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The safe use of nitrous oxide in the dental office has been an issue the ADA has monitored for many years. In 1977, an ad hoc committee convened by the Association published a report on the potential health hazards of trace anesthetics in dentistry. Also in 1977, the National Institute of Occupational Safety and Health (NIOSH) reported that, by using several control measures, nitrous oxide levels of approximately 50 parts per million were achievable in dental operatories during routine dental anesthesia/analgesia. A few years later, in 1980, the ADA Council on Dental Materials, Instruments and Equipment recommended that effective scavenging devices be installed and monitoring programs be instituted in dental offices in which nitrous oxide is used, and the council indicated that using these methods or devices would assist in keeping the levels of nitrous oxide at the lowest possible level.

NIOSH continued its activities relating to nitrous oxide concentrations in the dental office and, in 1994, published an alert called "Request for Assistance in Controlling Exposures to Nitrous Oxide During Anesthetic Administration." In the same year, NIOSH also reported on field evaluations and laboratory studies evaluating nitrous oxide scavenging systems and modifications in attempts to achieve the current NIOSH recommended exposure limit of 25 ppm during administration. NIOSH concluded that nitrous oxide levels may be controlled to about 25 ppm by maintaining leak-free delivery systems and using proper exhaust rates, better-fitting masks and auxiliary exhaust ventilation.

In 1995 the ADA Council on Scientific Affairs convened an expert panel to review scientific literature on nitrous oxide and to revise recommendations on controlling nitrous oxide concentrations in the dental office. What follows is an overview of the conclusions reached by that panel.

**ABSTRACT**

Nitrous oxide continues to be a valuable agent for the control of pain and anxiety. However, chronic occupational exposure in dental offices not using scavenging systems may be associated with possible deleterious neurological and reproductive effects. This report outlines recommendations for controlling nitrous oxide exposure that were made by an expert panel convened by the ADA.

**CONCLUSIONS AND RECOMMENDATIONS OF THE EXPERT PANEL**

Nitrous oxide continues to be a valuable agent for the control of pain and anxiety. However, chronic occupational exposure to nitrous oxide in offices not using scavenging systems may be associated with possible deleterious neurological and reproductive effects on dental personnel. Limited studies show that as little as three to five hours per week of unscavenged nitrous oxide exposure could result in adverse reproductive effects. In contrast, in dental offices using nitrous oxide scavenging systems, there has been no evidence of adverse health effects. It is strongly recommended, therefore, that while there is no consensus on a recommended exposure limit to nitrous oxide, appropriate scavenging systems and methods of administration should be adopted. A protocol for controlling nitrous oxide is outlined below.

**RECOMMENDATIONS FOR CONTROLLING NITROUS OXIDE EXPOSURE**

The expert panel identified a number of recommendations that are important to consider in the safe and effective use of...
The general nitrous oxide:
- The dental office should have a properly installed nitrous oxide delivery system. This includes appropriate scavenging equipment with a readily visible and accurate flow meter (or equivalent measuring device), a vacuum pump with the capacity for up to 45 liters of air per minute per workstation, and a variety of sizes of masks to ensure proper fit for individual patients.
- The vacuum exhaust and ventilation exhaust should be vented to the outside (for example, through the vacuum system) and not in close proximity to fresh-air intake vents.
- The general ventilation should provide good room air mixing.
- Each time the nitrous oxide machine is first turned on and every time a gas cylinder is changed, the pressure connections should be tested for leaks. High-pressure–line connections should be tested for leaks on a quarterly basis. A soap solution may be used to test for leaks. Alternatively, a portable infrared spectrophotometer can be used to diagnose an insidious leak.
- Prior to first daily use, all nitrous oxide equipment (reservoir bag, tubings, mask, connectors) should be inspected for worn parts, cracks, holes or tears. Replace as necessary.
- The mask may then be connected to the tubing and the vacuum pump turned on. All appropriate flow rates (that is, up to 45 L/min. or per manufacturer’s recommendations) should be verified.
- A properly sized mask should be selected and placed on the patient. A good, comfortable fit should be ensured. The reservoir (breathing) bag should not be over- or underinflated while the patient is breathing oxygen (before administering nitrous oxide).
- The patient should be encouraged to minimize talking and mouth breathing while the mask is in place.
- During administration, the reservoir bag should be periodically inspected for changes in tidal volume and the vacuum flow rate should be verified.
- On completing administration, 100 percent oxygen should be delivered to the patient for five minutes before removing the mask. In this way, both the patient and the system will be purged of residual nitrous oxide. Do not use an oxygen flush.
- Periodic (semiannual interval is suggested) personal sampling of dental personnel, with emphasis to chairside personnel exposed to nitrous oxide, should be conducted (for example, use of diffusive sampler [dosimeters] or infrared spectrophotometer).

RESEARCH PRIORITIES
The expert panel identified a number of areas that require high-priority research:
- the elucidation of biological mechanisms that result in the adverse health effects associated with exposure to nitrous oxide;
- studies to gain a full understanding of the potential health effects of chronic low-level exposure to nitrous oxide, with emphasis on prospective studies that use direct nitrous oxide exposure measurement;
- the investigation of possible cognitive effects related to exposure to low levels of nitrous oxide;
- the development of equipment to evaluate and control exposure to nitrous oxide;
- the study of ventilation systems and air-exchange mechanisms for dental office designs; and
- the evaluation of advantages associated with the use of nitrous oxide in combination with other sedative drugs.

The councils will continue to work with industry and the research community to address research and development needs that will further reduce occupational exposure to nitrous oxide.