Effect of Kinesotaping on Vital Capacity in Patient with Chronic Obstructive Pulmonary Disease

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Abstract

Background: Pulmonary Disease (COPD) cause ventilatory limitation and dyspnea, which then result in a reduction on ventilatory function. Kinesio Taping (KT) is a rehabilitative technique performed by the cutaneous application of a special elastic tape, thus increasing muscle activation and blood circulation.

Aim of Study: To detect the effect of kinesotaping in patient with vital capacity in chronic obstructive pulmonary disease.

Material and Methods: In total, 40 COPD patients (20 in KT group, 20 in control group) were included. KT was applied to facilitate the diaphragm muscle and inhibit sternocleidomastoid muscle for KT group. Breathing exercises were applied to both groups. Kineso tape were changed every fifth day through 4 weeks. Ventilatory function test and Severity of dyspnea were assessed with Modified Medical Research Council dyspnea scale.

Results: There was a significant increase in FEV1, FVC and FEV1/FVC post treatment compared with that pre treatment in the study and control groups (p>0.001). The percent of increase in FEV1, FVC and FEV1/ FVC in the study group were 31.74, 14.31 and 15.57% respectively, while that in the control group were 14.48, 4.54 and 9.52% for FEV1, FVC and FEV1/ FVC respectively.

Conclusions: Kineso tape beneficial for improving vital capacity and dyspnea in patients with chronic obstructive pulmonary disease.

Key Words: COPD – Kinesio Taping – Vital capacity – Breathing exercise – Respiratory muscle dysfunction.

Introduction

CHRONIC Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases and influenced by host factors including abnormal lung development. Significant comorbidities may have an impact on morbidity and mortality [1].

Disturbed ventilation and gas exchange, dysfunctional peripheral and respiratory muscles, reduction in the capacity of oxygen consumption, and shortness of breath and decrease in exercise capacity developing as a result of the combined effects of the above changes are observed in COPD [2].

The purpose of medical treatment of COPD is to reduce the frequency and severity of the symptoms and to improve the functional capacity and the quality of life [3].

Pulmonary rehabilitation (PR) is described in the update of ATS/ERS in 2013 as a comprehensive modality that aims to improve the physical and emotional status of COPD patients and involves individualized exercise training and behavioral modifications [4].

Pulmonary function tests are valuable investigations in the management of patients with suspected or previously diagnosed respiratory disease. They aid diagnosis, help monitor response to treatment and can guide decisions regarding further treatment and intervention [5].

Spirometry is simple is a measure of volume against time. It is a simple, easy to use, quick modality to measure lung volumes and capacities including, Forced expiratory volume in first second (FEV1), Forced vital capacity (FVC), The ratio of
the two volumes (FEV1/FVC), FEV1/FVC <70% in COPD [6].

Kinesiotherapy (KT) employs a cotton tape with a layer of hypoallergenic adhesive which can stretch up to 140% of its original length. It is known to have a mechanism of action exerted through a combination of its biomechanical, exteroceptive, circulatory, and analgesic effects [7].

Kinesiologic taping is currently used in several musculoskeletal system problems as well as in the rehabilitation of the patients with central nervous system disorders such as hemiplegia, cerebal palsy, multiple sclerosis, and also in nerve entrapment and peripheral nerve injuries including the brachial plexus. It has also been employed in headache, constipation, torticollis, temporoman-dibular joint disorders, asthma, and for the purpose of increasing the respiratory capacity [8].

The purpose of the study was to detect the effect of kinesotaping with ventilatory function in patient with chronic obstructive pulmonary disease.

**Material and Methods**

Patients recruited from chest hospital at El-Mansoura from August 2019 till April 2020 and assessed for eligibility. Inclusion criteria COPD patients (men and women). Duration of disease will be more than 5 years, their age between 40 and 55 years old. Not participate in any kind of pulmonary rehabilitation program, they are under full medical control. Exclusion criteria were COPD exacerbation period, cardiovascular disease (coronary artery disease – peripheral vascular insufficiency), Uncontrolled hypertension, Metabolic disorder (diabetes mellitus), Peripheral and central nervous system diseases, Polyneuropathy, Scar, lesion or incision in the area of kinesio tape application, Skin sensitivity against kinesio tape.

Eligible patients were randomly allocated to Kinesio Taping Group (KTG), or Control Group (CG). CG received deep breathing exercises, each consisting of three sets of 10 repetitions, with 30 seconds of rest between each set.

KTG received deep breathing exercises plus thoracic KT application. The kinesio tape wlastic adhesive tape, unit size 5m. (2.5 inch*16.4ft), made in korea sites were chosen according to techniques and principles described by saniye [2].

Kinesio tape will applied to the diaphragm from the back and abdomen Muscle facilitation technique was applied to the diaphragmatic muscle from proximal to distal with 10-15% tension) the taping on the diaphragm from the abdomen will performed when the participant will standing and breathed-out and the body will in extension. The base of the tape will about 1 inch below the xiphoid process area. Then the arms will lifted above the head and, with maximum deep inspiration and after maximum rib cage expansion, the tails will applied with 10% tension on the rib cage. The standing patient with the arms fully extended and scapulae retracted so as to narrow the space around the 12-th thoracic vertebra will asked to take a deep breath and slowly bend forward and adduct with the arms being crossed. While the patient is holding breath with maximum deep inspiration in this position, the tail of the tape was affixed to the subcostal area. Additionally sternocleidomastoid tapping Measured a length of tape from the mastoid process to the sternum. Participants were performed kinesiology taping on supine position. The neck was rotated to the opposite side and laterally flexed toward the same side. ‘I’ strip was applied from insertion to origin; mastoid process to sternoclavicular joint on the affected side with 10-15% tension using muscle-relaxing technique.

Kinesio tape will changed on every fifth day. The patients will instruct not to take the tapes off at any time but they will allow taking showers.

**Outcome measures:**

The outcome measures were pulmonary function forced vital capacity (FVC) forced expiratory volume in one second (FEV1), percentage of FEV1/FVC, severity of dyspnea Severity of dyspnea was measured using Modified Medical Research Council (mMRC) scale, All outcomes were assessed both before and after the treatment (at the end of forth week).

**Statistical analysis:**

Descriptive statistics and Unpaired t-test were conducted for comparison of subject characteristics between both groups. Chi-squared was carried out for comparison of sex distribution between groups. Unpaired t-test was conducted to compare the mean values of FEV1, FVC and FEV1/FVC ratio between the study and control groups. Paired t-test was conducted for comparison between pre and post treatment in each group. mMRC scale were compared between groups by Mann-Whitney U test and between pre and post treatment in each group by Wilcoxon Signed Ranks. The level of significance for all statistical tests was set at \( p < 0.05 \). All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).
Results

Subject characteristics:

Table (1) showed the subject characteristics of the study and control groups. There was no significant difference between both groups in the mean age and BMI ($p>0.05$). Also, there was no significant difference in sex distribution between groups ($p>0.05$).

Table (1): Comparison of subject characteristics between study and control groups.

<table>
<thead>
<tr>
<th></th>
<th>Study group</th>
<th>Control group</th>
<th>MD</th>
<th>t-value</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>51±3.35</td>
<td>53.1±6.03</td>
<td>–0.5</td>
<td>–0.49</td>
<td>0.62</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td>24.4±1.82</td>
<td>24.06±1.63</td>
<td>0.36</td>
<td>0.65</td>
<td>0.51</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>4 (20%)</td>
<td>5 (25%)</td>
<td>(X$^2$ = 0.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>16 (80%)</td>
<td>15 (75%)</td>
<td>(X$^2$ = 0.14)</td>
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Effect of treatment on FEV1, FVC and FEV1/FVC ratio:

- Within group comparison:

There was a significant increase in FEV1, FVC and FEV1/FVC post treatment compared with that pre treatment in the study and control groups ($p>0.001$). The percent of increase in FEV1, FVC and FEV1/FVC in the study group were 31.74, 14.31 and 15.57% respectively, while that in the control group were 14.48, 4.54 and 9.52% for FEV1, FVC and FEV1/FVC respectively. (Table 2, Fig. 1).

- Between groups comparison:

There was no significant difference in FEV1, FVC and FEV1/FVC between both groups pre-treatment ($p>0.05$). Comparison between both groups post treatment revealed a significant increase in FEV1, FVC and FEV1/FVC of the study group compared with that of the control group ($p<0.001$). (Table 2, Fig. 2).

Effect of treatment on mMRC scale:

There was a significant decrease in mMRC scale post treatment in the study and control groups compared with that pre treatment ($p<0.01$). (Table 3, Fig. 2).

Table (2): Mean FEV1, FVC and FEV1/FVC ratio pre and post treatment of the study and control groups.

<table>
<thead>
<tr>
<th></th>
<th>Study group</th>
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<th>MD</th>
<th>t-value</th>
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<tbody>
<tr>
<td>FEV1 (%):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pre treatment</td>
<td>37.56±3.64</td>
<td>38.05±5.16</td>
<td>–0.49</td>
<td>–0.35</td>
<td>0.72</td>
</tr>
<tr>
<td>- Post treatment</td>
<td>49.48±4.06</td>
<td>43.56±5.31</td>
<td>5.92</td>
<td>3.95</td>
<td>0.001**</td>
</tr>
<tr>
<td>- MD</td>
<td>–11.92</td>
<td>–5.51</td>
<td>–17.05</td>
<td>–14.7</td>
<td>0.001**</td>
</tr>
</tbody>
</table>

FCV (%):

<table>
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<tr>
<th></th>
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<th>Control group</th>
<th>MD</th>
<th>t-value</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>- Pre treatment</td>
<td>68.97±4.13</td>
<td>69.83±3.01</td>
<td>–0.86</td>
<td>–0.75</td>
<td>0.45</td>
</tr>
<tr>
<td>- Post treatment</td>
<td>78.36±4.78</td>
<td>73±3.55</td>
<td>5.36</td>
<td>4.02</td>
<td>0.001**</td>
</tr>
<tr>
<td>- MD</td>
<td>–9.4</td>
<td>–3.17</td>
<td>–11.45</td>
<td>–12.07</td>
<td>0.001**</td>
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FEV1/FVC (%):

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<tr>
<th></th>
<th>Study group</th>
<th>Control group</th>
<th>MD</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Pre treatment</td>
<td>54.65±6.33</td>
<td>54.4±6.99</td>
<td>0.25</td>
<td>0.12</td>
<td>0.9</td>
</tr>
<tr>
<td>- Post treatment</td>
<td>63.16±3.94</td>
<td>59.5±5.68</td>
<td>3.58</td>
<td>2.31</td>
<td>0.02**</td>
</tr>
<tr>
<td>- MD</td>
<td>–8.51</td>
<td>–5.18</td>
<td>–7.75</td>
<td>–9.86</td>
<td>0.001**</td>
</tr>
</tbody>
</table>

Fig. (1): Mean FEV1, FVC and FEV1/FVC ratio pre and post treatment of the study and control groups.
Effects of KT on pulmonary function and ventilator efficiency have been little investigated. Only one study conducted in patients with COPD exacerbation did investigate the effects of one-session KT application on pulmonary function and concluded that measures of FEV1 and PEF were not significantly improved after use of KT. The authors believed that only one session of KT was not enough to create significant changes in pulmonary function of these subjects [18]. Our results indicated that this belief could be true, thus we found a significant increase in measures of FEV1% after four-week of KT application in patients with COPD. Results of Malehorn et al.'s study also supported our findings. They found that KT applied on the chest of healthy individuals could augment ventilatory efficiency without the participants being aware of it [16].

The study conducted by Lee et al., found that KT added to inspiratory muscle training through four weeks was effective for improving MIP. However, no significant change was observed in pulmonary function (PEF, FVC, FEV1, FEV1/FVC) [17]. On the contrary, we found significant increase in FEV1, FEV1/FVC after use of KT. Given these results, it may be concluded that KT might be more effective when combined with pulmonary rehabilitation modalities. Whereas, it may improve MIP when combined with inspiratory muscle training, [2-11] and pulmonary function when combined with deep breathing exercises. However, to clearly elucidate these effects, more research is needed on this issue.

In conclusion, this study has showed kinesio tape play an important role in improving vital capacity and respiratory function (FEV1, FVC, FEV1/FVC) in patient with chronic obstructive pulmonary disease.

References


تأثیر شریط الکینژیو علی السعة الحیویة

فی مریضین السدة الرئویة

مرض الانسداد الرئوی المزمن يسبب خلل الجهاز التنفسی والعضلات المحيطة به يؤدي إلى الحد من النزعة وضيق التنفس. شریط الکینژیو هو تقنية تأهیلیة يتم تنفيذها من خلال التطبيق الجلدي لشریط مرن خاص، وبالتالي زيادة تشییع العضلات والدورات الدمویة ولذا فإن هدف الرسالة هو التأثیر شریط الکینژیو على وظائف النزعة في المرضى الذين يعانون من مرض الانسداد الرئوی المزمن وتم إجراء البحث على أربعة مرضى من الذين يعانون من الانسداد الرئوي المزمن تتراوح أعمارهم بين (44-55) عاماً. (20) في مجموعة التجربة. تم تطبيق شریط الکینژیو لزيادة عمل عضلة الحجاب الحاجز وتقليل عمل عضلة القصبة الترقبیة الخصائصية للجهاز التجربی. تم تمین تمارین النزعة على كل المجموعتين وتغییر شریط الکینژیو كل خمسة أيام خلال 4 أسابيع. تم تغییر وضعية النزعة وشدة ضيق التنفس مع مقياس ضيق التنفس عن طريق البحوث العلمیة المعدل قبل وبعد العلاج بأربعة أسابيع. وقد أظهرت النتائج فروق ذات دلالة إحصائیة لحجم الزفير القصیر، القدرة الحیویة القصیرة ونسبة بين حجم الزفير القصیر القدرة الحیویة القصیرة ومقياس صعوبة التنفس بعد العلاج في كل المجموعتين مع وجود فروق ذات دلالة إحصائیة كبيرة في المجموعة التجربیة عن المجموعة الضابطة. وذلك شریط الکینژیو مفيد لتحسين النزعه وضيق التنفس لدى المرضى الذين يعانون من مرض الانسداد الرئوي المزمن.