**PHYSICAL REHABILITATION INTERVENTION FOR COVID 19.**

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 **ABSTRACT**

Since its breakout in December 2019 in Wuhan, China, COVID-19, a pandemic of respiratory diseases, has become the most recent threat to international health. Due to the significant amount of deaths it has caused worldwide and the lack of an effective therapy up to this point, it has caused significant distress. This explains how the new virus, COVID-19, is highly contagious and can cross specific barriers to infect humans, causing illnesses ranging from the common cold (which can mimic the flu or influenza) to severe disease patterns like Middle East Respiratory Syndrome and Severe Acute Respiratory Syndrome, which pose a serious risk to public health. 1. From preclinical illness to upper respiratory tract disease, significant breathing failure, viral pneumonia, and/or death, the disease's severity can range widely. According to recent studies, 80% of cases are asymptomatic; 15% are serious (oxygen-requiring illnesses); and 5% are life-threatening and require ventilator assistance. Physical therapy societies throughout the world have made valiant attempts to establish standards and advice for treating COVID-19 patients in collaboration with intensivisits and nursing staff1. In order to help physical therapists manage confirmed or suspected cases of COVID-19, the World Confederation of Physical Therapy (WCPT) has published guidelines for physical therapists working in hospitals. Physical therapy is thought to help patients with COVID-19 who have respiratory issues and need physical rehabilitation because they have excessive secretions that are challenging for them to remove on their own. The ventilated patient may benefit from strategies like posture and airway clearance. Patients with acute respiratory distress syndrome (ARDS) may benefit from a prone position to improve breathing. ARDS might be thought of as a therapy option to reduce mortality in patients with reduced oxygenation in the early stages of disease because it is 17 percent common in COVID patients. Additionally, it aids in recruiting the dorsal lung areas, which increases end expiratory lung capacity, chest wall elastic, alveolar shunt, and tidal volume. According to reports, COVID-19 patients who are receiving prolonged ventilator support, sedatives, neurogenic inhibitors, analgesics, and antibiotics are more likely to contract an infection acquired in the intensive care unit (ICU), which could aggravate morbidity and mortality. According to reports, COVID-19 patients who are receiving prolonged ventilator support, sedatives, neurogenic inhibitors, analgesics, and antibiotics are more likely to contract an infection acquired in the intensive care unit (ICU), which could aggravate morbidity and mortality. It is crucial to plan ahead for early rehabilitation of patients with respiratory diseases in order to prevent ICU-induced weakness and promote early recovery2. In order to facilitate functional recovery for COVID-19 survivors, physical therapists play a significant role in delivering exercise therapy, mobilisation, and rehabilitation therapies. This supports the idea that physical treatment is important for people with COVID to recover quickly2.

**INTRODUCTION:**

Physical therapists are essential parts of the healthcare system, but they are adequately trained or involved in the current COVID-19 pandemic in India, despite the fact that there are more than 1 lakh affected cases, 61,149 active cases, 42,297 recovered cases, and 3303 deaths according to the Aarogya Setu database of the Ministry of Health and Family Welfare, Government of India, dated May 20, 20202. Physical therapists have been somewhat neglected as a result of the cancellation and limited availability of ambulatory and inpatient facilities. But according to the most recent WCPT recommendations, physical therapists unquestionably play a crucial part in satisfying patients' demands. In India, a Tribune News Service study on the results of physiotherapy in COVID-19 patients revealed the therapeutic effects of time-tested posture correction techniques. As a result, physical therapists in India should have the chance and training to use the numerous rehabilitation procedures that would aid in the recovery of patients with COVID-19, whether they are known cases or just suspected ones. Additionally, by activating the dorsal lung areas, it aids in improving tidal volume, boosting chest wall elastic, minimising alveolar shunt, and raising end expiratory lung capacity. According to reports, COVID-19 patients who use prolonged ventilator support, sedatives, neurogenic inhibitors, analgesics, and antibiotics are more likely to contract an infection acquired in the intensive care unit (ICU), which could aggravate morbidity and mortality. The prevention of ICU-induced weakness and the promotion of early recovery require early rehabilitation of patients with respiratory diseases. . Exercise therapy, mobilisation, and rehabilitation are all important aspects of physical therapy3. This supports the idea that physical treatment is important for patients with COVID to recover quickly4. Although it is advised to follow the standards for physical therapy, there are still many questions that remain unsolved and dangerous, such as the use of aerosol generating processes, bubble positive expiratory pressure, mechanical insufflations, exsufflations, and humidification. Disposable circuits may, however, be utilised with guidance, agreement, and consultation. As it entails disconnecting and opening the ventilator circuit, manual hyperinflation, also known as ambuing, is advised against. The leader of the physical therapist team may create screening and treatment recommendations in addition to those physical therapy associations have recommended for ICU. The hospital policy may be used to design and record these standards, which may include the discovery of mild, moderate, and severe. In rehabilitation, physical treatment is crucial. The advent of the coronavirus disease 2019 (COVID-19), however, has presented a significant obstacle to its practise, particularly with regard to the volume of patient contact. To stop the virus from spreading, it is imperative to investigate alternative rehabilitation solutions to face-to-face interactions5.

**TELE REHABILITATION:**

In light of the pandemic, this article examines telerehabilitation, its results, and the difficulties physiotherapists confront in providing patients with a continuum of care. A crucial tool for connecting practitioners and patients, tele rehabilitation makes use of technology. Telerehabilitation has received a lot of endorsement because it has historically produced positive results for the rehabilitation of specific illnesses. Traditionally, in order to use a physiotherapist's services, a person must make a physical appointment to see the physiotherapist at a predetermined place. But the spread of technology has eliminated any distance that might formerly have existed between different places, doctors, and patients. Telerehabilitation is the term for the practise of providing healthcare services remotely using ever-improving communication technology. Telerehabilitation was defined by Brennan et al. (2010) as rehabilitation services that are delivered remotely by a rehabilitation expert and are helpful for assessment, monitoring, prevention, intervention, supervision, education, consultation, and counselling. Utilizing virtual reality devices, phone conversations, and internet-based videoconferencing, it allows for real-time or delayed remote patient interaction.

 **PERSONAL PROTECTIVE EQUIPMENT:**

Several physiotherapy techniques could produce aerosols and droplets, which are sources of lung and respiratory infections. These techniques include non-invasive ventilation, high-flow oxygenation, endotracheal intubation, airway tracheostomy and endotracheal tube suction, cardiopulmonary resuscitation, high-frequency oscillatory ventilation, chest physiotherapy, prone patient positioning, ventilator disconnection, administration of nebulized treatment, and sputum induction. In addition, severe acute respiratory syndrome coronavirus 7 has the potential to infect humans and can linger in the air for hours and on surfaces made of different materials for days after being aerosolized. However, if aerosol-generating procedures must be done, they should be done in a room with negative pressure. Negative-pressure rooms are not always available, thus the procedures must be carried out in a room with closed doors and open windows, a minimum number of qualified specialists, the proper PPE, and a clear path to avoid other people. The use of appropriate PPE, such as surgical caps, safety goggles, face shields, N95 masks or similar, gowns, and gloves8, is therefore required for physiotherapists in order to prevent aerosol exposure and ensure contact isolation.

 **CHEST PHYSIOTHERAPY:**

There is currently no proof that treating patients with dry cough and hypoxemic respiratory failure with traditional chest physiotherapy alters the course of COVID-19 during the acute stage of the illness. However, some individuals with a productive cough could gain from bronchial hygiene treatments and manoeuvres that elicit coughing 8. Breathing exercises should be taught to patients who have a mild form of the disease so they can do them on their own. Pulmonary disease should be continuously monitored in patients with moderate to severe diseases. Only respiratory and pulmonary examinations should be conducted on the patient in these circumstances, notably during orotracheal intubation and oxygen supplementation, as well as for patients who are candidates for non-invasive ventilation or high-flow oxygen administration. The least amount of time required for assessment and support should be included in the professional exposure time.

•Manual Techniques (e.g. Percussion/Manual Assisted Cough) that may lead to coughing and expectoration of sputum

• Use of Positive Pressure Breathing Devices (e.g. IPPB), Mechanical Insufflation-Exsufflation (Cough Assist) Devices, Intra/Extra Pulmonary High Frequency Oscillation Devices (e.g. the Vest / MetaNeb / Percussionaire etc.)

• Any Mobilisation or Therapy that may result in Coughing and Expectoration of Mucus

• Any Diagnostic Interventions that involve use of Video Laryngoscopy that can result in Airway Irritation and Coughing (e.g. Direct Visualisation during airway clearance techniques or when assisting Speech and Language Therapists perform Fibreoptic Endoscopic Evaluation of Swallow)

**ACUTE PHASE:**

Care should be used when designing a treatment programme for COVID-19 and respiratory distress in the early phases. The acute phase may be contraindicated for the common modalities respiratory physiotherapists frequently employ because they could exacerbate the heightened work of breathing. In order to facilitate mobilisation, exercise, and rehabilitation, physiotherapists should continue to actively assess patients and/or accept recommendations. Before going inside a patient's isolation room, it is advised during screening to speak with the nursing staff, the patient (for example, over the phone), or family. For instance, physiotherapists may screen to identify an acceptable assistance to trial in an effort to reduce the number of staff members who come into touch with patients who have COVID-19. When the nursing team is already in an isolation room, they can test the assistance there with any necessary guidance.

Contraindicated interventions include:

• Manual mobilisation techniques or stretching of the rib cage

• Nasal washings

• Respiratory muscle training

• Exercise training

• Patient mobilisation during clinical instability

• Diaphragmatic breathing

• Pursed lips breathing

• Bronchial hygiene/lung re-expansion techniques (PEP Bottle, EzPAP®, cough machines, etc.)

• Incentive spirometry

**2.2 Rehabilitation Phase:**

Here, the primary function of the physiotherapist in the care of the COVID-19 patient will be seen. The earlier patients begin mobilising, the sooner they can leave the intensive care unit and possibly have better long-term outcomes. There is strong evidence to suggest that early mobilisation with a focus on returning to functional activities helps in reducing the length of hospital stay and minimising functional decline. A multidisciplinary approach should be used during this phase of management, including steps to prevent avoidable physical and non-physical morbidity, support adequate nutrition (especially in light of the effects of prone ventilation), and implement an individualised, structured rehabilitation programme. Following the transition to ward-based rehabilitation, this phase should follow the standard protocol for therapy and exercise in the intensive care unit.

• Passive, Active Assisted, Active, or Resisted Joint Range of Motion Exercises to maintain or improve joint integrity and range of motion and muscle strength; [6]

• Mobilisation and Rehabilitation (e.g. bed mobility, sitting out of bed, sitting balance, sit to stand, walking, tilt table, standing hoists, upper limb or lower limb ergometry, exercise programs.

**Exercise and early intervention:**

Patients typically have a debilitated physical condition due to the disease, which limits their ability to exercise, particularly when they have fever, dyspnea, myalgia, and weariness. The debilitated physical condition can also be the result of protracted mechanical ventilation and immobilisation. Even patients with mild disease severity who are hospitalised for weeks at a time might experience a considerable decline in activity levels and, as a result, their muscle strength and cardiorespiratory capacity 12. In order to preserve a minimum level of functional ability, patients in the acute period of mild disease should be encouraged to engage in gentle exercise. The exercises can be adjusted to maintain a Borg rating of three (on a scale of one to ten). Despite the lack of patient-specific studies.

**Oxygen Therapy:**

Oxygen therapy is a key treatment strategy for individuals with severe pulmonary dysfunction since hypoxic respiratory failure affects adults with COVID-19 at a rate of 19%. If the peripheral oxygen saturation (SpO2) is lower than 93 percent and the sustained oxygen saturation is no greater than 96 percent, adults with COVID-19 should begin receiving supplemental oxygen. If oxygen therapy is unsuccessful in treating respiratory failure, mechanical ventilation can be required. Aerosols can be produced by the interfaces used for oxygen supplementation. Therefore, when providing respiratory assistance to patients with COVID-19 complicated by respiratory failure, healthcare professionals should take the necessary measures and wear appropriate PPE. Use of oxygen humidification is not advised. For issues like dryness of the mouth, a prescription for moisturisers such self-applied nasal sodium chloride gel may be prescribed.

**2.5 NON INVASIVE VENTILATION AND HIGH FLOW OXYGEN:**

High-flow nasal oxygen therapy is advised above traditional oxygen therapy and non-invasive positive pressure ventilation for the treatment of acute hypoxemic respiratory failure. Non-invasive ventilation should be tried if high-flow nasal oxygen is unavailable. A human model experiment revealed that non-invasive ventilation or high-flow nasal oxygen, when properly used with an ideal fit, resulted in little exhaled air aerosolization. However, not all hospitals employ the exact kinds of masks and interfaces that were examined in the study16. Therefore, if an airborne infection isolation chamber is not available, we oppose doing this treatment and advise employing proper precautions and PPE to prevent any injury. Monitoring for deteriorating respiratory status and prompt intubation is advised.

**ENDOTRECHEAL INTUBATION:**

Patients who are admitted to the ICU in negative-pressure rooms and who qualify for non-invasive ventilation must be ventilated with positive end-expiratory pressure (PEEP) 8 cmH2O, support pressure for a tidal volume (TV) 8 mL/kg of the predicted weight, and a fraction of inspired oxygen (FiO2) to maintain SaO2 >92 percent. The application of the ventilator must be done while wearing a facial or full-face mask. In these situations, ventilation devices with two branches are recommended, with a heat moisture exchange filter (HMEF) between the face mask and the device and another high-efficiency particulate arrestance (HEPA) filter on the ventilator's exhalation outlet. For high-flow oxygen, a flow rate of 40 to 50 L/min should be maintained, and FiO2 to maintain SaO2 >92% should be started. The criteria for orotracheal intubation and invasive mechanical ventilation are FiO2 >60% in non-invasive ventilation or TV ≥9 mL/kg or inability to tolerate <2 hours without non-invasive ventilation or presence of other organic dysfunctions. For high-flow oxygen, the criteria for orotracheal intubation are FiO2 >60% or signs of respiratory distress, or other organic dysfunctions. It is important to reassess the patient after 30 to 60 minutes; if there is no improvement or if there is worsening of ventilatory parameters, endotracheal intubation and invasive mechanical ventilation should be considered. When aerosol-generating procedures are necessary, it is advised that they be carried out in a negative-pressure space while wearing the proper PPE. Only the medical personnel required for orotracheal intubation should stay in the space. Patients with COVID19 run the danger of having their arterial oxygen levels drop suddenly, hence efficient pre-oxygenation is essential18. Patients must receive an adequate oxygen flow to keep their blood oxygen levels above 93%, and intubation should be done quickly after induction. It is necessary to pre-oxygenate using a non-rebreather mask with the smallest airflow feasible in order to sustain effective oxygenation (SpO2 > 93 percent). A supraglottic device or assisted ventilation with a Bag-Valve-Mask device should not be used due to the risk of aerosolization and health contamination.

**PROTECTIVE MECHANICAL VENTILATION:**

mechanical mode that is invasive pressure-controlled ventilation (when there is neuromuscular block or when there is no inspiratory effort) or volume-controlled ventilation In the absence of neuromuscular block, mild respiratory effort, or asynchrony, controlled ventilation should be carried out using lower TVs (4 to 6 mL/kg predicted body weight) and lower inspiratory pressures, with a plateau pressure (Pplat) of about 28 to 30 cmH2O. To keep the driving pressure (Pplat PEEP) as low as possible (15 cmH2O) and the SpO2 between 88 and 95 percent, the PEEP must be as high as possible. Disconnection from the invasive mechanical ventilator must also be avoided in order to prevent PEEP loss and the subsequent development of atelectasis.

**MANAGEMENT OF MECHANICAL VENTILATION IN SEVERE AND REFRACTORY CASES OF HYPOXEMIA:**

In order to diminish respiratory drive and maintain protective ventilation in patients with PaO2/FiO2 150, an inability to maintain protective ventilation, the presence of asynchrony, or severe hypercapnia (pH 7.25), we advise sedation and continuous neuromuscular block.

The multidisciplinary team can discuss the following:

1. prone positioning;

2. alveolar recruitment maneuvers and PEEP adjustment for better pulmonary compliance;

 3. recruitment in the prone position for patients who responded to the supine recruitment maneuver;

4. nitric oxide administration in cases with a clinical history of “cor pulmonale” or as a recruitment maneuver for hypoxemia;

5. extracorporeal membrane oxygenation (ECMO) .

**PRONE POSITION:**

In adult patients with severe ARDS (PaO2/FiO2 150), prone ventilation for 12 to 16 hours per day is advised. Although it is highly advised for adult patients with severe ARDS, it needs enough personnel and training to be done properly. The 2013 study by Guérin et al. includes protocols and videos. A patient must increase their PaO2 by 10 mmHg or their PaO2/FiO2 ratio by 20 mmHg in order to show a successful response. When a PaO2/FiO2 ratio of less than 150 mmHg is noticed after six hours in the supine position, prone positioning should be performed once more. After two consecutive efforts at pronation or hemodynamic instability, PaO2/FiO2 declines of 20% in the supine position ought to be taken into consideration as a threshold for interrupting the prone posture.

**CUFF PRESSURE:**

For aerosols, invasive mechanical ventilation is a danger factor. In order to minimise leakage and the spread of aerosols, it is crucial to maintain a cuff pressure between 20 and 30 cmH2O, or 25 and 35 mmHg. We advise taking cuff measurements either every shift or at the very least every day.

**TUBE AND NASOTRACHEAL SUCTION:**

In order to prevent pressure loss in the respiratory system, atelectasis, or the distribution of aerosols throughout the room, it is important to prevent suction of the artificial airway as a result of ventilator disconnection. In all instances of intubation and invasive mechanical ventilation, a closed suction system is advised. To reduce the spread of aerosols in circumstances necessitating open suction, we advise using the mechanical ventilator's "stand by" mode. Due to the production of aerosols, physiotherapists should carefully assess any nasotracheal suction procedures. It is advised to wear the appropriate PPE when carrying out these procedures. This process should always be carried out in a negative-pressure environment.

**HUMIDIFIRES FOR VENTILATED PATIENTS:**

In individuals who require invasive mechanical ventilation, heated humidifiers or heat and moisture exchangers are more successful at reducing problems such airway obstructions and pneumonia. Therefore, COVID-19 patients should employ equipment that filters and humidifies their exhaled and inhaled air, respectively. As a result, HMEF is better suited for humidifying exchanged air because it also has the ability to filter out viruses and bacteria, which lowers air contamination. The mechanical ventilator's exhalation valve can be protected further by mounting a HEPA filter. In these patients, the use of heated humidifiers is discouraged.

**WEANING FROM MECHANICAL VENTILATION AND EXTUBATION:**

Every patient must undergo a daily assessment to determine whether they meet the requirements for the spontaneous breathing test, which include adequate oxygenation (PaO2/FiO2>200 with PEEP 5-7 cmH2O), hemodynamic stability (low, stabilised doses or no infusion of vasopressors), an appropriate level of consciousness (easily awake or wakened), and adequate cough and secretion management (presence of a cough reflex during closed aspiration). We advocate the use of the pressure support ventilation (PSV) mode for spontaneous breathing tests in order to wean patients with COVID-19 from mechanical invasive ventilation. The T-tube approach should not be used since it can cause more aerosolization.

The preferred method for extubating patients who pass the spontaneous breathing test is in a negative pressure environment or during respiratory isolation. Physiotherapists and other medical staff who are around while being extubated must adhere to PPE aerosol isolation protocols. Extra caution must be used during extubation, including maintaining the connection between the endotracheal tube and closed endotracheal suction (such as Trach-Care) while inflating the cuff. To prevent rough handling and coughing, the endotracheal tube should be taken out as gently as possible. If the patient's cough needs to be induced, the patient should be advised on proper cough technique. The tube needs to be thrown away in the infectious waste collection . It is always advised to have an intubation expert on hand in the intensive care unit.

Patients who repeatedly fail to wean or who have been intubated for extended periods of time may need a tracheostomy. Aerosol generation during tracheostomy is regarded as a high-risk technique. It is not advised to wean patients who have COVID-19 utilising tracheostomy masks (such as Trach-Vent® and T-tube). Instead, using HMEF connected to Trach-Care with oxygen supplementation directly in the HMEF to maintain SpO2 between 93 and 96 percent is advised for training sessions including spontaneous breathing. The closed suction system must be utilised if aspiration is necessary during the spontaneous breathing test. We want to be clear that clinical symptoms of pain or instability must be constantly monitored while using HMEF to wean tracheostomized patients. As patients' breathing efficiency and resistance improve, spontaneous breathing time should increase.

**SUPPORT FOR REHABILITATION SELF MANAGEMENT AFTER COVID 19 RELATED TO ILLNESS:**

World Health Organization guidelines for following areas :

• Managing breathlessness

• Exercising after leaving hospital

• Managing problem with your voice

• Managing eating, drinking and swallowing

• Managing problems with attention, memory, and thinking

• Managing activities of daily living

• Managing stress problems

• Contact to health care professionals.

**MANAGING BREATHLESSNESS:**

It is common to experience breathlessness after being in hospital losing strength and fitness.

Positions to ease breathlessness.

1. High side lying: lying on your side propped up by pillows, supporting your head and neck, with your knees slightly bent.

2. Forward lean sitting: Sitting at a table, lean forwards from the waist with your head and neck resting on the pillow, and your arms resting on the table. You can also try this without the pillows.

3. Forward lean sitting no table in front: Sitting on a chair, lean forwards to rest your arms on your lap or the armrests of the chair.

4. Forward lean standing: While standing, lean forwards onto a windowsill or other stable surface.

5. Standing with back support: Lean with your back against a wall and your hands by your side. Have your hands by your side. feet about a foot away from the wall slightly apart

**5.5 BREATHING TECHNIQUES:**

• Sit in a comfortable and supported position28

• Put one hand on your chest and the other on your stomach

• Only if it helps you to relax, close your eyes (otherwise leave them open) and focus on your breathing

• Slowly breathe in through your nose (or mouth if you are unable to do this) and then out through your mouth.

• As you breathe, you will feel the hand on your stomach rise more than the hand on your chest

• Try to use as little effort as possible and make your breaths slow, relaxed, and smooth.

**CONCLUSION:**

In conclusion, physical therapy will have a direct impact on patients' physical abilities, particularly their ability to breathe. The use of physical therapy during an ICU stay can facilitate an earlier transition of patients to general wards15). Patients who have been discharged will also be able to resume their social work careers with ADL and endurance training. It might contribute to maintaining social and political stability and indirectly lowers the likelihood of a medical emergency. In addition to decreasing patient mortality, hospital stay length, and medical costs, physical therapy for COVID-19 patients will also conserve medical resources, lessen individual and societal economic losses, and lessen the likelihood of unfavourable social stability events like a medical emergency. Therefore, physical therapy should be incorporated as soon as feasible into the standard of care for COVID-19 patients. Extremely ill confirmed.

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