

## HFCWO for COVID-19

Investigating Validity of High Frequency Chest Wall Oscillation as a Resource-Efficient Treatment for Coronavirus Patients

### Introduction

At Clarity Medtech, we aim to challenge convention and help offer more advanced medtech products to customers across the EU and USA. Where we see an opportunity to reduce healthcare costs and improve treatments available to patients, it is our duty to use our existing customer and supply-chain base to do so. In this white paper, we will investigate the validity of high frequency chest wall oscillation (HFCWO) technology as a resource-efficient treatment for mucus build-up in Coronavirus patients.

### Chapters

- 1 Current Resource Problems Due to COVID
- 2 Working Towards an Effective COVID Treatment Plan
- 3 The Danger of Mucus Build-Up in COVID Patients
- 4 Why Is Mucus Removal Not More Common?
- 5 What is High Frequency Chest Wall Oscillation (HFCWO)?
- 6 How HFCWO Compares With Other Solutions
  - i) Patient experience
  - ii) Staff experience
  - iii) Effectiveness
- 7 Why We Believe in HFCWO
- 8 About Clarity Medtech

### Current Resource Problems Due to COVID

In the UK, the NHS is under significant strain as the number of patients in intensive care reached all-time highs this year. As of 8<sup>th</sup> December 2020, there were 13,629 patients in hospitals across England with COVID-19, 1,118 of whom were receiving mechanical ventilation. (1)

In November, NHS England was forced to temporarily suspend the rule of one-to-one treatment in intensive care, (2) as those requiring close monitoring continues to rise and staffing levels remain affected by medical professionals becoming ill or having to isolate.

The resource strain is also affecting non-COVID care, with more than 20 NHS trusts cancelling thousands of planned surgeries. Professor Neil Mortensen, President of the Royal College of Surgeons, has been quoted in the Telegraph as saying,

*“Rising cases of COVID make it inevitable that some planned operations will need to be cancelled, so that urgent surgery for cancer and other life-threatening illnesses can continue.”* (3)

## Working Towards An Effective COVID Treatment Plan

Creating an effective treatment plan has been notably difficult as, during the first wave of the virus, relatively little was known about COVID-19 or how best to treat it. What's more, the strain on medical resources caused by a global pandemic meant that little effort could be spared for much more than keeping the worst affected alive.

However, it is vital that an effective treatment plan for COVID-19 is created without delay. **Improving recovery rates and reducing long-term associated health issues is with no doubt in the best interests of those infected with COVID-19.** Moreover, it would reduce the resource strain on our healthcare industry, alleviate the additional stress faced by medical professionals, and allow the vital treatment of non-COVID patients to return to normal levels.

With a healthcare system already facing tremendous strain both for COVID and non-COVID patient care, we are faced with two questions:

Firstly, we must ask whether a proposed treatment provides sufficient patient benefits to warrant any additional resources required.

Next, we should investigate whether there is any way the resource strain can be alleviated.

## The Danger of Mucus Build-Up in COVID Patients

For the most critically affected patients, COVID-19 can cause further complications such as pneumonia taking hold in both lungs and, in the most severe cases, acute respiratory distress syndrome (ARDS), sepsis, and vulnerability to infection from additional bacteria and viruses. (6) For these patients, breathing becomes so laborious that ventilation is required.

However, as we learn from the growing number of studies and the limited autopsy reports available, **one of the major immediate causes of death in COVID-19 is severe mucus blockage in the lungs, causing respiratory failure.** (4)

The mucus build-up is caused when the SARS-CoV-2 virus enters the airway, attacking capillary endothelial cells and causing infection of the bronchioles and alveoli (air pockets), which fill with large amounts of a plasma component exudate fluid. (5) Once the infection causes inflammation, the mucus both increases in quantity and becomes more viscous.

Mucus build-up also causes ciliary oscillation, which is the rhythmic beating of minute, hair-like processes on a cell's surface to move fluid or mucus over the surface, to slow down. **The crux of COVID-19 is that the bodies of severely ill patients are unable to effectively excrete mucus autonomously.**

Ventilation provides patients with much-needed oxygen until the body heals sufficiently to breathe unaided. However, **with severe mucus blockage and reduced ciliary oscillation, the average length of time COVID-19 patients spend on ventilators is 10 days: four to five times longer than normal.** (7) Long-term ventilation also increases the risks of ventilator-induced lung injury (VILI). (8)

Crucially, it also poses an increased strain on NHS resources in terms of available ventilators, medication, and intensive care staff. The latest version of Guidelines for Diagnosis and Treatment of COVID-19 issued by Chinese National Health Commission

emphasises the importance of mucus removal. We therefore must examine whether it is a suitable component of COVID treatment in the UK and EU as well.

### **Why Is Mucus Removal Not More Common?**

Professor Liu Liang, the doctor who performed the first COVID-19 autopsy, urged that when treating COVID-19 patients,

*“Ventilation is useless if mucus is not removed in advance.”*

In the 2018 article Chest physiotherapy with early mobilization may improve extubation outcome in critically ill patients in the intensive care units, (9) it was found that assisted mucus removal prior to ventilation serves to clear mucus build-up and allow ciliary oscillation to stabilise.

Mucus removal prior to ventilation in seriously ill COVID-19 patients has the potential to reduce time spent on life support and improve long-term recovery prospects.

As the value of mucus removal becomes clearer, we must further investigate the available techniques and technologies.

A number of mucus removal devices and techniques are currently available, yet are not in wide-spread use due in part to the increased risk of aerosol transmission with COVID patients.

They are also resource demanding in that they require trained medical professionals to solely treat one patient at a time, and offer varying results for patients' long-term recovery.

The UK, like many other countries, is faced with an already strained healthcare system. If we are to support medical staff through this pandemic whilst providing patients with the best treatment possible, it is vital to ensure that any assisted mucus removal treatment is a safe, effective, and efficient use of resources.

By closely comparing all available options to identify that which poses the least strain on resources and risk to medical professionals whilst providing patients with improved recovery prospects, we can help deliver a safer, more effective and efficient treatment for COVID-19.

### **What is High Frequency Chest Wall Oscillation (HFCWO)?**

High Frequency Chest Wall Oscillation (HFCWO) is a technology that has been specifically recommended by the Chinese Medical Association Respiratory Committee in their latest version of Guidelines for Rehabilitation of COVID-19 Patients. (10)

It generates high frequency air pulses and delivers them to the chest wall of a patient, via a vest, which dislodges mucus from the bronchial walls and mobilises secretions and mucus from the smaller to larger airways. From here, the mucus can be cleared by the patient coughing, or assisted by suction.

**Safe:** Compared with traditional techniques, such as chest physical therapy (CPT) and hand percussion, HFCWO could be much safer as it uses gentle air pulse compression and does not pose the risk of physical injuries to ribs and muscles.

**Effective:** HFCWO can mobilise mucus deeply seated in the lower airways. It could evidence in being more effective for mucus removal than conventional vibrating mucus removal devices, and three times more effective than CPT.

**Efficient:** Unlike other techniques which are performed manually by a nurse or a physiotherapist, HFCWO is a highly automated system, almost plug-and-play, and operates on its own, requiring little medical staff presence. This is extremely important in a pandemic context when hospitals are running short of human resources.

### Summary of the Clinical Benefits of HFCWO

- Increases sputum mobilisation
- Improves pulmonary function
- Decreases hospitalisations
- Potential to reduce number of days spent in ICU
- Decreases medical resource use e.g. antibiotics, oxygen
- Safe and efficient in different disease stages
- Safe for use in ICU and post cardiac surgery
- Cost effective

### How HFCWO Compares With Other Solutions

HFCWO could provide a safer, more effective, efficient and comfortable treatment for patients and medical staff alike. Here, we will compare the patient and staff experiences of HFCWO with Hand Percussion and Chest Physical Therapy (CPT), as well as the effectiveness of the options.

#### Patient experience

Hand Percussion and CPT require patients to be in a prone, lateral or seated position, while HFCWO can be performed on patients in any position they are comfortable, as well as those sedated or in a coma.

While the other techniques may not be suited to a number of patients, HFCWO is well tolerated in adults with acute asthma or chronic obstructive pulmonary disease (COPD). (11)

All techniques are considered generally safe for use, however HFCWO integrates Soft Mechanism Force to reduce the chances of physical discomfort or injury. It has been found to be safe for use on frail patients, children and trauma patients with lung and chest wall injuries. (12)

#### Staff experience

Both CPT and Hand Percussion must be performed by a professionally trained physiotherapist, and can be physically demanding and fatiguing. As HFCWO is mostly automatic, it could be operated without any special training, is mostly automatic and has previously been used by family members outside of hospital settings for non-COVID patients.

With Hand Percussion and CPT, each physiotherapist must work solely with one patient at a time. However, with HFCWO, one trained member of staff, who does not need to be a physiotherapist, could easily oversee the automated treatment of up to five patients. The

plug-and-play design also includes an intuitive interface on a large touch screen which makes it easy to operate from first use.

### Effectiveness

While Hand Percussion and CPT offer partial chest wall oscillation, HFCWO oscillates the entire chest wall. It is one of the most effective solutions for mucus removal in the example of COVID-19 and its common co-diagnoses.

The accelerated airflow creates shear force on the intima of the trachea wall, resulting in a significant increase in the airflow velocity inside the airways – over three times more so than Hand Percussion or CPT. The air velocity is less than that of a single cough, but patients are able to tolerate the shear force of HFCWO with regular frequency, without the physical demands felt from a coughing fit.

This helps mobilise mucus, assisting in moving it to the upper airways where it is more easily cleared by coughing or suctioning. In a clinical study, significantly more sputum was expectorated during HFCWO than the other methods. (13)

### Why We Believe in HFCWO

When in the midst of a pandemic, it is necessary to focus valuable medical resources on saving as many lives as possible. Healthcare professionals have gone above and beyond to achieve this, putting their own lives on the line, facing increasingly difficult decisions and suffering psychological distress. This is simply not sustainable, and it is our duty to find ways to alleviate the strains they currently face.

We are also compelled to improve the available treatment options for the tens of thousands of Coronavirus patients in hospital across the UK, and the many others across the world.

At Clarity Medtech, we believe that High Frequency Chest Wall Oscillation could provide an answer to both of these needs. As it causes no physical harm, offers one of the most effective treatment options and optimises much-needed medical resources, our aim is to use our expertise and resources to distribute this technology as widely as possible.

### About Clarity Medtech

Operating since 1998, Clarity Global Group are a leading pharmaceutical and healthcare distribution partner for global pharmaceutical companies. Clarity provides a unique blend of services, including bringing products and services to market through our dedicated sales and marketing teams, supported by our commercial intelligence capabilities and specialist warehouse and distribution services.

Clarity's ability to draw upon its existing customer and supply-chain base, makes the medtech a natural area of focus. Clarity will embrace a variety of new routes to market, whilst reshaping the way support services and value are offered to customers, across the EU and USA.

As Clarity Global Group's Managing Director, Oliver Law, commented,

*“Clarity will bring technology and people together, through a unique proposition, placing more technologically advanced pharmaceutical and medtech products into global communities, by challenging convention.”*

Operating from a newly build headquarters in Bishop's Stortford, and supported by our European offices, we aim to provide a truly 'world-class' customer experience, through offering more

products to our customers, as part of a managed portfolio, reducing healthcare costs and increasing efficiency.

## Sources

- 1 NHS England Weekly publication of Covid-19 admissions and bed occupancy data available at <https://www.england.nhs.uk/statistics/statistical-work-areas/covid-19-hospital-activity/>
- 2 “NHS England suspends one-to-one nursing for critically ill Covid patients” by Dennis Campbell for The Guardian, available at <https://www.theguardian.com/world/2020/nov/08/nhs-england-suspends-one-to-one-nursing-for-critically-ill-covid-patients>
- 3 “Operations cancelled as hospitals come under pressure from Covid cases” by Laura Donnelly for The Telegraph, available at <https://www.telegraph.co.uk/news/2020/11/02/operations-cancelled-hospitals-come-pressure-covid-cases/>
- 4 CGTN interview with Professor Liu Liang, available at [https://www.youtube.com/watch?v=2OXP7\\_aawUs](https://www.youtube.com/watch?v=2OXP7_aawUs)
- 5 “What COVID-19 does to your lungs” by Dana Sparks for the Mayo Clinic News Network, available at <https://newsnetwork.mayoclinic.org/discussion/what-covid-19-does-to-your-lungs/>
- 6 “What Coronavirus Does to the Lungs” by Panagis Galiatsatos, M.D., M.H.S. for Johns Hopkins Medicine, available at <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/what-coronavirus-does-to-the-lungs>
- 7 “So, what does a ventilator do?” interview with Albert Fantasia, RRT, NPS, director of pulmonary services at Cape Cod Healthcare, by Laurie Higgins for Cape Cod Healthcare, available at <https://www.capecodhealth.org/medical-services/infectious-disease/so-what-does-a-ventilator-do/>
- 8 “Ventilator-induced Lung Injury: Similarity and Differences between Children and Adults” by Kneyber, Zhang and Slutsky, Canadian Institutes of Health Research (2016), available at [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4896812/#:~:text=Mechanical%20ventilation%20is%20life%20saving,\)%20\(6%2C%209\).](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4896812/#:~:text=Mechanical%20ventilation%20is%20life%20saving,)%20(6%2C%209).)
- 9 <https://oce.ovid.com/article/01300413-201811000-00012>
- 10: “Chest physiotherapy with early mobilization may improve extubation outcome in critically ill patients in the intensive care units” Wang et al., The Clinical Respiratory Journal (2018), available at [https://journals.lww.com/cmj/fulltext/2020/07050/recommendations\\_for\\_respiratory\\_rehabilitation\\_in.11.aspx](https://journals.lww.com/cmj/fulltext/2020/07050/recommendations_for_respiratory_rehabilitation_in.11.aspx)
- 11 “High frequency chest wall oscillation for asthma and chronic obstructive pulmonary disease exacerbations: a randomized sham-controlled clinical trial” Mahajan et al., Respiratory Research (2011) available at <https://respiratory-research.biomedcentral.com/articles/10.1186/1465-9921-12-120>

12 "Evaluation of the safety of high-frequency chest wall oscillation (HFCWO) therapy in blunt thoracic trauma patients", Casandra A Anderson, Journal of Trauma Management & Outcomes (2008), available at <https://pubmed.ncbi.nlm.nih.gov/18837992/>

13 "A Comparison of Bronchial Drainage Treatments in Cystic Fibrosis", Janet Kluff, Pediatric Pulmonology (1996), available at <https://pubmed.ncbi.nlm.nih.gov/8905888/>