

SPECIAL ISSUE ARTICLE

Insights into laser safety considerations during COVID-19 pandemic

Mohamed L. Elsaie¹  | Hesham A. Nada²

¹Department of Dermatology and Venereology, National Research Centre, Giza, Egypt

²Department of Dermatology and Venereology, Faculty of Medicine, Suez Canal University, Ismailia, Egypt

Correspondence

Mohamed L. Elsaie, Department of Dermatology and Venereology, National Research Centre, Giza, Egypt.
Email: egyptdoc77@yahoo.com

Abstract

The World Health Organization has recently defined the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections as a pandemic. The infection, which may cause a potentially very severe respiratory disease, now called coronavirus disease 2019 (COVID-19), has airborne transmission via droplets while less attention focused on aerosol transmission. Surgical smoke and plumes in laser clinics represent a source for aerosol particles. The aim of this article is to provide the authors' opinion for the correct use of "laser devices" in the COVID-19 emergency and to reduce potential risks of laser airborne contaminants.

KEYWORDS

aerosol transmission, COVID19, laser, safety, SARS CoV2

1 | INTRODUCTION

Contact transmission and respiratory droplets were identified as the most significant routes of coronavirus disease (2019) (COVID-19) transmission; while other less potential routes include aerosol, body fluid, and oro-fecal routes.^{1,2} Asymptomatic and presymptomatic individuals, by definition, do not cough or sneeze to any appreciable extent. This leaves direct or indirect contact modes and aerosol transmission as the main possible modes of transmission.³ There is currently no data on the possible presence of the virus on hair shafts.⁴

Much media attention has correctly focused on the possibility of direct and indirect transmission via for example contaminated hands, with public health messages focusing on the importance of washing hands thoroughly and often, and of greeting others without shaking hands. Less attention has focused on aerosol transmission, but studies are underway to examine as to what extent aerosols could be a potential role of transmission.

A number of recent reports discussed aerosols as a possible culprit of COVID-19 transmission when saturated with the virus in closed environments for a prolonged duration. Blood samples and anal swabs of patients were found to contain SARS-CoV-2 ribonucleic acid (RNA).⁵

Aerosols are liquid and solid particles suspended in the air. An aerosol with a diameter of 2 to 5 μm or less can remain airborne for a

long period of time and enter the respiratory system. A recent study indicated that aerosol and fomite transmission of SARS-CoV-2 is plausible, since the virus can remain viable and infectious in aerosols for hours and on surfaces up to days (depending on the inoculum shed).⁶ While most of the danger of lasers surgery in dermatology comes from the beam itself include direct eye injury, there are certain non-beam hazards include flammability, electrical hazards, and airborne contaminants.⁷

The particulate matter in surgical smoke is roughly less than 1.1 μm in size. Lasers generate particles of 0.07 to 0.31 μm . It is worth mentioning that particulate sizes less than 2 μm can deposit in the respiratory system.⁸ Standard surgical masks can filter particulate matter greater than 5 μm in size and hence do not provide any protection against electrosurgical and laser plume. The aerosol particle sizes of COVID-19 range from 30 to 150 nm and using an FFP3 respirator offers a filtration rate of 99% and an N95 offer a filtration of 95% for all particles measuring up to 0.6 μm .⁹

Thermal disruption of viable human cells results in the release of carbon particles, virus, bacteria, deoxyribonucleic acid (DNA), and toxic gases. Viral transmission was demonstrated in surgical smoke in animal studies. Aerosolization of viral particles was confirmed in patients undergoing wart ablation by CO₂ lasers.¹⁰ Moreover, laser treatment of condyloma acuminata using lasers was found to be responsible for laryngeal papillomatosis in health care professionals.¹¹⁻¹⁴ Viable

bacteria such as *Staphylococcus*, *Corynebacterium*, and *Neisseria* have also been detected in plume associated with laser resurfacing. Tissue culture pellets obtained from human immune deficiency (HIV) infected patients were exposed to CO₂ lasers; and smoke debris of the procedure was found to contain proviral HIV DNA.¹⁵ On the other hand, Hughes and Hughes in 1998 examined ablative erbium:YAG laser plume for release of HPV DNA. One half of clinically and histopathologically confirmed verrucae vulgares from five patients were submitted for HPV DNA detection with in situ hybridization. After erbium:YAG laser ablation of the remainder of the warts, the laser plume was deposited on the handpiece as an abundant fluffy material and was submitted for evaluation of HPV DNA by polymerase chain reaction with consensus primers for the HPV-type detected in the wart specimens. HPV2 DNA was found in all warts while HPV DNA was not detected in the erbium:YAG laser plume after ablation of these same warts (Table 1).¹⁶

While it is not possible to completely postpone all procedures and with clinics slowly reopening amid this pandemic, some tips to be considered include the following sections.

1.1 | Social distancing

Depending on the size of your clinic, laser treatment patients should be socially distanced to at least 1 to 2 m apart from one another and from staff behind the reception desk.¹⁷ The only exception for this might be during the time of receiving the treatment with the physician or therapist.

1.2 | Contact tracing

In order to properly trace contacts in case of any suspicion, anyone who enters the clinic should leave their full data contacts. Staff must check on the full address and phone details and make sure details are

TABLE 1 Laser plume characteristics

	Laser plume
Source	Excimer, argon krypton, carbon dioxide, Erbium:YAG, ruby, diode, dyes, Nd:YAG, Alexandrite
Mean diameter	0.07-0.3 μm
Plume produced on treating 1 g of tissue	Equivalent to inhaling three unfiltered cigarettes
Chemicals found in significant concentrations	Acetonitrile, acrolein, ammonia, benzene, ethylene, and toluene
Infection particles detected in surgical plume	Human papillomavirus (HPV), hepatitis B virus (HBV) Human immune deficiency virus (HIV) proviral DNA <i>Staphylococcus</i> , <i>corynebacterium</i> , and <i>neisseria</i>

updated and appropriate. It is also advisable for those having laser sessions to show up in person and avoid companions.^{18,19}

1.3 | Health and safety

- The staff must ensure to the best of their ability measurement of temperature and ask possible symptoms of patients before they enter the clinic (if the patient is coughing, has a temperature above 38°C, or if they were in contact with a confirmed COVID-19 patient in the past 2 weeks).
- Bed sheets and head rest covers should be disposable and must be replaced for every treatment.
- Bathrobes or gowns used during laser hair removal procedures should be disposable and dumped into biohazards bags after procedures.
- Hand washing best practice implemented before and after every treatment and eye, nose, and mouth hand contact should be avoided.
- Patients are encouraged to disinfect hands with 60% to 70% isopropyl alcohol, provide verbal consents, and wear surgical masks before entering procedure rooms.
- Working surfaces must be sanitized with hospital-grade disinfectant between every treatment.
- Gloves and dry high-filtration media masks must be worn by handling physicians and nurses (filtration media stops working when the mask gets damp from breathing).
- It is advisable to wear adequate eye protection (goggles or visor) considering that exposed mucous membranes and unprotected eyes can increase the risk of SARS-CoV2 transmission.
- The clinic should be fully sanitized multiple times throughout the day.
- Staff members experiencing any flu or cold-like symptoms such as coughing, sneezing, runny nose, sore throat, and fever should rest at home till full recovery.
- Allowing enough time between appointments is advised to avoid crowding.
- A sign must be placed with instructions to keep distance between patients and to stick to safety rules.
- Machine body can be covered with disposable sheet/cling film for each procedure with the exhaust fan area open.
- Eye shields and connected straps as well as lens optics should be cleaned with 70% ethyl alcohol.
- Avoid laser gel contamination between patients by using disposable cups for each patient.
- Disinfect the entire laser hand piece between patients.
- Proper fitting high-filtration masks to be used by the surgical team during procedures.
- A smoke evacuator should be used while doing laser procedures that generate plume, for example, viral warts, epidermal nevi, laser ablation, and laser hair reduction. Also, maintain good general ventilation in the clinic to dilute any contaminants that skipped in the air.

- Contact cooling devices and tips pose a small but real risk of infection. Between patients, disinfection of the hand piece is mandatory.

2 | CONCLUSION

There are limited data to support performing or abstaining from laser procedures in dermatology and cosmetology clinics during the COVID-19 pandemic. According to the magnitude of the condition worldwide, many practitioners and service providers preferred to personally suspend their activities or completely lockdown in accordance with governmental laws, while others continued to provide laser sessions to their patients. Consequently, there is neither robust evidence nor guidelines for performing laser procedures in dermatology clinics at present. Special consideration on laser safety with focus on potential biological hazards is needed to reduce potential risks of laser airborne contaminants. The presented work represents the authors' opinion.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest

ORCID

Mohamed L. Elsaie  <https://orcid.org/0000-0001-7541-5241>

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