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Exercise and Yoga as Modalities for Post COVID-19 Rehabilitation

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Abstract: ***Background*: COVID-19 is an ongoing pandemic. Large numbers of people are affected for it all over the world. COVID-19 has good recovery rate. People who are surviving this pandemic have residual impacts on their physical, physiological and psychosocial health. There is an immense need for rehabilitation of patients after COVID-19. Considering the post viral impact, this paper tries to outline the role of exercises in rehabilitation after COVID-19. Main Text: In COVID-19 lung is the main target organ attacked by severe acute respiratory syndrome coronavirus (SARS-CoV-2) while immune system, physical health as well as mental health is highly affected due to COVID-19. The speed of spread of coronavirus disease infection is increasing day by day and still there is no availability vaccination till date which make necessary to discharge patients with mild symptoms as soon as possible. Due to above reasons, it is important to draw up rehabilitation programs for such mild cased patients to restore physical health, respiratory function, to reduce anxiety to restore good quality of life. Rehabilitation program play a vital role in post discharge patients with coronavirus disease. Yoga play a tremendous role in post COVID-19, which reduces psychological stress may had an important role to play in strengthening the immune system thereby reducing spread of infections and preventing complications. Yoga for maintaining respiratory health and improving immunity. Consistent practice of yogic breathing techniques (pranayama) increases the lung's airflow, air capacity, stamina and efficiency. Yoga could also be helpful in improving respiratory capacity along with breathing exercises thus overall effect of yoga training toward improved pulmonary function in patients with chronic obstructive pulmonary disease. Conclusion: Aasana (postures) and pranayam (breathing patterns) based on yoga has been outlined as effective method of exercises for post COVID rehabilitation. A sample exercise plan in this light has also been presented.*

Keywords: COVID-19 rehabilitation, pranayama, Aasana, pulmonary rehabilitation, cognitive rehabilitation

1. Background

The world has been hit by a global pandemic condition COVID-19, also known as coronavirus pandemic. Globally it has affected more than thirty three millionpeople. Among these affected cases around 80 percent had mild to moderate illness, 14 percent had severe symptoms and approx. 6 percent were critical. There are approximately 24 million recovered coronavirus cases globally. However, post viral effects are seen in the majority of recovered patients.

The primary organ affected by novel coronavirus is lungs, but impact on various body systems has been reported. Pneumonia, lung fibrosis with ground glass opacities, thickening of Broncho vascular bundles, hydrothorax and chest distress are the most common changes in respiratory system (Cao et al, 2020). Among other systems most common changes are seen in cardiac system, kidneys, gastrointestinal tract. In addition a wide range of neurological and musculoskeletal symptoms are also seen. These symptoms range from myocarditis, acute myocardial infarction, pyroptosis in kidneys, anorexia, vomiting, nausea, abdominal pain to gastrointestinal bleed (Balachandar et al, 2020). Neurological manifestations include smell impairment, taste impairment, headache, dizziness, acute cerebrovascular disease and triggering of neurodegenerative disease (Puja et al, 2020). Pain, tenderness, myalgia ad generalized muscle weakness are commonly reported musculoskeletal symptoms (Lopez et al, 2020). These symptoms may tend to persist even after the patient is infection free. Y Zhao et al, have reported presence of radiological and physiological abnormalities after 3 months in non-critical COVID cases (Y Zhao et al, 2020). The pathogenetic role of COVID in triggering of type I diabetes is also under consideration by researchers (Caruso et al, 2020). Fatigue and reduced exercise tolerance is usually seen in 80 percent of hospitalized patients after sepis (Prescott et al, 2020). Apart from medical impairments psychological and cognitive impairments may also be seen in COVID recovered patients. An Italian study found that 80 percent of patients admitted to COVID rehabilitation unit had abnormal scores at cognitive assessment (Iannaccone et al, 2020). Social strain or the eventual neurotropic effects of the virus may also trigger onset of psychiatric symptoms (Orsini et al, 2020). A United Kingdom based study also found symptoms of fatigue, breathlessness and psychological distress in patients 7 weeks post discharge from hospital (Halpin et al, 2020).There are no long term follow up studies on COVID survivors as of now but long term follow up of SARS (severe acute respiratory syndrome)

and MERS (middle east respiratory syndrome) show that there are long term effects on impaired diffusing capacity for carbon monoxide, reduced exercise capacity, post-traumatic stress disorder, depression and anxiety (Ahmed et al, 2020). Thus, COVID recovered patients may have a wide range of physical, cognitive and psychological impairments. Considering the presence these of symptoms in patients post discharge, there is a need for rehabilitation of patients after COVID-19.Due to load on the medical system worldwide and limitations of institutionalized rehabilitation most of the patients are discharged early without much rehabilitation. According to WHO rehabilitation is one of the quality health services and must be available to all people who are in need (WHO, 2019). The Global Rehabilitation Alliance has also urged the decision makers to ensure that rehabilitation services are made available to all COVID survivors in need (Gutenbrunner et al, 2020). These may include exercises, psychosocial support, education and other necessary interventions (Wade et al, 2020).Figure 1 summarizes the various components which need to be addressed during rehabilitation of COVID-19 recovered patients.

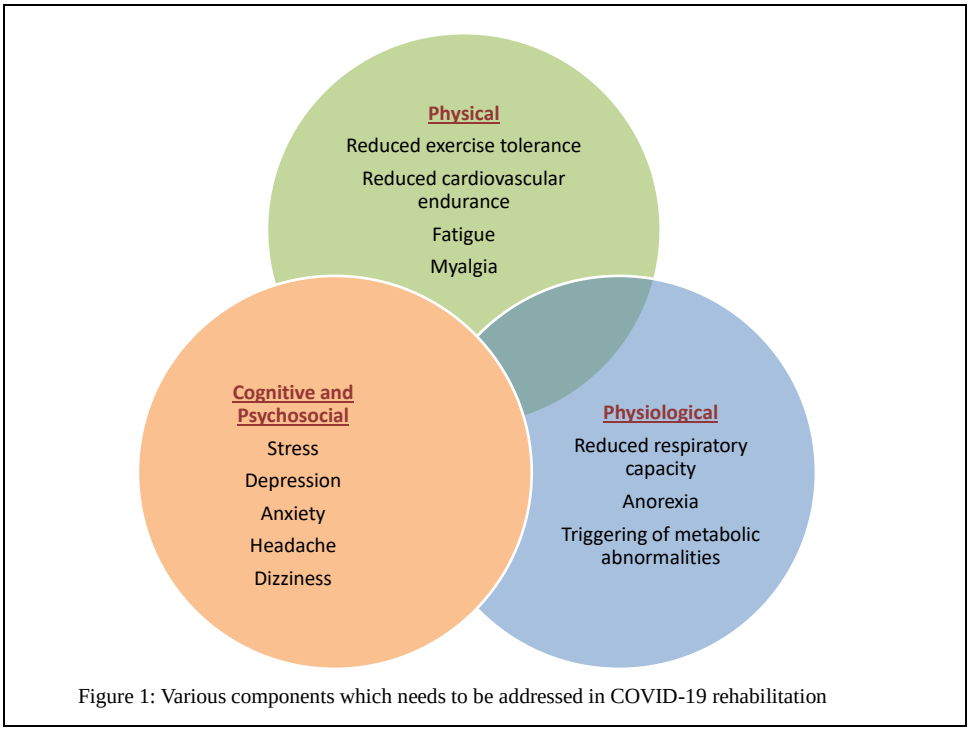

Figure 1: Various components which needs to be addressed in COVID-19 rehabilitation

Rehabilitation after COVID-19

There are some reports of preliminary studies and guidelines regarding the rehabilitation of COVID-19 patients. In the one of the earliest study on rehabilitation after COVID it was found that a 6 week rehabilitation program which included 2 sessions per week improved respiratory function, quality of life, mobility and stress level in elderly (Liu et al, 2020). The rehabilitation program included respiratory muscle training, cough exercises, diaphragmatic training and stretching exercises. The Chinese guidelines which recommend rehabilitation through hospitals, rehabilitation institutes and community include pulmonary function rehabilitation, exercise therapy and cognitive and behavior therapy (Zeng et al, 2020). Thorax mobilizing therapy, expectoration therapy and breathing training are included in pulmonary function rehabilitation. Aerobic exercises, resistance training and balance and coordination training are included in exercise therapy. Guidelines based on COVID literature review also indicate use of breathing exercises, aerobic exercises, strengthening exercises and balance training (Demco et al, 2020). Pulmonary rehabilitation based on principles of rehabilitation of chronic respiratory diseases is the most accepted option for patients with moderate to severe respiratory involvement (Polastri et al, 2020). Pulmonary rehabilitation has been recommended for all COVID-19 patients whether they were hospitalized or recovered in home isolation (L Yang et al, 2020). According to European respiratory society and American thoracic society the patient should perform low to moderate intensity physical exercise during first 6-8 weeks after discharge (Spruit et al, 2020). Individualized programs may be made for patients based on their physical, vocational and psychosocial needs (Babli et al, 2020).

Exercise for post COVID rehabilitation

Exercise has been considered as a main component of post COVID rehabilitation. The first component included in majority of the guidelines is pulmonary rehabilitation to improve respiratory function. It includes positioning for breathlessness, strategies to improve chest expansion including thorax mobilizing exercises, diaphragmatic breathing and inspiratory muscle training. Lung function is clinical defined as maintain lung function on spirometry and or pulmonary exercise capacity and being free from lung related symptoms (Camargo et al, 2014). Other than respiratory exercises physical activity has also been found to increase lung function (Luzak et al, 2017). Aerobic exercises of low to moderate intensities have been included in all guidelines of post COVID rehabilitation. Resistance exercises have also been found to improve respiratory function (Singh et al, 2011; Daabis et al, 2017). A combination of breathing training, aerobic exercises and

strength training is recommended for improving lung function in post COVID patients. Similar recommendations on exercise are available for primary and secondary prevention of cardiac symptoms as aerobic and strength training has found to reduce myocardial oxygen demand and enhance myocardial perfusion (Zachariah et al, 2017). Benefits of aerobic and resistance exercises has been found in improving glycemic control, chronic kidney disease and gastrointestinal function and disease (Madden et al, 2013; Kirkman et al, 2014; Bi L, Triadafilopoulos 2003). Aerobic exercises of moderate to high intensity has found to increase cognitive function in single bout as well as over several months by improving neuroplasticity, memory, counteracting neurodegeneration and reducing anxiety and depression (Mandolesi et al, 2018). The mechanisms through which exercise help to improve lung function, cognition and physiological parameters are shown in figure 2.

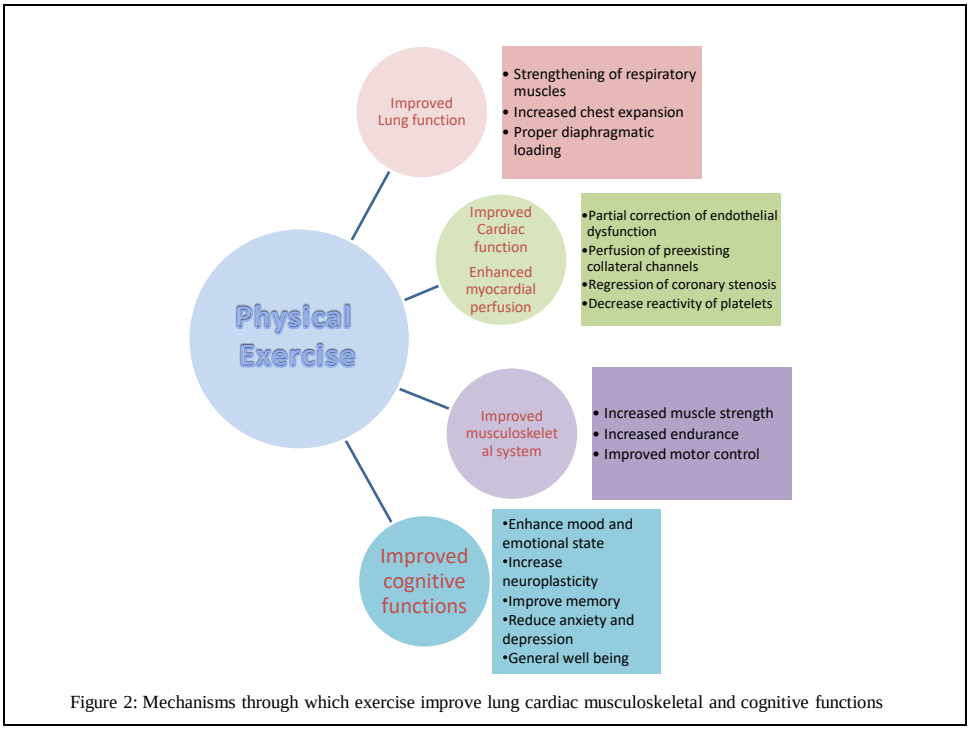

Figure 2: Mechanisms through which exercise improve lung cardiac musculoskeletal and cognitive functions

Yoga as exercise in COVID-19 rehabilitation

Though aerobic and strengthening exercise has proven benefits in rehabilitation the state of post viral fatigue is also a reality. Most of patients who had COVID are reporting high levels of fatigue and respiratory distress even after discharge from the hospital and first 6-8 weeks may be very crucial in this regard. Short exercise session may be more beneficial for patients with post viral fatigue (Ho- Yen. 1990). Also in cognitive impairments exercise session of short duration and higher frequency may generate best cognitive results (Sanders et al, 2019). Hence, we need to focus on exercise strategies which have low energy expenditure and still focus on strength, conditioning and improved respiratory and cognitive functions. Yoga as an exercise method may be one of the best strategies to achieve all these benefits. The combination of asanas and pranayam (breathing techniques) may be highly beneficial for the patients in first 6 weeks before they can return to recommended levels of regular aerobic and strength training. Yogic asanas ad pranayam have proven to improve respiratory function, physical fitness and cognition. Pranayam has been found to be as effective as spring loaded negative pressure breathing device used for inspiratory muscle training in frail older adults (Cberia et al, 2014). Pranayam was better tolerated by older patients than inspiratory threshold training. Improvement in expiratory lung volumes and chest expansion has been seen using yoga asanas (Chanavirut et al, 2006). In addition, Bhramri pranayam has been found to increase nitrous oxide expression due to humming and increase carbon dioxide by extended exhalation thus preventing coagulopathies (Taneja MK. 2020). Also, yoga practices has been found to be better than recommended exercise practices on some parameters of cardiorespiratory fitness (Sovova et al, 2015). Comparable results were found for yoga and stretching and strengthening exercise protocol for functional fitness (Gothe et al, 2016). Yoga has also been linked with better nutrient absorption in school children (Verma et al, 2017). Cognitive enhancement has also been reported with a 6 weeks yoga program (Brunner et al, 2017). 10 weeks Yoga intervention has been found to be more effective than relaxation in reducing stress and anxiety and improving mental health (Smith et al, 2007; Kim SD. 2015). Yogic practices improve quality of life by promoting muscle strength, flexibility, improving respiratory and cardiac function, reducing stress anxiety and improving sleep (Woodyard C. 2011). Figure 3 summarizes the beneficial effects of yoga as an exercise program.

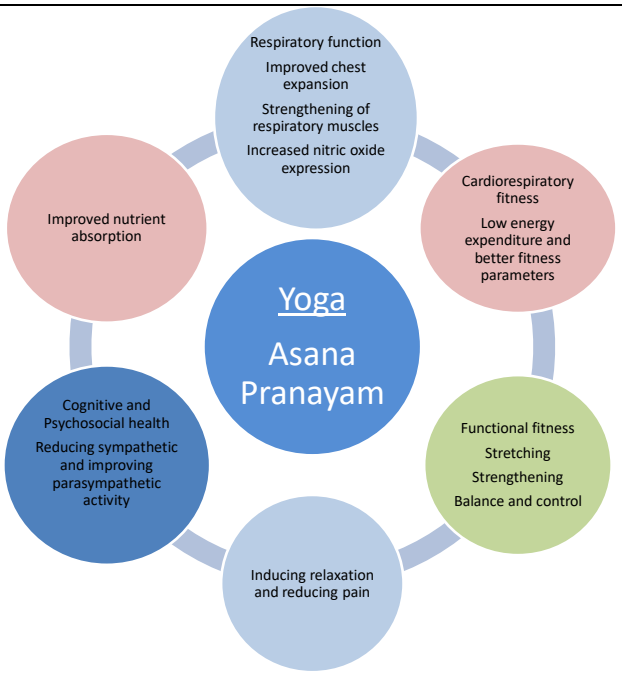

Figure 3: Beneficial effects of Yoga as an exercise

Outline of a sample yoga based exercise plan

The key components in post COVID rehabilitation are to focus on improving respiratory capacity and cardiovascular endurance keeping into consideration reduced energy levels and fatigue. Pranayam based breathing exercises are easy method to improve diaphragmatic breathing and improve gas exchange in lungs. Bhramri pranayam has been hypothesized to be of key importance in COVID-19. Aasanas which emphasize on chest expansion by improving thoracic mobility like matsyendrasana and its variants can help additionally in this regard. The stretching and maintaining of end range position additionally stimulates proprioception and flexibility. Working on the endurance of core muscles with setubandhasana and marjariasana can help to improve overall stability and endurance. Balasana and pawanmuktasana can aid better functioning of visceral organs and also help to load diaphragm and improve respiratory function. Balasana may be a good pose to induce relaxation in events of breathlessness. Shavasana has been considered as a very powerful relaxation technique and is a best method to end the exercise session. More strengthening and endurance components can be added by progressing the yoga exercises as the patient feels comfortable.

A sample exercise program for COVID patients to be used after recovery based on yogic asana and pranayam is presented in table 1.

Table 1: A Sample Yoga based Exercise Plan

Initial two weeks		
Yoga Asana and Pranayama		Exercise therapy variant

Rhythmic slow deep nostril breathing: Expansion of abdomen with inhalation and complete exhalation		Diaphragmatic breathing
BhramariPranayama (Taneja MK, 2020)		
Ardha pavanmuktasana		Supine knee to chest stretch
Supta Matsyendrasana		Supine spinal twist
Setubandhasana		Bridging

Marjariasana		Cat and camel exercise
Balasan (Singh et al, 2016)		Prayer stretch
Shavasana		Corpse pose
2-4 weeks (new additions)		
Anulom Vilompranayama (Saoji et al, 2019)		Alternate nostril breathing

Vajrasana (Thakur et al, 2016)		Heel sitting
Matsyendrasana		Sitting spinal twist
Paschimottanasana (Uday J Patil. 2017)		Forward bend stretch
Bhujangasana		Spinal extension

Tadasan		Standing upward stretch with calf raises
4-6 weeks (new additions)		
Mandukasana		
Utkatasan		Squats
Trikonasan		Lateral trunk stretches

Katichakrasan		Standing spinal twist

The exercise session may begin with pranayam. Each pranayam is initially done for 2-3 minutes and may be gradually progressed to five minutes. Asanas may be held for 15-30 seconds in beginning for 3-5 repetitions and gradually progressed to 1 minute. The exercise program may end with shavasana to induce relaxation. The contraindications and criteria to terminate exercise program may be followed as indicated in rehabilitation guidelines (Zeng et al, 2020; Spruit et al, 2020). In India yoga is well integrated in physiotherapy curriculum which provides physiotherapists with sound knowledge to implement yogic exercises during rehabilitation. It is the current need of the hour that development of a rehabilitation plan which is holistic and easy to practice should be on priority. The greater challenge will be to implement rehabilitation strategies for masses. Yoga has been a very popular medium of exercise among Indian population through television. This medium could be utilized to implement a simple and short yoga program for the benefit of COVID recovered patients. Utilization of physiotherapy professional worldwide may help in administering exercises for rehabilitation.

2. Conclusion

Considering the large number of people affected by COVID and availability of limited scientific evidences at present, it will be vital to design short and holistic exercise plans. Yogic asanas and pranayam have been proven to be effective in this regard from ages and provide answer to all physical exercise and psychosocial rehabilitation needs of the world.

Abbreviations: "Not Applicable"

Footnotes: None

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