Oral Surgery

Article Title: Using Inhalation Sedation for Oral Surgery

Abstract: With increasing waiting lists across the United Kingdom for oral surgery under general anaesthesia (GA), inhalation sedation (IS) may provide the answer for patients to be treated more quickly. The authors believe it is an underutilised technique for the management of anxious and medically compromised patients requiring oral surgery. This article demonstrates, with patient examples, how IS can be used effectively.

CPD/Clinical Relevance: This article is relevant to general dental practitioners, oral surgeons and those working in sedation services.

Objectives statement: The reader should understand the indications for offering inhalation sedation for oral surgery and recognise it as a treatment option.

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Many dentists associate inhalational sedation (IS) as a method of managing anxiety in children. While it is an excellent technique for younger people IS has applications for adults particularly those with medical complexities. This article highlights how the technique can be very effective for adult patients requiring oral surgery and can avoid the need for general anaesthesia for some.

With waiting lists at an all-time high and a shortage of anaesthetists, IS may provide the answer to long oral surgery waiting lists. The technique does require the operator to give psychological support and works best with an operator-sedationist. The equipment is bulky and requires either gases to be piped from centrally stored supplies or mobile E size cylinders. For mobile cylinders suitable gas storage is required. There are concerns about the effects of nitrous oxide (N_2O) as a greenhouse gas and its contribution to climate change. The advantages for patients are obvious with its fast action, anxiolytic effects and fast recovery which make it very suitable for mild to moderately anxious patients having oral surgery procedures. Although good local anaesthesia is required for any successful oral surgery, N_2O has excellent analgesic properties and can be as effective as morphine.[1]

N_2O meets almost all the requirements of the ideal gas for sedation (Table 1). N_2O acts on GABA receptors to produce anxiolysis in a similar way to benzodiazepines.[2] It has a weak potency with a mean alveolar concentration of 105%, higher than all anaesthetic gases, making it near impossible to anaesthetise with N_2O alone.

The gases are delivered by dedicated machines (figure 1).

Safety features of IS machines:

- Impossible to deliver less than 30% oxygen

- Pin index system which prevents gas cylinders being incorrectly interchanged
- Bodok seal which ensures a gas tight fit between the manifold and the valve block
- Oxygen fail safe: If the oxygen supply fails the N2O supply cuts out
- Oxygen flush button allowing delivery of 100% oxygen in the event of an emergency

Clinical technique:

Pre operative

Before using the machine standard checks must be carried out to ensure the safety features are working. Written consent for treatment should be gained at a prior assessment appointment and confirmed on the day of treatment. No escort is required for this technique, though some anxious or medically compromised patients may choose to bring one.

Intraoperative

When the patient is comfortable in the chair the nasal hood is passed over the patient's head, and the mask adjusted to ensure a tight seal. The patient breaths 100% oxygen for a few minutes to get them used to the mask and the flow rate is adjusted. The correct flow rate, usually 6-7 l/minute, can be determined by monitoring the movement of the reservoir bag, to ensure no over or under inflation. Clinical monitoring is sufficient during the procedure although some operators use pulse oximetry to provide an indication of anxiety reduction.

Titration of N_2O commences with 10% and most modern machines (e.g. matrx MDM, Accutron digital ultra™) automatically reduce O2 to 90%. After one minute give a further 10%, to 20% N_2O. Following this every minute increase the N_2O by 5% until the titration end point is reached. A maximum of 70% N_2O can be delivered. Even at this concentration the patient is receiving 30% oxygen which is more than in room air.[3]

Sedation with N_2O requires psychological support and verbal reassurance throughout for success. The drug alone cannot be relied upon to provide the anxiolysis required for treatment. Although a mouth prop is not usually advocated for IS because mouth closure is a sign of over sedation, a mouth prop can make surgical procedures more comfortable and can be used with IS.

The relative concentrations of each gas can be easily adjusted throughout treatment. For example, a patient who is needle phobic may require 65% N_2O for local anaesthetic administration but require 30% N_2O for the extractions. The titration method ensures the correct dose for the patient as overdose with N_2O can make patients feel restless, agitated, and panicky which is not conducive to successful oral surgery. Should oversedation occur the N_2O level should be reduced, and the patient encouraged to keep breathing through the nasal mask.

Post operative

Once treatment is complete the patient should be given 100% oxygen for 2 minutes at the end of treatment to prevent the theoretical risk of diffusion hypoxia where N_2O quickly fills the lungs displacing oxygen. The patient can then be discharged when they are orientated in time and space. They can return to work if they feel well enough to do so after the oral surgery procedure.

Oral surgery cases treated under inhalation sedation

Case 1

A 21-year-old female was referred following multiple episodes of pericoronitis associated with her lower wisdom teeth. She was fit and well and treatment planned for extraction of LR8, LL8 and UL8. The patient requested sedation but as a student new to Cardiff was unable to provide an escort. Given the lack of escort IS was offered to the patient over two visits for extraction of three wisdom teeth (figure 2). The first visit the patient required 40% N_2O for surgical removal of the lower left eight and simple extraction of the upper left eight.

The second visit the patient required 50% N_2O and the lower right eight was extracted simply. Each visit was carried out by different operator -sedationists, both with success.

Case 2

A 35-year-old female was referred from general practice for extraction of the unrestorable UL8, UL7, and UR4 (figure 3). The patient was dentally anxious. Medically, she was ASA III with poorly controlled type 1 diabetes, asthma and a body mass index of 45. Given the patients' medical background she was not deemed appropriate for intravenous sedation and offered IS for treatment. The patient went on to have all three teeth successfully removed in the same visit with 45% N_2O. The patient was supported by both the operator and the dental nurse with psychological support with a particular focus on breathing exercises. Although amnesia is not a listed property of N_2O, once treatment was completed the patient asked when the teeth would be removed and was delighted to learn they had already been extracted.

Case 3

A 70-year-old male was referred for a dental assessment to a tertiary centre before cardiac surgery: resection of subaortic membrane and possible aortic valve replacement. His medical history included severe left ventricular hypertrophy, moderate mitral valve regurgitation and episodes of paroxysmal atrial tachycardia. He was also a smoker. The cardiologist advised antibiotic cover to reduce the risk of infective endocarditis. His general dental practitioner had referred him to the local district hospital where they could only offer local anaesthesia for treatment, which was declined by the patient. At assessment IS was offered and although he was not initially convinced, he went on to have extraction of 6 teeth, restorations, and periodontal treatment over 2 visits (figure 4). Sedation also meant that treatment was carried out safely and more quickly than waiting for GA and that his cardiac surgery could go ahead more quickly.

Discussion

Many patients are anxious of dental extractions and are unable to tolerate treatment under local anaesthetic alone. There are many cohorts of patients where operator sedationist treatment with intravenous sedation with midazolam is not suitable. These include patients with high body mass index in conjunction with a potentially difficult airway, those who are difficult to cannulate or cannot tolerate cannulation, patients with medical conditions such as sleep apnoea, complex cardiac conditions and those who are unable to provide an escort.

As demonstrated by these cases oral surgeons should consider IS as a routine part of their armamentarium when assessing any patient for dental extractions and not limit sedation treatment options to intravenous midazolam. Without consideration of this modality, patients who are unsuitable for intravenous sedation will be referred to an anaesthetic led sedation service or for general anaesthesia. This can result in increased waiting times for treatment, particularly pertinent at present where the NHS is short of 1400 anaesthetists[4], waiting times for elective surgery are substantial, following the COVID-19 pandemic and the cost of an operating theatre per hour to the NHS is estimated at approximately £1200.[5] In addition, for medically compromised patients' general anaesthesia has increased morbidity and mortality. If patients are deemed unsuitable for intravenous sedation, some anxious patients may feel pressured into local anaesthesia alone which can make treatment unpleasant for all involved.

Issues with N_2O

Chronic exposure to N_2O experienced by healthcare professionals was a concern prior to active scavenging, with links to reduced fertility in males, and increased miscarriage in females.[6] A 1980 study of clinicians exposed to N_2O demonstrated increased risk of liver, kidney, and neurological disease.[7] Active scavenging is compulsory in the United Kingdom to keep background levels below 100 parts per million.[8,9]

The biggest obstacle for practitioners not already offering IS is the cost and maintenance of equipment, which is more expensive than intravenous midazolam. Training in IS requires 10 supervised cases, appropriate evidenced theoretical training, immediate life support training and maintenance of 12 hours of CPD in sedation every 5 years.[10] However, once set

up this relatively simple technique will allow the oral surgery treatment of patients in primary care.

Conclusion

This article has demonstrated with examples, how IS can be used simply and effectively to treat anxious and medically compromised patients for oral surgery. When assessing any patient for extractions if the patient is unsuitable for local anaesthesia alone IS should be seen as a routine treatment option to consider for all patients, particularly in those patients unsuitable for intravenous sedation operator -sedation techniques who would otherwise be referred onto an anaesthetic led service for treatment.

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