Original Article

Effects of Stacking Breathing Techniques on Respiratory Efficiency of Post COVID-19 Patients

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Abstract

Background: Long COVID is a term used to describe persistent symptoms and complications experienced by individuals after recovering from acute COVID-19 infection. Respiratory impairment, defined by diminished lung function, exercise intolerance, and diminished respiratory muscle strength, is one of the frequent long-term consequences of COVID-19 which can significantly impact the quality of life. Hence, exploring effective interventions to improve respiratory efficiency in this population is crucial.

Purpose: The purpose is to evaluate the effectiveness of stacking breathing techniques on respiratory efficiency in post COVID-19 patients.

Material and Method: This is an experimental study done using convenient sampling technique with inclusion criteria of age between 18 to 60 taken from siva physiotherapy clinic. Patients having SPO2 level of 95. History of Post Covid Patients with secondary disease and irregular heartbeat were excluded. The sampling size of the study is (n=60) subjects for a period of 4 weeks. The entire process was conducted from November 2022 to March 2023.

Results: According to the statistical analysis, Deep Breathing Techniques are successful in improving respiratory rate among Post Covid-19 Patients. The statistical analysis of both the groups with respect to the post-test values (mean ± SD) for respiratory rate 17.1700 ± 1.2600 and 15.47± 1.07 and showed that the p value is statistically significant <0.0001. Post intervention (mean ± SD) for post Covid -19 functional status scale(PCFS) 0.83 ± 0.75 and 1.40± 0.77and showed that the p value is statistically significant <0.0001.

Conclusion: This study finally concluded that deep breathing techniques have a high impact in improving Respiratory rate and Post Covid 19 functional status scale (PCFS) among Post Covid-19 Patients.

Keywords: Covid 19,Deep Breathing Technique, Respiratory rate, Pulse oximeters, Post Covid 19, Stacking Breathing Techniques.

Introduction

Since 2019, The SARS-CoV-19 coronavirus, which was first discovered in Wuhan, China, has now spread to all corners of the globe. India was infected by the virus in January 2020. Coronavirus disease 2019 (COVID-19) is a highly contagious

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respiratory ailment caused by coronavirus 2 (SARS-CoV-2) that is very contagious.[1,2] The virus mainly spreads through direct contact between people when respiratory droplets are secreted. It spreads considerably more quickly than it is detected, according to research findings.[3] The COVID-19 virus has spread rapidly throughout every country. However, those who haven't received a vaccination or those with weakened immune systems are more susceptible to contracting this virus. One or more of the symptoms of COVID-19 include shortness of breath, fever, cough, tiredness, dizziness, and a loss of taste .

The use of breathing exercises, which included forced expiratory technique (feat), diaphragmatic breathing, deep breathing, or chest expansion exercise, as well as breathing control. Data on the median values of respiratory rate (breaths/minute), and heart rate (beats/minute).[4] Numerous studies have demonstrated that physiotherapy is beneficial for COVID-19 patients, but they have also made some recommendations for its use in terms of preventing the spread of the virus. This case report will describe a case of a COVID-19 patient with shortness of breath that improved by serial breathing exercise and chest physiotherapy.[5]

Stacking breathing techniques involve a series of controlled breath-holding maneuvers, followed by slow and controlled exhalation and inhalation. These techniques aim to optimize respiratory muscle function, increase lung capacity, improve ventilation-perfusion matching, and enhance overall respiratory efficiency. While stacking breathing has been investigated in other respiratory conditions, limited research has specifically examined its effects on respiratory efficiency in long COVID patients.

Therefore, examining the effect of combining breathing techniques on the respiratory effectiveness of long-term COVID patients is the goal of this study. We can learn a lot about the potential advantages like respiratory muscle strength, exercise tolerance, forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and dyspnea levels.[6]

Understanding the effects of stacking breathing techniques on the respiratory efficiency of long COVID patients has important implications for their rehabilitation and recovery. If found to be effective, this intervention could provide a safe, accessible, and cost-effective approach to manage respiratory impairments and improve quality of life in long COVID patients.[7]

The primary outcome measures in this study include Respiratory rate (number of breaths per minute), and the Post Covid 19 Functional Scale (PCFS), which evaluates individual functional goals and their achievement.[8] These outcome measures capture key aspects of respiratory efficiency and functional abilities in post COVID-19 patients. Respiratory rate is another crucial outcome measure as it reflects the efficiency of the respiratory system. This study seeks to determine the effects of stacking breathing on respiratory muscle control and effectiveness by measuring respiratory rate. A reduction in respiratory rate would indicate improved respiratory efficiency and reduced energy expenditure associated with breathing.[9]

The Post COVID-19 Functional Status (PCFS) scale is an outcome measure used to assess the functional status of individuals who have recovered from COVID-19. It is designed to evaluate the impact of COVID-19 on various aspects of daily functioning, including physical, cognitive, and emotional well-being. The PCFS scale provides valuable information about a patient's recovery and helps healthcare professionals understand the extent of functional impairment caused by the virus.[10]

Aim

To evaluate the effectiveness of stacking breathing techniques on respiratory efficiency in post COVID-19 patients.

Material and Method

This is an Experimental study done using convenient sampling technique with inclusion criteria of age between 18 to 60. Patients having SPO2 level of 95. History of Post Covid Patients with secondary disease and irregular heartbeat were excluded. The sampling size of the study is (n=60) subjects for a period of 4 weeks.

Study period: November 2022 to March 2023.

Inclusion criteria:

1. SPO2 level of 95
2. Subjects with age between 18 - 60 years
3. Both male and female
4. BMI 25-29
5. Sleep Disturbance

Exclusion criteria:

1. Post Covid-19 Patients with Secondary disease
2. Co-morbidity patients
3. Rib fracture
4. Pneumothorax
5. Irregular heartbeat.

Outcome Measure

Assessment was done at initial and at the end of the study using

1. Respiratory Rate
2. Post COVID 19 functional scale

Procedure

This study's recruitment process resulted in a final participant count of 60 using a convenient sampling technique. According to the inclusion and exclusion criteria, all subjects were chosen for enrollment. All subjects received information sheets about the study protocols before the study's start, and informed consent was obtained. The enrolled subjects were divided into Groups A (n = 30) and B (n = 30), and they underwent pre-test analysis on respiration rate using a pulse oximeter to determine whether they had any breathing problems when doing ADL tasks and functional activity using the Post Covid-19 Functional Status Scale. Following the pre-test analysis, Group A subjects got Stacking Breathing Techniques for 4 weeks during 3 sessions per week, whereas Group B subjects received Deep Breathing Techniques during 3 sessions each week. After 4 weeks, the Post- test analysis was carried out and data were tabulated through SPSS. They will be well informed about the study and treatment protocols and informed consent will be obtained. The 60 subjects will be divided into group A and groupB where Group A is the experimental group (n=30) and they will be given stacking breathing exercise for weeks two times per days with 3 sets and 5 repetition for 20 minutes and Group B is the control group (n=30) and they will be given deep breathing exercises for 4 weeks two times per day with 3 sets and 5 repetitions for 20 minutes.

Exercise Protocol

STACKING BREATHING PROGRAMME:

Participants in the Group-A (n=30) will undergo a structured stacking breathing program, consisting of specific breathing techniques designed to optimize respiratory efficiency. Here are two types of stacking breathing techniques that can be incorporated into a program to improve Respiratory rate in post-COVID-19 patients:

Inspiratory Breath Hold Technique

The inspiratory breath hold technique focuses on enhancing lung capacity and oxygen uptake. Here's how to perform this technique:

1. Sit or stand in an upright position.
2. Take a slow, deep breath in through your nose, filling your lungs as much as possible.
3. Hold your breath for a short duration, around 2-3 seconds, at the end of inhalation.
4. Exhale slowly and fully through your mouth, emptying your lungs completely.
5. Pause briefly after the exhalation.
6. Inhale slowly and deeply again, repeating the cycle of breath hold, exhale, and pause.
7. Aim to gradually increase the duration of breath holds and the depth of inhalations over time as tolerated.

Expiratory Breath Hold Technique

The expiratory breath hold technique focuses on improving oxygenation and lung function by maximizing the elimination of carbon dioxide. Here's how to perform this technique:

1. Sit or stand in an upright position.
2. Take a slow, deep breath in through your nose, filling your lungs completely.
3. Exhale slowly and completely through your mouth, emptying your lungs as much as possible.
4. Hold your breath at the end of exhalation for a short duration, around 2-3 seconds.

5. Inhale slowly and deeply through your nose, maintaining a controlled and relaxed pace.
6. Pause briefly after the inhalation.
7. Repeat the cycle of exhale, breath hold,and inhale, gradually increasing the duration of breath holds and the depth of inhalations over time, as tolerated.

DEEP BREATHING PROGRAMME:

Participants in the Group-B (n=30) will undergo a deep breathing program, consisting of specific breathing techniques designed to promote relaxation and reduce stress. The program includes instructions on diaphragmatic breathing, pursed lip breathing, and box breathing.

Diaphragmatic Breathing

Gut breathing or abdominal breathing are other names for diaphragmatic breathing, involving consciously engaging the diaphragm muscle to promote deep inhalation and exhalation. This technique helps improve oxygen exchange and lung capacity. Here's how to perform diaphragmatic breathing:

1. Sit or lie down in a comfortable position.
2. Place one hand on your abdomen, just below your ribcage, and the other hand on your chest.
3. Take a slow, deep breath in through your nose, allowing your abdomen to rise as you inhale.
4. Exhale slowly through your mouth, feeling your abdomen fall naturally.
5. Focus on the movement of your abdomen, ensuring that it rises more than your chest as you inhale and falls as you exhale.
6. Repeat this deep breathing pattern for several minutes, aiming for a slow and relaxed pace.

Pursed Lip Breathing

Pursed lip breathing is a technique that helps regulate breathing, prevent air trapping, and enhance oxygenation. It involves inhaling slowly through the nose and exhaling gently through pursed lips. Here's how to perform pursed lip breathing:

1. Relax your facial muscles.
2. Breathe in through your nostrils slowly and deeply while counting to two.
3. Pucker your lips as if you were going to blow out a candle.
4. Exhale slowly and steadily through your pursed lips, counting to four.
5. Focus on making the exhale twice as long as the inhale.
6. Repeat this cycle of inhaling through the nose and exhaling through pursed lips for several minutes.

Box Breathing

Square breathing is another name for box breathing, is a technique that helps regulate breathing patterns and induce a state of relaxation. It involves equalizing the duration of inhalation, holding the breath, exhalation, and holding the breath again, creating a square-like pattern. Here's how to perform box breathing:

1. Find a comfortable position and relax your body.
2. Inhale slowly through your nose for a count of four, filling your lungs completely
3. For four counts, hold your breath.
4. For a count of four, softly exhale through your mouth, letting all the air out of your lungs.
5. Hold your breath again for a count of four.
6. Repeat this pattern of inhaling, holding, exhaling, and holding for several minutes.

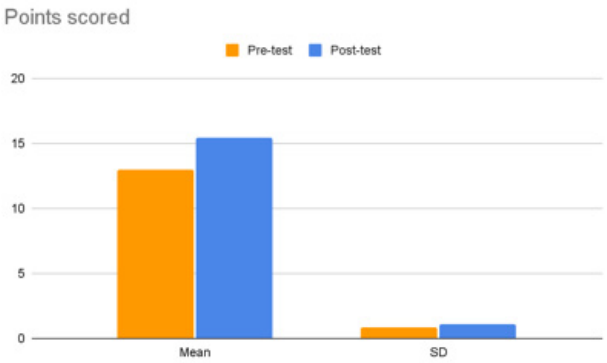
Data Analysis

Pre-test and post-test values of respiratory rate and Post Covid-19 Functional Status Scale (PCFS) using pulse oximeter.

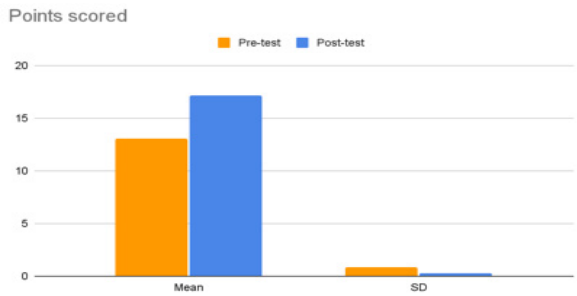
Result

The Pretest mean of Respiratory rate Level for Group A Stacking breathing technique showed 13.00, the standard deviation 0.87, whereas the Post-test mean of Respiratory rate Level for Group A Stacking breathing technique showed 15.47, the standard deviation 1.07.This showed statistically significant in p-value of less than 0.0001.The Pre-test mean of Respiratory rate for Group B Deep breathing technique showed 13.10, the standard deviation 0.84, whereas the Post- test mean value of the Respiratory rate Level for Group B Deep breathing

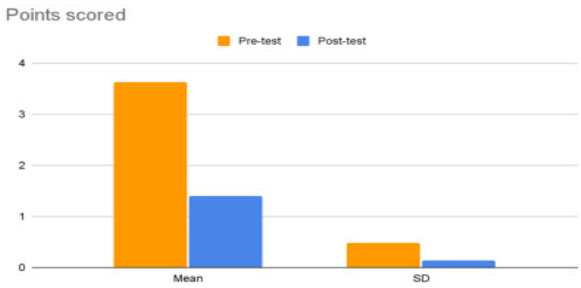
technique showed 17.17, the standard deviation 1.26.This showed statistical significance in p-value of less than 0.0001.The Pre-test mean of Post Covid 19 Functional Status Scale (PCFS) for Group A Stacking breathing technique showed 3.63, the standard deviation 0.49, whereas the Post-test mean of Post Covid 19 Functional Status Scale (PCFS) for Group A Stacking breathing technique showed 1.4, the standard deviation 0.77.This showed statistical significance in p-value of less than 0.0001.The Pre-test mean of Post Covid 19 Functional Status Scale (PCFS) for Group B Deep breathing technique showed 3.60, the standard deviation 0.50, whereas the Post-test mean of Post Covid 19 Functional Status Scale (PCFS) for Group A Stacking breathing technique showed 1.40, the standard deviation 0.77. This showed a statistical significance p-value of less than 0.0001. Post intervention, Respiratory rate of the participants those who received deep breathing for 4 weeks Mean (17.1700), standard deviation (1.2600) showed better results when comparing with participants those who underwent stacking breathing for 4 weeks Mean (15.47), the standard deviation (1.0700).This showed statistically significant in p- value of less than 0.0001.Post intervention, Post Covid 19 Functional Status Scale (PCFS) of the participants those who received deep breathing for 4 weeks Mean (0.83), the standard deviation (0.75) showed better result when comparing with participants those who underwent stacking breathing for 4 weeks Mean (1.40), the standard deviation (0.77).This showed statistical significance in p-value of less than 0.0001.



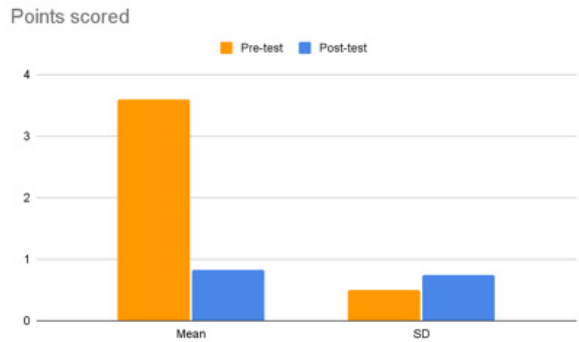
Graph-1: Comparison between pre-test and post-test values of respiratory rate Group A stacking breathing



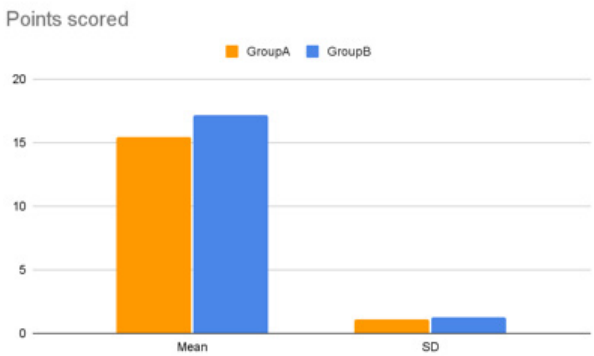
Graph-2: Comparison between pre-test and post-test values of respiratory rate Group B deep breathing.



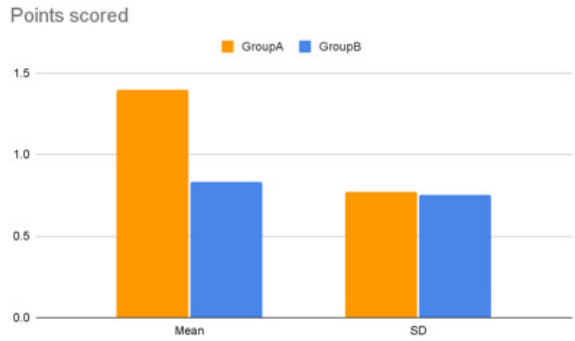
Graph-3: Comparison between pre-test and post-test values of post Covid 19 functional status scale.



Graph-4: Comparison between pre-test and post-test values of post Covid-19 functional status scale (PCFS) Group B deep breathing .



Graph-5: Comparison between the post- test values of group A and B of respiratory rate



Graph-6: Comparison between the post- test values of group A and B of Post Covid-19 functional status scale

Discussion

The results of this study demonstrated significant improvements in respiratory efficiency parameters among post- COVID-19 patients who underwent the deep breathing intervention compared to the stacking breathing technique. This finding suggests that deep breathing exercises contributed to enhanced respiratory muscle strength and improved ventilation in post-COVID-19 patients.

M. Widnyana, Ida Bagus, and colleagues (2021) conducted a single case study on a 53-year-old female who had been diagnosed with COVID-19 infection.. Chest physiotherapy is useful in assisting COVID-19 patients with sputum clearance and enhancing ventilation. By strengthening the respiratory muscles, increasing chest expansion, and decreasing sputum buildup in the airways, this physical treatment can increase the respiratory system's effectiveness. Breathing exercises and chest physiotherapy may also be used. As per this conclusion my study also concluded that deep breathing exercises are effective when compared to stacking breathing among post covid-19 patient.[11]

Another Study Saif Ullah Sheikh, Aneesa Rehmani et.al. (2023), they conducted a Quasi-experimental study on effectiveness of Deep breathing exercises regarding dyspnea among Post Covid 19 patients with a subject of 120 patients and the study. The experimental group received a 25 minute deep breathing exercise intervention twice a day and the dyspnea was evaluated using a modified Borg Balance scale. The study concluded that Deep breathing exercises are useful in reducing respiratory problems in covid-19 patients.[12] This study also shows that deep breathing exercises are more effective than stacking breathing techniques among post covid 19 patients.

Conclusion

This study finally concluded that deep breathing techniques have a high impact in improving Respiratory rate and Post Covid19 Functional Status Scale among Post Covid-19 Patients.

Ethical clearance; Taken from the institutional ethical committee.

ISRB number-03/060/2022/ISRB/SR/SCPT

Source of Funding: Self

Conflict of Interest: No conflict of interest during this research.

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