Exodontia of Third Molars in a Single Surgery Using Conscious Sedation in an Anxious Patient: Case Report

Exodontia de Terceiros Molares em Cirurgia Única Utilizando Sedação Consciente em Paciente Ansioso: Relato de Caso

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ABSTRACT

The conscious sedation performed by inhaling nitrous oxide gas (N2O) associated with oxygen gas (O2) provides an ideal analgesic and anxiolytic effect for patients who are insecure and anxious to undergo dental procedures. The aim of the present study is to report a clinical case of a single surgery to extract teeth 18, 28, 38, and 48 in an odontophobic patient who undergoes anxiety by using conscious sedation through the inhalation of nitrous oxide gas diluted in oxygen gas. The patient achieved a state of deep relaxation during sedation, with a decrease in his initial heart rate, high oxygen saturation, and low intraoperative bleeding. The authors concluded that conscious sedation using nitrous oxide is an important ally in oral surgeries for anxious patients.

Keywords: Nitrous Oxide; Conscious Sedation; Anxiety; Pharmacology; Anesthesia.
RESUMO

A sedação consciente feita a partir da inalação do gás óxido nitroso (N2O), associado ao gás oxigênio (O2), proporciona efeito analgésico e ansiolítico ideal para pacientes inseguros e ansiosos em submeter-se a procedimentos odontológicos. O objetivo do presente estudo é relatar um caso clínico de cirurgia única de exodontia dos elementos 18, 28, 38 e 48 em paciente odontofóbico que sofre de ansiedade, utilizando a sedação consciente por meio da inalação do gás óxido nitroso diluído em gás oxigênio. O paciente alcançou estado de profundo relaxamento durante a sedação, com diminuição da sua frequência cardíaca inicial, alta saturação de oxigênio e baixo sangramento no transoperatório. Os autores concluíram que a sedação consciente com o uso do óxido nitroso é um importante aliado nas cirurgias orais em pacientes ansiosos.

Palavras-chave: Óxido Nitroso; Sedação Consciente; Ansiedade; Farmacologia; Anestesia.
INTRODUCTION

The American dentist Horace Wells (1815-1848) was a pioneer in the use of nitrous oxide (N2O) in dental procedures. Wells, currently considered the Father of Anesthesia, performed the first conscious sedation by inhaling nitrous oxide with the intention of undergoing a tooth extraction procedure, thus verifying the analgesic properties of N2O [13]. Since then, numerous studies have been conducted confirming the efficacy of nitrous oxide use in dentistry [2, 3 and 9]. The gas promotes the release of endorphins in greater quantities, a hormone that provides analgesic and anxiolytic effects, reducing heart rate and aiding in the control of patient stress and anxiety [22]. For nitrous oxide sedation to achieve the desired effect, it must be combined with oxygen (O2). The maximum dilution of 70% N2O to 30% O2 allows for the safe attainment of the desired titration level, promoting anxiolysis and mild analgesia during dental procedures [1 and 7]. Given that anxiety and dental phobia are recognized as significant barriers to seeking oral health care, patients afraid of undergoing dental procedures are strongly indicated for nitrous oxide-oxygen inhalation sedation [14, 16, 19 and 20]. Contraindications for the use of N2O in dentistry are few. Patients with upper respiratory tract infections, chronic obstructive pulmonary disease, and recent middle ear surgery or current infection should not undergo conscious sedation [2, 4 and 25]. Guidelines recommend initial introduction of 100% O2 at 6L/minute for 1 to 2 minutes, followed by N2O titration at 10% intervals [11 and 16]. It is imperative that the dose administered during sedation places the patient in a comfortable and conscious state. Once pleasant relaxation is achieved, nitrous oxide concentrations should not be increased. During the state of relaxation, it is common for the patient to experience paresthesia in the extremities of the upper and lower limbs [16]. Nitrous oxide is an inorganic inhalation agent that is colorless, sweet-smelling, and non-irritating to tissues [2]. Due to its low solubility in blood and tissues, the use of N2O/O2 sedation allows the patient to remain in a state of consciousness close to normalcy, remaining responsive to external stimuli. Its action is rapid, and consequently, its elimination is also rapid. Thus, the patient will be able to resume their daily tasks shortly after inhaling 100% oxygen for about 5 minutes [8 and 9].
LITERATURE REVIEW

Anxiety is characterized by physical and mental discomfort capable of altering behavioral and neurological characteristics in individuals. This state is induced by the development of traumas, fear, and stress [18], being manifested acutely or chronically. Anxiety is related to the activation of the autonomic nervous system (ANS), which can cause a change in nerve impulses affecting cardiac movements [18 and 22]. The ANS exerts control over the cardiovascular system through transmissions by nerves connected to the heart, utilizing information sent by baroreceptors, chemoreceptors, atrial and ventricular receptors, and processing and triggering modifications in various compensatory systems, such as alterations in the respiratory system, vasomotor system, renin-angiotensin-aldosterone system, and thermoregulatory system. The ANS is divided into the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS, when activated, is responsible for the fight or flight response, causing a cascade of hormonal and physiological responses as the body continues to perceive stimuli as a threat. In a state of anxiety, SNS activation occurs, and consequently, the individual's heart rate (HR) increases [24].

Cortisol is the primary glucocorticoid of the adrenal cortex, profoundly affecting the metabolism of glucose, proteins, and free fatty acids [4]. According to Wilmore and Costil, cortisol is capable of decreasing glucose utilization, saving it for the brain, acting as an anti-inflammatory agent, depressing immune reactions, and increasing vasoconstriction caused by adrenaline [17 and 18]. Cortisol is known as the "stress hormone" because it is released in larger quantities when an individual is in a state of intense disturbance and frustration [22 and 24]. The term "stress" was conceptualized by the Canadian endocrinologist Hans Selye in 1936, who defined stress as a general and nonspecific response of the organism to a stimulus or stressful situation. The physiological response to a stressful situation acts on the activation of the Hypothalamic-Pituitary-Adrenal (HPA) axis, promoting regulatory action on itself and on other systems, such as the immune system, which in this case has the ability to induce T cell apoptosis, suppress B cell antibody production, and ultimately reduce neutrophil migration during the inflammatory process, thus its imbalance can lead to various diseases [24]. According to Thau, Gandhi, and Sharma (2020), cortisol is capable of affecting the sympathetic nervous system [26]. When an individual is subjected to stressful conditions, the body
secretes a large amount of cortisol, which can lead to compromised mental health, thus developing symptoms of anxiety, depression, among others [26]. It is worth noting that, according to Gomaa et al. (2019), oral inflammatory actions have been associated with elevated cortisol levels, contributing to a pro-inflammatory state, which will increase the risk of periodontal inflammation.

Normal resting heart rate parameters for adults range from 60 to 100 beats per minute, with lower heart rate parameters generally implying efficient cardiac function and better cardiac output [6]. It should be noted that many factors can influence cardiac output, including: age, activity and exercise levels, smoking status, presence of cardiovascular diseases, high cholesterol or diabetes, ambient temperature, body position (standing or lying down), emotions, body size, and medications [15 and 21].

MATERIALS AND METHODS

This work is a clinical case report with a descriptive and qualitative approach, in which an anxious patient undergoes third molar extraction surgery using conscious sedation with nitrous oxide. Regarding ethical aspects, the risks and benefits of the procedure were informed through the Informed Consent Form (ICF), signed by the patient, also granting permission for the publication of data, photographs, and radiographs contained in the medical record for scientific publications or academic activities, agreeing with the international guidelines present in the Helsinki Declaration.

CASE REPORT

Male patient, 23 years old, attended a private dental clinic in Recife (PE) complaining of pain in the region of tooth 48 and presenting mild trismus. Upon clinical examination, pericoronitis was diagnosed. The patient was prescribed an anti-inflammatory, 100 mg nimesulide tablets, to be taken every 12 hours for 5 days, and an analgesic, 1 g metamizole (dipyrone) tablets, to be taken every 6 hours if needed for pain for 3 days, with the aim of resolving the acute phase. Subsequently, panoramic
radiography of the maxillae and cone beam computed tomography of the mandible were requested (Figures 1 and 2).

After resolution of symptoms, the patient returned to the clinic with the imaging exams and received a recommendation for extraction of the third molars. The patient then underwent preoperative laboratory tests, which were within normal limits. He reported being very anxious and insecure about the surgical procedure. In order to reassure him and to provide a more comfortable surgery for the patient, the dentist suggested the use of sedation with nitrous oxide, explaining the anxiolytic benefits it offers. Finally, the patient opted for conscious sedation.

Initially, the surgical plan aimed to extract only teeth 18 and 48. After 15 days, the patient was scheduled to return for extraction of teeth 28 and 38.

**Figure 1** – Figure 1 displays both the panoramic radiograph, detailing the dental elements to be extracted, and the Cone Beam Computed Tomography (CBCT) scan relevant to the case.

![Figure 1](image)

Source: Own authorship (2024).

On the scheduled date, preoperative medication was administered, dexamethasone 8 mg, 1 hour before the procedure. The patient's blood pressure, heart rate, and oxygen saturation were measured, showing the respective values, 157x96 mmHg, 122 bpm, indicating anxiety before the surgical procedure. Conscious sedation with oxygen release at 6L/minute for 5 minutes was initiated, followed by the release of nitrous oxide with an increment of 10% every minute. The patient was instructed to report signs of tingling in the upper and lower limbs, as well as feelings of relaxation and well-being. The desired state was achieved with a 60% N2O and 40% O2 mixture (Figure 2).
Figure 2 – The figure depicts both the patient’s blood pressure measurement, 157x96 mmHg using an (HEM-7320, OMRON Healthcare, Hoffman Estates, IL, United States of America) (left side), and their oxygen saturation at 99% (SpO2) and heart rate at 122 bpm (right side).

For better visualization, Figure 3 shows the nitrous oxide device used in the clinical procedure.

Figure 3 – The (Serena, Xdent Equipamentos Odontológicos LTDA., Ribeirão Preto, SP, Brazil) equipment was the device used in conscious sedation in this case.

It was decided to begin the surgery by performing the extraction of tooth 48, classified as class II, position B, according to Pell and Gregory. The surgical table was set up, and the operative field was prepared, followed by extra and intraoral antisepsis using 2% chlorhexidine digluconate. Local anesthesia was then administered by blocking the right inferior alveolar nerve, supplemented with infiltrative anesthesia using 2%
mepivacaine with 1:100,000 epinephrine (Mepiadre 100, DFL INDUSTRIA E COMERCIO S/A, Rio de Janeiro, RJ, Brazil). The patient did not complain of pain during anesthesia. Once the area was properly anesthetized, the gingival tissue around tooth 48 was dissected using a 9 Molt periosteal elevator (QD.935.18, Schobell Industrial Ltda., Rio Claro, SP, Brazil). Osteotomy was then performed using a Zekrya FG surgical drill (Dentsply Sirona, Bensheim, Hessen, Germany) in a high-speed handpiece with irrigation.

The tooth was luxated using Seldin elevator (QD.405.21, Schobell Industrial Ltda., Rio Claro, SP, Brazil) adapted to the mesial surface of the tooth, with movements in the mesio-distal direction. With complete luxation and extraction achieved, the alveolus was curetted, the bone was smoothed, and irrigation with 0.9% saline solution was performed. Passive tissue repositioning was carried out, followed by closure with a simple suture using 5-0 nylon thread (Ethilon, Ethicon Inc, Somerville, NJ, United States of America) (Figure 5).

**Figure 5** – Initiation of local anesthesia (top left). Osteotomy performed (top right). Luxation of tooth 48 (bottom left). Removal of tooth 48 (bottom right).

Source: Own authorship (2024).
For the extraction of tooth 18, which was already erupted, local anesthesia was also administered using 2% mepivacaine with 1:100,000 epinephrine (Mepiadre 100, DFL INDUSTRIA E COMERCIO S/A, Rio de Janeiro, RJ, Brazil), by blocking the right posterior superior alveolar nerve and supplemented with infiltrative anesthesia; only 1 cartridge of anesthetic was needed. Once again, the patient did not complain of pain during anesthesia. After analgesia, the gingival tissue around the tooth was dissected using a 9 Molt periosteal elevator (QD.935.18, Schobell Industrial Ltda., Rio Claro, SP, Brazil). As there was no need for osteotomy, the tooth was luxated using Seldin elevator (QD.405.21, Schobell Industrial Ltda., Rio Claro, SP, Brazil), followed by the same process of extraction, curettage, bone irrigation, and closure with a simple suture using 5-0 nylon thread (Ethilon, Ethicon Inc, Somerville, NJ, United States of America) (Figure 6).

Figure 6 – Initiation of the anesthetic technique (left side) and luxation of tooth 18 using Seldin elevator (QD.405.21, Schobell Industrial Ltda., Rio Claro, SP, Brazil) (right side).

The surgery lasted approximately 30 minutes, and throughout the procedure, the patient's heart rate and oxygen saturation were monitored. It was evident that the anxiolytic effect of N2O caused a decrease in the patient's heart rate, ranging from 90 bpm to 98 bpm during the sedation period. Meanwhile, oxygen saturation remained at 99% SpO2 and did not fluctuate. The patient, who continued to experience well-being and relaxation, was removed from nitrous oxide and asked whether they would like to conclude the surgical procedure or proceed with the extraction of teeth 28 and 38, completing the extraction of the third molars in a single procedure. The patient chose to
proceed with the extraction of the remaining teeth in a single surgery, and sedation was resumed (Figure 7).

Figure 7 – The heart rate reached its lowest level at 90 bpm during the procedure (left side). After entering a state of relaxation, the highest heart rate recorded was 98 bpm (right side).

Source: Own authorship (2024).

Continuing the surgical procedure, identical protocols as previously described were followed for the extraction of the left third molars. Tooth 38, also classified as class II, position B, as per Pell and Gregory's classification, received the same local anesthetic for the blockage of the left inferior alveolar nerve, supplemented with infiltrative anesthesia. The gingival tissue surrounding the tooth was dissected once more, and osteotomy was conducted using a Zekrya FG surgical drill (Dentsply Sirona, Bensheim, Hessen, Germany) in a high-speed handpiece with irrigation. Employing Seldin elevator (QD.405.20, Schobell Industrial Ltda., Rio Claro, SP, Brazil), the tooth was luxated following the same protocol. Following successful luxation and extraction, bone regularization, curettage, and alveolar irrigation were performed. Subsequently, closure was achieved through a simple suture utilizing 5-0 nylon thread (Ethilon, Ethicon Inc, Somerville, NJ, United States of America).

Tooth 28 was also erupted at the time of surgery. The same anesthetic protocol was applied, involving blocking of the left posterior superior alveolar nerve supplemented with infiltrative anesthesia. Following the gingival tissue displacement procedures, luxation maneuvers, extraction, alveolar socket preparation, and identical suturing as those performed on tooth 18, the surgery was concluded (Figure 8).
At the end of the sedation, the patient inhaled pure O2 for 5 minutes, before removing the mask and receiving instructions regarding post-operative care. The following medications were prescribed: amoxicillin 875 mg tablets to be taken every 12 hours for 7 days, nimesulide 100 mg tablets to be taken every 12 hours for 5 days, and 1 g metamizole (dipyrone) tablets to be taken every 6 hours as needed for pain for 3 days. Additionally, the patient was advised to use ice packs on both sides of the face intermittently for 48 hours and to rinse with 0.12% chlorhexidine (Periogard, Colgate-Palmolive Ind. Brasileira, Osasco, SP, Brazil) after meals for 7 days.

The patient returned for suture removal 10 days after the procedure and exhibited good recovery and immense satisfaction with the surgery.

DISCUSSION

Anxious and dentophobic patients often avoid seeking dental treatment due to fear of procedures performed by the dentist, as evidenced by [10, 14, 16 and 20]. The use of conscious sedation with nitrous oxide is of paramount importance in managing these patients in a dental setting, as demonstrated by [11, 15 and 20]. Current studies show that inhalation of nitrous oxide combined with oxygen produces analgesic and anxiolytic effects, reducing heart rate and aiding in stress and anxiety control safely. This promotes a deep state of relaxation in the patient, who remains conscious and responsive to external stimuli throughout the sedation, as presented by [1, 7, 8 and 9].
In the present case, the anxiolysis of conscious sedation was evidenced by the patient's decreased heart rate, initially at 122 bpm and ranging from 90 bpm to 98 bpm during N2O inhalation, in agreement with reports from [22]. In this case, the patient achieved a state of relaxation with a 60% N2O and 40% O2 mixture, following the principles advocated by [1 and 7]. The gas introduction was carried out with 100% O2 at 6L/minute for 5 minutes, followed by gradual release of nitrous oxide with a 10% increase every minute, following safety standards reported by [11 and 16].

Due to its low solubility in blood and tissues, N2O/O2 sedation allows the patient to remain conscious in a state close to normal. Moreover, after a few minutes of inhaling pure oxygen, the patient can be released for normal daily activities, as stated by [8 and 9]. This statement was confirmed in this case, where the patient was active, reflexive, and conscious after 5 minutes of inhaling pure O2.

CONCLUSION

This work is a clinical case report with a descriptive and qualitative approach, in which an anxious patient undergoes third molar extraction surgery using conscious sedation with nitrous oxide. Regarding ethical aspects, the risks and benefits of the procedure were informed through the Informed Consent Form (ICF), signed by the patient, also granting permission for the publication of data, photographs, and radiographs contained in the medical record for scientific publications or academic activities, agreeing with the international guidelines present in the Helsinki Declaration.

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