Nitrous oxide/oxygen sedation: multidisciplinary application resurgence

A brief Internet search would quickly reveal the multitude of health disciplines and their new, or sometimes renewed, interest in the use of nitrous oxide as an ideal sedative agent for dealing with fear and anxiety associated with an ever-expanding list of procedures. The main reason for this rebirth in popularity lies in the basic properties of the drug itself. Nitrous oxide has a rapid onset and is quickly reversible. The long history of dentistry’s use of nitrous oxide is well documented and the safety record has been an enviable one.

A review of current findings includes interest in pediatric medicine and obstetrics. Pediatric emergency rooms have established nitrous oxide sedation protocols for procedures, including sutures, setting broken bones and placing IV lines.

Other countries have successfully used nitrous oxide and oxygen in obstetric clinics. These clinics have been equipped with “on-demand” machines that deliver a 50 percent blend of nitrous oxide and oxygen. Mothers in labor prepare for the next contraction by taking a few breaths of the mixture to help them through the contraction. This application is currently being evaluated at some prominent U.S. universities that specialize in childbirth education.

When administering nitrous oxide to patients, some very simple points should be remembered. First, nitrous oxide works best in those situations where its use is planned and discussed with the patient beforehand. To attempt to use nitrous oxide as a rescue agent after an unpleasant situation has developed will have little chance to be effective. Second, nitrous oxide is not a potent agent. It will have varying degrees of success; therefore, it should not be expected to work miracles in patient management.

Third, the patient should be instructed what sensations he or she will experience when adequately sedated. The goal of monitoring the patient’s experience will help the practitioner assess the level of sedation achieved and prevent over sedation and a possible unfavorable reaction by the patient.
For dental use, nitrous oxide has some unique advantages. The onset time is very rapid and it is easily titrated by adjusting the administered concentration. Most clinicians advocate 100 percent oxygen administration for several minutes, followed by titration to the desired level of sedation. Titration is a very important practice in preventing over sedation of the patient and the possibility of a “roller coaster effect” caused by raising and lowering the nitrous oxide concentration, often resulting in nausea.

The proper flow rate (the minute ventilation volume [in liters] of the patient) is established by observing the movement of the breathing (reservoir) bag. It should not be flat (increase flow) or overextended (decrease flow). Postoperative oxygenation with 100 percent oxygen is also recommended for several minutes to assist with both patient recovery as well as removal of nitrous oxide from the patient’s system. Generally, due to fast recovery from nitrous oxide sedation, patients can leave the office unassisted and an adult escort is not needed.

The machines that control and administer the gases through a breathing circuit are called flowmeters and provide practitioners with a tremendous variety of options and safety features. All flowmeters should include a failsafe to prevent the flow of nitrous oxide without the flow of oxygen. Gas flow and mixture can be precisely measured and adjusted. Typically, the flowmeter will have a maximum nitrous concentration capability of 70 percent nitrous oxide. Some flowmeters can be capped at a 50 percent maximum concentration.

Flowmeters are typically designed with a narrow upright shape to enable clear visibility of the flow tubes and easy access to the control valves. These devices are available in either analog or digital models. Porter Instrument manufactures a flowmeter that combines both analog and digital technology. Control options vary from needle valves to knobs to push-button operation.

Various mounting options include wall arms and mobile carts (which have E-size cylinders of the gases), allowing for a portable system. Cabinet-mounted flowmeters generally use gases that are supplied from a central tank room (with larger size gas cylinders) located in the facility. The savings in the cost of the gas (generally five times less per procedure) as compared to portable E-size cylinders and the convenience of delivery make this method of installation an ergonomic and cost-effective preference.

Probably the most important consideration should be given to the breathing circuit. The fit of the mask is an important element to the predictable analgesic outcome. A mask that doesn’t seal properly around the nose will allow ambient air to be drawn in and dilute the gas mixture that comes from the breathing bag. This may result in the patient reporting he or she “doesn’t feel the gas.” Improper fitting masks may also allow gas to escape, exposing the dentist and staff to unsafe levels of nitrous oxide. Breathing circuits come with masks that are autoclavable or single-use disposable. Scented and plain options are available as well. All breathing circuits should be supplied with a vacuum control gauge that indicates the proper level of vacuum is being achieved.

The use of nitrous oxide is no longer just a standard practice in the United States but virtually every continent has “clinical champions” who provide lectures, seminars and hands-on training in the proper use of nitrous oxide sedation. Internationally, what had started as a pediatric initiative with the European Academy of Pediatric Dentistry (EAPD) and the International Academy of Pediatric Dentistry (IAPD) has gained acceptance in general dentistry in the Middle East, India, China and the Pacific Rim countries. The popular “Handbook of Nitrous Oxide and Oxygen Sedation,” written by Clark and Brunick, has been translated into several different languages.

Nitrous oxide is the oldest and only inorganic anesthetic agent still in clinical use today. It appears to have reached a tipping point both globally and across all medical and dental disciplines. When administered appropriately by trained health care providers, nitrous oxide is a valuable asset in decreasing the pain and anxiety experienced by patients during certain dental and medical procedures.