



Decontamination of Used Face Masks in COVID Times

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Abstract

Face masks are a must for venturing outdoors in COVID times, for both the general public as well as healthcare professionals. They have to be decontaminated periodically since they can act as fomites for the transmission of various infections. Many options are there for decontamination but they have to be chosen wisely because they can destroy the filtration efficacy of the masks.

Keywords: Decontamination; Mask; Fomites

Abbreviations: w/v: Weight/Volume; Mesh: Medical Subject Headings.

Introduction

Since the beginning of the current pandemic of COVID 19, people have been using face masks. They are a form of Personal Protective Equipment or PPE. They stop the spread of virus-laden aerosols from a COVID-19 infected person to other susceptible persons. However, with time the masks that are being used can be colonized with many bacteria, fungi, and viruses which can transmit infections. Different types of face masks are there, like surgical masks, FFP Masks, N95 masks, and others like washable or cloth masks. There may be an impending crisis of masks and other forms of PPE due to huge demand. So, there should be available options to decontaminate face masks without hampering their filtration efficacy.

Materials and Methods

Through and meticulous scientific literature search by Google, Pubmed, and other portals was done, by using MeSH terms for obtaining information about types of masks and how to decontaminate them without harming their filtration efficiency.

Types of surgical masks

Many types of surgical masks are there, like:

Type 1 and Type 1R: These masks are not meant for use by healthcare workers. Type 1 masks have a BFE or bacterial filtration efficiency of 95% but are not said to be effective enough to be used in medical settings.

Type 2 and Type 2R: They are used by Healthcare professionals. These medical PPE masks are designed to be worn by healthcare workers. The difference between Type 1 and Type 2 is the filtration efficiency that they afford: Type 2 has 98% filtration efficiency, 3 % more than the Type 1 mask. The term 'R' refers to the fact that the mask is splash-resistant [1].

FFP Masks

The full form of FFP is "filtering face piece" mask [2]. There are 2 types of FFP Masks, viz. FF2 and FFP3. FFP2 is the minimum standard laid out by the WHO for optimum protection from aerosols. FFP2 masks are used mainly in industry and filter at least 80% of airborne particles and microbes as well [2]. FFP2 Masks are similar to KN95 and N95 masks but differ in some parameters. FFP3 is still better and has got 99% filtration efficiency [1].

N95 Masks

The letter “N” in N95 masks stands for non-oil, indicating that it is not resistant to oil. The filtration material on the mask is an electrostatic non-woven polypropylene fiber and can hence repel aerosols effectively. The minimum size of 0.3 microns of particles and large droplets will not pass through the mask barrier, as per the centers for Disease Control and Prevention (CDC) [3]. Sometimes N95 masks are provided with exhalation valves to facilitate easy exhalation. N95 masks can protect a person for up to 25 hours continuously against aerosols.

KN95 Masks

KN95 masks are also a form of PPE used to protect oneself from aerosol and related hazards [4]. They are manufactured in China. They are often very similar to N95 masks and are mainly used in industrial settings. They offer the same filtration efficacy as N95 masks.

Cloth Masks

They have poor filtration efficacy and are not recommended to be used by healthcare professionals. However, they can be washed repeatedly and reused.

Microbes Harboring Mask Surfaces

With time, as one wears masks, environmental microbes and also commensals from the skin and external nares colonize the surfaces of the masks. Viruses like Bocavirus, RSV (Respiratory Syncytial Virus) and Influenza virus can harbour mask surfaces frequently as some studies observe [5]. We have also observed according to our data that bacteria like *Micrococcus* spp., Coagulase-negative *Staphylococcus* spp., *Staphylococcus aureus* can colonize inner and outer mask surfaces. Other studies corroborate these findings, and have also retrieved *Legionella* spp., *Mycobacterium tuberculosis* and *Corynebacterium* spp. along with *S. aureus* on mask surfaces. We have also found fungi of genera *Candida* spp. and *Aspergillus* spp. to harbour mask surfaces very often.

Ways for Decontaminating Face Masks

Surgical: Dry heat pasteurization at both 60°C and 70°C for 1 hour can successfully kill 6 species of respiratory bacteria and one fungal species, and inactivate the H1N1 indicator virus on surface of surgical masks, as per some studies [6].

FFP 2/3 Masks: The masks can be decontaminated by subjecting the device to a temperature of at least 56° for at least 30 minutes. This does not alter the filtration efficacy of the mask [7]. A temperature of 70 °C can also be used safely

according to some reports.

N95: Dry heat pasteurization can be used to disinfect N95 masks, much like surgical masks.

KN95: KN95 masks can be disinfected by Soaking the mask in hot water, rinsing the mask and air-drying the masks [4]. Vaporized hydrogen peroxide can also be safely used for decontaminating these masks effectively.

Cloth Masks: Cloth masks can be simply washed and reused. According to our findings, 76% ethanol or spirit can be used for decontaminating surfaces of N95 and cloth masks effectively and can reduce the number of bacteria on mask surfaces appreciably. However, we have still not studied its effect on the filtration efficiency of the mask. We have also found a mixture of 1% (w/v) shredded sweet betel leaf and 1% (w/v) shredded curry leaves to be effective in this regard.

The Way Forward

Antimicrobial Masks

Scientists at the School of Biomedical Engineering, IIT (BHU), India had devised an antimicrobial face mask in 2020 [8]. The first layer of the mask can degrade any type of RNA; the next layer is said to be anti-microbial, the third one is for air filtration, and the fourth and fifth layers are ‘comfortable layers’, which remain close to the nose and mouth of the wearer. The mask also has hydrophobic surface on the outer layer to deflect droplets containing SARS-CoV2 and other viruses.

Discussion

In the ongoing pandemic, people are left with no choice but to use face masks while venturing out for work or in offices. Face masks can be contaminated with a plethora of microorganisms like bacteria or fungi with prolonged or repeated use. They can come from the air or the hands or skin of the wearer and adhere to the surfaces of the masks. These microorganisms can be bacteria, viruses, or parasites and can colonize the mask surfaces. Especially in the hospitals, they come from aerosols generated by coughing or sneezing of the patients or by various aerosol-generating procedures [5]. Cloth masks can be washed and reused a number of times, but the same cannot be done with FFP2 or N95 masks because that would harm their filtering efficiency. Reuse and extended use of masks are also being seen commonly in many corners of the world, especially during outbreaks and pandemics like the current pandemic [5,9]. They can hence serve as good fomites for the onward transmission of infections. The face masks should be disinfected properly with available decontaminants. The global COVID-19 pandemic has already resulted in a long-term shortage of PPE including face masks the world over, which has already become one of the most urgent challenges to our collective ability to save

precious lives in this pandemic. Hence, searching for different easy, potent and cost-effective methods to decontaminate and reuse face masks is important and the need of the hour. Effective decontamination of face masks and other PPE with chemicals or herbal moieties might be a very useful strategy at this juncture [7]. Cheap and easily available chemical disinfectants and natural compounds can be tried for this purpose. However, these molecules should not compromise the filtering efficacy of these masks. Decontamination of face masks should hence be a priority, for all and the healthcare facilities in particular. Adequate steps should be taken in that direction.

Conclusion

Many methods can be there for decontamination and reuse of masks and such a method has to be chosen wisely depending on the type of mask used.

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