

# A STUDY ON KINESIOLOGY TAPING OF DIAPHRAGM VERSUS DIAPHRAGMATIC BREATHING USING PROGRESSIVE RESISTED EXERCISE IN ASYMPTOMATIC YOUNG MALE SMOKERS

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**ABSTRACT:** *Kinesiology taping on diaphragm is one of the newer techniques used for the facilitation of muscles in order to improve strength of the diaphragm. Diaphragmatic breathing using progressive resisted exercises is commonly used for improving respiratory muscle strength. The main objective of this study is to compare the effect of kinesiology taping on diaphragm with diaphragmatic breathing exercises using progressive resisted exercises in asymptomatic young male smokers. 30 subjects were selected according to eligibility criteria and randomly allocated into 2 groups. Group A received kinesiology taping on diaphragm and Group B received diaphragmatic breathing using progressive resisted exercises. Maximum inspiratory pressure and range of diaphragmatic excursion were the 2 outcome measures used. Data was collected and results were analyzed using the unpaired t test. Both groups showed significant improvement for both the outcome measures. But, kinesiology taping on diaphragm was slightly more effective than diaphragmatic breathing exercise using progressive resisted exercises in asymptomatic young male smokers.*

**Key words:** *Kinesiology Taping, Diaphragm, Diaphragmatic Breathing, Progressive resisted exercises*

## INTRODUCTION

The second largest consumer and third largest producer of tobacco in the world is India.<sup>1</sup> Bidi, cigar or cigarette are the various forms of smoking tobacco.<sup>2</sup> Smoking can lead to various disorders of the pulmonary and cardiovascular system like lung cancer and emphysema.<sup>3</sup> WHO has estimated that tobacco use (smoking and smokeless) is currently responsible for the death of about six million people across the world each year.<sup>4</sup> 19.7% and 16.5% are the prevalence of smoking in Egypt and Mexico respectively.<sup>5</sup> 24.3% of the male population in India smoke while 14% females smoke tobacco.<sup>2,6</sup>

Smoking in adults affects the cilia, thus movement of the cilia is restricted. This leads to retention of the mucus in the air passages of the respiratory tract.<sup>7</sup> Cigarette smoke inhalation leads to oxidative stress and sarcomeric injury to the diaphragm. Thus, the proteolytic machinery is activated to cause contractile protein wasting, and a loss of force production of the diaphragm in smokers.<sup>8,9</sup>

Exercise therapy, Biofeedback, taping are the various interventions used to improve diaphragm excursion.<sup>10</sup> Kinesiology taping is a modern technique developed by Dr. Kenzo Kase in 1993. The application of the tape results in therapeutic effects resulting in cutaneous stimulation of the sensorimotor and proprioceptive systems. The application of the tape from origin to insertion has a facilitatory effect whereas the application of the tape from insertion to origin has an inhibitory effect.<sup>11</sup>

Diaphragmatic breathing exercises helps in enhancing the recruitment of the diaphragm. Thus, improving the breathing pattern. It reduces the work of breathing by reducing energy expenditure by facilitating the diaphragm and inhibiting the recruitment of the accessory muscles of respiration.<sup>10</sup> The principles of progressive resistance exercise (PRE) for increasing force production in muscles have remained virtually unchanged since they were described by DeLorme and Watkins. These principles are (1) to perform a small number of repetitions until fatigue, (2) to allow sufficient rest between exercises for recovery, and (3) to increase the resistance as the ability to generate force increases. Traditionally, PRE has been used by young adults who are healthy to improve athletic performance.<sup>12</sup> Thus, Diaphragmatic breathing using progressive resisted exercises can be used to improve the recruitment of the diaphragm.

There is extremely limited evidence to associate muscle strength of the diaphragm and range of diaphragmatic excursion in asymptomatic young adult male smokers. Presently, there are few physiotherapy interventions used for enhancing the recruitment of the diaphragm in an efficient manner to reduce the work of breathing by reducing the energy expenditure in smokers by facilitating the activation of the diaphragm, thus inhibiting the activation of the accessory muscles of respiration. This is a sincere effort to compare the effect of kinesiology taping on diaphragm and diaphragmatic breathing using progressive resisted exercise.

The main aim of the study was to compare the effect of kinesiology taping on diaphragm and diaphragmatic breathing using progressive resisted exercises in asymptomatic young male smokers. The objectives of the study were, firstly to study the effect of kinesiology taping on diaphragm in asymptomatic young male smokers. Secondly, to study the effect of diaphragmatic breathing using progressive resisted exercises in

asymptomatic young male smokers. Thirdly, to compare the effect of kinesiology taping on diaphragm and diaphragmatic breathing using progressive resisted exercises in asymptomatic young male smokers.

### RESEARCH METHODOLOGY

An ethical committee approval was taken prior to the study from Dr. D. Y. Patil College of physiotherapy, Pune. Male subjects, 20 to 30 years of age, and smokers with the history of smoking since five years were included in the study. Subjects with respiratory diseases, cardiovascular diseases like unstable angina and skin diseases or infections or allergic rashes were excluded from the study. An informed consent was taken from the subjects. Thirty asymptomatic young male smokers were allocated randomly into two groups by using the chit method. The study took place at Dr. D.Y. Patil College of Physiotherapy, Pune from August, 2015 to February, 2016. The outcome measures used were maximum inspiratory pressure ( $PI_{max}$ ) in mm Hg and range of diaphragmatic excursion in cms. Subjects were then assessed for inspiratory muscle strength by measuring the  $PI_{max}$  by using a negative pressure gauge manometer. For measuring  $PI_{max}$  each subject was seated and was asked to wear a nose clip. The subject held the negative pressure gauge manometer in his hand and pressed the mouthpiece tightly against his lips during the pressure measurement to prevent perioral leak. Maximum inspiratory pressure was measured near residual volume (RV) after a maximum expiration. The pressure measured was maintained for at least one second. The same process was repeated two more times until two satisfactorily measurements were recorded; the higher value was used in subsequent calculations.<sup>13</sup> Diaphragmatic movement was then assessed by measuring the range of diaphragmatic excursion. The percussion of the diaphragm began superiorly and extend inferiorly to identify the level during normal quiet (tidal volume) breathing. The position of the diaphragm was noted. The subject was then asked to 'inhale fully' and then 'Hold it' and then again begin percussing inferiorly, to determine the new level of the diaphragm during forced maximal inspiration. The new level was noted and the subject was asked to 'breathe normally'.<sup>14</sup> The treatment duration was for seven days consecutively. The subjects were randomly allocated into two groups by using chit method. Group A received kinesiology taping on diaphragm and Group B received Diaphragmatic Breathing using Progressive Resisted Exercise. Group A received kinesiology taping for 7 days. One 'I' strip was applied on the origin of the diaphragm with the middle part of the diaphragm on the xiphoid process. A second 'I' tape was applied on the corresponding level on the posterior surface of the back. This is the facilitatory technique for muscle recruitment with Kinesiology taping. Image 1 and 2 shows the application of kinesiology taping for diaphragm.<sup>15</sup> Group B received Diaphragmatic Breathing using Progressive Resisted Exercise for 7 days. The subjects were taught diaphragmatic breathing in the semi-fowler's position.<sup>10</sup> And on the 5<sup>th</sup> day, the subject was taught diaphragmatic breathing using an elastic resistance band for progressive resisted exercise. Image 3 shows a subject performing diaphragmatic breathing using progressive resisted exercises. After seven days, both the groups were assessed with the same outcome measures.



Image 1 shows kinesiology taping on diaphragm applied on the anterior aspect of a subject



Image 2 shows kinesiology taping on diaphragm applied on the posterior aspect



Image 3 shows a subject performing diaphragmatic breathing using progressive resisted exercises

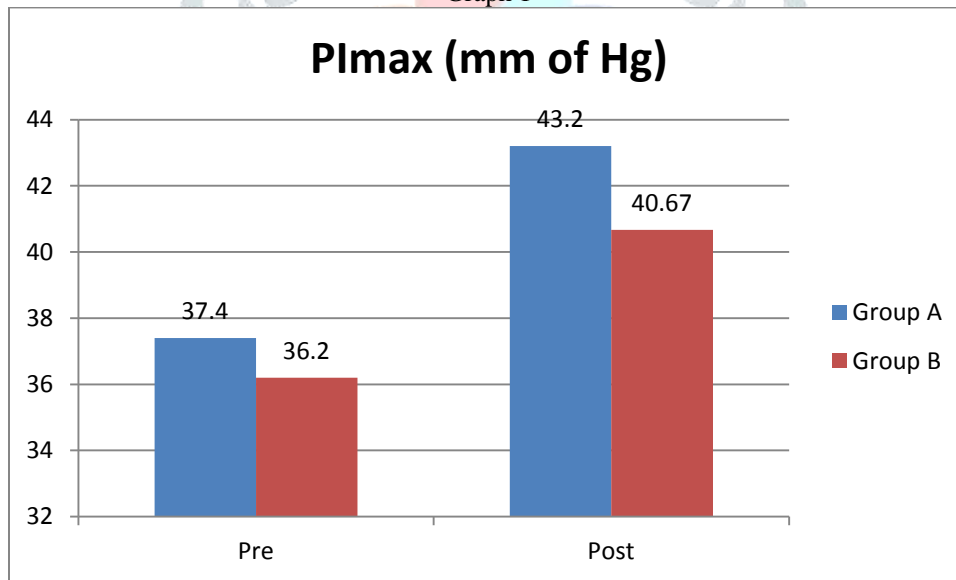
**RESULTS**

The data collected was analyzed using the unpaired ‘t’ test for both groups using P<sub>Imax</sub> (Pre) and (Post) and the range of diaphragmatic excursion pre and post values. These values were used to find the p value for these parameters. The p value was calculated and was found to be highly significant.

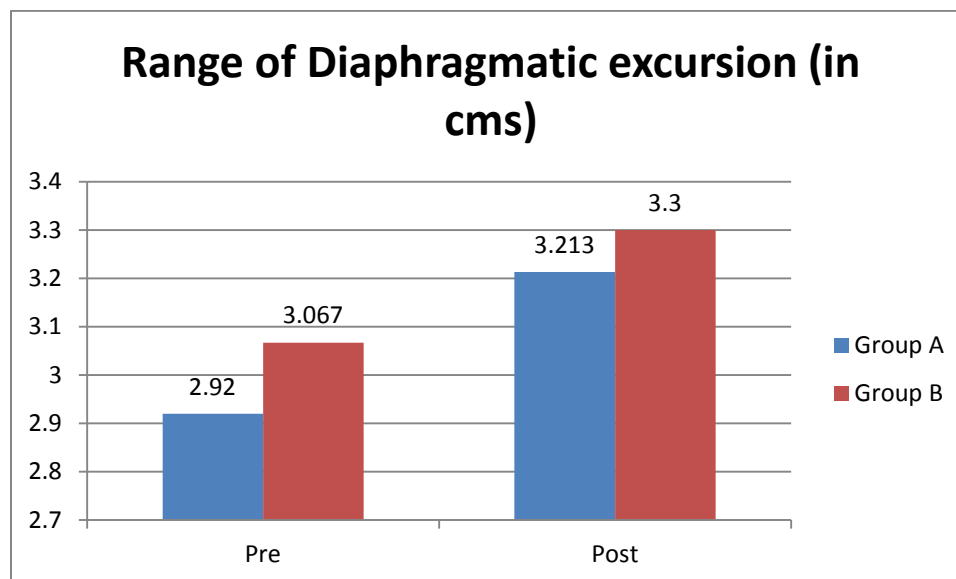
Table 1 shows, the Pre and Post values of P<sub>Imax</sub> and range of diaphragmatic excursion.

	P <sub>Imax</sub> (Pre)	P <sub>Imax</sub> (Post)	Range of Diaphragmatic Excursion (Pre)	Range of Diaphragmatic Excursion (Post)
<b>Group A</b>	37.4±4.837	43.2±6.625	2.92±0.3629	3.213±0.40
<b>Group B</b>	36.2±5.967	40.67±6.377	3.067±0.3086	3.3±0.3873
<b>P value</b>	P = 0.550	P = 0.295	P = 0.243	P = 0.550

Graph 1



Graph 1 shows average maximum inspiratory pressure pre and post treatment for both groups in mm Hg.  
Graph 2



Graph 2 shows range of diaphragmatic excursion in cms for both pre and post values in both the groups.

30 subjects were randomly allocated into 2 groups. Each group had 15 subjects each. The statistical analysis was carried for both groups. The data collected was analyzed using the unpaired t test for both groups using  $PI_{max}$  (Pre) and  $PI_{max}$  (Post) and the range of diaphragmatic excursions pre and post values. The Pre  $PI_{max}$  score for Group A was 37.4 and the post  $PI_{max}$  score was 36.2, for Group B the pre  $PI_{max}$  score was 36.2 while and the post  $PI_{max}$  score was 40.67 as shown in Graph 1. The pre score of range of diaphragmatic excursion for the Group A was 2.92 and for Group B was 3.067 and the post score for range of diaphragmatic excursion for Group A was 3.213 and for Group B were 3.3. The p value was found to not be statistically significant. The results show that the study carried out using these interventions is clinically significant, but statistically insignificant.

## DISCUSSION

In our study, thirty asymptomatic young male smokers were examined for inspiratory muscle strength by using  $PI_{max}$  in mm Hg and range of diaphragmatic excursion in cms.

Group A received kinesiology taping on the diaphragm in a muscle facilitatory approach. This resulted in better activation of the diaphragm mainly because of cutaneous sensorimotor stimulation of the diaphragm because of kinesiology taping. Similarly, in another study, Zubeyir S. et al stated that kinesiology taping on the diaphragm can help in re-educating the diaphragm for working efficiently as a chief inspiratory muscle.<sup>15</sup> Szegieliak J. et al studied that kinesiology taping can be used to improve muscular activity.<sup>11</sup> Also, Huang C. et al in a study in 2011 on kinesiology taping on medial gastrocnemius found a significant increase on muscle activity on EMG. This was mainly due to better proprioceptive stimulation and recruitment of the muscles due to kinesiology taping.<sup>16</sup> Also, Kalantari K. et al in a study on kinesiology taping on diaphragm on the extensor aspect found a significant increase in grip strength. This improvement was found mainly due to better recruitment of the muscle fibres.<sup>17</sup>

Group B which received diaphragmatic breathing using progressive resisted exercises also improved. This could mainly be due to increased activating of the diaphragm, thus facilitating the diaphragm muscle activity. Thus, showing positive effects on  $PI_{max}$  in mm Hg and range of diaphragmatic excursion in cms. A progressive resisted exercise increases the ability of the muscles to generate force. Diaphragmatic breathing helps control breathing at an involuntary level by effectively learning how to use the diaphragm at an optimal level. It helps in improving the efficiency of ventilation, decrease the work of breathing, increase the muscle force generation, increase the excursion of the diaphragm and improve the gas exchange and oxygenation. Similarly, Taylor F. et al found significant improvement by using progressive resisted exercise. This was also mainly due to increased activity of the diaphragm.<sup>12</sup> Also Ike D. et al in a study mentioned that diaphragmatic breathing helps improve the diaphragm muscle activation, thus reducing the sarcomeric injury on the diaphragm.<sup>18</sup> Desai R. et al in 2018, in another study found that kinesiology taping on diaphragm in asymptomatic young male smokers to be highly effective in improving the diaphragm muscle function.<sup>14</sup>

Both the interventions have shown improvement in  $PI_{max}$  and range of diaphragmatic excursion. The results have shown to be statistically not significant. Kinesiology taping on diaphragm group was found to be clinically better than the diaphragmatic breathing using progressive resisted exercise group. No adverse events during the course of the treatment session were noted. There were no dropouts in the study.

Khandare S. et al in 2018 have found exercises to be effective in improving function.<sup>20</sup> Gonsalves N. et al similarly in 2018, also stated that physical activity tends to improve physical function in individuals.<sup>21</sup> Khandare S. et al also in 2018, in another study found manual therapy exercises to improve function.<sup>22</sup>

A few limitations of the study were that the duration of the progressive resisted exercise is too small to obtain optimal muscle strength gain. Also, the duration of the kinesiology taping on diaphragm was also small in order to expect improvement in muscle strength. Thus, the duration of the progressive resisted exercise should be longer duration optimally ten weeks.<sup>19</sup>

## CONCLUSION

Thus, we can conclude that kinesiology taping on diaphragm is better than diaphragmatic breathing using progressive resisted exercise.

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