Inhalation Sedation During the COVID-19 Outbreak: An Expert Opinion

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ABSTRACT Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the pathogen that causes coronavirus disease-2019 (COVID-19), is thought to be transmitted via droplets and aerosols, and was detected in saliva of infected individuals. These droplets from the upper airway may infect the inhalation sedation mask and tubing. The authors determined the adequate measures needed to prevent the transmission of COVID-19 by nitrous-oxide (N2O) system during inhalation sedation in dentistry and provided evidence on mask and tubing sterilization. Additional measures to protect patients and healthcare workers from COVID-19 that may be transmitted by the inhalation sedation system are discussed. The authors recommend minimal use of a N2O system during inhalation sedation in dentistry. In case of need, the practitioners should have more than one scavenger kit and nasal masks for each N2O/O2 mixer. Biologic barriers should be mounted between the scavenger's tubing and the central evacuation system. Strict cleansing and sterilization should be performed for all parts of the N2O system. The use a disposable scavenger system and nasal mask should be considered as a viable option.

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In December 2019, Wuhan, Hubei province, China, became the center of an outbreak of pneumonia of unknown cause [1]. By January 2020, Chinese scientists isolated and identified the causative agent as a novel coronavirus named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), as the clinical symptoms presented by the patients were mainly dry cough and fever. Imaging revealed bilateral lung infiltrates [1,2]. Disease severity is dynamic and patients may deteriorate from mild to moderate and severe within hours. [3]. After the outbreak was reported to the World Health Organization (WHO), the disease caused by the new virus was named coronavirus disease-2019 (COVID-19) [1-3]. On 30 January 2020, the WHO declared that the Chinese outbreak was a worldwide public health emergency and posed a high risk to countries with vulnerable healthcare systems [2].

Transmission of COVID-19 through medical treatment involving the upper airway and oral cavity is hazardous for patients and medical teams

As more countries were affected by the rapidly evolving pandemic, the scientific community reported that the highly contagious virus was transmitted through direct or indirect contact, droplet spray, and aerosol. It infected the lower respiratory tract and caused pneumonia [4,5]. The first COVID-19 patient diagnosed and hospitalized in Israel was a 40-year-old male who returned from Italy on 20 February 2020 [6]. By 8 March 2020, there were 39 diagnosed cases of COVID-19 in Israel, and the first quarantine steps were implemented, specifically, reducing the number of flights to Israel. The evolving isolation protocols in Israel led to growing numbers of people in quarantine, including thousands of medical workers. The Israeli government imposed behavioral guidelines to limit the COVID-19 outbreak, in almost every field.

Considering the high contamination rate via aerosols and droplets, dentists were guided to defer elective treatments and only perform emergency treatments [7-9]. Dental treatments, elective or emergency, are stressful and conscious sedation methods allow the performance of essential procedures for children and phobic patients. Individuals with special needs and patients with a complex medical background may also benefit from sedation as anxiety and involuntary patient movement is reduced [10,11].

The Oral Medicine, Sedation and Maxillofacial Imaging (OMSMI) department at the Hadassah Medical Center in Jerusalem routinely provides dental treatment under conscious and unconscious sedation, supported by the division of anesthesia. Moreover, our department teaches dental students about inhalation sedation in dental practice and provides continuing education courses on these subjects to physicians, dentists, and nurses. Inhalation sedation is a method of conscious sedations and is performed by inhalation of a combination of nitrous oxide (N2O), which is a colorless gas with a sweetish smell, and oxygen (O2). It is an effective analgesic/anxiolytic agent that causes depression and euphoria in the central nervous system with negligible effects on the respiratory and cardiovascular systems [10,12]. In the dental clinic, N2O is inhaled from a non-disposable facemask covering the patient's nose (in some cases, the mask may also cover the mouth for a few minutes). Thereafter the facemask is connected to a non-disposable tube system leading to the N2O and oxygen storage system.

Based on the instructions of Israeli Ministry of Health, adjustments were made by dental professionals to treat emergency and urgent cases, while minimizing the risk of spreading infection. The COVID-19 guidelines raised many questions regarding the utilization of N2O inhalation sedation systems.

Observation and practice

During the restriction period, we continued to provide all dental treatments under sedation due to our understanding that postponing these procedures could cause serious deteriorations and lead to unnecessary/preventable dental emergencies.

Routine inhalation sedation should be postponed until secure sterilization methods can be applied to all components of the system

Considering that SARS-CoV-2 resides in the respiratory system and has been detected in the saliva of infected individuals [13-15], it seems that transmission through the inhalation sedation system, including the tubing, is highly likely. Therefore, the extremely high contamination and transmission potential of the virus via the mouth and nose as well as the unclear means of protection needed for the operators, primarily dentists, otorhinolaryngologic and patients led us to believe that routine inhalation sedation, should not be performed until secure disinfection and sterilization methods can be applied to all components of the system.

Inhalation sedation is based on breathing a mixture of N2O and O2. The ratio of gasses in the mixture is set by the operator and is dependent on patient needs. It can reach up to 70% N2O (and 30% of O2) [12,16]. The delivery system includes a variety of nasal masks connected by silicone tubing to a mixer\flow meter and enables the operator to control the ratio between the two gases and also serves as a safety device by limiting the maximum amount of N2O in the mixture to 70% and disconnecting N2O delivery in the absence of oxygen (fail-safe mechanism).

The other side of the nasal mask is connected to an active scavenger system, sucking the gases exhaled by the patient. The use of the scavenger system is mandatory to remove the high residues of unused N2O from the operatory.

Until the recent outbreak, inhalation sedation systems were routinely used in medicine and dentistry. The nasal masks and their components were sterilized after being cleaned with antibacterial\antiviral wipes. The outside of the tubing was wiped down and no sanitation or sterilization was performed on the lumen of the tubing.

The suggested protocol will minimize the contamination potential through the inhalation sedation system

The COVID-19 outbreak was a game changer since the inside of the tube had to be disinfected to stop virus transfer. Logically, we should run the sedation systems with disposable nasal masks and tubing, similar to those used in general anesthesia machines. There are three major limitations to utilizing disposable equipment: increased costs by 25–35%, limited inventory, and more plastic waste leading to environmental contamination.

Thorough investigations of manufacture's guidelines, websites of WHO, Israeli Ministry of Health, Israel Dental Association, Israel Medical Association did not yield satisfactory information about the likelihood of spreading SARS-CoV-2 via inhalation sedation tubing. No references on this issue were found in the literature as well as no conclusive solutions by national and international experts. Consequently, we changed our inhalation sedation paradigm based on our experience and expertise. We provided a practical solution to this problem.

Insights for inhalation sedation following the COVID-19 outbreak

GENERAL CONSIDERATIONS

- Use the system sparingly. Other types of sedation, primarily intravenous approaches are preferable
- Keep more than one scavenger kit and nasal mask for each N2O/O2 mixer to enable the suggested cleaning and sterilization processes between patients
- Mount biologic barriers, which have proven to be effective in stopping coronavirus (Intersurgical™) [Figure 1, Figure 2, Figure 3] [17], between the scavenger's tubing and the central evacuation system as used in anesthesia machines

PROCEDURES TO BE IMPLEMENTED AFTER EACH USE

- Remove the nasal mask and scavenger from the N2O/O2 mixer
- Mechanically clean to remove all biological materials, as performed for all other instruments
- Soak all components in antiseptic soapy water for 15–20 minutes. Make sure to flood all the tubes
- Rinse and dry all parts and place in autoclave bag
- Sterilize in autoclave as suggested by manufacturer [Figure 3]
- Only use silicone reservoir bags which should be treated in the same manner as the scavengers and nasal masks

These guidelines should be performed by staff dressed in complete work uniform, covered by a waterproof robe. An N-95, FFP 2, or FFP 3 mask covering the nose and mouth should be applied, with a full-face guard over the entire face area [18].

CONCLUSIONS

These suggestions are based on our extensive experience in the field, and the current need to prevent the spread of COVID-19 infection during inhalation sedation. The efficacy of our suggested protocol should be thoroughly validated based on evidence.

Figure 1. Intersurgical™ Biologic barrier

Figure 2. Biologic barrier mounted between the scavenger's tubing and the central evacuation system

Figure 3. Nasal mask and scavenger tubing placed in autoclave bag before sterilization

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The happiest is the person who suffers the least pain; the most miserable who enjoys the least pleasure.
Jean Jacques Rousseau (1712–1778), philosopher and author