



## HOW TO MEET OXYGEN DEMAND FOR SEVERELY HYPOXIC PATIENTS IN A RESSOURCE LIMITED SETTING

The tidal volume is the amount of air inhaled during comfortable breathing at rest (approximately 500ml for adults). The minute ventilation corresponds to the tidal volume x the respiratory rate.

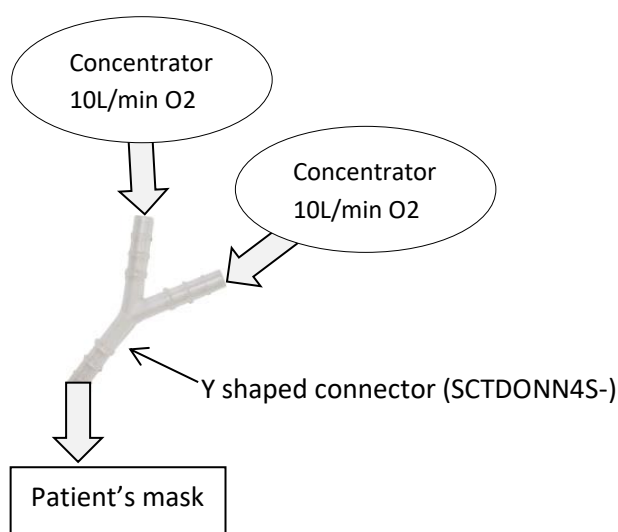
If gas exchange is impaired at the level of the alveoli (pneumonia, pulmonary edema, thoracic trauma...), then compensatory mechanisms increase the respiratory rate and tidal volume. Thus, the minute ventilation can increase up to 20-40L/min in critically ill patients with an acute respiratory illness (e.g. 600ml x 40/min = 24L).

Oxygen enters the circulation blood stream at the alveoli level by a concentration gradient (difference of concentration between the 2 sides of the alveoli membrane). The more oxygen you bring in the alveoli, the more likely it is to pass to the blood stream if the alveoli is functional. During severe pneumonia for instance, some of the alveoli are filled by secretions and don't allow any gas exchange. Remaining alveoli can, to a certain extent, compensate if the oxygen supply is increased, throughout the increased minute ventilation and an increased FiO<sub>2</sub>.

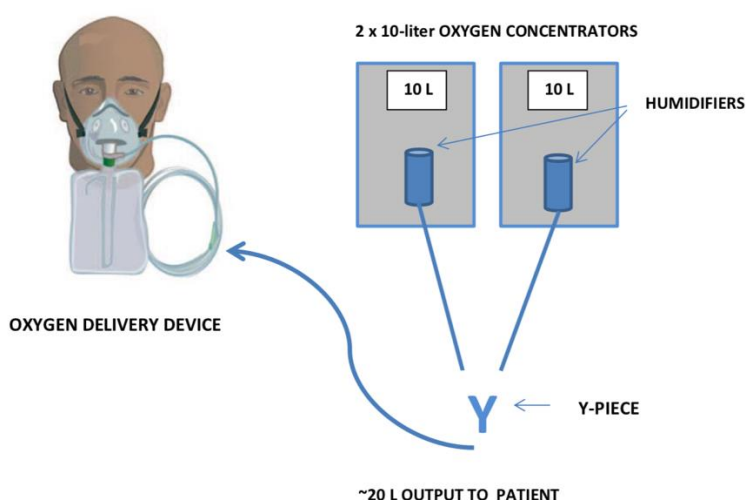
Oxygen delivery, above 6-8L/min is better achieved by a non rebreather mask (NRM), also called 'reservoir mask'. Its principle is to have small circular valves on the mask, occluded by inspiration. Air is therefore sucked preferentially from the reservoir, which is filled in by oxygen.



The highest output of oxygen in most of MSF settings is 10L/min via the concentrator, which is insufficient to meet the 20-30L/min inhaled in by the patient, leading to collapse of the reservoir on the NRM. In absence of alternative oxygen source (cylinders, oxygen from wall source, 20L/min concentrators...), 2 concentrators can be plugged together through a Y shaped autoclavable connector (SCTDCONN4S-), in order to provide a total of 20L/min of oxygen, closer to the respiratory demand of the patient.



Tubing from the NRM can be plugged into the Y-piece. Concentrators are connected with either the silicone tubing 5mm (SCTDTUBE052) or with the standard tubing that comes with each face mask. The tubing should be secured onto the Y-piece



Alternatively, if this connector doesn't exist in the field, 2 oxygen concentrators can still be used for a single patient who is hypoxic or the NRM reservoir is collapsing:

- 10L/min are administered by nasal canula, and *concurrently*,
- 10L are supplying the NRM

10L/min is usually not a suitable flow through nasal canula due to 'back flow' from the nostrils/cannula bottleneck (above 4L/min, oxygen will not penetrate into the nose). But in this scenario, oxygen rejected from the nasal cannula will be trapped in the NRM and will prevent the reservoir from collapsing during inspiration and augment the FiO<sub>2</sub>.