



Effectiveness of Structured Exercise Protocol on Functional Performance in Subjects with Covid-19

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ABSTRACT

It is a well-established fact that patients of Covid 19 have musculoskeletal dysfunctions in addition to cardiorespiratory and psychosocial problems. Musculoskeletal system is amongst the most common systems found to be affected in patients admitted in ICU for prolonged periods and some patients of Covid 19 do have to spend a reasonably long period in ICU's. Prolonged hospital stay may be needed in Covid 19 patients having ARDS or pneumonia and symptoms of fever, cold and cough to monitor their recovery. This may result in musculoskeletal dysfunctions as demonstrated in some studies. Thus, treating the musculoskeletal system becomes a vital part of the regimen to be followed during the patients stay in the ICU which needs to be followed up even after the patient is shifted from the ICU by keeping a track of Physical Functional performance of the subjects after discharge. This experimental study was done on 150 Covid-19 positive subjects to see the long term effectiveness of a structured exercise protocol on the Physical Functional performance of Covid 19 patients. The results of the study were analysed statistically and both the outcome measures FIMS and POMA showed significant changes with p value <0.05 and <0.05 respectively. The study thus shows that the structured exercise protocol helped in maintaining the Physical Functional performance of the subjects through-out the hospital stay and also after discharge during follow up.

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INTRODUCTION

COVID-19: The novel coronavirus or Covid 19 as it was later on called was first reported in Wuhan, China, and since then it has spread across the globe affecting millions of people of all ages. This public health emergency was declared as a pandemic by the WHO on the 11th of March 2020. There has been a worldwide restriction on everyday activities, and along with the need of social distancing, it has put restrictions on a lot of physical activities and movements that were performed by people at large in the pre-Covid 19 world. The novel coronavirus, though similar to the SARS virus that caused an outbreak in

2003, is more intelligent than a lot of known viruses. The virus, which in the initial days, was supposed to cause pneumonia-like symptoms is found to affect several vital organs and systems of the body. It has been seen in various studies published that subjects with COVID 19 have demonstrated chest symptoms, cardiac symptoms as well as musculoskeletal dysfunctions (Abdullahi, 2020). The infection of Covid 19 can be broadly categorised into four different stages depending on the extent of spread and the resulting symptoms. The first category will have those people who get infected by the virus but do not exhibit any visible symptoms and are capable of spreading this infection to others with those having weaker immune systems due to other comorbid conditions being particularly at risk of acquiring the infection. The second category includes those with the involvement of mainly the upper respiratory tract, thus having symptoms like mild cough along with fever or headache in some cases. The third category of a patient may have symptoms similar to that of the second. Still, the degree will be more significant, and they may need hospitalisation for regular and proper monitoring of their condition. The last and the fourth stage of patients will have symptoms like ARDS and/or pneumonia which may be fatal. The pandemic mainly involves the respiratory system with symptoms similar to that of interstitial and alveolar pneumonia. Still, directly or indirectly, it also affects the other systems of the body. The musculoskeletal system is amongst the most common systems found to be affected in patients admitted in ICU for prolonged periods (Parry and Puthuchery, 2015). In chronic cases of COVID 19, the disease spreads to almost all the organs, including the nervous system and the musculoskeletal system (Huang, 2020). Prolonged bed rest has been found to lead to a decrease in the functional status of an individual as a result of muscle loss being caused by a decrease or complete loss of physical activity in critically ill patients admitted to ICU (Kizilarlanoglu et al., 2016). Also, subjects with COVID are known to develop musculoskeletal dysfunctions due to the intensive hospital stay (Cipollaro et al., 2020).

Few studies have demonstrated that the blood analysis has shown ascend in eosinophil and leucocyte count showing marked infection. This persisting infection leads to reduced immunity, causing impaired movement, which has an impact on the musculoskeletal system (Rothan and Byrareddy, 2020).

Drug therapy is known to be very effective in treating subjects with COVID-19 by boosting their immunity (Chen et al., 2020).

A short term Physiotherapy study conducted by Radhika et al. demonstrated that Chest Physiotherapy reduced the respiratory and cardiovascular symptoms in COVID-19 subjects after seven days, including X-ray changes. Studies have advocated for prone lying to be effective in improving the respiratory and cardiac parameters in subjects with COVID-19 (Ghelichkhani and Esmaeili, 2020). Few more studies have demonstrated and recommended Chest Physiotherapy and CARP protocol to improve the respiratory and cardiac parameters in subjects with COVID (Thomas, 2020). There exists some evidence regarding physiotherapy being effective in improving the cardiorespiratory parameters in patients with Covid 19. However, according to the author's knowledge, there is still a lack of literature on the effectiveness of a structured exercise protocol for subjects with COVID 19 with the main focus being the Physical Functional performance of the patient. Hence this study has been undertaken which not only involves giving the structured exercise protocol in the hospital but has also a follow up of these patients up to one-month post-discharge regarding the improvement in their Physical Functional performance.

Need for the study

The subjects infected with COVID-19 get admitted to the COVID care hospital and depending upon the severity of their problems, patients are kept in the ICU or isolation wards. The impact of Covid 19 in many cases, may not directly lead to problems related to physical dysfunction. Still, the psychological impact or illness caused by Covid 19 in due course of time can be a significant contributing factor leading ultimately to the deterioration of physical functional performance in many of the patients admitted in the hospital or even kept in isolation after Covid 19 (Joseph, 2020). It has been proven in studies that elderly patients can have a loss of around 10% of their total body mass within three days of their immobility following hospitalisation and healthy individuals also after a week of complete bed rest have shown a loss of around 10% of their postural muscle strength (Kizilarlanoglu et al., 2016). The correlation between critical illness in patients and the subsequent bone loss in them is a well-established fact (Orford et al., 2019).

Regular exercises play a very significant role in preventing or reducing the rate of bone loss, and it is a standard routine to advise flexibility, weight-bearing and resistance exercises to these patients. The Covid 19 virus, though primarily affecting the respiratory system, also affects the other systems of the body, including the musculoskeletal system

either directly or indirectly (Disser, 2020). Studies have demonstrated that planned aerobic and strengthening exercises are effective in improving the strength and function in patients suffering from SARS infection. It has also been found that 10% of Covid 19 patients have back pain, whereas around 19% of them may complain of myalgia (Abdullahi, 2020). A detailed view of the broad spectrum of all the possible systems that may be affected by a disease or infection is always considered useful in the early diagnosis of the disease-preventing its spread and providing early and effective treatment to the patients. Thus as a part of medical intervention, there is a need for therapeutic exercises to improve the physical and mental well being of Covid 19 affected patients (Ángel Rodríguez *et al.*, 2020). The therapeutic exercises need to be planned based on the individual need of the patient. Thus an adequately thought of structured exercise protocol will undoubtedly be useful and should be incorporated in the interventional plan of COVID-19 patients. Since it is a recent pandemic, there have not been many studies to correlate the benefits of a well-structured exercise protocol in the management of COVID management. Thus the researcher intends to do this study.

Aim

Find out long term effectiveness of structured exercise protocol on the physical functional performance in subjects with COVID-19 having physical dysfunction.

Objectives

1. To assess physical functional performance in COVID-19 Patients before and after the intervention with Structured Exercise Protocol.
2. To investigate the long term effectiveness of Structured Exercise Protocol on Physical Functional performance in subjects infected with COVID-19

MATERIALS AND METHODS

Participants

It is an experimental study including 150 subjects who were diagnosed as COVID-19 positive. Inclusion criteria for recruitment were; COVID-19 positive, FIMS score, POMA score: both the genders, subjects willing to participate in the study. Exclusion criteria were: fever, unconscious subjects, subjects with neurological or cardio-respiratory instability, subjects with surgical history, neoplasia, and known cases of severe balance issues. Subjects were recruited by convenience sampling. The study population was selected from the Intensive Care Unit of KRISHNA HOSPITAL- Karad India, diagnosed

with COVID-19. The Institutional Ethics Committee KIMSDU Karad approved this study. All participants were informed about the procedures, and the written informed consent form was taken to participate in the study. Subjects were recruited based on inclusion and exclusion criteria.

Experimental Procedure

Demographic details and outcome measures like Age, Gender, Height, Weight, BMI, FIMS and POMA score were recorded pre-therapy. The structured exercise protocol was imposed every day for seven days during ICU stay, seven days during recovery ward stay and finally one-month follow-up with a home program. Subjects were called after one month from discharge from the hospital. After one month of the home program, outcome measures were re-recorded and tallied with baseline measures.

Structured Exercise protocol

Stage I-ICU

1. Deep breathing exercises.
2. Bed mobility exercises, including Ankle Toe Movements.
3. In progression, Functional Mobility In and Around the bed.

Stage II- Recovery ward

1. The exercise protocol of Stage 1 was continued, and besides, Graded upper limb and lower limb strengthening exercises were included.
2. Graded Spinal exercises were also added.

Stage III- Isolation ward continued as the Home Exercise Program

The exercises are given in Stage 1, and Stage 2 were continued as before, and Aerobic exercises were initiated.

The outcome measures were noted both before and after one month of intervention which included interventions during the hospital stay and also that done after discharge as a follow up of the patient and the results tallied statistically using 16.0 version.

Outcome Measures

1. Functional Independence Measure Score: The functional Independence measure; a widely accepted tool to measure the functional activities carried out. The scale ranges from 1 to 7. A score was falling below 7= complete independence—possible total score range from 18 (lowest)-126 (highest). A telephonic version of FIM was used for follow-up.

2. Performance Orientated Mobility Assessment: It is a 3 point ordinal scale ranging from 0-2, where the highest score indicates independence with each test item. As the name suggests, the scale measures the performance orientation, thus, tackling the neurological system along with the musculoskeletal system while performing daily activities.

The outcome measure readings were taken on pre-therapy and after 1month follow-up (Figure 1).

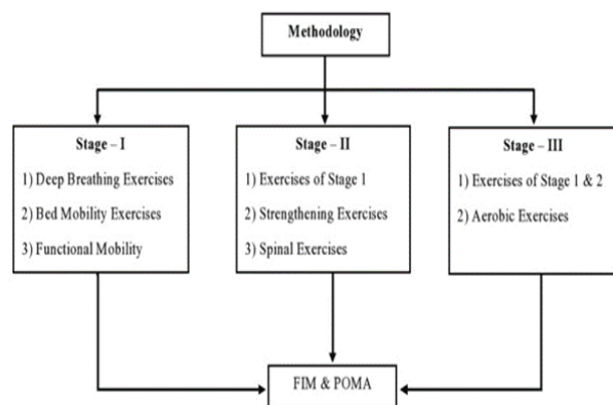


Figure 1: Flow Chart for Methodology

RESULTS AND DISCUSSION

Statistical analysis was done using 16.0 version, and the Student unpaired test was used for analysis.

Demographic Characteristics of Participants

Age, Gender and weight showed no significant difference between pre-therapy and post-therapy.

FIMS

Before the study that is pre-intervention the Functional Impairment Measure Score was; 72.4 ± 21.7 and post-therapy at the end of 1-month follow-up the score was 91.2 ± 25.2 , thus showing a significant difference in pre and post score with p-value $<0.05^*$

POMA

The pre and post-intervention score showed significant differences with values 11.9 ± 3.6 and 21.9 ± 5.5 , respectively. Thus the p-value was significant with $<0.05^*$ (Table 1).

In the present study, both the outcome measures enlisted were significantly improved post-therapy after a month of follow-up. It is already demonstrated in various studies that subjects with COVID-19 positive have tachycardia, tachypnea and deprivation of oxygen saturation in the blood hence lower SPO2 levels (Menni, 2020). It is a fact that Physiotherapy treatment particularly chest physiotherapy helps in maintaining the normal respiratory and

heart rate along with improvement in SPO2 levels by incorporating active cough extraction with basic chest exercises like deep breathing exercises and chest expansion along with several other techniques (Sultanpuram et al., 2016). There are comparatively fewer studies to demonstrate the extent of reduction in physical and functional abilities in subjects admitted in ICU. Studies have established that Covid 19 affects not only the cardiorespiratory functions, but it has an impact on the other systems of our body also (Cascella, 2020). Also, some COVID studies have shown that in chronic cases of COVID-19 there is a decrease in the immunity of the patients and thus their ability to fight against the disease which in many cases will result in reduced Physical Functional performance as well (Jesenak et al., 2020). All the exercises incorporated in this study have individually demonstrated their effectiveness in treating not only respiratory and cardiac-related symptoms, but also Physical Functional performance like; sitting balance, arising from chair or bed with and without help, attempts to arise, immediate standing balance, and gait as well, along with toileting, bladder and bowel management, eating, grooming, and other functional activities.

In the present study, Pre therapy, FIMS score was too low, suggesting that subjects with COVID tend to have low or impaired physical capability. The reason for this can be both their being bedridden in ICU for some days and also their low immunity (Shang, 2020). A study conducted by Kantonspsital W et al. demonstrated that COVID subjects had reduced functional ability. The reason he quoted was Vitamin D level reduction which is vital in the immune system. In our present study, the COVID subjects recruited had low calcium level, which may be affecting their immunity and physical capability. Another study conducted by Simeon G et al. X-ray quoted the same reason for reduction of immunity, thus leading to reduction of Functional performance. The present study was conducted on subjects with COVID. Studies have already demonstrated low levels of calcium lead to reduced immunity (Grazio et al., 2015).

The results of this study are following the other studies as the patients included in the present study also had reduced immunity, thus reducing their functional and physical capability. Covid 19 presents with a lot of heterogeneous symptoms has a visible impact on physical well being along with mental, cognitive and social health status even in patients with a mild presentation (Klok, 2020). Few researchers have advocated the need for a tool to measure and monitor the impact of the Covid 19 symptoms on the functional capabilities on the

Table 1: Scales x time analysis by student's t-test (Mean±SD)

Parameters	Pre therapy	Post therapy	p-value
FIMS	72.4±21.7	91.2±25.2	<0.05*
POMA	11.9±3.6	21.9±5.5	<0.05*

patients over a while to understand the range of functional limitations that can result from Covid 19 considering the heterogeneous nature of symptoms seen in the affected patients (Klok, 2020). Studies have demonstrated reduced physical functional capabilities along with the cardiorespiratory involvement in patients suffering from SARS, resulting in these patients having a compromised quality of life even after the end of the disease. The patients will need physiotherapy intervention for improvement in their functional capabilities.

Similarly, a well-planned rehabilitation protocol will help the patients suffering from Covid 19 to improve their physical functional capabilities not only during the hospital stay but also as a follow-up measure to maintain and improve their physical functional capability (Silva and Sousa, 2020). The exercises given in the present study have similarly demonstrated improvement of both physical and functional capability even up to 1 month of follow-up after the discharge of the subject.

CONCLUSION

The Structured Physiotherapy Protocol delivered for subjects with COVID showed definite improvement in both Physical and Functional capability. This shows significant improvement and maintenance in immunity and health as well as conditioning of the body as a whole suggesting the effectiveness towards its use in future for COVID subjects for the maintenance of their health and immunity to prevent re-infection. The strength of the present study was that the outcome measures were measured after a month from discharge to keep a track on immunity and their health as they are in hand with physical and functional ability.

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Conflict Of Interest

The authors declare that they have no conflict of interest for this study.

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