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Surgical instrument disinfection during the era of COVID-19

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To the Editor:
Health care workers are at increased risk for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), as evidenced by high infection and related mortality rates. The virus is transmitted through fomites, person-to-person contact, droplets, and aerosols, harboring a half-life of 5.6 hours on stainless steel and 6.8 hours on plastic surfaces, with infectivity lasting up to 72 hours on steel [1]. Viral transmissibility is accentuated in Mohs micrographic surgery (MMS), given prolonged contact with virus carriage sites such as the head and neck and mucosal surfaces. In addition to utilizing personal protective equipment, proper instrument decontamination and sterilization strategies should be employed. Although many reports detail decontamination strategies for single-use N95 respirators [2,3], discussion of surgical instrument sterilization in the dermatologic literature is lacking.

Most MMS practices recycle surgical equipment individually after office-dependent sterilization techniques. Although infection rates after dermatologic surgery are less than 5%, intraoperative pathogen transmissibility is increased with sustained patient-instrument contact. Common human viruses are inactivated at 50°-60°C for 30min. Although nonspecific for SARS-CoV-2, temperatures of 60°C at a relative humidity of 80% for 15-30min eradicate viruses on N95 masks per the Centers for Disease Control. The World Health Organization notes 56°C kills SARS-CoV-1 within 15min. With limited information about SARS-CoV-2, expert consensus advises 56°C for 30min to inactivate the virus. Analyses of four different decontamination

UV irradiation at 260-285nm, 70ºC dry heat, 70% ethanol, and vaporized hydrogen peroxide (VHP) at 59% indicates that 70°C dry heat for one hour was sufficient to reduce SARS-CoV-2 concentration on steel, and that VHP, ethanol, and UV yielded rapid virus inactivation [2]. The efficacy of VHP and UV germicidal irradiation has similarly been noted by other studies on N95 respirators [3].

Sanitization strategies of metal orthodontics equipment during COVID-19 proposed steam autoclave sterilization as primary methods, with ultrasound bath/thermal disinfection or chemical sterilization (2% glutaraldehyde or 0.25% peracetic acid) as adjuncts [4]. Based on early clinical/experimental data specific to SARS-CoV-2 [5], protocols achieving temperatures of >70°C for 1hr or those using the following chemicals are preferred: ethanol in concentrations from 30-95% (>70% recommended), 2-propanol (>30% recommended) or VHP, and quaternary ammonium compounds [2]. Quaternary ammonium compounds are common biocides that interfere with viral lipid membranes, and three in particular show efficacy against SARS-CoV-2 [5]. Efficacy data on glutaraldehyde (0.5–2.5%) and formaldehyde (0.7–1%) is based on nonspecific human coronaviruses. Formaldehyde is classified as a human carcinogen, discouraging its use.

As differences among coronaviruses exist, SARS-CoV-2 needs further experimental and clinical study to understand its greater relevance. SARS-CoV-2 can survive on stainless steel for four days and plastic for up to 7 days. Hence, additional layers of protection include waiting for extended time periods prior to reutilizing instruments. Altering equipment composition and packaging is challenging but UV irradiation of instrument trays prior to and after use may be advised.

In office-based surgical settings, COVID-19 containment strategies necessitate re-evaluating infection control practices in a framework that encompasses proper surgical instrument sterilization (**Table 1**). Fortunately, steam autoclave requires little maintenance, is well established in many dermatology practices, and is efficacious in SARS-CoV-2 reduction and inactivation.

Potential conflicts of interest

The authors declare no conflicts of interest.

Table 1. *Common instrument sterilization techniques.*

Method	Advantages	Disadvantages	Note of use against SARS-CoV-2
Steam autoclave	- readily available - easy to operate - rapidly microcidal	- cannot use with heat sensitive instruments - may be corrosive to instruments - potential for burns	- may achieve temperatures required to inactivate SARS-CoV-2
Chemical sterilization (formaldehyde, methyl ethyl ketone, acetone, alcohols)	- lower humidity, less dulling	- need materials - ventilation required - unknown efficacy against hepatitis	- formaldehyde inactivates coronaviruses in general - methyl ethyl ketones and acetone have unclear efficacy against SARS-CoV-2 - ethanol in concentrations varying from 30-95% (recommend 70%), 2-propanol (recommend over 30%) inactivate SARS-CoV-2
Dry Heat	- inexpensive - non-corrosive	- cloth, paper, plastic cannot be used - high temperature, prolonged time requirements	- may achieve temperatures required to inactivate SARS-CoV-2
Gas sterilization (ETO, formaldehyde, VHP)	- good for large volumes - good for heat and moisture-sensitive instruments	- expensive - prolonged time requirement - toxic at high levels (eye damage), ETO is carcinogenic and flammable - may corrode instruments - formaldehyde is carcinogenic	- formaldehyde inactivates coronaviruses in general - VHP inactivate coronaviruses, including SARS-CoV-2 - ETO has unclear efficacy against SARS-CoV-2
Cold sterilization* (alcohol, detergent, quaternary ammonium, glutaraldehyde >2% solution, peracetic acid >0.2%)	- easy to operate - inexpensive	- not effective against hepatitis B - irritating to the skin/eyes - prolonged time requirement - instruments must be used immediately after rinsing with sterile water -may corrode instruments	- see above regarding alcohols - glutaraldehyde, peracetic acid inactivate coronaviruses in general - three individual quaternary ammonium compounds inactivate SARS-CoV-2; data on benzalkonium chloride unclear

**Considered a high-level disinfection procedure.*
VHP, vaporized hydrogen peroxide; ETO, ethylene oxide.

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