ORIGINAL RESEARCH PAPER

Physiotherapy

EFFECTIVENESS OF PHYSIOTHERAPY TREATMENT ON FUNCTIONAL CAPACITY IN POST COVID-19 SURVIVAL SUBJECTS.

KEY WORDS:

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ABSTRACT

Introduction: In late December 2019, an outbreak of a highly contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) started from the city of Wuhan, China. A high proportion of individuals who recovered from the acute phase of COVID-19 including SARS and MERS reported persistence of fatigue. Rehabilitation of post-COVID-19 patients is crucial for recovering from fatigue and improving functional status. **Need for the study (brief):** There are currently scarcity reports on the physiotherapy of COVID-19 patients that focus on fatigue, grip strength and endurance and their overall contribution to improve functional capacity. **Study Methodology (brief):** Our study design focussed on randomized controlled trial. We took sample size of 30, based on various inclusion and exclusion criteria. We included only those patients for our test who were a) non-critical and had tested positive for SARS-COV 2 virus based on RT-PCR test (Nasopharyngeal and Oropharyngeal swabs). These patients were admitted to COVID wards however not admitted in ICU. b) Recovered Patient who were referred either by physician or pulmonologist for post-covid rehabilitation (post 14/17 days of quarantine). We excluded those patients from our studies a) who refused to give their consent b) who had neurological deficits c) who were unable to ambulate/with any lower limb disability or fractures d) who were haemodynamically unstable. We segregated our subjects into two categories either experimental group or control group based on sequential envelope method. Our analysis for the data is based on statistical software R version 4.1.1 and Microsoft Excel. We have used Shapiro-Wilk's test to check the normality of variables and Paired t-test/Wilcoxon's test to compare the mean/distributions of pre-operative and post-operative parameters. The ethical clearance was obtained from SDM institutional ethical committee. We had done the CLINICAL REGISTRATION TRIAL with the CTRI reference number is REF/2021/07/045807. Finally derived **conclusion** from the study highlighted the role of physiotherapy intervention in not just improving the endurance and fatigue in covid 19 patients but also helped in reducing the complications and helped the patients to carry out their ADLS much more efficiently and helped in improving their quality of life.

INTRODUCTION

In late December 2019, an outbreak of a highly contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) started from the city of Wuhan, China.[1,3] It is a new virus and the population is not immune to it and has the potential to spread rapidly. It can affect the respiratory system, which in subsequent stages leads to its insufficiency and to a decrease in the physical and mental capacity of patients. In January 2020, the World Health Organization (WHO) declared an epidemic and on 11th March 2020 COVID-19 was defined as a pandemic.[3]

Clinical features of COVID-19 can be characterized as mild and moderate symptoms which includes fever, cough, fatigue, sputum production, muscle pain, myalgia, arthralgia, dyspnoea, sore throat, headache, diarrhoea and vomiting.[5,10] Among patients who develop the disease in its most severe form, 15% require hospitalization and 5% require further advanced life support in intensive care units (ICU) over prolonged periods.[4] Physiotherapy team plays an essential role in the recovery of patients who require hospital care and/or in intensive care units (ICU).[2]

There is the negative impact of prolonged hospitalization on post-discharge functional capacity, so the challenge for the Covid-19 survivors can be even greater, as both the pathophysiology and the necessity for prolonged treatment during the acute severe stage of the disease can cause organ damage that compromises functional recovery and the capacity to perform activities of daily living (ADLs). Considering that Covid-19 can affect different physiological systems, with more than 80% of the survivors present with some long-term functional limitation months after initial symptom onset, several factors influence the patient's functional capacity.[4]

A high proportion of individuals who recover from the acute phase of COVID-19 including SARS and MERS report persistence of fatigue. Fatigue is defined as a debilitating, non-transient feeling of physical and mental tiredness or exhaustion characterized by lack of energy, muscle weakness, slowed reactions, drowsiness, and deficit in concentration. It has been ranked amongst the top 3 symptoms and can be the consequence of biologic, behavioural, and environmental factors.[7,8] Rehabilitation of post-COVID-19 patients is crucial for recovering from fatigue and improving functional status even in a chronic phase.[13]

Grip strength is a simple but powerful predictor of future disability, morbidity, and mortality in elderly population, in middle-aged and young population. A study conducted in 17 countries says that grip strength can predict all-cause mortality, specifically cardiovascular morbidity and mortality, even more than the systolic blood pressure. Being non-invasive, simple, and inexpensive; measurement of the grip strength in Covid-19 patients especially with high-risks (e.g., hypertensive elderly, etc) would be noteworthy. [11]Physical therapists play an important role in hospitalized post-COVID-19 patients by providing respiratory support and active mobilization aiming to help patients to recover the ability to perform the daily life activities (ADLs). Rehabilitation is crucial for recovering from fatigue and improving functional status in a chronic phase. It is important to understand the late functional complications and start an early rehabilitation and mobilization right after the COVID-19 acute phase depending on the severity of critical illness and individual goals.[2,9,13]

Need For The Study.

There are currently no scientific reports on the physiotherapy of COVID-19 patients that focuses on fatigue, grip strength and endurance and their overall contribution to improve functional capacity.[3]Therefore a need arises for rehabilitation and interventions for COVID-19 survivors in order to enable a functional return to home by limiting the fatigue and improve functioning.

Objectives Of The Study:
To assess effectiveness of physiotherapy on functional capacity in COVID-19 survivors.

Methodology Of The Study:
Study Design: Randomized Controlled Trial

Sample size-
30 samples will be selected randomly depending on the inclusion and exclusion criteria for the study

Inclusion & Exclusion criteria:
Inclusion Criteria
Non-critically ill patients who are tested positive for SARS-COV 2 virus based on RT-PCR test (Nasopharyngeal and Oropharyngeal swabs), **later shifted to ward and not admitted in ICU or on OPD basis.**

Recovered Patient referred either by physician or pulmonologist for post-covid rehabilitation **(post 14/17 days of quarantine).**

Patients those who are willing to participate

Participants of either gender

Patients above 18 years of age

COVID-19 severity classified as mild, moderate Mild: ambulatory without hypoxemia

Moderate: ambulatory but requiring supplemental oxygen5L/m

Exclusion Criteria
Patients who refuse to give their consent
Patients with any neurological deficits
Patients who are unable to ambulate/with any lower limb disability or fractures
Patients who are haemodynamically unstable
Patients with psychiatric illness, severe mental illness
Pregnant women
Patients who are unable to follow verbal instructions as assessed by primary investigator or co-investigator
Patients with any acute medical condition that may interfere with the participation

Source of data: Patients admitted to SDM College of Medical Sciences and Hospital, Dharwad

Method Of Collection Of Data:
A written consent form was obtained before the commencement of the study. All the Covid-19 recovered patients, referred either by physician or pulmonologist for post-covid rehabilitation (post 14/17 days of quarantine) meeting the inclusion criteria, above 18 years of age from SDM Medical Hospital will be chosen for the study. The subjects will be allocated to either experimental group or control group by sequential envelope method. All subject will be informed that they were free to back out from the study at any time and that no advance consequences would follow their withdrawal. The participating subjects will be briefed about the study and the survey.

Once the subjects were admitted in the hospital ward, they will be assessed for vitals – Heart Rate, Blood Pressure, SPO2 and Respiratory Rate prior to the commencement of assessment of functional capacity. Followed by which fatigue will be assessed using the Fatigue Numeric Rating Scale, Grip strength will be assessed using a dynamometer and L- test will be asked to perform by the patient.

A 1-minute Sit to Stand test will be asked to Perform to assess the Functional Capacity of the patient. If any patient is unable to complete the 1-minute Sit to Stand test, a modified version of the same – 30 second Sit to Stand test will be considered.

Experimental Group-
A following set of exercise protocol will be administered for the experimental group which includes – Seated knee extension, Seated hip flexion, Seated triceps dips, Bridging, Sideways leg lift, Straight leg raise, standing leg exercises (hip extension with chair support, hip abduction with chair support and hip knee flexion with chair support) accompanied by breathing exercises. Each of these exercises will be asked to perform for ten repetitions for a week.

Control Group -
The patients in the control group will be given general mobility exercises followed by breathing exercises for 1 week. Vitals will be checked post the exercise session as well. At the end of the week, functional capacity of all the patients will be reassessed; using the 1 min sit to stand test and fatigue severity scale, grip strength and L-test will be done.

Ethical clearance was obtained from SDM institutional ethical committee.

CLINICAL REGISTRATION TRIAL was also carried out. CTRI reference number is **REF/2021/07/045807.**

Statistical Analysis
METHOD:
Data is analysed using statistical software R version 4.1.1 and Microsoft Excel. Continuous variables were represented by mean± SD/Median (minimum, maximum). Shapiro-Wilk's test is used to check the normality of variables. Paired t-test/Wilcoxon's test is used to compare the mean/ distributions of pre-operative and post-operative parameters. Two sample t-test will be used to compare the parameters between the groups. P-value less than or equal to 0.05 indicates statistical significance.

SUMMARY:
In the study there were 30 subjects and different parameters recorded pre-operatively and post operatively for each of the subject. Below table compares the different parameters across time points.

Table 1: Comparison Of Different Parameters Over Time.

Variables	Time		p-value
	Pre-test	Post-test	
1 Min STS test	26.75±5.04	28.75±5.6	0.002119*[pt]
Fatigue score	2.72±1.33	2.26±1.19	0.0223*[pt]
L-test (in secs)	19.18±5.08 18 (14.6, 34.06)	18.24±3.64 18 (14, 29)	0.006627*[W]

Abbreviations: STS: Sit to stand; pt.: paired t-test; W: Wilcoxon's test

In the above table we can observe that, mean score of 1 min sit to stand test is significantly less in pre-test compared to post-test by one-tailed paired t-test.

By one-tailed paired t-test, mean of fatigue score is significantly more in pre-test compared to post test.

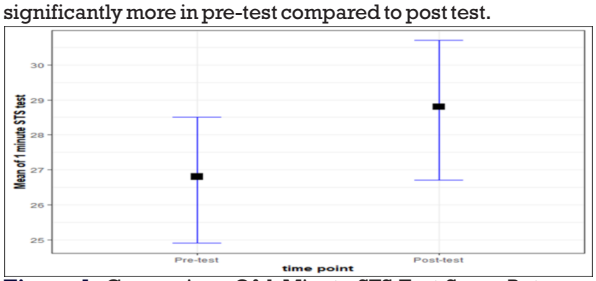

Figure 1: Comparison Of 1 Minute STS Test Score Between Time Points.

Similarly, there is significant difference in the distribution of L-test scores in pre and post time point by Wilcoxon's test.
Below plot visualizes the above table.

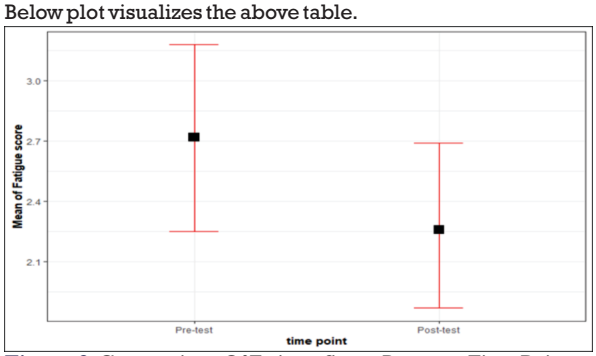

Figure 2: Comparison Of Fatigue Score Between Time Points.

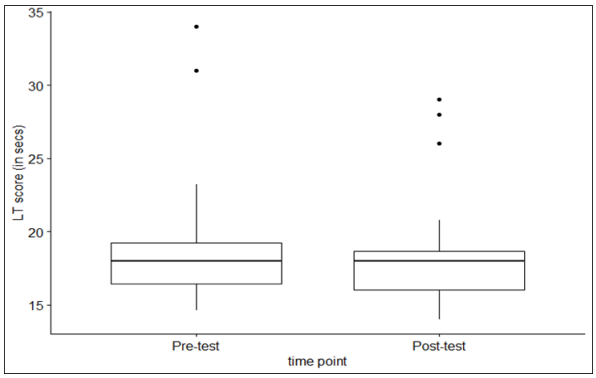

Figure 3: Comparison Of L-Test Score Over Times.

Below table compares the hand grip strength between and within the group.

Table 2: Comparison Of Hand Grip Strength Between And Within The Groups.

Variables	Time point	Hand		p-value
		Right	Left	
Hand grip strength	Pre-test	14.27±4.39	14.05±4.58	0.8546[t]
	Post-test	14.35±4.75	14±4.45	0.7694[t]
Within group p-value		0.8722[pt]	0.8965[pt]	-
Change		0.08±2.7	0.06±2.37	0.9717[t]

Abbreviations: t: two sample t-test; pt: paired t-test; W: Wilcoxon's test.

By two sample t-test, there is no significant difference in the mean of hand grip strength at pre-test and post-test between right hand and left hand.

There is no significant difference in the mean of hand grip strength between pre-test and post-test within each group by paired t-test.

There is no significant difference in the mean of change in hand grip strength between the groups by two sample t-test.

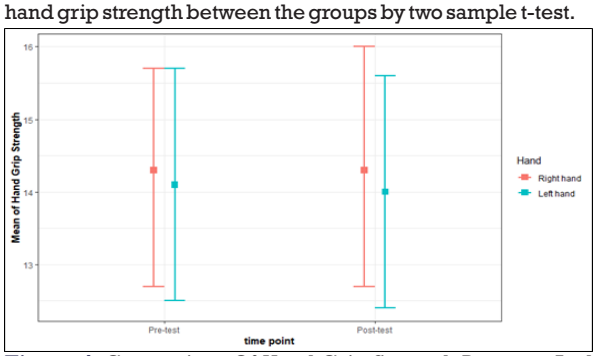

Figure 4: Comparison Of Hand Grip Strength Between And Within The Group.

DISCUSSION

Respiratory physiotherapy is an important part of multidisciplinary treatment and plays a very important role in the treatment, improvement and care of patients with respiratory dysfunctions. Through a wide range of activities, physiotherapists support the treatment of patients of various ages and diseases, with critical, acute or chronic conditions, in hospitals, home care or rehabilitation centres [5,6-8]. In the case of COVID-19, the ones most vulnerable to developing severe disease and death are elderly people with reduced immunity, which is accompanied by other, particularly chronic diseases (including cardiological, pulmonary, oncological) [7,8,9]. The role of physiotherapists in treating these patients is essential. Currently we have a small number of scientific reports on enhancing role physiotherapy of COVID-19 patients. However, there are international indications for respiratory physiotherapy in patients with acute and chronic respiratory failure [2,3,4,5,6,10], as well as indications for handling the contact with the infected patient.

Physiotherapy intervention was found to be beneficial in improving Pao2/fio2 ratio or oxygenation index as seen using ultrasound and CT scan [1], dyspnea heart rate level, functional independence [13,14]. Approaches in hospital setups and pre discharge in the admitted patients has suggested greater improvement in patients [7,8,9]. Majority of patients had tailored rehabilitation related to fatigue and depending upon their prescreening of muscular strength, endurance and hurdles encountered while carrying out activities of daily living. [9,13]

Techniques such as Positioning, controlled mobilization, breathing retraining, thoracic expansion exercises, airway clearance techniques, respiratory muscle strengthening, active range of motion exercises, endurance training in form of cycle ergometer has shown reduction in hospital stay and greater improvement in patients with Covid 19. [9,13]

Fatigue that is observed in patients is also said to be linked to sleep deprivation, drowsiness and low-grade inflammation in both elderly and young population. [18] Physiotherapy intervention has also shown that it reduces fatiguability and improve functioning in patients at admission and discharge due to covid 19. [7,8,9,13]

Supportive therapy is also seen to be effective in covid-19 thus stating to be helpful for clinicians for developing target therapy [5]. Studies have stated that grip strength is a predictor of future disability, morbidity and mortality. Low grip strength can lead to re – intubation rate and post extubating grip strength was related to ventilator free days. [11] Grip strength has also been linked to better pulmonary function, as it inversely correlates to age, dominance of hand and body mass index. [15,17] Moreover, it is affected by nutritional, genetic and environmental factors. The position to carry out was shoulder adduction, neutral rotated, elbow flexed at 90 and wrist at neutral position. [15] The greater lever arm for force generation and better is mechanical advantage. [15]

A retrospective study has been done which shows that myalgia can be assessed using Visual Analogue Scale and Numeric Rating Scale. Handgrip was assessed using Jamar hand held dynamometer and physical fatigue was much higher than mental fatigue. [10]. It was assessed could suggested that females were having lower grip strength as compared to males [17] The male gender participated grip was not affected in non-severe and severe COVID -19 cases. [10] Whereas they showed increased level of CRP, ferratin and LDH. All of the above suggested that cause to be the triangle of muscular involvement in covid 19 being myalgia, physical fatigue and muscular weakness. [10]

Studies have also shown that jammer hand held dynamometer in Indian population in age group 21 to 80 years as a measurement of power, skill and dexterity [18]

The one-minute sit to stand test which has been used in this study has been proved to be as effective as 6 min walk test as it consumes the same METS [4.5] as 6 min walk test. [14] Thus it can be used to assess functional capacity of patients with respiratory dysfunction. [14]]. Moreover, L test is potential important clinical and research tool to assess the mobility function, in older population as then they are back to community. [12]

CONCLUSION

According to our study, 30 participants underwent 1 min sit to stand test, grip strength evaluation and L-test. We also assessed their fatigue level on fatigue severity scale.

When 1 min sit to stand was taken into consideration, subjects took less time in pretest compared to post test. The physiotherapy intervention did make much of a difference in this aspect.

Similarly, when grip strength was taken into consideration, there was no significant difference in the strength pre-test to post-test between right and left hand after the physiotherapy intervention there was no change in grip strength observed in males.

The fatigue levels of the patients when assessed pre physiotherapy intervention it was found to be more as compared to fatigue assessed post physiotherapy intervention. Hence showing improvement in fatigue levels experienced by the patient.

When L-test was taken into consideration, it was observed that participants consumed less time in performing the task after a week of physiotherapy intervention as compared to pre-test.

Therefore, we conclude that physiotherapy intervention not only improved the endurance and fatigue in covid 19 patients but also helped in reducing the complications and helped the patients to carry out their activity of daily living much more efficiently and hence improved their health-related quality of life.

Limitation And Future Scope Of Study

It could have been better insight in case it was administered for large size population. Some other measures of sarcopenia are gait speed, skeletal muscle index is inversely associated with global measures of maximal inspiratory pressure and maximal expiratory pressure. The Chelsea Critical Care Physical Assessment Tool, can also be used. L test could be used in combination with time up and go test.

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