Original Article

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Physiotherapy Section

Short-term Effect of Kinesio Taping on Arterial Blood Gas and Oxygen Saturation in Individuals with Chronic Obstructive Pulmonary Disease: A Randomised Controlled Trial

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ABSTRACT

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is associated with impaired respiratory mechanics, postural abnormalities, and reduced oxygenation. A forward shoulder posture contributes to inefficient ventilation. Kinesio Taping (KT) has been proposed as a postural correction strategy to enhance respiratory efficiency in individuals with COPD.

Aim: To evaluate the short-term effect of KT on Arterial Blood Gas (ABG) parameters and Oxygen Saturation (SpO_2) in individuals with COPD.

Materials and Methods: The present Randomised Controlled Trial (RCT) was conducted at the Department of Physiotherapy and Department of Pulmonology, SDM College of Medical Sciences and Hospital, Dharwad, Karnataka, India, from September 2024 to August 2025 and included 40 participants aged 40-70 years with mild-to-moderate COPD. Participants were allocated to two groups using the concealed envelope method. Group A received KT along with conventional physiotherapy, whereas Group B received conventional physiotherapy alone. The intervention was administered over three to five days. The outcome measures included ABG parameters (Potential of Hydrogen (pH), Partial pressure of oxygen (PaO_2), Partial pressure of carbon dioxide ($PaCO_2$), and Bicarbonate (HCO_3) and SpO_2. Statistical analysis was performed using paired and independent t-tests and non-parametric tests, where appropriate. Statistical significance was set at $p<0.05$.

Results: Significant improvement in SpO_2 was observed in the experimental group ($p<0.0001$). No significant between-group differences were observed in the change scores of ABG parameters. ($p>0.05$)

Conclusion: KT, as an adjunct to conventional physiotherapy, improved SpO_2, while no significant treatment-related changes were observed in ABG parameters.

Keywords: Chronic airflow obstruction, Hypoxaemia, Posture, Pulmonary rehabilitation, Respiratory function

INTRODUCTION

COPD is characterised by persistent airflow limitation and impaired gas exchange, and it continues to be a major contributor to global morbidity and mortality [1]. In countries such as India, the burden is further influenced by exposure to tobacco smoke, biomass fuels, and environmental pollutants [2].

Beyond pulmonary impairment, individuals with COPD often present with musculoskeletal and postural alterations. Forward shoulder posture and thoracic kyphosis are frequently observed and may negatively influence respiratory mechanics by restricting thoracic expansion and reducing diaphragmatic efficiency [3,4]. These changes can increase dependence on accessory respiratory muscles, thereby raising the work of breathing and reducing ventilatory efficiency. Such alterations in breathing mechanics can affect physiological parameters, including ABG values and SpO_2. Hypoxaemia and disturbances in acid-base balance are commonly seen in COPD and are associated with reduced functional capacity and quality of life [5].

Pulmonary rehabilitation plays a key role in COPD management; however, postural correction is often not emphasised as a primary component. Improving thoracic alignment may help optimise respiratory muscle function and contribute to better physical performance in individuals with COPD [6].

The KT is a non invasive intervention designed to facilitate muscle activity, enhance proprioceptive input, and support optimal alignment [7]. While it is widely used in musculoskeletal practice, its application in respiratory conditions is still evolving.

Previous studies have reported improvements in pulmonary function, chest expansion, and SpO_2 following KT application in individuals with COPD [8-10]. However, these findings are largely based on indirect functional measures such as spirometry and exercise performance. A recent systematic review has also highlighted that evidence regarding the effectiveness of KT in improving pulmonary function in COPD remains limited and inconsistent [11].

The ABG analysis provides a more direct and clinically relevant assessment of oxygenation, ventilation, and acid-base balance. Despite this, there is limited evidence evaluating the effect of KT on ABG parameters in patients with COPD, particularly in short-term clinical settings.

Therefore, the present study aimed to evaluate the short-term effects of postural correction using KT on ABG parameters and SpO_2 in individuals with COPD. We hypothesised that KT, when used as an adjunct to conventional physiotherapy, would improve ABG parameters and SpO_2 compared with conventional physiotherapy alone. The present study reports a predefined analysis of a larger randomised controlled trial that investigated multiple physiological and functional outcomes in individuals with COPD, with the present analysis focusing specifically on ABG parameters and SpO_2.

MATERIALS AND METHODS

The present randomised controlled trial was conducted at the Department of Physiotherapy and Department of Pulmonology, SDM College of Medical Sciences and Hospital, Dharwad, Karnataka, India, from September 2024 to August 2025 in both inpatient and outpatient settings. Ethical approval was obtained from the Institutional Ethics Committee of SDM College of Physiotherapy, Dharwad (Approval No. SDMIEC/2024/737). The study was prospectively registered with the Clinical Trials Registry of India (CTRI/2025/01/079728). Written informed consent was obtained from all participants before their inclusion in the study after the purpose and procedures were explained.

A total of 40 individuals aged 40-70 years with a confirmed diagnosis of mild-to-moderate COPD were recruited from the Department of Pulmonology. COPD severity was classified according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria based on post-bronchodilator spirometry (GOLD stages I and II) [1]. The diagnosis and severity classification were confirmed by the treating pulmonologist. Participants were recruited based on their eligibility and willingness to participate in the study.

Inclusion and Exclusion criteria: Individuals were included if they were haemodynamically stable, not receiving supplemental oxygen, and able to understand and follow instructions. Participants with a history of recent thoracic or abdominal surgery, fractures involving the ribs or upper limb, neurological disorders, or significant musculoskeletal conditions were excluded from the study.

Sample size calculation: The sample size was calculated a priori using G*Power software (version 3.1) [12]. An effect size (Cohen's d=0.8), corresponding to a large effect as described by Cohen [13], was assumed for the sample size calculation. Assuming a statistical power of 80% and a two-sided alpha level of 0.05, the minimum required sample size was estimated to be 30 participants. To compensate for potential dropouts and maintain adequate statistical power, 40 participants were recruited and equally allocated to the experimental (n=20) and control (n=20) groups.

Participants were randomly allocated into either the experimental group or control group using the concealed envelope method. Opaque sealed envelopes containing group assignments were prepared and handled by an independent third party not involved in recruitment, treatment, or assessment. Due to the nature of the intervention, participant and therapist blinding was not feasible. Outcome assessment and statistical analysis were performed by an investigator blinded to group allocation.

Participants were allocated into two groups:

Group A (Experimental Group): Received KT in addition to conventional physiotherapy.

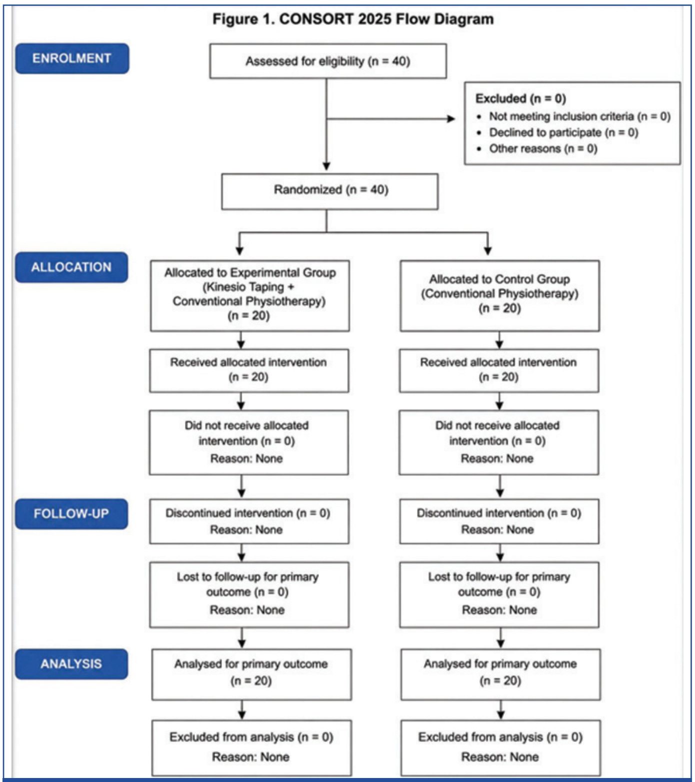
Group B (Control Group): Received conventional physiotherapy alone [Table/Fig-1].

Study Procedure

Conventional physiotherapy protocol: All participants received conventional physiotherapy once daily, consisting of diaphragmatic breathing exercises, segmental breathing exercises, airway clearance techniques including huffing and coughing, and postural drainage. Treatment was administered under the supervision of a physiotherapist and was modified according to individual tolerance and clinical condition.

Kinesio Taping (KT) protocol

Participants in the experimental group received KT. KT was applied with the aim of facilitating postural alignment according to a standardised application protocol described by Kase K et al., and adapted for individuals with COPD. A 5-cm wide elastic Kinesio® Tex Tape was applied by a physiotherapist trained in the standardised KT application technique using a standardised application procedure [14].



[Table/Fig-1]: CONSORT 2025 flow diagram.

For postural correction, I-strips were applied bilaterally over the pectoralis major muscle from its insertion towards its origin with approximately 10-15% tension while the participant maintained an upright posture with gentle shoulder retraction. Additional I-strips were applied over the scapular stabilisers to facilitate scapular retraction and improve thoracic alignment [8-10,14].

The anchors were applied without tension, whereas the therapeutic zone was applied with light corrective tension (10-15%) in accordance with standard KT application guidelines [14].

The skin was cleaned and dried before application. Participants were instructed to avoid excessive rubbing of the tape and to report any discomfort or skin irritation. The tape remained in place throughout the intervention period (3-5 days) unless removal was required because of skin irritation or participant discomfort. Tape application was monitored daily for participant comfort, skin integrity, and adherence.

Baseline assessments were performed before initiation of treatment. Post-intervention assessments were conducted after 3-5 days depending on the participant's duration of hospital stay. All measurements were obtained under similar clinical conditions by the same assessor to maintain consistency. Postural alignment was targeted as part of the intervention; however, posture was not objectively quantified using a standardised assessment tool and therefore was not included as an outcome measure.

Outcome measures:

The following outcome measures were assessed before and after intervention:

- Arterial Blood Gas (ABG): pH, partial pressure of oxygen (PaO_2), partial pressure of carbon dioxide ($PaCO_2$), and bicarbonate concentration (HCO_3)
- Oxygen Saturation (SpO_2): measured using a calibrated pulse oximeter

STATISTICAL ANALYSIS

Data were analysed using Statistical Package for the Social Sciences (SPSS) version 23.0. Descriptive statistics were used to summarise demographic and clinical characteristics. Normality of data distribution was assessed using the Shapiro-Wilk test. Within-group comparisons were performed using paired t-tests, while between-group comparisons were conducted using independent t-tests. Non parametric data were analysed using the Wilcoxon signed-rank test for within-group comparisons and the Mann-Whitney U test for between-group comparisons. Statistical significance was set at $p<0.05$.

RESULTS

A total of 40 participants were enrolled and equally allocated to the experimental and control groups (20 participants each). All participants completed the study, and none were lost to follow-up, discontinued the intervention, or were excluded from the final analysis.

The participants were between 40 and 70 years of age. Most individuals in the experimental group were aged 61-70 years (55.0%), whereas the largest proportion in the control group belonged to the 51-60 year age category (55.0%). However, the distribution of age was comparable between the groups (χ^2=2.559, p=0.278). Likewise, there was no significant difference in sex distribution (χ^2=0.902, p=0.342), with females slightly predominating in the experimental group and males in the control group. Smoking status was also similar, as non smokers accounted for 60.0% of the experimental group and 50.0% of the control group (χ^2=0.404, p=0.525). Collectively, these findings indicate that the two groups were well matched before the intervention [Table/Fig-2].

Variables	Category	Experimental group (n=20)	Control group (n=20)	Total (N=40)	χ^2 value	p-value
Age (years)	≤50	3 (15.0%)	2 (10.0%)	5 (12.5%)	2.5590	0.2780
	51–60	6 (30.0%)	11 (55.0%)	17 (42.5%)		
	61–70	11 (55.0%)	7 (35.0%)	18 (45.0%)		
Gender	Male	9 (45.0%)	12 (60.0%)	21 (52.5%)	0.9020	0.3420
	Female	11 (55.0%)	8 (40.0%)	19 (47.5%)		
Smoking status	Yes	8 (40.0%)	10 (50.0%)	18 (45.0%)	0.4040	0.5250
	No	12 (60.0%)	10 (50.0%)	22 (55.0%)		

[Table/Fig-2]: Baseline characteristics of participants.
The values are presented in n (%)

As summarised in [Table/Fig-3], the changes in SpO_2 and ABG parameters within each group are presented. A significant increase in SpO_2 was observed in the experimental group, with a mean improvement of 1.75% (p<0.0001), whereas the control group showed no significant change. The remaining ABG parameters, including pH, PaO_2, $PaCO_2$, and HCO_3, showed only minor variations that did not reach statistical significance within either group.

Parameters	Group	Pre-intervention (Mean±SD)	Post-intervention (Mean±SD)	Mean change	p-value
SpO_2 (%)	Experimental	95.85±1.50	97.60±1.39	+1.75	<0.0001*
	Control	97.35±1.95	96.75±1.33	-0.60	0.0967
pH	Experimental	7.39±0.05	7.41±0.04	+0.02	0.0904
	Control	7.38±0.05	7.40±0.04	+0.02	0.0754
PaO_2 (mmHg)	Experimental	80.35±22.46	85.60±13.06	+5.25	0.0806
	Control	88.00±11.24	90.15±8.62	+2.15	0.2022
$PaCO_2$ (mmHg)	Experimental	41.50±11.02	38.70±8.21	-2.80	0.0772
	Control	42.20±4.44	40.95±3.05	-1.25	0.1366
HCO_3 (mmol/L)	Experimental	26.57±5.26	26.00±3.06	-0.57	0.4641
	Control	23.93±2.32	24.45±1.39	+0.53	0.1631

[Table/Fig-3]: Within-group comparison of pre and post-intervention outcomes.
*Statistically significant at p<0.05

As presented in [Table/Fig-4], the comparison of post-intervention physiological outcomes between the two groups is shown. A significantly greater improvement in SpO_2 was observed in the experimental group based on the change scores (p<0.0001). No significant differences were identified for arterial pH, PaO_2, or $PaCO_2$. Although post-intervention HCO_3 levels differed significantly between the groups (p=0.0462), the change scores were not significantly different (p=0.2013). Therefore, this finding should be interpreted cautiously.

Parameters	Time point	Experimental group (Mean±SD)	Control group (Mean±SD)	p-value
SpO_2 (%)	Pre-test	95.85±1.50	97.35±1.95	0.0097*
	Post-test	97.60±1.39	96.75±1.33	0.0558
	Change Score	+1.75	-0.60	<0.0001*
pH	Pre-test	7.39±0.05	7.38±0.05	0.3594
	Post-test	7.41±0.04	7.40±0.04	0.2473
	Change Score	+0.02	+0.02	0.9726
PaO_2 (mmHg)	Pre-test	80.35±22.46	88.00±11.24	0.1812
	Post-test	85.60±13.06	90.15±8.62	0.2013
	Change Score	+5.25	+2.15	0.3502
$PaCO_2$ (mmHg)	Pre-test	41.50±11.02	42.20±4.44	0.7937
	Post-test	38.70±8.21	40.95±3.05	0.2577
	Change Score	-2.80	-1.25	0.3678
HCO_3 (mmol/L)	Pre-test	26.57±5.26	23.93±2.32	0.0569
	Post-test	26.00±3.06	24.45±1.39	0.0462*
	Change Score	-0.57	+0.53	0.2013

[Table/Fig-4]: Intergroup comparison of outcomes between experimental and control groups.
*Statistically significant at p<0.05; SD: Standard deviation

The addition of KT to conventional physiotherapy resulted in better improvement in SpO_2 compared with conventional physiotherapy alone. Among the outcome measures evaluated, SpO_2 demonstrated significantly greater improvement in the experimental group. Although post-intervention HCO_3 levels differed between groups, no significant difference was observed in change scores. These observations indicate that KT may enhance oxygenation in individuals with COPD. No significant treatment-related changes were observed in ABG parameters. No intervention-related adverse events were reported during the study.

DISCUSSION

The present study demonstrated that individuals with COPD who received KT in addition to conventional physiotherapy experienced improvements in SpO_2 and selected ABG parameters over a short intervention period. A significant increase in SpO_2 was observed following the intervention. Although post-intervention HCO_3 levels differed between groups, this finding should be interpreted cautiously because baseline HCO_3 values also differed and the change scores were not statistically significant [8,9].

The improvement in SpO_2 observed in the experimental group may be explained by better thoracic alignment and more efficient recruitment of the respiratory muscles following postural correction. Previous studies have shown that postural abnormalities, including forward shoulder posture and increased thoracic kyphosis, can restrict chest wall expansion, reduce diaphragmatic efficiency, and impair ventilation in individuals with COPD [3,4]. Correcting these biomechanical alterations may therefore contribute to improved breathing mechanics and oxygenation.

Although post-intervention HCO_3 levels differed between groups, the groups also differed at baseline and the change scores were not statistically significant. Therefore, the observed HCO_3 findings should be interpreted cautiously and cannot be attributed solely to the intervention. COPD is characterised by chronic ventilatory impairment and compensatory changes in ABG parameters. Consequently, longer intervention periods may be necessary before measurable changes in pH or $PaCO_2$ become evident because ABG abnormalities in COPD reflect chronic ventilatory impairment and physiological compensation [1,5].

The findings of the present study are consistent with previous investigations reporting beneficial effects of KT on respiratory function in individuals with COPD. Baxi G et al., reported improvements in SpO_2, chest expansion, and pulmonary function following KT [8]. Similarly, Ganesh BR et al., observed improvements in SpO_2, pulmonary function, and exercise capacity after thoracic KT [9]. In addition, a recent systematic review by de Campos L et al., concluded that although current evidence remains limited, KT may provide adjunctive benefits when incorporated into pulmonary rehabilitation programmes [11].

Unlike many previous studies that primarily assessed spirometric outcomes and functional performance [8-11], the present study included ABG analysis, providing additional objective information regarding gas exchange and physiological responses to the intervention. This broader assessment contributes to the existing evidence on the potential role of KT as an adjunct to conventional pulmonary rehabilitation in individuals with COPD.

The beneficial effects observed in the present study may be explained by several physiological mechanisms. KT may improve thoracic alignment and posture, thereby facilitating greater chest wall mobility and enhancing lung expansion during breathing [3,4,8]. In addition, stimulation of the respiratory and postural muscles may improve muscle activation, reduce excessive reliance on accessory muscles of respiration, and promote more efficient diaphragmatic function [6,7]. The continuous sensory input provided by the elastic tape may also enhance proprioception, encouraging maintenance of an optimal thoracic posture throughout the respiratory cycle [14]. Taken together, these biomechanical and neuromuscular effects may contribute to improved ventilation, more efficient breathing mechanics, and enhanced oxygenation in individuals with COPD [6,11].

The present findings highlight the potential value of incorporating postural correction strategies into pulmonary rehabilitation programmes for individuals with COPD. KT is a simple, non invasive, and relatively inexpensive intervention that can be readily integrated into routine physiotherapy practice. The significant improvement in SpO_2 observed in the experimental group suggests that KT, when used as an adjunct to conventional physiotherapy, may enhance oxygenation in individuals with COPD. However, these findings should be interpreted with caution because of the short intervention period, and further studies are required to establish the long-term clinical benefits and functional impact of this intervention.

Limitation(s)

Several limitations should be considered while interpreting the findings. First, the intervention was administered for only 3-5 days, which may have been insufficient to produce measurable changes in ABG parameters such as PaO_2 and $PaCO_2$. Second, the study was conducted at a single centre with a relatively small sample size, which may limit the generalisability of the results. Although KT was applied for postural correction, objective assessment of postural alignment was not included among the outcome measures. Consequently, it was not possible to establish whether the improvements in respiratory parameters were directly associated with changes in posture. Incorporating validated measures of postural alignment in future studies would help clarify this relationship.

Further research involving larger samples, multicentre settings, and longer intervention periods is recommended to confirm these findings. Inclusion of additional outcome measures, such as pulmonary function tests, chest wall mobility, respiratory muscle performance, exercise capacity, and long-term follow-up assessments, would provide a more comprehensive evaluation of the therapeutic effects of KT in individuals with COPD.

CONCLUSION(S)

The findings of the present study indicate that adding KT to conventional physiotherapy improved SpO_2 following short-term intervention. No significant treatment-related changes were observed in ABG parameters, although post-intervention HCO_3 values differed between groups. These results support the potential role of postural correction as an adjunct to pulmonary rehabilitation. Nevertheless, larger well-designed clinical trials with longer follow-up are required to confirm the effectiveness and long-term clinical benefits of this intervention.

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Authors' contribution: SP: Participated in data collection, participant recruitment, intervention administration, data curation, preliminary data analysis, manuscript drafting, and revision of the manuscript; SA: Conceived and designed the study, developed the methodology, supervised the research, monitored study conduct, critically reviewed the manuscript, and approved the final version; SK: Contributed to statistical analysis and interpretation of data, scientific revision of the manuscript, language editing, preparation of responses to reviewers, and critical intellectual input; PM: Provided methodological guidance, contributed to interpretation of the findings, critically reviewed the manuscript, and approved the final version; SA: Assisted with clinical supervision, participant assessment, intervention standardisation, manuscript review, and critical revision of the manuscript; SV: Assisted with participant coordination, data collection, data verification, and manuscript review. All authors contributed substantially to the work, reviewed and approved the final manuscript, and agree to be accountable for all aspects of the work in accordance with the ICMJE authorship criteria.

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