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Role of Physical Therapy and Virtual Rehabilitation during and after COVID-19 Disease

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ABSTRACT

Early physical therapy rehabilitation protocols have shown improved functional outcomes and a reduction in mortality rates. Virtual rehabilitation (VR) has allowed practitioners to provide safe treatment without any risk of viral contamination. This review aimed to evaluate the importance of physical therapy and rehabilitation during and after the infection of coronavirus (COVID-19). To do so, four electronic databases such as PubMed, ResearchGate, Science Direct, and Google Scholars were searched to retrieve articles published after the outbreaks of the COVID-19 pandemic. Six studies were included in the final review. It is a compilation and examination of physical therapy treatments provided by various hospitals and organizations during and after COVID-19. The present review throws light on physical therapy, going hand in hand with VR, to play a promising role in patients with mild to moderate symptoms, thus improving their quality of life. The necessary references, as well as the statistics gathered from the published articles, are available. A total of 12 046 patients were included. Of the total patients, 3085 (25.6%) had fatigue symptoms and 1866 (15.5%) had arthralgia/myalgia. Within an hour of being in the prone position, patients were found to have an increase in the oxygen saturation (SpO₂) level from 94% to 98%. The pace of breathing also improved, dropping from 31 to 22 per minute. Physical therapy and VR have improved daily activities while assisting in the recovery of health, lifestyle, and lowering post-illness physical and mental deficiencies.

Keywords: COVID-19, physical therapy, virtual rehabilitations



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INTRODUCTION

"To keep the body in good health is a duty, for otherwise we shall not be able to trim the lamp of wisdom and keep our mind strong and clear"

Buddha

In December 2019, the world was shaken by the sudden outburst of a previously identified coronavirus in Wuhan, Hubei Province, China.^[1] The disease, on February 11, 2020, was officially named Coronavirus disease-2019 (COVID-19) by the World Health Organization (WHO). It is a registrable communicable disease of the fifth category.^[2] The WHO declared the invasion a pandemic on February 20, 2020. As stated in many published articles, it was recognized that the virus was a prospective disease having a zoonotic origin with a low to moderate (estimated 2%–5%) mortality rate. Various theories were put forward for the identification of the origin

of the virus, but none was confirmed. The symptoms varied from person to person, but the most often seen symptoms were fever, cough, headache, fatigue, dyspnea, anosmia, and ageusia. The incubation period of the disease ranged from 3 to 14 days after exposure to the virus. At least, one-third of the people who are infected do not develop noticeable symptoms. The geriatric population, as well as people with any underlying health condition, was at a high risk of contracting the infection. The mode of transmission of the disease occurs mainly through the direct transmission of droplets from an infected person to a healthy person. Contact transmission was also a possible reason as the droplets containing the virus could stay on the surface for about 3–24 h. Airborne transmission may also be seen, as smaller droplets or particles contaminated by the virus may float in the air for minutes to hours where ventilation was not adequate. It was identified during the COVID-19 era that the majority of people suffered mild to moderate to severe periods of critical illness and hospitalization due to symptoms such as dyspnea, cough, and fatigue. Patients usually present with a deteriorating physical condition, which results in a significant reduction in exercise capacity. It has been described as the late consequence of mechanical ventilation and immobilization. The lack of sanitization and personal protective equipment may threaten the lives of the first-line health workers. In particular, the hospitalized patients who spent weeks in hospital isolation had a significant reduction in strength and cardiorespiratory capacity. Prolonged periods of immobility during the aforementioned phase lead to deconditioning (i.e., a reduction in physical fitness such as muscle strength and aerobic capacity), further leading to impaired neuromuscular function. Severe cases of acute respiratory distress syndrome (ARDS), which occurred in more than 30% of COVID-19 and

related intensive care unit (ICU) admissions, also resulted in long-term impairments and deconditioning in physical functions, leaving patients despondent and depressed.^[3] The objective of this review was to determine the value of physical therapy and rehabilitation for patients who have been infected with coronavirus and have recovered from COVID-19 disease.

Role of Physical Therapy

Physical therapy is a branch of rehabilitation aimed at the restoration and enhancement of physical function and movement impaired by disease or disability.^[4,5] It utilizes modalities, therapeutic exercises, and manual therapeutic techniques for the rehabilitation of the patients. The ultimate aim of therapy is to prevent, promote, and restore function, and bring the patient to the preinjury state as much as possible.^[6,7]

COVID-19 and Related Changes

Several bodily changes occur in patients after recovery from COVID-19. Studies depicting the role of physical therapy during and after COVID-19 are summarized in Table 1.^[8–29] These changes may be divided into four categories as follows:

1. *Musculoskeletal changes:* Although musculoskeletal changes are not directly seen in patients infected with the respiratory virus, they could be a consequence of the hyper-inflammatory state due to prolonged periods of immobility and decreased appetite (nausea, vomiting, and diarrhea).^[8] Myalgia and arthralgia are common symptoms, along with a dry cough and fever.^[9,10] Immobilization following critical illness results in a sequelae of contractures, postural instability, pressure sores, deep vein thrombosis, and deconditioning.^[11]

Table 1. Studies depicting the role of physical therapy during and after COVID-19

Domains	Symptoms	Treatment protocol
Musculoskeletal changes	Decreased muscular strength and endurance. Prolonged immobility following critical illness deconditioning, postural instability, and contractures	Muscle rehabilitation begins with overall muscle strengthening and stretching. Reconditioning from exercise using cycle ergometers. Posture correction exercises
Neurological changes	Malaise, headache, dizziness, loss of smell and taste sensation. Polyneuropathy	In the ICU, delirium screening and the implementation of general preventive methods may be part of the rehabilitation process
Psychological changes	Fever, cough, weariness, sputum production, and/or dyspnea are symptoms of a respiratory tract infection	Aerobic exercises. Interval training for patients who cannot tolerate aerobic exercises
Respiratory changes	Severe acute respiratory syndrome coronavirus	Prone position and improvement in SpO ₂

ICU: Intensive care unit.

2. **Neurological changes:** Several neurological abnormalities have been described in patients with COVID-19.^[12-14] These abnormalities may involve the central and peripheral nervous system and may range from mild to fatal or asymptomatic.^[15] The effectiveness of rehabilitation may only be successful when the consequences are clear.^[16]
3. **Psychological changes:** Psychological ripostes to the COVID-19 pandemic vary from panic behavior or collective hysteria to feelings of hopelessness.^[17,18] Desperation during critical illness and ICU treatment, cognitive dysfunction such as delirium, and chronic psychological impairments such as depression, post-traumatic stress disorder (PTSD), and anxiety were observed. Isolation of people is associated with negative psychological effects, including posttraumatic stress symptoms.^[19-21] Long-term behavioral changes such as frequent handwashing, use of face masks, and avoidance of crowds, as well as a delayed return to normality even after months of quarantine, were reported in daily life.^[22]
4. **Respiratory changes:** COVID-19 is particularly a respiratory virus; therefore, the most critical and fatal consequences are seen in the cardiopulmonary system.^[13] Pneumonia and ARDS predispose to further complications. A reduction in oxygen saturation below 80% in room air leads to the requirement of oxygen therapy, and, in the worst scenario, mechanical ventilation (invasive and noninvasive ventilation).^[23] Mechanical ventilation and ICU care made patients prone to atelectasis and nosocomial acquired pneumonia. Furthermore, oxygen saturation levels below 80% are considered life-threatening. In patients with COVID-19, the vicious circle is noted with a drop in oxygen saturation leading to multiorgan dysfunction, eventually leading to death. A drop in oxygen saturation levels is a detrimental feature of viral pneumonia which befalls as a complication of COVID-19. Pneumonia as a complication occurs when the COVID-19 viral strain enters the human respiratory tract. The drop in SpO₂ levels is mainly caused by alveolar membrane fibrosis due to alveolitis, as COVID-19 deleteriously affects the alveolar epithelial and endothelial barriers, which become a prime cause of ARDS. The consequences of the drop in SpO₂ is shown in Figure 1. Accumulation of secretion may also be seen on a chest X-ray. The role of the cardiorespiratory physical therapist has been appreciable during this phase of treatment.^[15]

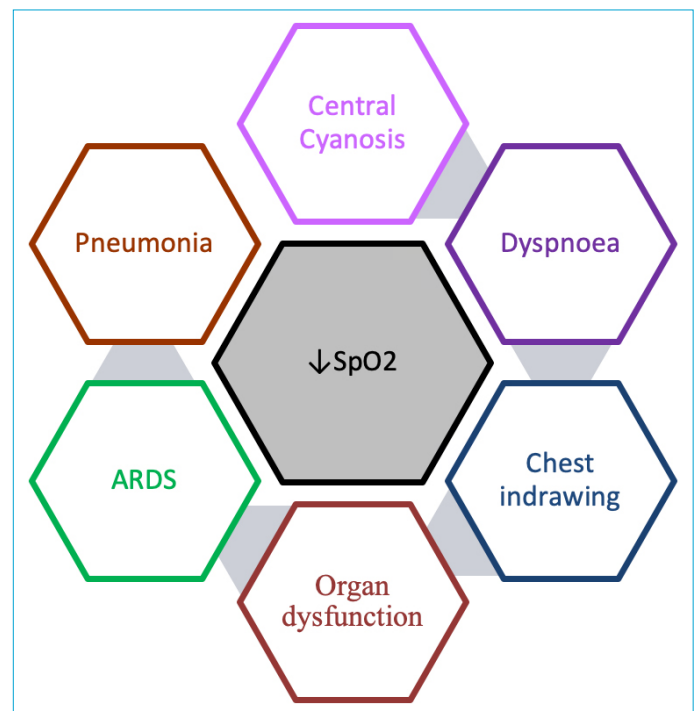


Figure 1. Consequences of the drop in SpO₂.

Importance of Physical Therapy during and after COVID-19

A multidisciplinary team (physical therapist, medical staff, nurses, and supporting staff) plays a vital role in the rehabilitation of the patient. Evidence shows that postinfection patients have severe overall deconditioning. Recovery is incomplete, and it is expected that people infected with COVID-19 will present with persistent deficits in physical function 1–2 years after infection.^[3] Patients account for various functional disabilities across biopsychosocial dimensions.^[11] Thus, rehabilitation is the key to optimum recovery. It is a holistic approach that focuses not only on patients but also on the family. Therapy sessions in acute hospital settings were divided into shorter interval sessions with frequent rest breaks during exercise sets. As patients were unable to handle continuous aerobic activities, interval training was used in the early stages of rehabilitation before eventually graduating to continuous training. Muscle rehabilitation began with overall muscle strengthening, using cycle ergometers. Reconditioning will be helpful for an early return to socio-professional activities.^[24]

Role of Chest Physical Therapy

Chest physical therapists emerged as frontline health professionals, walking hand in hand with the multidisciplinary team in combating the ill effects of the disease.^[11] The role of therapists can be divided into two stages: (1) during critical illness (moderate-to-severe symptoms) and (2) rehabilitation. Both roles are significant as one is fighting to

survive while the other is vulnerable. Physical therapy is an effective intervention for reconditioning among ICU survivors. Critically ill patients, for many reasons, are most likely to face major long-term sequels. This may include post-ICU syndrome (new or worsening impairments in physical, mental, or cognitive healthcare status, even after discharge from an acute care setting). ARDS is the most devastating and fatal complication of the virus. Rehabilitation in ICU settings is very critical and may include screening for delirium along with proper patient counseling, general preventive measures, medication monitoring, planned regular sedation breaks, physical therapy twice a day for active or passive mobilization of the limbs, chest clearance, and proper positioning of the patients. During the pandemic, physical therapists proved to be frontline workers in preventing chest complications and thrombosis, as well as building an empathic, compassionate, and therapeutic alliance with the patient and family.^[11,17,18] Among all other symptoms of COVID-19, respiratory symptoms had long-term effects. Therefore, cardiopulmonary physical therapists played the most promising role during the pandemic.^[25] Physical therapists practicing in an ICU setup provided airway clearance techniques such as manual vibration, percussion for ventilated patients, and assisted in positioning patients with severe respiratory failure associated with COVID-19, including the use of prone position in combination with postural drainage to optimize oxygen saturation.^[26,27] Neuro-facilitatory techniques, active cycles of breathing techniques, and huffing and coughing were employed to optimize alveolar ventilation. Reconditioning was maneuvered by exercise, mobilization, and rehabilitation interventions.^[27,28] Although the prone position is underutilized, it is effective in patients with low SpO₂ and aids in the reduction of work-related breathing.^[29] It also provides many physiological benefits. It is difficult with a big, protruding stomach. Respiratory failure patients show improvements from the prone position. The position can be modified to ease breathlessness: high side-lying on the bed with three pillows placed on the patient's head with the neck supported. Prone positioning of the patient to ease breathing is shown in Figure 2. Chest physical therapy is found to be more effective in patients in reducing lung complications as well as being effective in improving oxygenation. Maneuvering techniques of chest physiotherapy aid critically ill patients through percussion, vibration, shaking, and rib springing. These maneuvers assist the patient to expectorate, as after them, the patient can be encouraged to cough, resulting in the removal of the secretion. Suctioning is performed as an option for those who have a loose cough reflex or weak expiratory muscles.^[30]

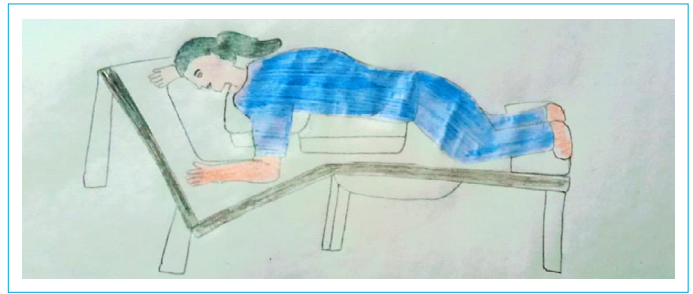


Figure 2. Prone positioning of the patient to ease breathing.

Virtual Rehabilitation

Innovative methods such as virtual rehabilitation (VR) played a crucial role during COVID-19.^[24,31] The outbreak led to an immediate digital revolution.^[32] Individuals with post-COVID-19 disease, who need the most care are expected to have requirements for physical, psychological, and cognitive rehabilitation. Tele-rehabilitation was alluded to as a clinical restoration administration with a focal point of assessment, finding, and treatment. It may drastically act as a fuel to promote innovation in a new scientific discovery and learning opportunity. Telehealth is an expansive umbrella of modalities that incorporates clinical and nonclinical services.^[33] For several reasons, virtual care sessions may be preferable to face-to-face contact during a pandemic. During a pandemic, virtual consideration episodes might be desirable over vis-à-vis communication for obvious reasons. As the therapist is at a high risk of being asymptomatic, spreading the disease and acting as a super spreader, virtual care is convenient and allows for customized meetings and treatment through phone, live web association, or prerecorded sessions. Literature has demonstrated the positive effects of VR on the viability of joint mobility and motor function with severe musculoskeletal problems in the rehabilitation of people with geriatric syndromes and better balance among kids with cerebral palsy.^[34] The use of VR may result in a blessing for psychologically suffering patients, whether they are patients in quarantine or people locked in their homes due to lockdown. VR has been used in conjunction with counseling and cognitive behavioral therapy. It is widely used in cognitive rehabilitation. The application of VR was crucial in patients suffering from COVID-19, as the pandemic has inculcated fear of death by feeling the struggle for breathing. People during this pandemic have suffered a lot. Even on their death beds, they could not hold the hands of their loved ones. Therefore, PTSD was mainly identified both during and after COVID-19.^[35] In patients with psychosis, VR has been used for assessment, symptom correlation, identification of predictive variables, differential diagnosis, and treatment. However, there are certain limitations, such as technical issues,

limited scope of examination, and less communication and interaction opportunities.

CONCLUSION

Fever, fatigue, and dry cough are the most common symptoms in patients with a mild to moderate clinical presentation, followed by headache, nasal congestion, sore throat, myalgia, and arthralgia. Moreover, the cardiorespiratory dysfunction is very obvious in COVID-19 patients, and positioning in the ICU and wards, particularly the prone position, is reported to be very effective in overcoming COVID-19 symptoms and has dramatic implications for the lives of the patients and their families. After prone positioning, oxygenation improved quickly. A multidisciplinary team should respond quickly to these patients to maintain their best health status. Rehabilitation plays a crucial role in bringing the patients back to a normal life, especially critically ill patients. One of these is ARDS, and the other is the musculoskeletal changes in individuals post-lockdown. During COVID-19, innovative methods such as VR were promoted and encouraged by both the therapists and patients. COVID-19 ushers in a new era in which everyone should focus on the proverb "Prevention is better than cure."

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