



Use of the Frequencer® for Treatment of COVID-19

COVID-19 leads to acute respiratory distress syndrome (ARDS)

As the world is acutely aware, new respiratory pathogens are emerging that cause severe respiratory distress, requiring effective mobilization of secretions, particular in intensive care units (ICUs). In 2003, severe acute respiratory syndrome (SARS), caused by a previously unrecognised coronavirus (SARS-CoV) rapidly spread throughout the world. It was contained relatively rapidly. Middle East Respiratory Syndrome (MERS; MERS-CoV) is another example of a viral respiratory illness that is new to humans. Most people infected with MERS developed severe respiratory illness, including fever, cough, and shortness of breath. Finally, COVID-19 is a severe respiratory syndrome caused by another novel coronavirus (SARS-CoV-2). These acute respiratory infections can cause serious inflammation to the respiratory system and damage the cilia in the airways, resulting in severe respiratory distress requiring mobilization of secretions in the hospital ward and ICU). In the COVID-19 case, researchers have performed autopsies on deceased patients and found large amounts of sticky mucus and hyaline membranes in the deep-seated airways.¹

Although data is still being collected, the clinical spectrum of COVID-19 is wide, encompassing asymptomatic infection, mild upper respiratory tract illness, and severe viral pneumonia with respiratory failure. Acute respiratory distress syndrome (ARDS) from COVID viral pneumonia has been the most serious and lethal consequence of COVID-19 since the pandemic began in March of 2020.² In a retrospective study of 191 COVID-19 in-patients in China, it was found that 98% of non-survivors had respiratory failure and 93% had ARDS (compared to 36% of survivors with respiratory failure and 9% with ARDS).³ As of Oct 2020, there were ~8 million cases of COVID-19 in the United States and over 220,000 deaths.⁴ Matthay et al., 2020,² estimate that at least 50% of patients with COVID-19 who died developed ARDS, resulting in a minimum of 100,000 deaths from COVID-19 ARDS in the United States. Furthermore, if mortality from ARDS is estimated to be 25%, there have been at least 400,000 ARDS cases. Worldwide, as of Jan 2021, there have been ~97 million confirmed cases of COVID-19, with ~2 million deaths.⁵ Using the same calculation as above, a minimum of 1 million deaths may have resulted from COVID-19 ARDS, with 4 million total cases of ARDS. It is proposed that the incidence of COVID-19 ARDS exceeds that of classical ARDS by at least twofold.² These estimates confirm earlier results suggesting that 13.8% of COVID-19 patients have severe disease with respiratory issues and 6.1% have critical illness with respiratory failure.⁶

Dymedso's Frequencer® uses acoustics to promote airway clearance

There is critical and immediate need for simple and effective airway clearance devices in untold numbers of COVID-19 hospitalized patients. A non-invasive device that is compatible with ventilation that effectively clears airway secretions would be extremely valuable. Additionally, a treatment modality that rapidly and effectively clears the airways of mucus and fluid and recruits smaller airways in the early stages of infection could alter the course and outcome of disease.

Dymedso's Frequencer® is a novel device that promotes bronchial drainage by using acoustic waves at an optimized frequency that easily travels through the chest, causing the lungs to vibrate and the viscosity of mucus to decrease. It can be positioned selectively on different areas of the chest (front or back), particularly the low lung areas, with no discomfort or pain, and can be used in intubated patients. The Frequencer® is effective and consistent at clearing pulmonary secretions in a variety of airway clearance diseases, and prior to COVID-19 more than 600 devices were deployed across the world.

The Frequencer® for COVID-19 treatment

Based on available data, Dymedso strongly believes that the Frequencer® could help a significant number of COVID-19 patients potentially alleviating the need for mechanical ventilation and ultimately reducing mortality. Several devices are currently in the hands of clinicians for treatment of COVID-19.

At the **Asklepios Klinik** Barmbek, Hamburg, Dr. Lars Fischer utilized the Frequencer® in combination with FLO cough assist to treat COVID-19 patients during the first wave. Although difficult to make direct correlations to outcome due to patients being treated with multiple therapies, the Frequencer® was safely and successfully incorporated into the COVID-19 clinical setting and appeared useful as a tool for the treatment of COVID-19.

The Frequencer® was placed at the **Jaber Hospital, Corona Centre, Kuwait** in mid 2020, and is routinely used in the ICU to improve airway clearance. In June 2020, Dr. Samar Haitham provided written case studies on 4 patients. All patients were on ventilation and were treated with the Frequencer® for 1 week, 20 minutes daily, followed by closed catheter suctioning. Improvement was observed after application of the device (i.e., breathing function showed improvement) in 2 of the 4 patients. Treatment was halted due to inability to conduct closed suction due to a bleeding tracheostomy (this was not caused by the Frequencer®) in 1 patient, while one patient showed no significant improvement due to a host of other complications. The physician concluded that the Frequencer® *“should be used for most of the patients with COVID-19, especially those having high thick mucus. It provides easy and consistent effective therapy, also it was very safe to use for patients on ventilators or having tubes.”*

Dymedso has solidified a collaboration with the **Ministère de la Santé et des Services sociaux (MSSS), Quebec**, to address the critical need for treatment of COVID-19 patients during the second wave. An observational study is underway on COVID-19 patients at **11 University Hospitals and 1 Long- Term Care Facility** (Centre hospitalier universitaire Sainte-Justine; McGill University Health Centre, Glen site; McGill University Health Centre, Montreal General Hospital; Hôpital de Verdun; Hôpital Sacré-Cœur; Hôpital de Saint-Jérôme; Hôpital Charles-Le Moyne; Hôpital Pierre Boucher; Hôpital Honoré-Mercier; Hôpital de Gaspé; Hôpital de Chicoutimi; CHSLD Monseigneur Ross (Gaspé)). The Frequencer® is being employed in this non-comparative multicenter clinical-economic study as an addition to standard care with the goal of demonstrating clinical relevance and economic efficiency. Several outcomes will be assessed including the frequency of use of the device, exposure time of the professionals to contagious patients during treatment, length of hospital stays, ICU admissions, need for ventilation, quality of life and patient satisfaction. Additionally, clinical efficacy will be measured where possible by documenting the evolution of O2 saturation, evolution of the respiratory rate and other parameters such as subjective dyspnea, patient and caregiver satisfaction.

The Frequencer® was utilized at the **Medical Center of Brest University Hospital, France** by Professor Erwan L'Her, Head of the ICU, for 3 weeks at the end of 2020. The unit was successfully integrated into the ICU and is shown in use on the patient's chest in the accompanying picture.



Finally, a multicenter prospective crossover noninferiority randomized controlled trial is underway at **CHU Sainte-Justine, Dept of Pediatrics, Montreal** and the **Montreal General Hospital** to compare the effectiveness of the Frequencer® vs. Chest Physiotherapy (CPT) for mobilizing secretions in mechanically ventilated children and adults with respiratory distress linked to COVID-19 infection. The trial design was recently published by Kawaguchi and colleagues in the medical journal *Trials* (2020, 21:610, see <https://doi.org/10.1186/s13063-020-04533-6>). Rationale for the study include expected improvement in the respiratory status of patients with COVID-19 due to the ability for increased treatments vs. CPT, reduction of the impact of COVID-19 on the health system, decreased exposure of physiotherapists to COVID-19 and improved working conditions in ICUs.

Summary

There is critical and immediate need for simple and effective airway clearance devices for treatment of ARDS resulting from COVID-19. Dymedso's Frequencer® could help a significant number of COVID-19 patients potentially alleviating the need for mechanical ventilation and ultimately reducing mortality. Several devices are currently in the hands of clinicians for treatment of COVID-19 and results will be reported as soon as available. To date, there have not been any adverse events and early results suggest improvement in breathing function after application of the device.

References

1. <https://www.youtube.com/watch?v=Nw-zXURqWe8>
2. Matthay et al., Biological mechanisms of COVID-19 acute respiratory distress syndrome. *Am J Respir Crit Care Med* 2020; 202: 1489-1502.
3. Zhou F, Yu T, Du R, et al: Clinical course and risk factors for mortality of adult in patients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020; 395: 1054–62.
4. CDC COVID Data Tracker. <https://covid.cdc.gov/covid-data-tracker>
5. WHO. <https://covid19.who.int/>
6. <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf>