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OPEN ACCESS

International Journal of Nursing and Health Care Research

Bruyneel A, et al. Int J Nurs Health Care Res 03: 1192.

DOI: 10.29011/2688-9501.101192

Letter to Editor

The Double-Trunk-Mask: A Simple System to Save Oxygen Supplies

Arnaud Bruyneel*, Frédéric Duprez, William Poncin, Xavier Wittebole

SIZ Nursing, A Society of Intensive Care Nurses, Tivoli University Hospital, CHU Tivoli, Belgium

***Corresponding author:** Arnaud Bruyneel, PhD Student in Public Health at ULB, Vice-President, SIZ Nursing, asbl, Member of the Council, EfCCNa, Nurse, Intensive Care, Tivoli University Hospital, Belgium

Citation: Bruyneel A, Duprez F, Poncin W, Wittebole X (2020) The Double-Trunk-Mask: A Simple System to Save Oxygen Supplies. Int J Nurs Health Care Res 03: 1192. DOI: 10.29011/2688-9501.101192

Received Date: 03 October, 2020; **Accepted Date:** 21 October, 2020; **Published Date**: 27 October, 2020

Letter to Editor

Dear editor,

Since March 2020, after China, Europe and the rest of the world are facing the COVID-19 pandemic, caused by the SARS-COV-2 virus [1]. This health crisis has led to oxygen shortages in developing countries but also in nursing homes because of the limited capacity of oxy-concentrators, when present, to provide an adequate oxygen flow [2-4].

The Double-Trunk-Mask (DTM) is a device designed to increase the fraction of inspired oxygen in adult patients who receive oxygen by a nasal cannula (Figure 1). The mask was developed by Duprez et al in 2001 [5]. The DTM is composed of a regular aerosol mask with corrugated tubing (ISO 22 - 15 cm length) inserted into two lateral holes. The tubing collects oxygen that is wasted from the nasal cannula during expiration or because of mouth breathing. During the next inspiration, the subject inhales the enriched oxygen gas mixture sequestered in the tubing instead of room air. Therefore, the DTM acts as a FiO_2 booster.

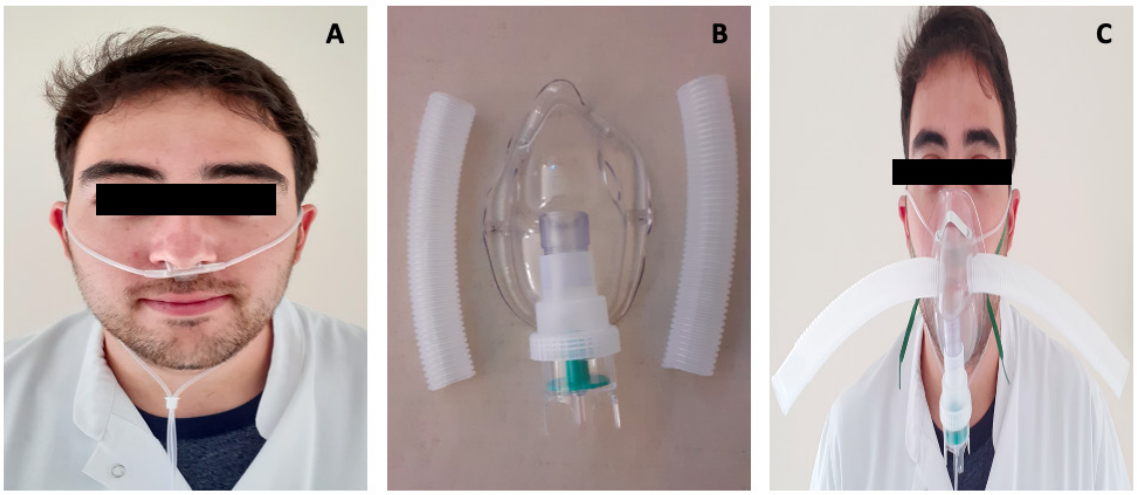

Figure 1: Mounting the Double-Trunk-Mask. a Subject with low flow nasal cannula (Convatec™-New Zealand-Auckland ref. 1616-21). b Aerosol mask (Dahlhausen, Köln, Germany-ref: 01.000.01.120 (CE0123) with two corrugated tubing (Trunks) (ISO 22, ± 15 cm length). c Double Trunk Mask (DTM): Aerosol mask + two corrugated tubing ISO 22, ± 15 cm length inserted in the two lateral holes of the mask. Subject equipped with DTM and nasal cannula. The DTM is just placed over the nasal prongs. Oxygen delivery is made through the nasal cannula and not into aerosol mask.

When the DTM is placed above low-flow or high-flow nasal cannula and the oxygen output is not modified; the PaO_2 increases without clinical impact on the $PaCO_2$ in patients hospitalized in intensive care [6,7]. In the same vein, a recent publication also showed that, for an identical oxygen saturation, the DTM can be used to reduce de oxygen output by 50% on average in COVID-19 patients hospitalized in COVID-19 wards [8] (Table 1).

Author, year	Study type	Patients	Comparison	Findings
[7]	Prospective multi-center Crossover in ICU	15 patients with AHRF, FiO_2 0.78 ± 0.14	HFNC vs HNFC + DTM	PaO^2: 68 ± 14 mm Hg vs 85 ± 22 mm Hg ($p <$ .001) and did not affect $PaCO_2$ (p .18)
[6]	Prospective Crossover in ICU	15 hypoxemic patients with oxygen (flow: 5 ± 3 L/min)	NC vs NC + DTM	PaO_2: 60 ± 7 mmHg vs 90 ± 14 mmHg ($p<$ .001) and $PaCO_2$: 39 ± 5 mmHg to 42 ± 6 mmHg ($p <$ .001)
[8]	Prospective Crossover in conventional care units	11 COVID-19 patients with oxygen flow between 4 and 15 L/min	Standard oxygen vs NC + DTM	Oxygen flow: 5 [4-8] L/min vs 1.5 [1.5-4] L/min (p = .003)
ICU: Intensive Care Unit, AHRF: acute hypoxemic respiratory failure, HNFC: High-flow nasal cannula, DTM: Double-Trunk-Mask, mean ± standard deviation, NC: nasal cannulas, median [p25-p75].				

Table 1: Clinical studies using the DTM.

Other practical issues are associated with the use of the DTM. First, this patent-free system is easy to assemble and inexpensive since all disposables are readily found in various clinical settings. Second, if required, performing a nebulization is facilitated because a regular aerosol mask composes the whole mask. Third, if the patient removes the DTM, he conserves at least a source of oxygen through the nasal cannulas. In view of the above considerations, in Belgium, the use of the DTM has been integrated in a step-by-step algorithm for oxygenation of hospitalized patients with COVID-19 by the Federal Agency for Medicines and Health Products [9]. This health crisis has highlighted the lack of and the need for oxygen, so we believe that this mask may be a part of the solutions to these problems.

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