

COVID-19 mask: A modified anatomical face mask

Sir,

The COVID-19 outbreak was declared a Public Health Emergency of international concern on 30 January 2020 by World Health Organization (WHO). Subsequently, on March 11 2020, WHO declared the outbreak as a pandemic and till date, it continues to spread globally into new countries.^[1] Leading the fight against this deadly disease are the health care workers (HCW) who are at the frontline. Amongst all the shortcomings they are facing, the most striking concern which has emerged is the lack of sufficient number of N95 mask/respirators. Even countries like United States of America and Italy which have a health care system that is far better than India are struggling to meet the demand of N95 masks for their health care workers. These numbers explain why China is the world's largest producer of them, with a reported daily capacity of 20 million pieces, but by the estimate of its manufacturers, the domestic demand alone is around 50-60 million per day.^[2]

There is clearly a huge supply-demand gap here in India, and in the near future, when we enter the stage of community spread, the number of cases are bound to soar and it is likely to further widen the gap putting the lives of HCW at risk, while trying to get a grasp on the growing crisis. Across the nation, their mission to provide patients with reliable care is becoming an increasingly difficult task as hospitals and clinics confront a limited supply of N95 masks.

In this current crisis, a "Modified anatomical face mask (M-AFM)" can serve as an equally effective alternative to N95 respirator. A simple modification of attaching a heat and moisture exchanger bacterial/viral filter (HME+bv) at its orifice can convert the anatomical face mask (AFM) into an effective interface in protecting the HCW from the aerosol spread of Covid-19. In addition, cushioned tapes or a harness attached at the retaining hooks can hold the MAFM firmly on to the face of the HCW [Figure 1]. We have used the IS Indosurgical air cushion facemask (anatomical face mask) used in our operating theatres for preoxygenation and oxygenation before induction of anaesthesia or providing oxygen enrichment during RA. There are many companies



Figure 1: Showing how to wear the M-AFM properly with protective goggles

which are manufacturing anatomical face masks and any of them can be used as per the regular consumable supply of the centre. Even the NIV face masks can be used.

HME filter used was from Drager Safestar. Being reusable, it does not contribute to the hazards of biomedical waste which poses a significant threat of spread in the current circumstance. HME filter will be only component that will require safe disposal after use. Rest of the components can be washed, chemically disinfected, washed again and dried for reuse.

There are several advantages of the M-AFM when used by HCW: 1) The soft air cushion present on the rim of the AFM creates an air tight yet a gentle low-pressure comfortable seal on the face. An "Occlusion test" can be performed to check for the airtight fitting. Once M-AFM is attached firmly on the face of the HCW, the HME+bv filter is occluded and HCW takes a deep inspiratory breath, if the HCW is unable to draw in the air, it suggests there is proper airtight fitting and air is not entering through the sides of the mask. Alternatively, we can attach a non-invasive ventilator and check for leaks around the mask, because NIV uses high flows the leaks can be identified by the person wearing it; 2) These masks are available in different sizes and one can select the size which fits the best. The mask has a colour coded hook ring based on the size for easy affixation with harness/straps. Every anaesthetist uses a well fit AFM for the patient before administering general anaesthesia. Hence the same check can be performed to determine a suitable size with a perfect fit of the M-AFM for self; 3) It also has an air inflation valve/port for customized fit

and increased comfort allowing it to be used easily for more than 3 hours; 4) M-AFM can be washed in running water soap/hypochlorite solution,^[3] after one shift and reused. There is a 22 mm orifice for fresh gas inlet in the centre of the dome where the HME+bv filter will be attached. Being reusable, it does not contribute to the hazards of biomedical waste which poses a significant threat of spread in the current circumstance. HME+bv filter will be only component that will require safe disposal after 24 hours of use; 5) HME+bv filters are disposable and have filtration efficiency of 99.999%,^[4] compared to 95% of N95 mask. It has low flow resistance and high filtration efficiency. Cushioned strap/harness with the help of hooks on the mask can be used for wearing the mask and adjusted as per comfort making sure air tightness is maintained; 6) M-AFM is a much cheaper alternative to N95. HME+bv filter costs around Rs 100 as compared to N95 which costs around Rs 400 at this time of crisis and the HCW will require at least three to four N95 masks per day.^[5] The demerits of the M-AFM are: 1) Wearing a face shield over this assembly will not be possible because the HME+bv attached at the orifice which appears as a projection. Hence, a protective goggle should be used along with this assembly as shown in the Figure 1; 2) Arranging for a harness which may not be readily available in all centres. However, velcro tapes can be used instead to fasten the M-AFM assembly around the face; 3) The humidification function is not necessary but to get specific bv filter only in current scenario with lockdown was difficult, thus the authors chose this assembly because it was readily available. If available, bv filter alone can be used.

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Conflicts of interest

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