

Policy on Minimizing Occupational Health Hazards Associated with Nitrous Oxide

Originating Committee

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1993, 1996, 2000, 2003

Purpose

The American Academy of Pediatric Dentistry (AAPD) recommends that exposure to ambient nitrous oxide be minimized to reduce occupational health hazards associated with nitrous oxide.

Methods

This document is based on current dental, medical, and public health literature regarding the potential risks of ambient nitrous oxide exposure. Guidelines and recommendations from the National Institute for Occupational Safety and Health (NIOSH) were reviewed also.¹⁻²

Background

Epidemiologic studies provide strong evidence that there are increased general health problems and reproductive difficulties among dental personnel chronically exposed to significant levels of ambient nitrous oxide.³⁻⁷ Nitrous oxide acts by oxidizing vitamin B₁₂ from the active, reduced cobalamin to the inactive form. In turn, this inactivates the enzyme methionine synthetase, which requires both the active cobalamin and folate as cofactors. The inactivation of methionine synthetase decreases DNA production, thereby interfering with cell proliferation.⁸

While nitrous oxide has been linked epidemiologically to reproductive, hematologic, immunologic, neurologic, hepatic, and renal disorders, symptoms are time and dose dependent. Neurologic symptoms are reported most frequently in cases of chronic (recreational) abuse. Absolute occupational effects are still uncertain.⁹ Epidemiologic conclusions have been challenged.¹⁰ Adverse reproductive outcomes are linked to B₁₂ deficient individuals and those exposed to "high nitrous oxide levels".⁹ A maximum permissible level of ambient nitrous oxide in the dental environment has not been determined.⁹⁻¹⁴

Collection of ambient nitrous oxide involves 2 separate mechanisms. The first, the scavenging system, is part of the nitrous oxide delivery system. It begins at the nitrous oxide tanks and terminates at the expiratory valve in the mask. Canadian studies in hospital settings have shown that frequent

and regular inspection and maintenance of the nitrous oxide delivery system, together with the use of a scavenging system, can reduce ambient nitrous oxide significantly.¹⁵ In the dental environment, patient behaviors such as talking, crying, and moving have been shown to result in significant increases in baseline ambient nitrous oxide levels despite the use of the mask-type scavenging systems.¹⁷ By using a well-fitted mask and an appropriate amount of suction via the scavenging system, the increased pressure on the patient's face by the mask will reduce leakage.¹⁸ NIOSH has recommended an oral evacuation rate of 45 L/min for maximizing scavenger effectiveness. However, scavenging at this rate has been shown to reduce the level of psychosedation achieved with nitrous oxide inhalation.¹⁹

The second mechanism, the "exhaust system", collects escaped nitrous oxide and includes 2 entities. First, an appropriate nonrecirculating ventilation system is recommended by NIOSH to provide continuous rapid air exchange. It is important to vent waste gases outside of the building and away from fresh air intakes.² Second, a high-volume aspirator, placed near or within 20 cm of the patient's mouth, has been shown to reduce significantly ambient nitrous oxide levels in the dental environment.²⁰⁻²² Diligent use of these 2 mechanisms in the pediatric dental environment has allowed for the reduction of ambient nitrous oxide to the levels recommended by NIOSH.²³

Policy statement

The AAPD recommends that dentists and dental auxiliaries minimize their exposure to nitrous oxide by maintaining the lowest practical levels in the dental environment. Adherence to the recommendations below can help minimize occupational exposure to nitrous oxide.

1. Scavenging systems must be used when nitrous oxide is employed.
2. Exhaust systems that adequately vent scavenged air and gases to the outside of the building and away from fresh air intake vents should be employed.

3. Careful, regular surveillance and maintenance of the nitrous oxide/oxygen delivery equipment must be practiced.
4. Mask size should be such as to ensure proper fit for each patient.
5. Nitrous oxide discharge from the oral cavity of the patient should be minimized during dental procedures.

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