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LETTER TO THE EDITOR

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Use of nitrous oxide-oxygen inhalation sedation in the COVID-19 era

Dear Editor,

The era of COVID-19 has created the first major impact in dentistry after HIV. New guidelines have been suggested and adopted to make our practices safe for both providers and patients. One area, where there continues to be ambiguity, is the use of nitrous oxide inhalation sedation (NOIS). NOIS, as an anxiolytic and behaviour guidance technique, is an important and integral part of a paediatric dental practice.[1] In this letter, we seek to clarify and present recommendations for the practice of NOIS in the dental office to ensure its continued and safe use in the context of COVID-19. Even with the available vaccines, the virus in its various mutated forms will continue to be present in the future.

The main apprehensions that have arisen for the use of nitrous oxide are related to the presence of a breathing circuit through which air is inhaled and exhaled (COVID-19 being a respiratory disease) and the transmission of the virus through the 'aerosol' of nitrous oxide-oxygen leaking from the mask peripheries.

There is an ongoing debate on the relationship between aerosol generation from the use of nitrous oxide in a dental practice and transmission of virus. This is often being considered akin to the dental aerosol-generating procedures such as dental drills, ultrasonic scalers, and three-way syringes. Nevertheless, nitrous oxide can be categorized as a low-risk aerosol-generating procedure with the nasal hood, comparable to a loosely fitting oxygen mask having a flow rate of less than 15 L/min.[2] Simonds et al (2010) considered non-invasive ventilation (NIV) procedures as non–aerosol-generating, not only in healthy volunteers but also in patients with chronic lung disease.[3] Furthermore, a nitrous oxide nasal hood, which usually delivers gases at a rate less than 5 L/min for a paediatric patient with a normal breathing pattern, is considered to have lower risk of generating aerosols than a loosely fitting oxygen mask. Of greater importance is the fact that there is the presence of a negative pressure in the nitrous oxide nasal hood assembly, which scavenges the expired air, thereby minimizing chances of leakage of gases from the peripheries of the mask on expiration. Not surprisingly, the Royal College of Surgeons, England, does not consider the use of NOIS as an aerosol-generating procedure.[4]

To mitigate any risks associated with NOIS as an aerosol-generating procedure, before a child walks into a paediatric dental practice, a basic screening should be carried out eliciting important aspects, such as previous COVID-19 infection of family members, respiratory symptoms, and family's vaccination status.[5] In countries, where the infection rate is still rising, every child should be considered as an asymptomatic carrier and nonessential dental treatment should be deferred.[6]

A paediatric dentist has always been at high risk of infection, being exposed to bioaerosols (produced by talking, coughing, crying) when treating a child patient even if nitrous oxide is not being used (aerosols from human breath having maximum propagation of 0.6 m from nasal breathing).[7] On the contrary, the use of nitrous oxide, being anxiolytic, reduces bioaerosols produced by unnecessary talking or crying in an anxious child. Consequently, it can be highlighted that nitrous oxide is not adding much to the already existing bioaerosols if they can be minimized. Obviously, all precautions recommended for the various AGP or non-AGP dental procedures should be followed such as the use of personal protective equipment—gloves, long-sleeved gowns, fit-tested N95 masks (National Institute for Occupational Safety and Health (NIOSH)-certified N95, European Standard Filtering Face Piece 2 (EU FFP2), or equivalent and protective eye cover or face shield.[8]

In the light of COVID-19, the use of nitrous oxide, however, should be avoided for children who are not cognitively developed enough to accept the nasal hood or cry upon introduction, which in turn increases bioaerosol generation. Extra attention should be paid to curtail leakage of gases by using slider clamps, continuous monitoring of nasal hood seal over the nose, proper scavenging pressure of 45 L/min, and use of masks with better scavenging efficiency such as the silhouette mask. The use of a rubber dam (placed in a proper manner with the sheet rolled over the nasal hood) is highly recommended to further reduce the likelihood of leakage of exhaled gases from the mouth.[9] The role of ventilation of operatory is undoubtedly crucial with 10-15 air changes per hour.[10]

Besides these safeguards, certain modifications are desirable in the technique of administration. The child should be instructed to breathe 'normally' in the nasal hood and not take slow deep breaths, which was told repeatedly in the pre–COVID-19 era. Slow deep breaths increase the possibility of droplets containing respiratory tract mucus in the exhaled

air due to shear forces being produced as air rushes over the mucus lining the respiratory tract. This also reinforces the protocol that nitrous oxide should not be used on a child having nasal congestion or increased respiratory secretions. Verbal communication should be completely avoided during the treatment, and hand gestures are encouraged. An oxygen flush should also be avoided as it increases the total flow rate of gases, which is undesirable as it causes greater dispersion of respiratory droplets.[11] Additionally, an appropriately sized mask should be chosen to avoid salivary contamination, especially in children with the short upper lip.

A thorough infection control protocol is desirable for the nitrous oxide delivery system. The risk of contamination from the flow meter assembly and the breathing circuit is low due to the unidirectional flow of gases and the presence of non-rebreathing valve, which prevents entry of exhaled air into the flow meter assembly. For filtration of air within the breathing circuit, bacterial viral filters, also known as HME filters (heat and moisture exchange filters), can be attached between the corrugated tube and the coaxial tube. These filters are similar to the ones used in anaesthesia circuits, mechanical ventilation circuits, etc Corrugated axial tubing has medium infection prevention control (IPC) risk and should be washed with warm water /detergent in an instrument washer. The tubing should be dried before reusing it. It may be autoclaved once a week. The reservoir bag, Y connector, vacuum hose, and vacuum control block have low IPC risk. They can be wiped with a disinfectant or covered with a plastic barrier sleeve. The scavenging circuit has a high IPC risk with the tubings requiring autoclave every day. Single-use nasal hoods should be discarded after each use. To diminish surface contamination of the nitrous oxide delivery system from the aerosols generated in a dental procedure, the exposed tubings and flow meter surfaces may be covered with a barrier sleeve and wiped with disinfectant. Regular use of disinfectant can lead to discolouration of tubings.

Dental procedures that are done in emergency situations means increased fear and anxiety for children or special care patients. Managing an anxious child shall remain the focus of a paediatric dental practice, and the anxiety levels are bound to increase in the COVID-19 era. NOIS will continue to play an essential role in a paediatric dental practice for anxiolysis and will become even more essential in managing children with uncalm and fidgety behaviour, who pose a greater threat of contamination. NOIS does not add to the existing risk of exposure to a paediatric dentist, which always exists from various respiratory droplets. The safe practice modifications and precautions put forth above such as proper screening, risk assessment, use of rubber dam, maintaining a low flow rate of gases, ensuring a normal breathing pattern, avoiding forced exhalations, minimising verbal communications, maintaining good ventilation in dental offices, and a strict disinfection protocol aim at providing a cohesive document so that nitrous oxide continues to be a valuable tool in a paediatric dental practice.

AUTHOR CONTRIBUTION

KG, DE, and AS conceived the idea. KG and AS collected the data. KG, DE, and AS analysed the data. KG wrote the manuscript.

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