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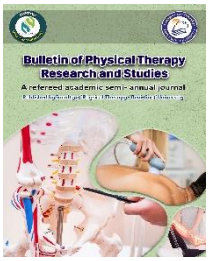

Inspiratory verses expiratory muscles Kinesio taping effect on dyspnea perception in COPD patient

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Running Title: inspiratory verses expiratory muscles Kinesio taping effect on dyspnea perception in COPD patient

Abstract:

Background: chronic obstructive pulmonary disease (COPD) has many symptoms include persistent airway inflammation and a consistent reduction in lung function. Kinesio-taping (KT) is a relatively recent treatment approach for COPD. We propose that applying KT to the thorax and abdomen could have positive effects in restoring respiratory muscle function.

Methods: This was a single-blinded, randomized experimental trial. The study was conducted with 12 male patients diagnosed with mild-to-moderate COPD, divided into two experimental groups (n = 6).

Group **A** received expiratory muscle Kinesio taping (abdominal muscle) plus breathing exercises (pursed lip and diaphragmatic breathing), and group **B** received inspiratory muscle taping (diaphragm, scalenes, external intercostal muscle) plus breathing exercises (pursed lip and diaphragmatic breathing). Deep breathing exercises were individually provided to the patients (two times per day for 14 days), and KT was changed every seven days by the same therapist. Assessment modalities was done before and after intervention to measure outcomes. primary outcomes were (Sao2 and dyspnea scale) and secondary outcomes were (chest expansion and 6MWT)

Result After intervention, the mean SaO2 in group B increased by 1.1 %, while the mean SaO2 in group A increased by 0.5 %. The mean value of upper chest expansion in group B increased by 3.2 cm, whereas the mean value of upper chest expansion in group A increased by 0.83 cm. The mean value of lower chest expansion in group B increased by 0.5 cm, whereas the mean value of lower chest expansion in group A increased by 0.84 cm. The Mean value of the 6 MWT in group B increased by 28.7m, while the mean value of the 6 MWT in group A increased by 27.6 m.

Conclusion: The results indicated that kinesiology taping applied to inspiratory muscles (Diaphragm- scalene-external intercostal) and Expiratory muscles(abdominal) lead to improvement in muscle performance evident by slight improvement secondary outcomes (chest expansion and 6MWT) in both groups

Keywords: COPD, Kinesio tape, Inspiratory & expiratory muscle

Introduction

Inhaling tobacco smoke or other irritants can lead to the long-term inflammatory condition known as chronic obstructive pulmonary disease (COPD). It is defined as a persistent decline in lung function and ongoing inflammation of the airways (1). The symptoms associated with this condition comprise shortness of breath, persistent coughing, excessive mucus production, and labored breathing, along with wheezing.(2). Patients with COPD typically display an upper chest breathing complications and experience shortness of breath during physical activity. Additionally, this condition can display extrapulmonary symptoms, as skeletal muscle dysfunction, which is a significant predictor of exercise intolerance in patients with COPD (2).

The literature now accessible on COPD offers a range of therapeutic options, such as oxygen therapy, pharmaceutical therapy, limited bed rest, and physical therapy. During acute episodes of COPD, physiotherapy therapies such early mobilization and breathing exercises are intended to restore muscle function. These techniques are employed by physical therapists to help patients with COPD exacerbations regain functional capacity, reduce dyspnea, and enhance coordination between the thorax and abdomen (1).

A relatively novel approach for treating COPD is Kinesio taping (KT), which is increasingly being used as a noninvasive method to alleviate the discomfort associated with musculoskeletal conditions. KT is a versatile and durable elastic tape with high tensile strength that allows for free movement in the application area without the need for chemicals or pharmaceuticals. This tape can be stretched to 140 % of its original length, providing an excellent range of motion (ROM) compared with other types of tape. Research has demonstrated that KT enhances blood and lymphatic circulation, eases pain, realigns joints, and reduces muscle tension. Although the precise impact of KT on pain remains uncertain, it is believed to stimulate afferent nerves, which can promote pain inhibition mechanisms and provide pain relief. Given these potential effects, we hypothesized that applying KT to the thorax and abdominal regions could have beneficial

effects in restoring respiratory muscle function and reducing hyperinflation, leading to increased functional capacity in individuals with COPD. (4,5)

Research methodology

Research design: Multicenter Single-blinded randomized experimental trial and included COPD patient's trial.
Study location: The study was be performed in upper Egypt
Outcomes: **Primary outcomes** (SaO2 and dyspnea scale) **Secondary outcomes** (6MWT and chest expansion)

Inclusion criteria

- Patients' ages are 40 TO 60 YEARS
- Patients who have been diagnosed with COPD in accordance with the GOLD criteria for at least 4 months or longer
- Participants who are conscious and have full orientation with no physical and mental health problems including disabling communication

Exclusion criteria

- Patients were diagnosed with physical and mental health illnesses.
- Patients with hearing problems and who are unable to regularly implement relaxation exercises.
- Patients who want to leave the study
- Participants who have cardiac disease as heart failure and anemia
- Participants who have fracturs at ribs or any surgery in thorax

Sampling and study setting

The study was conducted with 12 male patients who were diagnosed with mild to moderate COPD by the physician according to (GOLD) criteria, agreed to participate after receiving information on the study, It is determined that the study should be performed by total 12 patients 6 in each group with two experimental groups

Group (A):
expiratory muscle taping (abdominal muscle)
breathing exercise (pursed lip and diaphragmatic breathing)
Group (B):
Inspiratory muscle taping (diaphragm, scalenes, external intercostal muscle) Breathing exercise (pursed lip and diaphragmatic breathing)

Subjects

The subjects was be randomized into two groups

Assessment

Assessment modalities was individually provided to patients on each group before and after intervention, intervention duration is 14 days

Pretest measurements: HR, breathing rate and blood pressure to exclude any contraindication for functional test

1-SaO2 was measured using a pulse oximeter (Accare Fingertip) to determine the amount of oxygen in the blood (6).

2- Dyspnoea scale: This is a 5 grades scale based on the sensation of breathing difficulty sensed by the patient during daily life activities.

The lowest level of dyspnea perception was represented by Level 0, while the highest level of dyspnea perception was represented by Level 4. (See Table). With regard to the activity threshold able to evoke the sensation of dyspnoea, the MRC is not able to evaluate the mode of performing the task or the effort or time required to complete it. (7,8)

Grade	Degree
None (0)	Not troubled with breathlessness except with strenuous exercise
Slight (1)	Troubled by shortness of breath when hurrying on the level or walking up a slight hill.
Moderate (2)	Walks slower than people of the same age on the level because of breathlessness or has to stop for breath when walking at own pace on the level.
Severe (3)	Stops for breath after walking about 100 yards or after a few minutes on the level
Very severe (4)	Too breathless to leave the house or breathless when dressing or undressing

3- chest expansion CE: A The CE was measured in centimeters (cm) at two different rib cage levels using a measuring tape. The center of the clavicular line, the third intercostal gap, and the spinous process of the fifth thoracic vertebra served as anatomical landmarks for the upper CE. The xiphoid process and the spinous process of the tenth thoracic vertebra served as anatomical landmarks for a lower CE.

The patient was advised to "exhale completely through the mouth" and then "inhale slowly and rhythmically from the nose against the inch tape to expand the lungs as much as possible" before the thoracic measurements. During the examination, the subjects were

instructed to stand with their arms at their sides, and CE measurements were taken at the end of the inspiration and expiration cycles. The examiner placed the measuring tape's "0" point on the spinous process of the vertebrae. The inspiratory diameter was subtracted from the expiratory diameter to calculate the CE. We performed the measurements three times and averaged the results to obtain the upper and lower CE. (9).

4-6-minute walking test: The 6-minute walk test (6 MWT) is commonly used as a sub-maximal exercise test to evaluate a person's aerobic capacity and endurance. This test assesses the distance covered in six minutes as a measure of performance capacity (21). In our study, we utilized a 30-meter walkway for the 6 MWT.

Treatment

The training on deep breathing exercises was individually provided to patients in both groups (5 sets of 5 deep press 2 times per day for 14 days) by diaphragmatic breathing exercise and pursed lip breathing exercise

A-Breathing exercise

1-Diaphragmatic breathing exercise: The therapist instructed the patient to lie supine on a flat surface or bed with bent knees. The patient could use a pillow for support under the head and knees for comfort. The patients were then instructed to place one hand on their upper chest and the other on their abdomen, just below the ribcage. The patient was advised to breathe slowly through the nose, allowing air to fill their lower belly. During inhalation, the hand on the chest should remain intact, and the hand on the abdomen should rise. The patients were then instructed to tighten their abdominal muscles and allow them to fall inward as they exhaled through the pursed lips. The hand on the abdomen should be moved back to its original position. (10)

2-Pursed lip breathing: The therapist advised the patient to loosen his neck and shoulder muscles and keep his mouth closed while inhaling slowly through his nose for two seconds. Deep inhalation is not necessary; a regular breath suffices. As he breathes in, he feels that his abdomen gradually expands. Placing the hands on the stomach can be helpful for some individuals. The therapist instructed the patient to purse his lips as if he were going to whistle or gently blow on a hot beverage, and then to exhale slowly and softly through them for at least four seconds. As he releases the breath, he gradually feels his stomach contract. The patient should not force air out of his lungs while practising pursed lip breathing; instead, he should always breathe out longer than breathe in and breathe slowly and effortlessly in and out until he has complete control over his breathing (11,12).

B-Muscle Taping

For a total of two times and 14 days, the same therapist changed the KT every seven days. While showering was permitted, the patients were told not to remove the tape at any point.

Each patient's post-treatment (14th day) evaluation was finished by the researcher, who was blind to the type of treatment, and the data was recorded. From the point of origin until the point of insertion, KT was administered.

1- expiratory muscle taping (abdominal muscle)

This method is utilised for group A, and it entails making use of two KT components, each measuring two inches in width and varying in length from the anterior superior iliac spine (ASIS) to the tenth rib for every patient. KT is applied across the internal and external obliques, and hyperextension of the abdominal area is necessary to apply it. Patients were placed in a supine position on a physio-roll (peanut-shaped) to facilitate. KT was applied over the abdominal area without any tension, starting from the origin and ending at insertion, with a total elastic stretch of 25-30 %. It is important to note that the KT does not extend to the umbilicus to prevent fluid accumulation in the cavity. (13,14)

2-Inspiratory muscle taping

Taping of diaphragm muscle

This method is utilized in group B to effectively depress the rib cage, and the patient should stand with their hands above their head. Starting with the tape below the sternum, the line of the rib cage was followed posteriorly without stretching it. The midline was then crossed posteriorly and inferiorly towards the opposite hip. The posterior tape should intersect at the proximal attachment of the quadratus lumborum and the thoracolumbar fascia, as demonstrated in studies (15, 16)

Taping the scalenes

The patients were seated with their neck extended and laterally flexed away from the taped side. To stretch the tissue further, neck rotation was performed. Beginning by applying a common anchor to the clavicle. With the tails positioned up towards C3, below the border of the SCM and upper trapezius, apply 25-30 % tension. For each tail, the angle of the neck was adjusted to achieve maximum stretch. Finally, the anchors were applied with no tension. (References 17 and 18)

Taping for external intercostal muscles

While the patients were seated, the technique was applied bilaterally, with a tension of 25-30 %, along the anterior and posterior axillary lines longitudinally and on the fifth to sixth and ninth to tenth intercostal muscles transversely. This was performed when the patient took a deep breath and bent their body towards the opposite side of the region. This approach aims to maintain muscle function and stimulate muscles. (References 19 and 20)

Results

Subject characteristics

Table (1): present the statistical analysis of age, BMI, gender percentage of the group (A) as well as group (B)

Table 1

Characteristics	Group A	Group B
Age (Mean± SD)	59.3 ±19.39	56.6 ±21.22
BMI (Mean± SD)	29.72 ±5.05	28.48 ±6.51
Gender percentage	100 % male	100 % male

Table (2) presents the mean and standard deviation of SaO2,upper chest expansion, lower chest expansion, and 6 MWT poststudy results of groups (A) and (B).

Table 2

Assessment modalities	Standard deviation Group A	Mean value Group A	Standard deviation Group B	Mean value Group B
SaO2	2.02	93.5 %	1.63	93.3 %
Upper CE	0.93	3.83 cm	3.11	3.41 cm
Lowe CE	1.01	4.25 cm	3.71	3.35 cm
6MWT	55.86	339.6 m	155.13	280 m

Discussion

After the intervention, the mean SaO2 in group B increased by 1.1 %, while the mean value of SaO2 in group A increased by 0.5 %. The mean value of upper chest expansion in group B increased by 3.2 cm, whereas the mean value of upper chest expansion in group A increased by 0.83 cm. The mean value of lower chest expansion in group B increased by 0.5 cm, whereas the mean value of lower chest expansion in group A increased by 0.84 cm. The Mean value of 6MWT in group B increased by 28.7m, while Mean value in the 6 MWT in group A increased by 27.6 m.

COPD can cause alterations in cardiopulmonary, musculoskeletal, and neurological systems. Patients with COPD experience musculoskeletal changes due to oxidative stress, which causes a shift in the muscle fibre type from type I (slow twitch) to type II (fast twitch), resulting in diminished oxidative capacity and increased glycolytic capacity. This

is accompanied by fibre atrophy, loss of muscle mass, reduced muscle strength and endurance, and muscle fatigue (27).

The study findings indicate that KT enhances muscle performance, as demonstrated by the improvement in Sao2, chest expansion, and 6 MWT in both groups. This can be attributed to KT's ability of KT to improve blood and lymph circulation, reduce pain, adjust joints, and alleviate muscle tension. Depending on the proposed effects, KT can be used in an inhibitory or excitatory manner (28).

A study conducted by Cheung in 2016 revealed that there is no evidence to support the proposed functions of KT in modulating muscle activity and force generation using facilitatory or inhibitory techniques. Therefore, the clinical application of KT in promoting or inhibiting muscle activity may be exaggerated.

According to a study conducted by Rodrigo Boff Daitx in 2018, the use of Kinesio Taping® in combination with physiotherapy enhanced the SpO2 levels of non-hypoxaemic patients experiencing COPD exacerbation. Further research is required to assess the long-term effectiveness of this method and other outcomes. Another study by Murat Tomruk in 2020 found that Thoracic KT may be useful in improving pulmonary function and functional capacity in patients with COPD.

Diaphragmatic breathing is known to have physiological effects, one of which is an increase in the venous return in the heart. When the diaphragm contracts during inhalation, it creates negative intrathoracic pressure, which draws blood into the thorax (25). This results in an increase in stroke volume, leading to a decrease in sympathetic activity and an increase in parasympathetic activity through activation of arterial stretch receptors. Consequently, modifications in heart rate, total peripheral resistance, and ventilation occur, leading to a reduction in these parameters (26).
Pursed lip breathing is an effective method for controlling shortness of breath by slowing the breathing rate and enhancing oxygen exchange. This technique involves breathing in through the nose and out through the mouth with pursed lips. In doing so, it increases the time that air is in the lungs, which results in better oxygenation and a reduction in dyspnoea.

Conclusion

The results indicate that kinesiology taping applied to primary and accessory inspiratory muscles (Diaphragm-scalene-external intercostal) and Expiratory muscles(abdominal) lead to improvement in muscle performance evident by improvement in primary outcomes (Sao2 and dyspnea scale), and secondary outcomes (chest expansion and 6MWT)

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