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Nitrous Oxide Risks Are No Laughing Matter

The use of nitrous oxide in dentistry dates all the way back to 1844, when Dr. Horace Wells first used it on his patients. Since that time, many patients have elected to have nitrous oxide analgesia during their dental appointments for its analgesic, anxiolytic and amnesic effects.

Liability Risks

A review of the legal literature and dental malpractice claims shows a variety of allegations stemming from the use of nitrous oxide. Fortunately, significant adverse patient care outcomes associated with nitrous oxide use are rather rare.

One of the more severe injuries involved a woman who suffered persistent nausea and a burning sensation in her throat and chest for four days following a dental appointment involving nitrous oxide. Her physician referred her to a pulmonary specialist who concluded that during her "excessive" exposure to nitrous oxide she had aspirated stomach acid into her lungs, which left her with a permanent asthmatic condition and a loss of 35 to 40 percent of her lung capacity. The defendant dentist had

- administered nitrous oxide to her without first reviewing her medical history and current medications
- given her a rather high concentration of nitrous oxide for more than twice his usual appointment time
- not checked the accuracy of the machine for at least three years

Before this incident, the plaintiff had been a professional singer in her own band. Following the incident, her income was significantly reduced due to her diminished lung capacity. The jury awarded both general and punitive damages to the plaintiff.

A more tragic outcome involved a newly constructed facility with a central nitrous oxide and oxygen delivery system. During installation, the N₂O and O₂ lines had been inadvertently crossed. One patient died of anoxia after receiving 100 percent nitrous oxide rather than the intended pure oxygen. Allegations included failure to

- make proper preoperative checks and inspections
- detect the crossing of oxygen and nitrous oxide lines
- recognize and act upon signs of anoxia and nitrous oxide poisoning

Some claimants have alleged an allergic response to nitrous oxide, although Clark and Brunick report that there have been no known reported allergies to N₂O for more than 150 years. (*Handbook of Nitrous Oxide and Oxygen Sedation*, Mosby, 1999.) Despite such findings, patients may believe that their experience with nitrous oxide was aberrant to the extent that it constituted negligence on the part of the dentist. Many of the claims could have been prevented had the dentist better informed the patient of what to expect before, during and after its administration.

Every dental practice that administers nitrous oxide should have risk management protocols to minimize the risk of real and perceived patient injuries associated with its use.

Equipment and Maintenance

Whether you use a central or portable delivery system, inspect all equipment before administering N₂O/O₂ to any patient. Your inspection should include gas tanks, tubing, flowmeter, reservoir bag, nasal hood and scavenger system. Check for adequate tank reserves, sufficient ventilation, proper connections and leaks.

Before administering any gases, be certain each tank has enough gas to last the desired time. If low, switch to a full tank before starting the procedure.

Current flow-meters employ a fail-safe mechanism that stops the flow of nitrous oxide whenever the percentage of oxygen drops below 30 percent. This mechanism also prevents the delivery of N₂O in concentrations greater than 70 percent, preventing anoxia. This feature, introduced in 1976, is standard on every flowmeter unit manufactured today. Flowmeters without fail-safe mechanisms should be replaced with up-to-date units.

Your system should make it impossible to attach a nitrous oxide cylinder or hose to an oxygen portal or thread (and vice versa) by using indexing pins on portable machines or by having hoses and couplers of differing diameters for each gas. Again, machines manufactured today incorporate these safety features.

Have your flowmeter serviced periodically at intervals recommended by the manufacturer, checking for proper calibration, pressure testing and functioning of all components.

A scavenger system is essential to protect you and other dental personnel from the occupational risks of nitrous oxide. Scavenger systems should have an evacuation flow rate of 45 liters per minute and incorporate a scavenging nasal mask, or hood. It is inadvisable to use a nitrous oxide system that lacks a scavenging nasal hood.

Medical Assessment and Patient Monitoring

Always review the patient's medical history before initiating nitrous oxide analgesia. Patients with chronic pulmonary disease should have a physician consultation prior to N₂O exposure. Because of the expansive nature of nitrous oxide gas, it is not recommended for use in patients with bowel obstructions or middle ear disturbances. When the N₂O flow is stopped and the gas begins to leave the body, a negative pressure results, possibly leading to complications in the ear, nose and throat, especially after recent infections or inflammation.

Keep in mind that the sedative effects of nitrous oxide may enhance medications that produce sleep or lethargy, either directly or indirectly. Take these potential effects into consideration when titrating levels of nitrous oxide.

The vital signs of blood pressure, pulse and respiration should be recorded before, during and after the administration of N₂O/O₂ analgesia. The preoperative readings provide a base-line against which intraoperative and postoperative readings can be compared, while postoperative readings provide an opportunity to confirm the patient's recovery or identify adverse responses.

Before You Begin

Obtain the patient's informed consent before administering N₂O/O₂ analgesia, giving the patient enough information about the risks, benefits, and alternatives to nitrous oxide to make an informed, reasoned decision whether or not to proceed with its use. If you choose not to use a written informed consent document, record receiving the patient's informed consent in the progress notes section of the patient record.

Always thoroughly describe the potential effects and sensations the patient might experience during nitrous oxide analgesia. Even though these effects and sensations may not seem like “risks,” disclose them fully to the patient in order to better manage expectations. Potential sensations worth noting include

- relaxation
- reduced sense of fear and anxiety
- increased pain tolerance
- altered perception of time
- tingling sensations, especially in the fingers and toes
- giddiness and lightheadedness
- nausea

Higher levels of nitrous oxide increase the potential for severe nausea and vomiting, as with the patient mentioned earlier who silently regurgitated and aspirated the vomitus.

Patients using nitrous oxide have also been known to experience hallucinations or dreams, including those of a sexual nature. Whether real or imagined, such experiences may induce a patient to file not only a malpractice claim, but also criminal charges.

To protect against false accusations of sexual misconduct, have a staff member with you in the operatory at all times — including emergency after-hours visits — when using nitrous oxide or other sedatives or anesthesia.

Never leave a patient unattended while administering nitrous oxide analgesia. Nitrous oxide is classified in *The ADA Guide to Dental Therapeutics* as a general anesthetic, capable of producing central nervous system depression. It takes only a moment for an adverse event to occur. If no one is nearby to assist the patient in a crisis, the severity of the consequences could be greatly increased.

Follow all statutes governing the administration and monitoring of nitrous oxide as described in your state’s dental practice act and/or administrative code. Do not permit any auxiliary to administer or monitor N₂O/O₂ analgesia unless he or she has the required training and education, and is expressly eligible according to state rules. Violating these rules could subject you to disciplinary proceedings by the state board of dentistry.

Sadly, some dentists have committed intentional criminal sexual assaults upon patients under the influence of nitrous oxide. These predatory actions have no place in dental practice, and dentists who engage in such behavior face incarceration and loss of their dental license.

Administering Nitrous Oxide

Nitrous oxide analgesia should begin and end with the administration of 100 percent oxygen. Start with pure oxygen while establishing the patient’s tidal volume, then slowly titrate the nitrous oxide until the desired results are achieved.

Patients can respond differently to nitrous oxide from one appointment to the next. The dosage given at one appointment may seem too much or not enough to the patient at a later visit. There is no set dosage regimen, only the goal of titration to the patient’s needs. The level of N₂O can be increased or decreased during the appointment based on the level of stimulation. Remember, however, that concentrations greater than 50 percent increase the risk of dreaming and fantasizing.

Patients should refrain from talking or mouth breathing, which expels N₂O into the air you and your assistant breathe and also reduces the concentration of N₂O inhaled by the patient. The N₂O/O₂

analgesia should end with the administration of 100% oxygen for three to five minutes. Assess the patient afterwards for dizziness, headache or lethargy, and continue 100% oxygen if such symptoms exist. After the patient once again feels normal, obtain postoperative vital signs and compare them to the preop and intraoperative values to spot possible aberrations.

If a patient does not adequately recover following continued oxygenation, contact the patient's physician or consider calling 911 for emergency care. Do not let patients drive themselves home if you believe they pose a risk to themselves or others.

Record Keeping

Maintaining accurate records is an essential aspect of N₂O/O₂ analgesia. Always document the following measures and observations:

- review of patient's medical history
- preoperative and postoperative vital signs
- patient's tidal volume
- time N₂O flow began and ended
- peak concentration of N₂O administered
- amount of postoperative oxygenation time (in minutes) for patient recovery
- adverse events or patient complaints

Record this information in the progress notes section of the patient record or on a separate nitrous oxide sedation form.

Nitrous oxide analgesia enhances the dental experiences of many individuals. When incorporated within a sound risk management program that emphasizes patient safety, good communication and thorough record keeping, it can be a safe and effective way of facilitating the improved oral health of patients.

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