment. Our findings do not highlight any negative safety signals that would preclude the use of nitrous oxide in conscious sedation on current dental practice. There are important limitations to note with our study. Our findings should be viewed as specific to the selected patient population enrolled into the study and may not be extrapolated to all ASA Class II patients, particularly those undergoing tooth extraction. Also, although we did not find any significant associations between nitrous oxide use and physiologic parameters, a larger study of ASA class II dental patients would be required to confirm these results.

CONCLUSIONS

We found no evidence that conscious sedation with nitrous oxide/oxygen modified the physiologic parameters in ASA Class II patients undergoing tooth extraction. However, additional studies are required to assess the safety of nitrous oxide in ASA Class II dental patients.

Conflict of interest

The authors declare that they have no conflict of interest.

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