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ORIGINAL ARTICLE

A cloth mask for under-resourced healthcare settings in the COVID19 pandemic

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Abstract

Introduction COVID19 pandemic poses a global threat, with many unknowns. The potential for resource limited countries to suffer huge mortality is of major concern. Prevention and risk reduction strategies are paramount in the current absence of effective treatment or a vaccine. There is a global shortage of personal protective equipment.

Aims This short paper describes the rationale for and development of a cloth homemade mask and has a step by step video.

Results The template is reproducible around the world and is both washable and cheap.

Conclusion This article describes a simple way to make a cloth mask, suitable if medical masks are not available.

Keywords COVID19 · Face mask · Infectious disease · Pandemic · Personal protection equipment · SARS-CoV-2

Introduction

The COVID19 pandemic drives the need to maximise the use of available resources to protect people from contracting the virus to minimise morbidity and mortality. There are universal reports of limitations on personal protective equipment (PPE), and many countries in resource-challenged regions have minimal or no reserves [1]. This will result in an inability to control the pandemic and poor outcomes.

There are a wide range of PPE and very robust criteria to assess its efficacy and suitability [2]. Facial morphology and hair may confound the standards of protection and tolerance of the protection [3].

Doremalen and colleagues have recently shown that SARS-CoV-2 remained viable in aerosols for over 3 hours, with a reduction in infectious titre from 103.5 to 102.7 TCID50 per litre of air [4]. Over a decade ago, van der Sande identified that a tea towel offered some protection, all be it suboptimal compared to an FFP2 commercial mask [5].

The aim of this report is to share the details for the design and rapid fabrication of a cloth face mask, with the potential to provide the population with alternatives when medical grade face masks are not available.

Methods

A dress maker (MV) designed multiple prototypes of cloth face masks and after six versions came up with the pattern shown in Fig. 1. The base of the parabolic curved pattern for this full size adult mask was 29 cm. The curve of the mask creates a duckbilled design similar to a commercial FFP2 mask, with a facial cup, nasal bone bridge and two elastic bands.

The material used was a polycotton with a tight weave. The nasal bone was created from a coated 3-mm metal garden wire obtained from a hardware shop. The first step was to fold the material in two and pin the pattern to the material. This is cut with a scissors (a view of the step by step mask manufacture and application is available in supplementary video www.dcra.ie) [6]. A small hem is added to the lateral edges to

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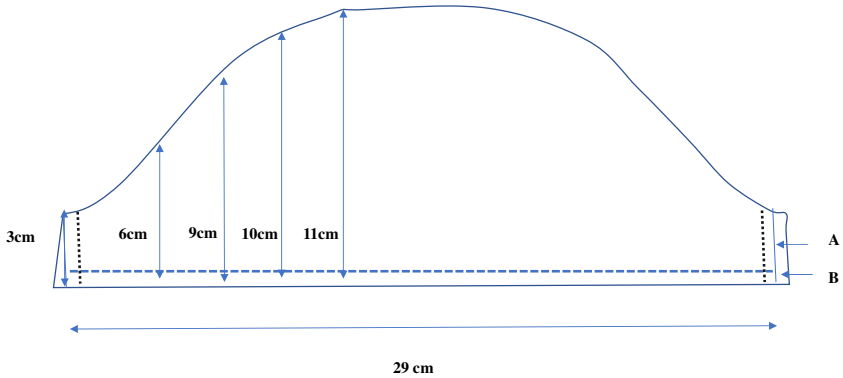

Fig. 1 The pattern for the home made mask

allow the elastic strap to be inserted with ease (marked as B in Fig. 1). Folding the top flaps over, the leaves are sewn together and then stitched to the bottom unfolded leaf. The free flap of the bottom end is then stitched to the top but leaving a 6-cm opening to allow it to be inverted. The mask is then turned inside out. The apical defect of approximately 6 cm is hand stitched closed. All the seams are on the inside so an overlocking stitch was not necessary. At both bases, a 7-mm tunnel was created by stitching to allow the passage of the elastic bands, which can be facilitated by a small round safety pin (marked as A in Fig. 1 in video). The nasal bridge bone was made from a 14 cm length of 3-mm wire coated in plastic and an additional layer of insulating tape was wound the exterior of the wire. The elastic strapping used was 5 mm in width and 60 cm in length for both top and bottom straps.

Results

The mask fitted comfortably and provides a good seal (Fig. 2). The elastic bands are placed over the crown of the head and the occiput. There is an additional opportunity to apply tape to the superior edge of the mask to increase the seal or reduce fogging. The cost of the material was less than 1€. The measurements shown in the mask fit an adult male face and adjustment would need to be made according to facial size and features.

Discussion

This work reports the design and fabrication steps of a simple cloth face mask, which may be considered as a last resort for those wishing to have some protection and protect others from aerosol and droplet spread. The enormity of this COVID19 pandemic remains to be seen, but apart from China and Korea, it remains unabated, with over 1,982,552 cases and 126,753 deaths [7].

Protective effects of face masks have been studied extensively, often involving personal respirators for professionals under idealized conditions, involving protection of specifically trained personnel. Van de Sande has suggested the deployment of masks in the general population during an outbreak of an infectious disease, where anyone may encounter the infectious micro-organism, implying much greater heterogeneity,

Fig. 2 Lateral view of homemade mask in place

in training levels (experience and understanding), goodness of fit of a mask and activities interfering with mask use and thus reducing potential reduction of transmission [5].

Transmission barriers, isolation and hygienic measures are effective at containing respiratory virus epidemics. Surgical masks are most consistent and comprehensive supportive measures and are not inferior to N95 masks [8, 9].

Face masks are only a part of the overall approach but together with personal distancing, hand hygiene and other measures form a bundle which may overcome this disease [8]. The protection conferred by face masks appeared stable over time and was not dependent on activity [5].

Given Doremalen's recent results indicating that aerosol and fomite transmission of SARS-CoV-2 is plausible, and since the virus can remain viable and infectious in aerosols for hours and on surfaces up to days, extra caution is required [4]. These findings echo those with SARS-CoV-1, in which these forms of transmission were associated with nosocomial spread and super-spreading events [10]. The Centers for Disease Control and Prevention recommends a 6-ft (2-m) separation [11]. However, Bourouiba et al. suggest that these distances are based on estimates of range that have not considered the possible presence of a high-momentum cloud carrying the droplets long distances. Given the turbulent puff cloud dynamic model, recommendations for separations of 3 to 6 feet (1–2 m) may underestimate the distance, timescale and persistence over which the cloud and its pathogenic payload travel, thus generating an underappreciated potential exposure range for a health care worker. For these and other reasons, wearing of PPE is important for health care workers caring for patients who may be infected, even if they are farther than 6 ft away from a patient [12]. This may apply to patients and their families also in clinical areas. There is increasing global suggestions that face masks should be worn at all times, but this strategy has yet to be proven.

In its current guidance to optimise use of face masks during the pandemic, the Centers for Disease Control and Prevention (CDC) identifies three levels of operational status: conventional, contingency and crisis [13]. This mask would be in the crisis category and would intuitively offer more protection to the wearer than no PPE at all. Well-resourced countries are increasingly becoming under-resourced in PPE. Innovative ideas are required to ensure adequate supplies.

Conclusion

The cloth face mask is simple, cheap and made from materials that are globally available. We would not advocate its use in preference over proven medical masks that have been rigidly tested, rather as a last but important option, in the fight against the COVID19 pandemic, and is consistent with the application of the precautionary principle [14].

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