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Review Article

Physiotherapy Section

Efficacy of Advanced Allied Interventions for Dyspnoea, Exercise Capacity, and Quality of Life among the Geriatric Population: A Literature Review

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ABSTRACT

Ageing is a gradual and irreversible pathophysiological process that results in the decline of function in all the body's systems, including the respiratory system. With age, the respiratory muscles lose their strength and become tight, thus affecting lung function. Exercise has been seen to have a positive influence on delaying the ageing process, reducing its ill effects on all systems. Apart from conventional physiotherapy, studies show that other allied therapies, such as the Buteyko breathing technique, respiratory muscle stretch gymnastics, fan therapy, Tai Chi exercise, and many others, have an influence on the cardiorespiratory system. These allied therapies help improve breath control, increase the strength and flexibility of respiratory muscles, stimulate the trigeminal nerve, and contribute differently to reducing symptoms of dyspnoea and fatigue, increasing exercise capacity, and improving Quality of Life (QoL). The purpose of present literature review is to identify various allied therapies that decrease dyspnoea associated with ageing and increase exercise capacity and QoL in the elderly population. A literature search was conducted to find relevant guidelines on interventions for dyspnoea, exercise capacity, and improving QoL in the geriatric population. Total 13 studies related to treatments for dyspnoea and exercise capacity among the geriatric population, aimed at decreasing symptoms and improving QoL, were included in present review article. The number of new and advanced allied methods developed was limited, so more articles could not be added as they did not serve the purpose. The search keywords used were geriatric, dyspnoea, exercise capacity, QoL, and allied therapies. Electronic databases such as PubMed, Google Scholar, Medline, and ResearchGate were used to complete the study. The findings reveal that advanced allied therapies, including fan therapy, Tai Chi exercise, respiratory muscle stretch exercises, pranayama, and video-assisted exercises, are easier and more entertaining ways to engage in regular physical activity, increase exercise capacity, decrease dyspnoea, and improve QoL among the geriatric population.

Keywords: Buteyko breathing technique, Respiratory muscles, Tai Chi excercise

INTRODUCTION

Ageing is defined as the gradual functional and structural decline of an organism, resulting in an increasing risk of disease, impairment, and mortality over the lifespan [1]. The advancement of medical science has increased overall life expectancy by many years, thus increasing the numbers in the geriatric population. With increasing age, there is an effect on all systems of the body, including the respiratory system. Advancement of age causes a decrease in the intervertebral disc space, which leads to kyphosis, resulting in decreased vital capacity. Muscle function in the body decreases annually by 2% with age [2]. All these factors lead to decreased respiratory muscle strength, hence contributing to dyspnoea and decreased exercise capacity, affecting the QoL.

Evidence from various studies proves that pulmonary rehabilitation programs improve respiratory symptoms such as dyspnoea and exercise capacity [3,4]. Various exercise therapy protocols, along with adjuncts, are used to reduce symptoms, thereby increasing the QoL of geriatric individuals. It is also recommended that older people should engage in moderate-intensity exercises and functional training to increase their cardiovascular endurance. Despite the highly published benefits of exercise among the elderly, the majority of older people are seen not engaging in even the minimum exercise to maintain health [5]. This may be due to pain, weakness, or lack of energy during their later years. Older generations are more prone to living a sedentary lifestyle. This further adds to respiratory complications such as dyspnoea and decreased exercise capacity, which will, in turn, lead to a further decrease in activity and form a vicious cycle, ultimately decreasing the QoL of the individual.

The aim of present review is to assess different multidisciplinary approaches developed for treating respiratory problems in the geriatric population and to find out if these therapies impact dyspnoea, increase exercise capacity, and improve the QoL in the geriatric population.

REVIEW OF LITERATURE

In a study on the presence of dyspnoea affecting the QoL of a geriatric population, Huijnen B et al., stated that dyspnoea occurs frequently in elderly patients, interfering with their daily activities and contributing to mortality [6]. According to a review by Roman MA et al., which focused on age-related pulmonary physiology, there is a 40% decline in pulmonary function and aerobic exercise capacity between the ages of 25 and 80 years [7]. This highlights the importance of various physiotherapy interventions to increase exercise capacity and decrease the pervasiveness of breathlessness, thereby having a positive impact on the QoL among the geriatric population.

According to a systematic review conducted by Li W et al., on the effectiveness of Pulmonary Rehabilitation (PR) in elderly Chronic Obstructive Pulmonary Disease (COPD) patients, it was found that there is a significant increase in exercise capacity and QoL among them [8]. Although PR appears to be effective, it is not always possible to have the geriatric population undergo an exercise regime due to the presence of various musculoskeletal and neurological conditions. Therefore, less stressful and advanced interventions can be used that have a similar or better effect on the cardiorespiratory system.

It is believed that respiratory muscle stretch gymnastics, which is a combination of respiratory muscle stretching combined with breathing exercises, can have a tremendous effect on pulmonary function. A randomised controlled trial conducted by Awachal AC et al., investigated the effects of Respiratory Muscle Stretch Gymnastics (RMSG) in elderly individuals. Their study comprised of two groups, with one group acting as the control and the other group receiving RMSG for four weeks. The results demonstrated that when RMSG was performed on elderly individuals for four weeks, their exercise capacity increased, and their QoL improved [9].

The Buteyko technique is a breathing therapy that aims to reduce hyperventilation through periods of slow breathing and control pause. This technique is popular for the treatment of asthma and has also shown to be beneficial in COPD, sleep apnoea, stress-related disorders, and chronic mouth breathing [10]. Hidayat M and Multazam A conducted an experimental study on the effect of RMSG and the Buteyko technique on the elderly population and summarised that increased pulmonary functions could be seen. There was a reduction in chronic hyperventilation and an increase in QoL seen after performing the Buteyko technique [11].

Ozasa N et al., aimed to determine if machine-assisted cycling is effective in increasing exercise capacity and endothelial function in elderly patients with heart failure. They selected 27 elderly patients and randomly divided them into two groups. One group was given conventional exercise training, while the other group was assigned to machine-assisted cycling. At the end of two weeks, it was found that exercise capacity increased in both groups, and endothelial function improved with low-intensity machine-assisted cycling. Therefore, it can be used as an alternative treatment to conventional exercise training [12].

Liu Zi Jue exercise is a combination of a respiratory pattern involving abdominal breathing and pursed lip breathing, performed to produce six different sounds (xu, he, hu, si, chui, xi) during expiration, accompanied by specific body movements. This technique is a low-to-moderate intensity exercise that is easy to learn and not limited by location or equipment [13]. Li P et al., aimed to study the effectiveness of this exercise protocol in elderly patients with moderate to severe COPD. The exercise protocol included a 10-minute warm-up, 40 minutes of Liu Zi Jue exercise, and a 10-minute cool down. The exercise was performed six times a week for six months, with two days under supervision and four times at home. The study concluded that home-based Liu Zi Jue exercise, combined with clinical guidance, can help improve pulmonary function, exercise capacity, and QoL in elderly patients with moderate to severe COPD [13].

Cool facial airflow from a handheld fan stimulates the skin and the mucosal layer supplied by the second and third branches of the trigeminal nerve. Moreover, the distraction provided by the handheld airflow helps reduce the sensation of breathlessness. Long A et al., used a commercially available battery-operated fan on 14 COPD patients with an mMRC score of ≥2 and a mean age of 66.5 years to observe the effect of fan therapy on exercise-induced breathlessness and post-exercise recovery time. They found that fan therapy is easily accepted by the population, provides symptomatic relief, and reduces recovery time [14].

Tai Chi is a type of psychophysiological exercise of light to medium frequency. Many studies have shown that Tai Chi is suitable for the elderly population [15,16]. Xia H studied the effect of Tai Chi on the cardiopulmonary system in middle-aged and elderly individuals. The author selected 63 persons and divided them into an exercise and a non exercise group. Parameters such as heart rate, lung capacity, and 6-Minute Walk Distance (6MWD) were calculated after 10 minutes of recovery following exercise. The study concluded that Tai Chi practitioners showed better cardiopulmonary function in middle-aged and elderly individuals, with improved lung capacity, lower heart rate, and increased exercise capacity [17].

Qigong is an ancient Chinese exercise involving movement of extremities, meditation, and breathing control. Qigong intervention shows benefits in exercise tolerance, QoL, and dyspnoea remission. Dong X et al., conducted a randomised single-blind controlled trial on 26 individuals to compare the effect of Qigong exercise with a cycle ergometer in COPD patients. They divided the participants into two groups, with one group receiving Qigong exercise and the other group undergoing cycle ergometer training. Both interventions lasted for 12 weeks and consisted of 30 minutes of supervised training twice a week. The primary outcome measured was endurance capacity using the 6-minute walk test. Patients aged 40 to 75 years with COPD GOLD stages I-III were included. The statistical results showed that both techniques led to similar improvements in cardiopulmonary endurance and QoL in COPD patients [18].

Pranayama is a form of yogic breathing technique that increases lung capacity, strengthens internal organs, and aids in relaxation. Katier SK et al., studied the effect of pranayama in the rehabilitation of COPD patients. In their study, they divided 48 patients over 40 years of age with severe airflow limitation in spirometry into two groups. One group received Pranayama training for three months in addition to their regular physical activities and medication, while the other group served as the control. Spirometry, 6-minute walk test, Arterial Blood Gas (ABG) analysis, and the St. George's Respiratory Questionnaire (SGRQ) were conducted before and after treatment. The study showed that yogic breathing pranayama improves lung function parameters, exercise tolerance, and QoL in COPD patients [19].

Acupuncture is an ancient Chinese traditional medicine that has gained popularity as a complementary therapy due to its simplicity and effectiveness. Moxibustion, an auxiliary part of acupuncture, involves conducting heat at specific meridian acupuncture points for healing purposes. Warm needling acupuncture is a classification under indirect moxibustion [20].

Gao J et al., conducted a comparative study between warm needling and seretide inhalant in stable-phase COPD patients to determine the effects on pulmonary function and QoL. Total 60 cases were randomly divided between the two groups. In the intervention group, acupuncture with filiform needles was applied at EX-B1, BL13, and ST26 points, with warm needling also administered on the back shu point and ST36. This treatment was given once every other day, thrice a week. The study concluded that warm needling is as effective as seretide inhalant medication, but QoL was observed to be more improved with warm needling [21].

Thai dancing is a traditional slow classical dance form similar to Tai Chi but with complex postures and a focus on coordination. It resembles aerobic dance with minimal impact on the knees and ankles. Due to its simplicity, it is suitable for the elderly to enhance physical capability and QoL. An open-label randomised controlled intervention trial was conducted in Thailand by Janyacharoen T et al., to assess the effect of Thai dancing on the physical performance of Thai elderly individuals. Total 42 individuals over 60 years of age were randomly divided into two groups. In the intervention group, Thai dance was performed for 40 minutes, three times a week, for a total of 6 weeks. The results showed an improvement in cardiovascular endurance in the 6-minute walk test and increased lower limb strength in the Five Times Sit to Stand Test (FTSST) test [22].

The use of interactive video games in the 21st century has increased in the fields of physical therapy, sports medicine, and pulmonary rehabilitation. To evaluate if video game systems bring any difference in the exercise training system for individuals with pulmonary disease, Sutanto YS et al., conducted a study on COPD patients. They divided 20 patients aged between 40 to 75 years into two groups: a controlled group and an experimental group. The controlled group performed cycle ergometer exercises three times

a week for six weeks, while the experimental group engaged in a program (yoga, strength training, aerobic exercise) using the Wii Fit system. In both groups, the 6MWD, Traditional Dyspnoea Index (TDI), MRC score, SGRQ, Body mass index, Airflow obstruction, Dyspnoea, and Exercise index (BODE) were assessed before and after treatment. The results concluded that the 6MWD, TDI, and SGRQ increased in both groups, but there were no significant changes in Medical Research Council (MRC) and BODE [23].

The summary of past studies has been provided in [Table/Fig-1] [9,11-14,17-19, 21-25].

Name of the author	Total patient	Participants	Intervention	Outcome studied	Conclusion
Awachat AC et al., [9]	82	Elderly individual between 60-70 years	Respiratory muscle stretch gymnastics for 4 weeks	2 minute walk test, modified Borg scale, incentive spirometer, wright peak flow meter	Statistically significant changes were seen in exercise capacity, dyspnoea, maximum breathing capacity and peak expiratory flow rate following the intervention.
Hidayat M and Multazam A, [11]	56	Elderly individual more than 60 years of age	Combination of RMSG and Buteyko breathing	Wilcoxon signed rank test	Statistically improved changes can be seen in pulmonary function and QoL.
Ozasa N, [12]	27	Elderly heart failure patient of age more than 65 years	Machine-assisted cycling at pedaling frequencies of 30 to 40 rpm for 15 min, 5 sessions per week	6 minute walk test, RH-PAT	Machine assisted cycling is as effective as conventional ET on exercise capacity in elderly HF patient. Additionally, machine-assisted cycling has the potential to improve endothelial function in these patients.
Li P et al., [13]	40	Patient between 40-80 years of age having COPD stage II or III	Liuzijue training sessions, 60 minutes/day for 6 months, where 4 days at home and 2 days at hospital under clinical guidance	6 minute walk test, 30 sec sit to stand, spirometry, St George's Respiratory Questionnaire (SGRQ)	Liuzijine training combined with clinical guidance can effectively improve the pulmonary function, exercise capacity, QoL of elderly patient with mild or moderate COPD.
Long A et al., [14]	14	Patient more than 60 years of age with COPD and mMRC of dyspnoea ≥2	Hand held fan used towards their face during 6 minutes' walk test and during recovery phase	Numerical rating scale Modified Borg scale 6 min walk test Likert scale questionnaire	Fan therapy is accepted and provides symptomatic relieve to dyspnoea during exercise.
Xia H et al., [17]	63	Healthy elderly person between 50 to 75 years of age	Tai Chi exercise for 1 year vs no exercise	6 minute walk test Borg scale Electronic spirometric tester	Tai Chi exercise can improve the adaptability of cardiopulmonary function in middle aged and elderly aged people after exercise.
Dong X et al., [18]	26 (13=QE 13=CE)	40 to 75 years of age with COPD having GOLD standard I to III	Qigong intervention to one group and cycle ergometer intervention to one group	6 minute walk test St. George's Hospital Respiratory Questionnaire (SGRQ) COPD assessment test	Statistically both the technique showed similar improvement in cardiopulmonary endurance and QoL in the COPD patients.
Katiyar S and Bihari S, [19]	48	Patient more than 40 years of age with chronic airflow limitation	Pranayama along with pulmonary rehabilitation	Spirometry 6 min walk test ABG, SGRQ	Pranayama when done with pulmonary rehab increases exercise capacity and QoL and decrease dyspnoea.
Gao J et al., [21]	60 (30=warm needling 30=seratide inhalant	COPD patients in stable phase	Acupuncture with filiform needle applied at EX-B1, BL13, ST26 points and warm needling supplemented on back shu point and ST 36 once every other day, thrice each week	SGRQ , FEV1	Warm needling is as effective as seretide inhalant medication in improving pulmonary function and QoL.
Janyacharoen T et al., [22]	42 (20=Thai dance, 18=control)	Aged Thai adult more than 60 years of age	40 minutes Thai group dance for 3 times per week for 6 weeks	6 minute walk test, FTSST	Thai dance increases physical performance, cardiovascular endurance in elderly females.
Sutanto YS et al., [23]	20 (10=video assisted group, 10=control)	COPD patient within 40 to 75 years of age	Yoga, strength training, aerobic exercise using the Wii Fit system for 30 min	6MWD, TDI, SGRQ, MRC and BODE	6MWD, TDI and SGRQ was seen to be increased in video assisted training as in controlled group.
Deng B et al., [24]	70	Acute coronary syndrome patients of age more than 75 years undergoing percutaneous coronary intervention	Exercise based cardiac rehabilitation	Cardio pulmonary exercise test report, QoL and mental health questionnaire	Exercise based cardiac rehabilitation increases exercise capacity and QoL in these patient.
Roomi J et al., [25]	15	Men between 70-89 years suffering from chronic obstructive airway disease	12 weeks incremental respiratory rehabilitation	Six minute walk test, Guyatt respiratory questionnaire	Elderly individual tolerated incremental respiratory rehabilitation and showed better result in 6 minute walk test.

[Table/Fig-1]: Summary of the advanced allied interventions conducted for dyspnoea remission, exercise capacity, and Quality of Life (QoL) in the elderly population [9,11-14,17-19, 21-25].
RH-PAT: Reactive hyperaemia peripheral arterial tonometry; FEV1; Forced expiratory volume; ET; Excercise training; HF; Heart failure; ABG: Arterial blood gas; TDI: Traditional dyspnoea index; BODE: Body mass index, airflow obstruction, dyspnoea and excercise capacity index

CONCLUSION(S)

The lungs mature between 20 to 25 years, and thereafter, aging begins, leading to a progressive decline in lung function. As a result of aging, individuals experience shortness of breath, abnormal breathing patterns, and decreased exercise capacity. Besides the respiratory system, other systems such as the musculoskeletal and nervous systems are also affected, making regular exercise using resistance challenging for the elderly. As a therapist, it is essential to identify alternative effective methods to address these issues so that the elderly can maintain a better QoL in their later years without engaging in strenuous activities that could lead to problems such as low back pain or joint pains.

Simpler exercise protocols are more likely to be accepted and continued in the long run by the older generation as they are less tiring and more enjoyable. Published literature indicates that a variety of interventions based on newer forms of breathing techniques and adjuncts benefit elderly individuals with dyspnoea and exercise capacity, thereby improving their QoL. While pulmonary rehabilitation

is a highly regarded component in managing lung function, alternative training methods such as Respiratory Muscle Stretch Gymnastics, Luizijue training, Tai Chi, and Qigong interventions appear to be beneficial alternatives to standard exercises. There is strong evidence that combining various exercises produces better results.

Fan therapy appears to be an excellent way to reduce dyspnoea in the elderly population by stimulating the trigeminal nerve with cool air and can serve as an emergency tool during exertional dyspnoea. Moxibustion and virtual training also seem to have a positive effect on QoL, dyspnoea, and lung function. A more in-depth systematic review of advanced interventions in this field is required to narrow down the optimal interventions and develop an effective treatment protocol for the geriatric population.

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