

Systematic Review

Physiotherapy management in patients with sleep apnea - a systematic review

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ABSTRACT

Sleep apnea, particularly obstructive sleep apnea (OSA), is a common disorder associated with various systemic health complications. Recent studies have highlighted the role of physiotherapy in managing OSA symptoms and improving patient outcomes. However, the effectiveness of physiotherapy interventions remains unclear. This systematic review aims to: assess the current literature on physiotherapy management in patients with sleep apnea, evaluate the effectiveness of various physiotherapy interventions in alleviating sleep apnea symptoms, and to identify gaps in research and suggest areas for future studies. The study period was from February 2024 to February 2025. A comprehensive literature search was conducted in databases including PubMed, Cochrane, CINAHL, and PEDro, following PRISMA guidelines. Studies published from 2015 to 2024 were considered, focusing on randomized controlled trials (RCT), cohort studies, and systematic reviews. A total of 20 studies met the initial inclusion criteria. After applying the exclusion filters, 15 studies were included in the final review. The findings indicated that physiotherapy interventions, such as continuous positive airway pressure (CPAP) therapy adjuncts, inspiratory muscle training, and sleep posture training, showed positive outcomes in reducing apnea severity, improving sleep quality, and enhancing daytime functioning. Physiotherapy interventions offer promising benefits in the management of sleep apnea, particularly in improving the quality of sleep and reducing symptom severity. However, further high-quality studies are needed to determine the long-term effectiveness and best physiotherapy protocols for sleep apnea management.

Keywords: Physiotherapy, Sleep apnea, Intervention, Systematic review, CPAP therapy, Inspiratory muscle training, Sleep quality

INTRODUCTION

Sleep apnea is a frequent condition in which your breathing stops and resumes repeatedly while you sleep. This can prevent your body from receiving adequate oxygen.¹ Every night, there are multiple pauses that might last anywhere from a few seconds to several minutes.¹ This is the most common form of loud snoring.² As breathing resumes, a snort or choking sound may occur. Those with the condition may feel drowsy or exhausted during the day since it interferes with their ability to sleep well. It may cause hyperactivity or academic issues in kids.¹

There are two types of sleep apnea.

Obstructive sleep apnea (OSA) occurs when your upper airway is repeatedly closed while you sleep, lowering or entirely stopping airflow. This is the most frequent form of sleep apnea. Obesity, large tonsils, and hormonal fluctuations all raise your risk of developing OSA.

Central sleep apnea occurs when your brain does not deliver the necessary impulses to breathe. Central sleep apnea can be caused by health issues that interfere with how your brain controls your airway and chest muscles.¹

Mixed apnea occurs in some people who suffer from a combination of the two types of sleep apnea, with prevalence ranging from 0.56% to 18%. When CPAP is used to treat OSA and central sleep apnea develops, the cause is usually discovered. Although the exact reason of OSA patients' loss of central respiratory drive when sleeping is unknown, it is most likely related to underlying medical conditions and incorrect continuous positive airway pressure (CPAP) therapy settings.

The four primary causes of OSA are a narrow, obstructed, or collapsed upper airway, insufficient pharyngeal dilator muscle activation during sleep, airway constriction during sleep, and unstable breathing regulation (high loop gain).³ It is typically chronic in character. Additional risk factors include allergies, swollen tonsils, being overweight, and having a family history of the condition.⁴ Some people with sleep apnea are unaware that they have the illness. A family member often discovers it for the first time.¹ Overnight sleep studies are commonly used to diagnose sleep apnea.⁵ At least five episodes per hour are required to diagnose sleep apnea.⁶

When someone has CSA, their basic neurological controls for breathing rate fail and do not convey the signal to inhale, resulting in one or more missed breathing cycles. Hypercapnia is caused by a prolonged breathing pause, which raises the concentration of carbon dioxide in the blood above normal levels, whereas hypoxaemia is caused by a decrease in oxygen in the blood to a lower than normal level.⁷ The organism will then suffer further consequences (such as Cheyne-Stokes respiration) as a result of these hypoxic and hypercapnic conditions.⁸ Brain damage and even death can happen from blood oxygen levels dropping too low for an extended period of time, as brain cells require oxygen to exist. Sleep apnea is a systemic issue that has been related to a variety of adverse outcomes, including an increased risk of cardiovascular disease, myocardial infarction, stroke, atrial fibrillation, insulin resistance, cancer, and neurodegeneration.⁹ The severity of the apnea and the individual characteristics of the apnea sufferer dictate the exact effects of the sickness.

People with sleep apnea experience excessive daytime sleepiness (EDS) and decreased awareness.¹⁰ OSA may raise the risk of driving and workplace accidents. If OSA is not treated, patients are more likely to develop other health concerns, such as diabetes. Behavioral consequences may occur as a result of the interruption to daily cognitive state. These may include moodiness, belligerence, and a decrease in attentiveness and vitality.¹¹ These effects can become intractable, resulting in depression.¹²

When you stop breathing, your bloodstream fills with more carbon dioxide. The blood's chemoreceptors detect higher carbon dioxide levels. Breathing may resume if the airway is cleared by the brain's signal to wake the individual up.¹³ Normal breathing will increase oxygen levels, allowing the person to fall back asleep.¹⁴ The

accumulation of carbon dioxide could be caused by a decrease in the brainstem's output directing the chest wall or pharyngeal muscles, resulting in throat collapse.¹⁵ People with sleep apnea spend less time in REM sleep and have little or no slow-wave sleep.¹⁶

Central sleep apnea is treated differently than obstructive sleep apnea. Behavioral therapy is typically the first step in treatment, and for some patients, a continuous positive airway pressure device may be prescribed.¹⁷ Many people are advised to avoid sedatives such as alcohol and sleeping pills because they might relax the muscles of the throat, increasing the risk of airway collapse at night.¹⁸ It is uncertain if a specific patient would benefit more from one course of treatment than another.

CPAP is the primary treatment for moderate to severe OSA. It has been shown that regular use of CPAP reduces mortality while enhancing patients' quality of life.^{19,20} Several variables contribute to poor long-term CPAP adherence, including mask discomfort, dry upper airways, frequent awakenings, claustrophobia, and nasal stuffiness or blockage.²¹ Other treatment options include oral appliances (such as a mandibular advancement device), electrical nerve stimulation, behavioral modification (such as weight loss, sleeping position changes, and good sleep hygiene), and surgical intervention (such as hyoid suspension, uvulopalatopharyngoplasty, and maxilla-mandibular advancement).²²

Physiotherapy can be beneficial in managing sleep apnea. There are so many treatments available to manage sleep apnea. Exercise physiotherapy shows greater improvement in patients with sleep apnea. Other treatment include diet modification, lifestyle modification, and also inspiratory muscle training shows beneficial improvement in patient with sleep apnea. Due to substantial technological advancements in this field, therapy modalities that target patients with moderate to severe OSA, as well as trouble accepting or following CPAP therapy. The aim of the present study was to systematically review the evidence regarding the key clinical questions of efficacy and safety of physiotherapy treatment in sleep apnea.

METHODS

A comprehensive literature searches of electronic databases including PubMed, EMBase, Cochrane library, physiotherapy evidence database (PEDro) and PsycINFO from the inception to March 2024 was performed to identify relevant RCTs which were reported in English language. The search terms of sleep apnea, apnea, OSA and a string of words previously proposed were used individually or in combination. To raise the sensitivity of the search, words related to the outcomes of interest were not included. In addition, reference lists of retrieved articles were searched as an additional source to identify other relevant studies. The complete search strategy was conducted with the PubMed database.

Selection criteria

After the initial search was completed abstracts and titles from the database searches were screened for relevance and selected if they met the following criteria: full text articles, case control study, prospective study, retrospective study, observational study, cross sectional study, controlled clinical trial, pre and post study, systematic review, randomized controlled trial, and articles which are referred from last 13 years. Exclusion criteria was: articles with only abstracts, studies containing no original data, and articles in other than English language.

Exclusion criteria

Articles including simply abstracts, studies that do not give actual data, and those published in languages other than English may present difficulties for full study analysis. Abstract-only papers frequently lack the whole context and methods required for critical evaluation, whereas studies lacking original data, such as reviews or opinion pieces, do not add novel empirical discoveries. Furthermore, language hurdles can restrict access and interpretation, thereby omitting valuable information from non-English sources. These variables can influence the reliability and inclusivity of a study's findings.

Data abstraction

Data related to sleep apnea were extracted from articles meeting the inclusion criteria by the lead author and reviewed by a second author. Each article was categorized based on study methods (quantitative, qualitative, mixed-methods, systematic review or meta-synthesis, narrative reviews or discussion paper). The following information was extracted and synthesised in summary format from the articles: authorship, publication year, aims, design, participants, themes, and findings. Secondary data extracted included information on the adherence to exercise, measures of sleep apnea.

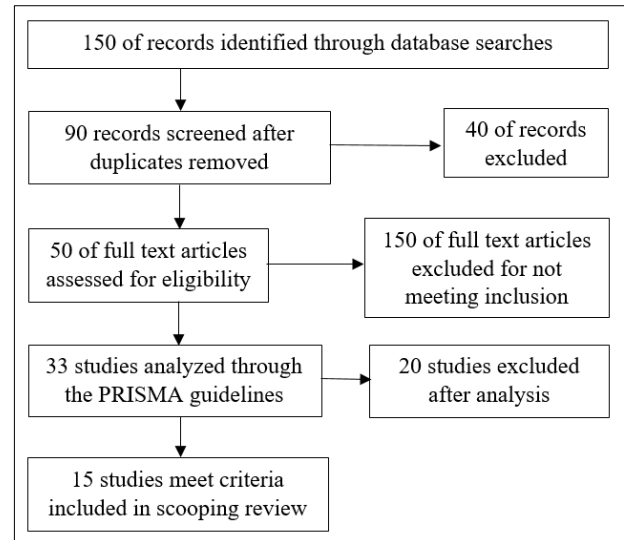


Figure 1: Flowchart of PRISMA.

RESULTS

Studies were selected according to above mentioned inclusion and exclusion criteria. The current study followed the preferred reporting-items for systematic reviews and meta-analyses (PRISMA) standards for systematic reviews and meta-analyses in its design and reporting. On how the study was carried out, the graphic clearly specifies four phases: inclusion, eligibility, screening and identification. First records discovered through database searches $n=50$ were followed by records obtained through sources $n=10$. After that, carefully sorting the screening proceeds $n=40$ with the duplicates with the exception of the exclusion $n=30$. As we get further towards eligibility, were left with the final phase, which is crucial. There are a total of 15 studies that are included in the qualitative synthesis $n=15$ which consisted of controlled trial, retrospective study, cross sectional study, comparative study, case control study, experimental, and crossover design.

Table 1: Studies.

Reference	Study design	Title	Intervention	Result
O'Connor-Reina et al²³	A randomized controlled trial	Myofunctional therapy app for severe apnea–hypopnea sleep obstructive syndrome	Myofunctional therapy app: the app contains 9 myofunctional therapy-based exercises designed to increase the tonicity of the different muscles implicated in the pathophysiology of OSAHS.	In this study, patients with OSAHS who used this app to complete myofunctional therapy exercises saw a reduction in the intensity of their symptoms and an increase in upper airway muscle tone.
Lins-Filho et al²⁴	A randomized controlled trial	Effect of high-intensity interval training on obstructive sleep apnea severity	High-intensity interval training	In this study, 12 weeks of HIIT significantly reduced AHI, minimum oxygen saturation, sleep efficiency, total sleep time, and cardiorespiratory fitness in

Continued.

Reference	Study design	Title	Intervention	Result
				individuals with moderate/severe OSA. This modality as a viable alternative or adjunct treatment for OSA.
Poncin et al²⁵	A randomized controlled trial	The effect of tongue elevation muscle training in patients with obstructive sleep apnea	Training protocol: strength and endurance exercises with anterior tongue elevation comprised the training regimen. For 6 weeks, once daily, 4 times a week. The average session lasted 15 minutes. Sham protocol: using a positive expiratory pressure device with a resistance set at the lowest output (4 cmH ₂ O), perform 10 rep × 3 consecutive sets with a 2-minute pause in between series Over the course of six weeks, the resistance increased	In this study, according to research, the severity of OSA is unaffected by a 6-week isolated tongue muscle elevation task.
Dedhia²⁶	A randomized controlled trial	Hypoglossal nerve stimulation and cardiovascular outcomes for patients with obstructive sleep apnea	HGNS therapy: 4 weeks of active HGNS therapy. Sham HGNS therapy: 4 weeks of sham HGNS therapy	In this study, there was no significant difference between sham and active HGNS in mean 24-hour systolic blood pressure and other cardiovascular parameters.
Silva et al²⁷	A randomized controlled trial	The effects of resistance exercise on obstructive sleep apnea severity and body water content in older adults	Resistance training (intervention group): for 12 weeks, there will be two resistance training sessions per week. Every session was separated by a minimum of 48 hours. A warm-up consisting of 15–20 repetitions below 50% of maximum load and effort preceded each exercise. Control group: healthy life-style recommendations	In this study, resistance training for 12 weeks was well tolerated and dramatically altered the respiratory event index in older individuals. Although they were minor, changes in body water content cannot be ruled out as a factor in the decline in REI.
Bughin et al²⁸	A randomized controlled trial	Effects of an individualized exercise training program on severity markers of obstructive sleep apnea syndrome	Intervention group: 3 sessions a week are part of the eight-week IET curriculum. The following activities were performed throughout each 120-minute session: stretching (15 minutes), postural and balance exercises (15 minutes), endurance training (45 minutes), resistance training (30 minutes), and muscle warming (15 minutes). Control group: patients were not given an exercise program; they just received instructional sessions. For both groups, the health education curriculum had comparable learning exercises and topics.	IET did not lower AHI in adult patients with moderate-to-severe OSA when compared to the control group, but it did improve OSA severity indicators, including AHI in REM sleep and objective daytime drowsiness.

Continued.

Reference	Study design	Title	Intervention	Result
Tanriverdi et al²⁹	A randomized controlled trial	Effect of virtual reality-based exercise intervention on sleep quality in children with acute lymphoblastic leukemia and healthy siblings	Intervention group: exercise group who received VRBE in two days in a week, 45 min of each session for 12 weeks. The VRBE comprised of aerobic exercise in four different games by Nintendo Wii Fit Plus®. Control group: managed with supportive measures.	In this study, VRBE have positive effects on sleep disorders in children with ALL and also healthy siblings.
Jurado-García et al³⁰	A randomized controlled trial	Effect of a graduated walking program on the severity of obstructive sleep apnea syndrome	Intervention group was encouraged in the implementation of an exercise program based on progressive walks without direct supervision for 6 months. Control group received general therapeutic measures and regular physical activity monitored with a pedometer was recommended.	In this study, exercise lowers body weight and drowsiness in sedentary OSAS patients and lessens the impact on their felt well-being.
Lin et al³¹	A randomized controlled trial	The effects of threshold inspiratory muscle training in patients with obstructive sleep apnea	Intervention group: threshold IMT group members were given medical treatment, routine care, and TIMT, threshold pressure between 11 and 21 cmH ₂ O; the pressure increased once a week as tolerated. Control group: members were given only medical treatment and routine care, but no TIMT	In this study, severity of OSA and daytime sleepiness were considerably reduced following TIMT, indicating the potential therapeutic benefits of TIMT for OSA.
Shen et al³²	A randomized controlled trial	Efficacy of pulmonary rehabilitation in patients with chronic obstructive pulmonary disease and obstructive sleep apnea	Intervention group: positive airway pressure therapy additionally moderate-intensity aerobic exercise for 20 weeks. Control group: positive airway pressure therapy	In this study, pulmonary rehabilitation that includes moderate-intensity aerobic exercise may help people with chronic obstructive pulmonary disease-obstructive sleep apnea overlap syndrome improve their physical endurance and motor skills.
Kim et al³³	A randomized controlled trial	Development and evaluation of myofunctional therapy support program (MTSP) based on self-efficacy theory for patients with obstructive sleep apnea	Intervention group: myofunctional therapy support program (MTSP) two, 30-minute face-to-face education sessions, eight mobile text messages, and a weekly 10-minute telephone coaching session, during the 12-week program. Control group: MT was designed based on the educational material introduced in a blog from the Stanford sleep medicine center	In this study, experimental group also showed a significant improvement in objective measurements of OSA severity and subjective measurements of daytime sleepiness, snoring intensity, and dry mouth.
Costanzo et al³⁴	A randomized controlled trial	Phrenic nerve stimulation to treat patients with central sleep apnoea and heart failure	Intervention group: unilateral phrenic nerve stimulation. Control group: no stimulation	In this study, phrenic nerve stimulation lessens the severity of CSA. this CSA treatment was linked to improvements in the quality of life for HF patients.

Continued.

Reference	Study design	Title	Intervention	Result
Cai et al³⁵	A case series	Impact of hypoglossal nerve stimulation on consumer sleep technology metrics and patient symptoms	Intervention group: hypoglossal nerve stimulator (HGNS) patients who had an effective treatment response for an 8-week	In this study, Sleep symptoms associated with OSA were affected by a 1 week HGNS therapy discontinuation period. There may be benefits to using wearable CSTs for OSA patients' longitudinal sleep tracking, as evidenced by the correlation between sleep-related measures and symptom scores.
Neumannova et al³⁶	A randomized controlled trial	Pulmonary rehabilitation and oropharynx-geal exercises as an adjunct therapy in obstructive sleep apnea	Intervention group: continuous positive airway pressure (CPAP) + PR. Control group: CPAP	In this study, combining the PR program with CPAP enhanced OSA patients more than just using CPAP.
Gupta et al³⁷	A randomized controlled trial	Effect of yoga-based lifestyle and dietary modification in overweight individuals with sleep apnea	Intervention group: Yoga addition to similar dietary modification and regular exercise counselling. Control group: dietary modification (staple Indian) with regular exercise	In this study, modifications to the staple Indian cuisine and yoga intervention may be useful in lowering the severity of OSA in obese patients.

DISCUSSION

This systematic review provides an overview of various physiotherapy management strategies and their effects on patients with OSA. The findings were drawn from 15 studies evaluating physiotherapy interventions in OSA patients.

A pilot randomized trial by O'Connor-Reina et al examined a mobile health app for oropharyngeal exercises in severe OSA patients. The intervention group exhibited a 53.4% reduction in the apnea-hypoxia index (AHI) and a 46.5% decrease in oxygen desaturation index (ODI). Improvements were also noted in tongue and lip strength, as well as the Epworth sleepiness scale (ESS) scores, suggesting that mHealth-delivered exercises could be a viable OSA therapy.²³

A study by Lins-Filho et al investigated the impact of a 12-week HIIT program on OSA severity. Significant improvements were found in AHI, minimum oxygen saturation (SaO₂), total sleep time, and sleep efficiency. While no major changes in BMI were observed, increased VO₂max highlighted HIIT's potential in reducing OSA severity through cardiovascular and respiratory muscle adaptations.²⁴

Poncin et al trial on a 6-week tongue elevation training program in moderate OSA patients showed improvements in daytime sleepiness and tongue endurance but no significant change in OSA severity. Strengthening tongue

and soft palate muscles may aid in symptom management.²⁵

Dedhia et al randomized trial assessed HGNS therapy's impact on cardiovascular outcomes in moderate to severe OSA. No significant differences were found in systolic blood pressure or pre-ejection period. However, AHI improvements were observed in a per-protocol analysis, suggesting a potential role in managing airway obstruction.²⁶ da Silva et al study on 12 weeks of resistance training demonstrated a significant reduction in respiratory event index (REI). Although body water content changes were minimal, improved muscle strength contributed to better airway stability and reduced OSA severity in older adults.²⁷

Bughin et al study on IET combined with educational sessions found no significant AHI changes overall but a reduction in AHI during REM sleep. Participants experienced improved fitness, reduced fatigue, and fewer depressive symptoms, supporting personalized exercise as an OSA management tool.²⁸ Tanriverdi et al study on VRBE in children with acute lymphoblastic leukemia found improvements in total sleep time, respiratory disturbance index, and AHI. The immersive nature of VRBE reduced stress and fatigue, enhancing sleep quality.²⁹ Jurado-García et al study found that a six-month home-based walking program significantly reduced AHI and improved oxygen desaturation index and lipid profiles. Patients with severe OSA experienced greater benefits, emphasizing walking as a feasible home intervention.³⁰

Shen et al study compared CPAP alone versus CPAP plus PR. While both controlled OSA severity, the combination led to better pulmonary function and reduced neck, waist, and hip circumferences. PR enhances respiratory muscle strength and complements CPAP therapy.³¹ Kim et al study on MTSP based on self-efficacy theory showed improvements in self-efficacy, AHI, daytime sleepiness, and snoring intensity. Encouraging patient engagement in myofunctional therapy may enhance treatment adherence and effectiveness.³² Costanzo et al study on PNS in heart failure patients with CSA reported improved sleep metrics and quality of life at 6 and 12 months. Although the reduction in hospitalization rates was not statistically significant, PNS showed promise for CSA management.³³

Cai et al study found that discontinuing HGNS worsened OSA symptoms. CST data correlated with symptom changes, suggesting potential for tracking therapy effectiveness in OSA patients.³⁴ Gupta et al study on yoga's impact on OSA in obese patients showed no significant weight reduction but a higher proportion of participants achieved over 40% AHI reduction. Yoga improved relaxation, muscle strength, and airway stability.³⁵ Lin et al study on a 12-week TIMT program in newly diagnosed OSA patients found significant reductions in AHI and ESS scores, along with improved pulmonary function. TIMT enhances diaphragm strength and ventilation, reducing OSA severity.³⁶

CONCLUSION

Physiotherapy interventions offer a promising, non-invasive approach to managing OSA. Techniques such as breathing exercises, myofunctional therapy, resistance training, and pulmonary rehabilitation have shown improvements in sleep quality and symptom severity. These interventions can serve as alternatives or complements to traditional treatments like CPAP, particularly in mild to moderate cases. However, further high-quality studies are needed to establish standardized protocols and long-term efficacy, ensuring physiotherapy's role in comprehensive OSA management.

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