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Design and development of reusable facial deactivation masks for COVID-19

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Introduction

Coronavirus (COVID-19) is believed to be transmitted from person to person via droplets, however the United States' Centre for Disease Control and Prevention recommends that face masks not be worn unless a person is suspected to carry COVID-19 or around someone infected. By putting on a face mask, someone can take precautionary harm reduction steps to spread of disease via coughing, sneezing, speaking, breathing, and eating. However, concerns exist that people excessively touch their faces and potentially bring viral particulates close to orifices of entry (i.e. nose, mouth, eyes) into the body. Despite controversies on their efficacy, masks have still been widely adopted during H1N1 swine flu in 2009 along with other large scale pandemics.1 Researchers from the University of Alberta has recently found universal and reusable virus deactivation systems for respiratory protection in mice models.2 In this paper, we suggest the development of a 3D-printed face mask, which uses table salt (NaCl) as a deactivating, neutralizing agent against the virus.

The goal of developing this mask lies on the principle that it may be used against aerosols and droplets, which are the underlying mechanism for transmission, by creating an aseptic, sterile environment around the face. Furthermore, masks are not one-size-fits-all solutions. The contours, sizes, and shapes of facial features can influence the fit of the mask.

Method

Here we suggest two possible applications. The first is a 3D print design with commercial thermoplastic (PLA, ABS) that capitalizes on perforations and coating of existing N95 respirator design. The schematic below (Fig.1) shows a CAD sketch up of an inhaler conduit nebulizer. Here we suggest compressor filters and channels for tubing (as indicated by arrows in the figure) can be coated with NaCl brine solution. This ensures that during respiration, there will be an aseptic environment around the face.

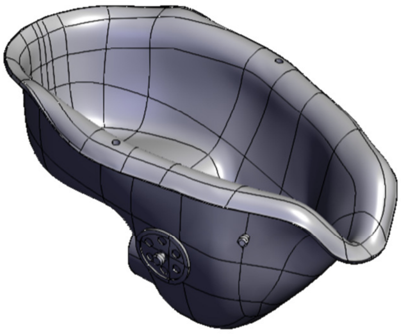

Fig.1: CAD sketch up of an inhaler conduit nebulizer and potential targets of NaCl coating

The second application borrows elements from clay masks and biocellulose masks. An important part of these masks is the fact that these masks are formed to fit the face. Salt can be infused or layered on these maks as they are either applied to the face or during their manufacturing. In light of the mass shortage of face masks around the world, it may be advisable to dip mask cloth in brine prior to application.

Conclusion

While the efficacy of masks is controversial, its widespread use warrants more sterile and hygienic tools and techniques. This proposal suggests a potential application for the seamless incorporation of salt, postulated to have beneficial effects in "flattening the curve," into masks a method for curbing the current COVID-19 pandemic.