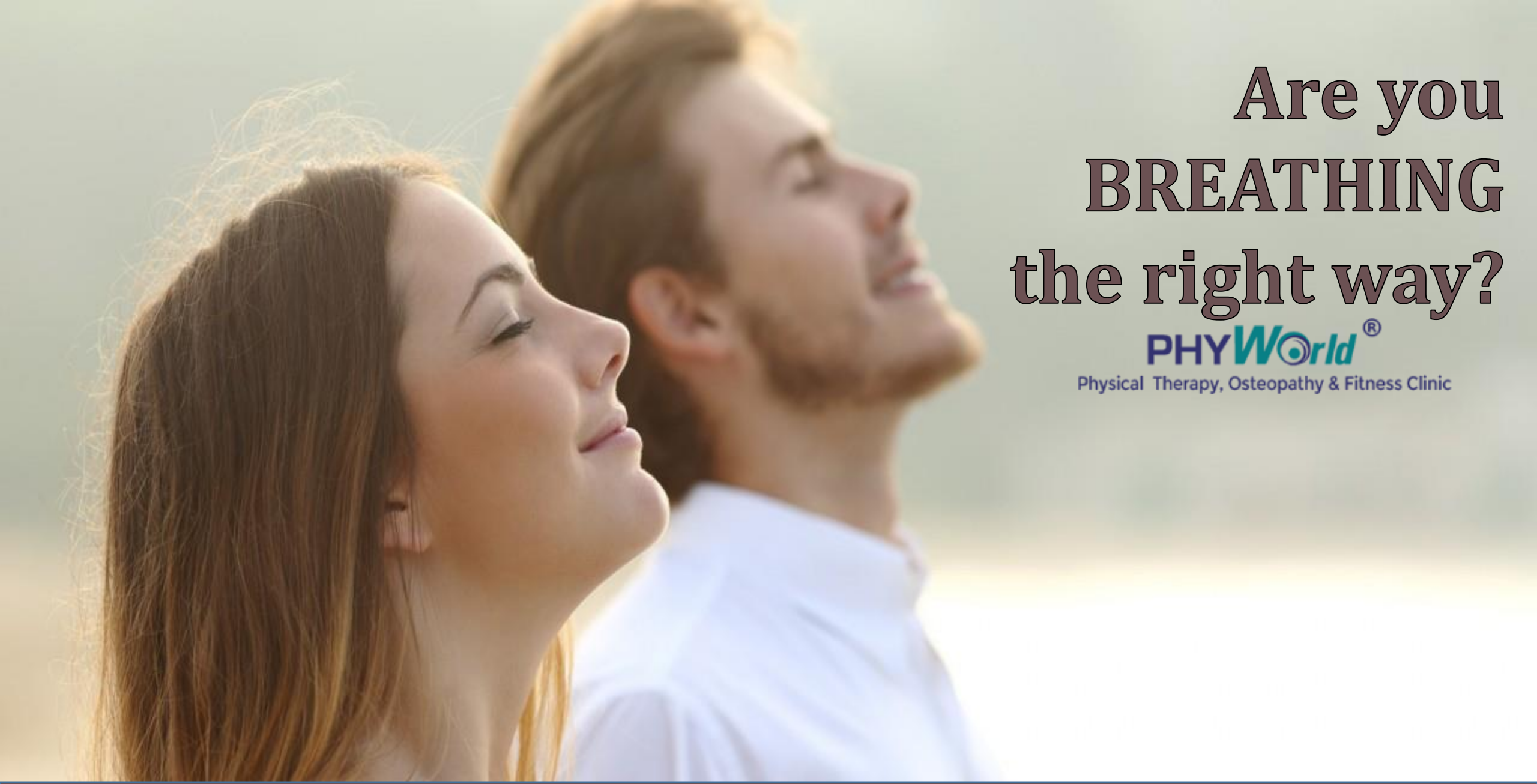


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# COMPARISON OF BIOFEEDBACK TRAINING AND MANUAL TRAINING FOR CORRECTION OF PARADOXICAL BREATHING PATTERN

# ABOUT PHYWORLD

PHYWorld®
Physical Therapy, Osteopathy & Fitness Clinic

- One of the largest, state-of-the-art clinics of India

- Started in 1996

- Manages an O.P. D of about a lac patients per annum

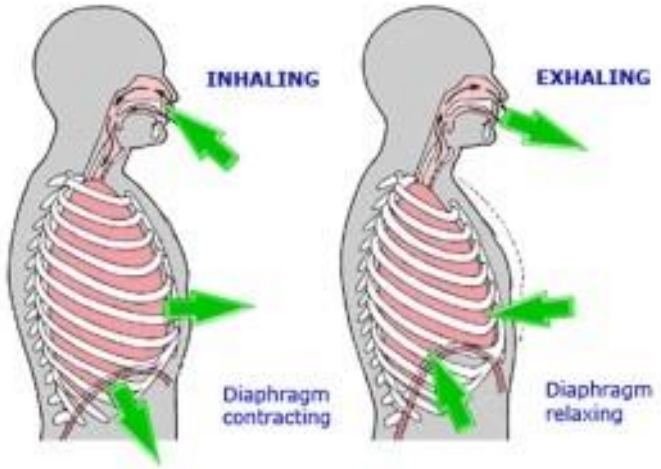
- Pioneers in WEIGHT MANAGEMENT through OSTEOPATHIC TECHNIQUES to lose in inches (First in India)

- SPORTS INJURY REHABILITATION (First in India)

# INTRODUCTION



- The respiratory system delivers oxygen and removes carbon dioxide to tightly regulate the partial pressures of oxygen and carbon dioxide in arterial blood.
- Normal tidal breathing is comprised of inspiratory and expiratory phases and occurs with the synchronous movement of the thorax and abdomen.



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# NORMAL BREATHING SYSTEM

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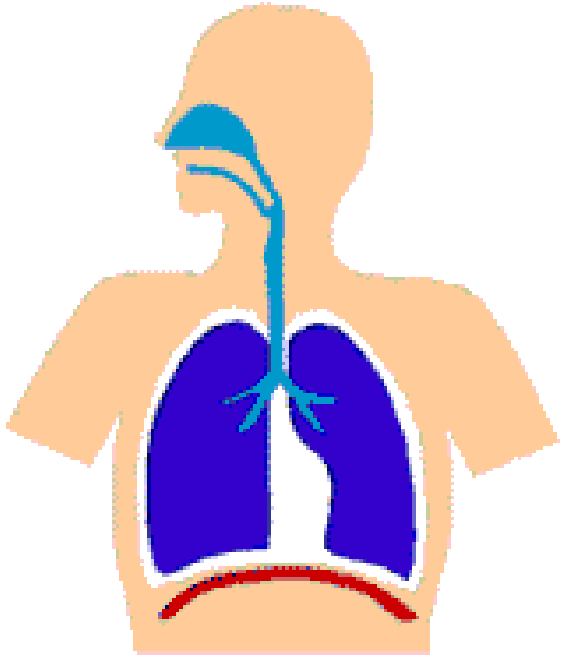

# DIAPHRAGM

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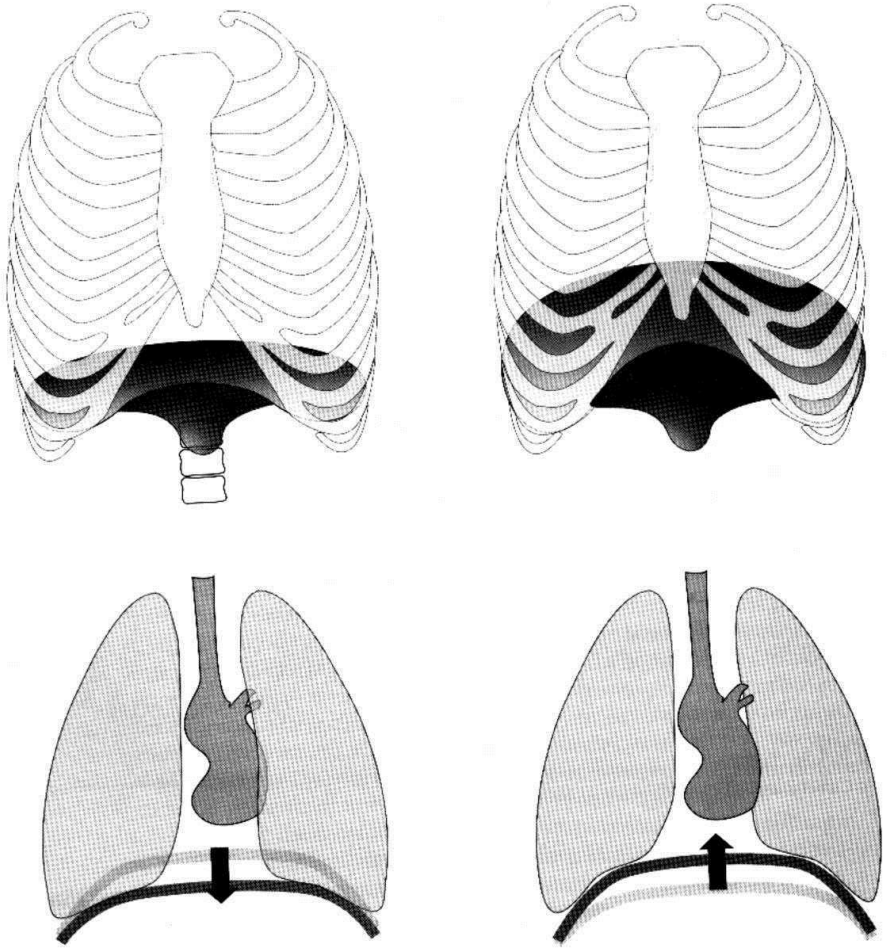
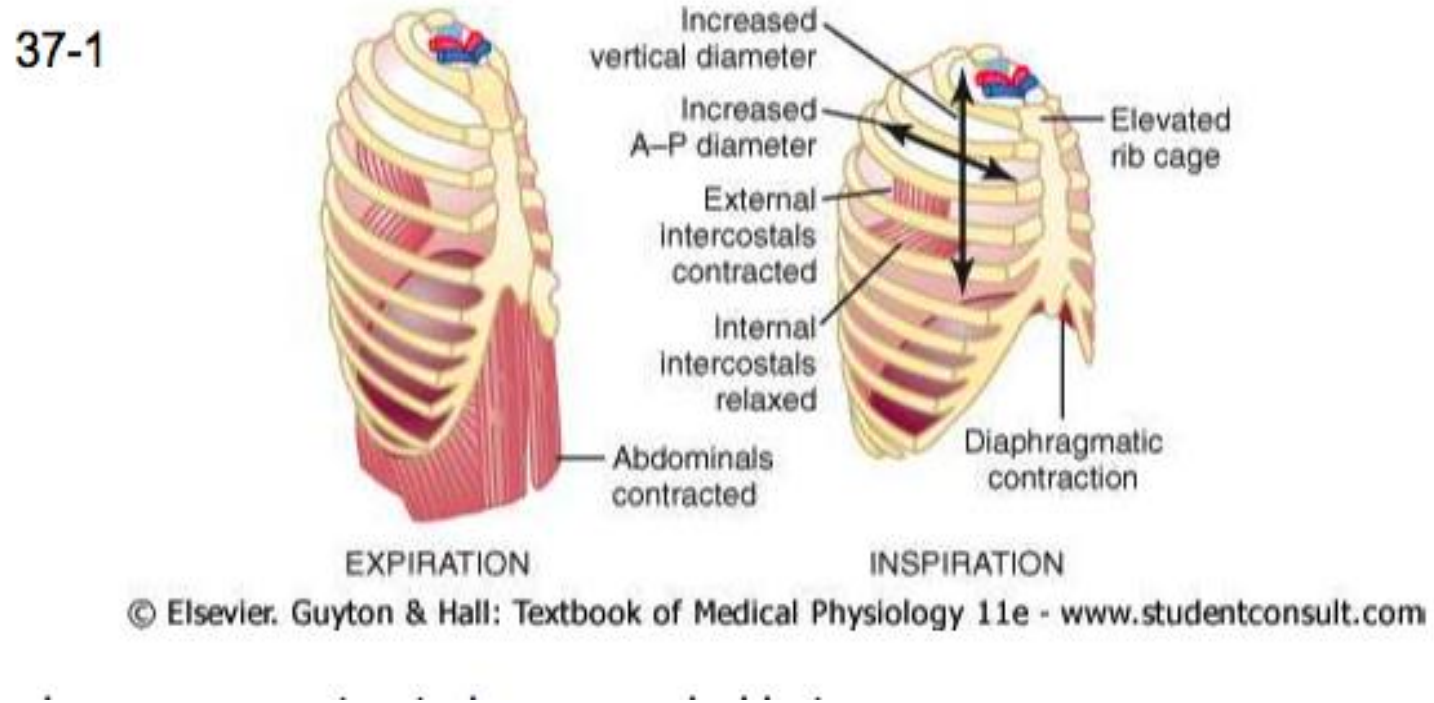


# CONTRACTION AND EXPANSION OF THE THORACIC CAGE



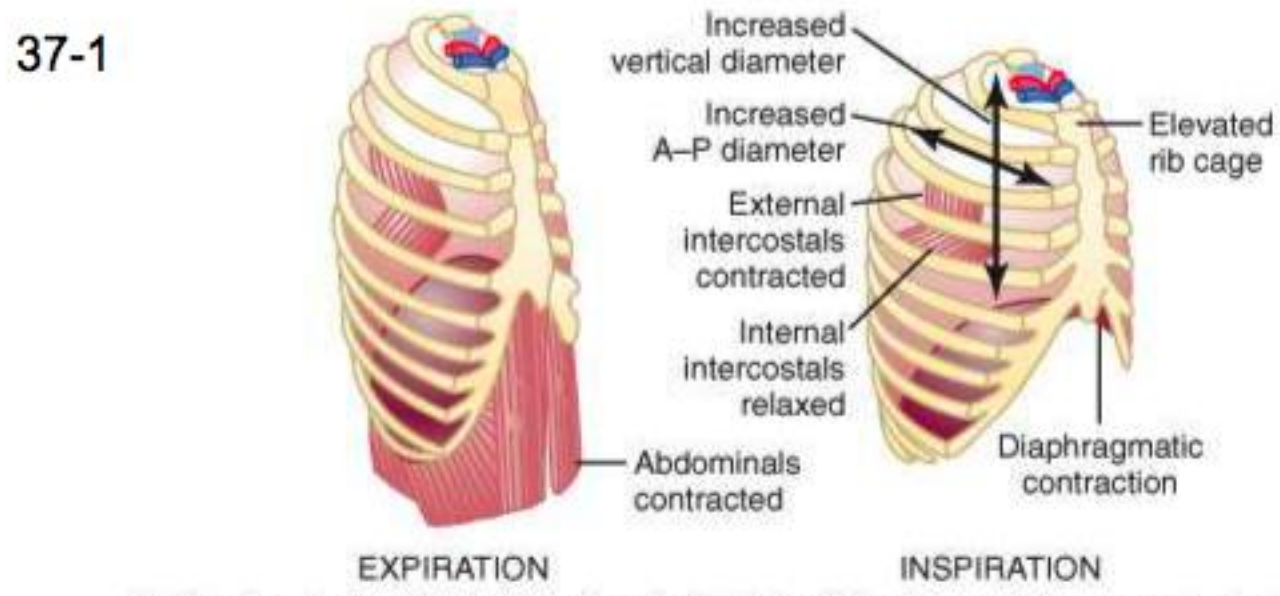



Lungs contract or expand in two ways:

1. Downward and upward movement of diaphragm (major force during normal, quiet breathing.
2. Elevation and depression of the ribs, using abdominal and rib cage (intercostal) muscles.

# CONTRACTION AND EXPANSION OF THE THORACIC CAGE






**Expiration** – Diaphragm relaxes and moves up. Rib cage is pulled downward and the chest wall
and abdominal structures compress the lungs.

**Inspiration** – Diaphragm contracts and moves down. Rib cage is pulled upward and expanded.

# PARADOXICAL BREATHING

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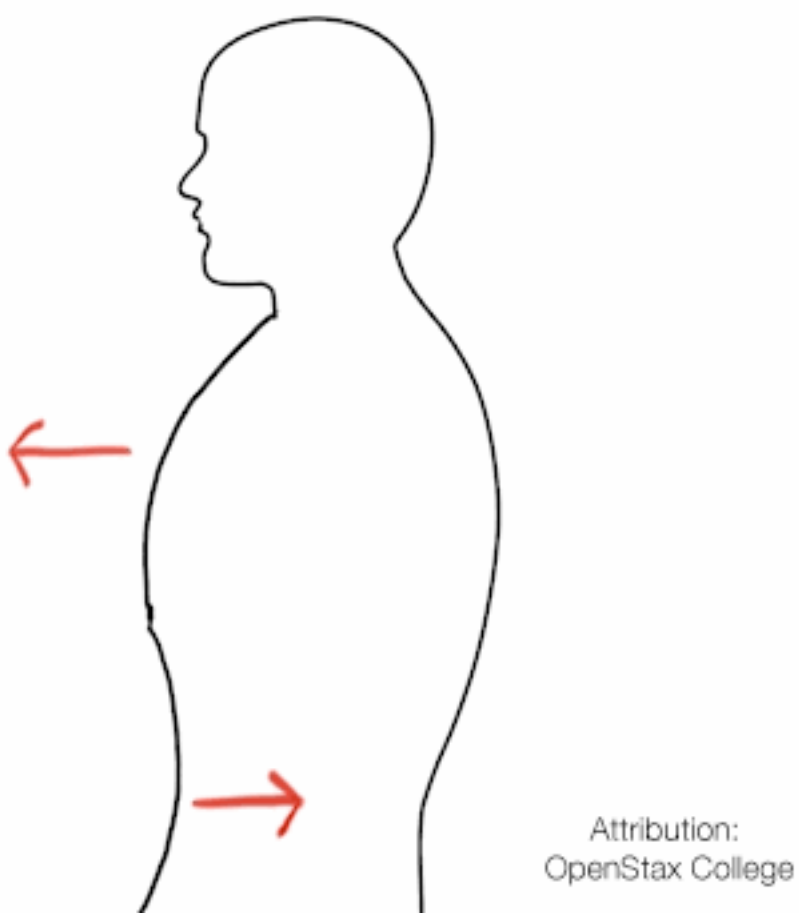

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# THORACOABDOMINAL PARADOX

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**Thoracoabdominal Asynchrony/Paradox –** refers to the asynchronous movement of the thorax and abdomen that can be seen with respiratory muscle dysfunction and increased work of breathing. This can be seen as a time lag/phase shift of thoracoabdominal motion or as pure paradox where the thorax and abdomen are moving in completely opposite directions at the same time.

# OBESITY: IMPACT ON RESPIRATORY SYSTEM

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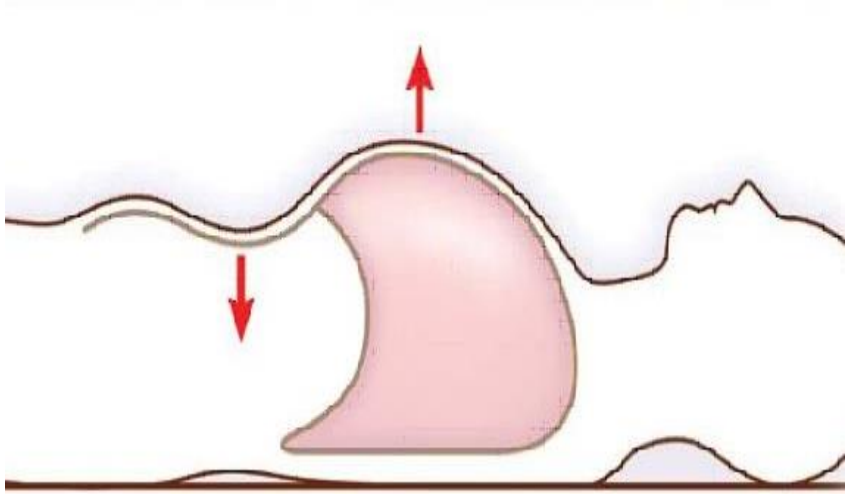
Obesity is also known to have an important impact on the respiratory system. For example, obesity can have deleterious effects on pulmonary function, respiratory mechanics, pulmonary gas exchange, the control of breathing, respiratory muscle performance, and exercise capacity, and has been linked to a range of respiratory conditions such as chronic obstructive pulmonary disease (COPD)

# PARADOXICAL BREATHING



Abnormal patterns of breathing are frequently caused by injury to respiratory centres in pons and medulla, use of narcotic medications, metabolic derangements, and respiratory muscle weakness.



# PARADOXICAL BREATHING IN OBESITY

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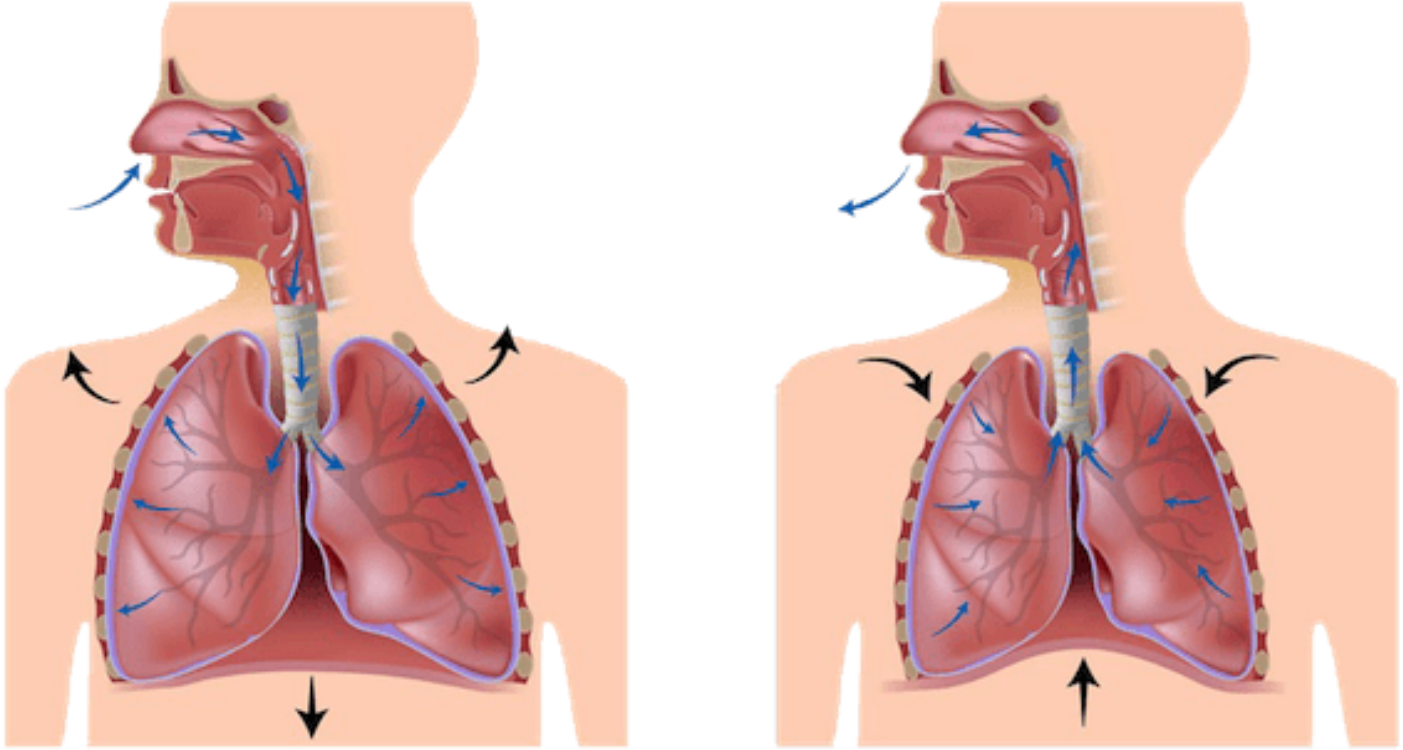
- So in an obese person the upper ribs are pulled upward and outward.
- Diaphragm has limited efficiency to push the abdominal contents downward.
- So the abdomen and diaphragm moves upward , underneath the rib cage .
- This is paradoxical thoracoabdominal breathing.
- Where inspiration: abdomen goes inward and upward.
- Where expiration: abdomen goes outward and downward.



Inspiration



Expiration

- Airway resistance increases as BMI increases
- Overall increased work of breathing due to increased forces needed to inflate the lungs (can be 60-250% higher)
- Weakening of respiratory muscles (impaired diaphragmatic function)

# DYSFUNCTIONAL BREATHING

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- Dysfunctional breathing patterns are associated with decreased ability to achieve HRV patterns that reflect cardiorespiratory efficiency and autonomic nervous system balance.
- This suggest that dysfunctional breathing patterns are not only biomechanically inefficient but also reflect decreased physiological resilience.
- The respiratory muscle activity decreases and it increases the residual volume and decreases the vital capacity

# EMG BIOFEEDBACK

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- An electromyograph detects the electrical potential generated by muscle cells when these cells are electrically or neurologically activated. The signals can be analyzed to detect medical abnormalities, activation level, recruitment order or to analyze the biomechanics of human movement.

- There are lot of recent studies showing the effect of breathing exercises and diaphragmatic breathing for improvement in paradoxical breathing pattern in obesity. The effect of electromyography( EMG) biofeedback to improve thoracoabdominal paradox has not been studied yet.

# PURPOSE OF STUDY

To assess the effect of EMG biofeedback in reducing paradoxical breathing pattern in obese patients

# METHODOLOGY

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- **Research design**

Type of study: Comparative

Population: Obese patient with BMI> 30

- **Sampling**

Random sampling

Sample size: 40

# INCLUSION CRITERIA

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- Patient with paradoxical breathing pattern
- Patient whose cross sectional diameter of abdomen decreases during inspiration
- Patient whose cross sectional diameter of abdomen increases during expiration
- Obesity

# EXCLUSION CRITERIA

- Asthma Patients
- COPD Patients
- Any other pathological condition
- Any pathology which decreases the effect of diaphragm
- Any abdominal or respiratory surgeries

## Instrumentation

- Biofeedback thought technology (U.K)
- Measuring tape

## Parameters

- Thoracic amplitude (EMG)
- Abdominal amplitude (EMG)
- Cross sectional area of abdomen

# CHEST EXPANSION EXAMINATION

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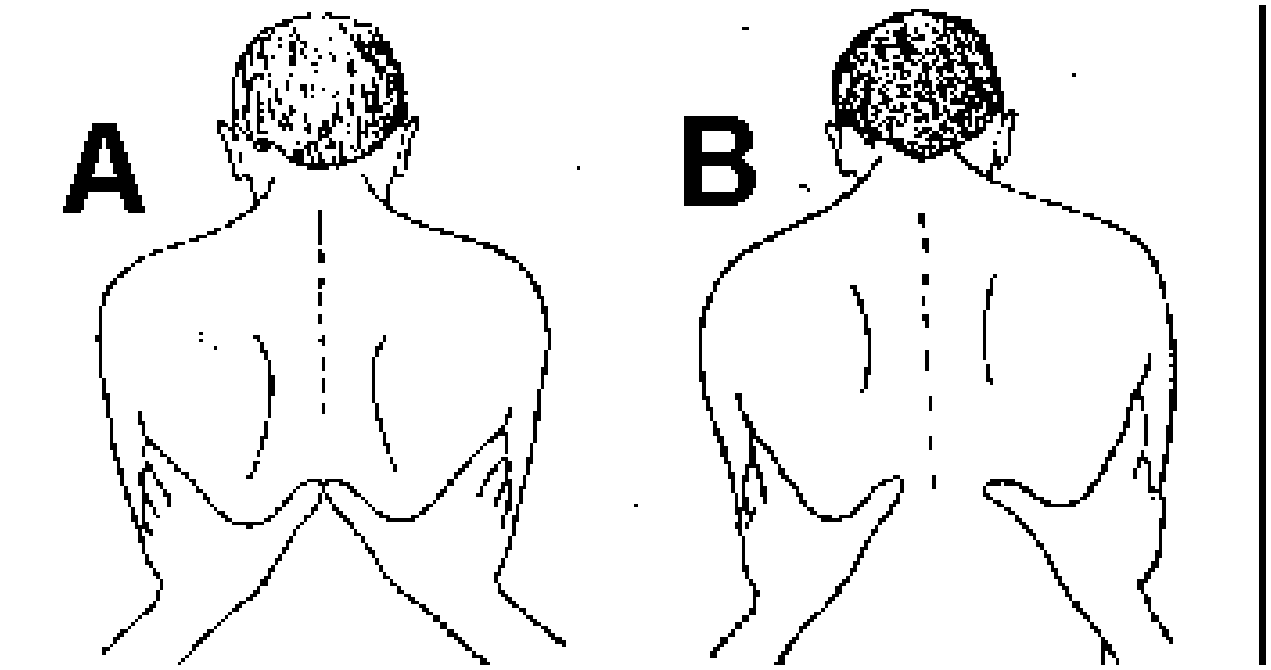


A. Exhalation B. Maximal Inhalation

# PROCEDURE



Obese patients with BMI > 30 were taken in the study, all patients were evaluated for their cardio-pulmonary assessment. Consent forms were taken from the concerned patients for the study.

The subjects were divided into two groups:

Group A

Group B

# GROUP A

Patients received manual training including diaphragmatic scooping with diaphragmatic breathing to recruit the abdomen muscles for 20 sessions.

# GROUP B

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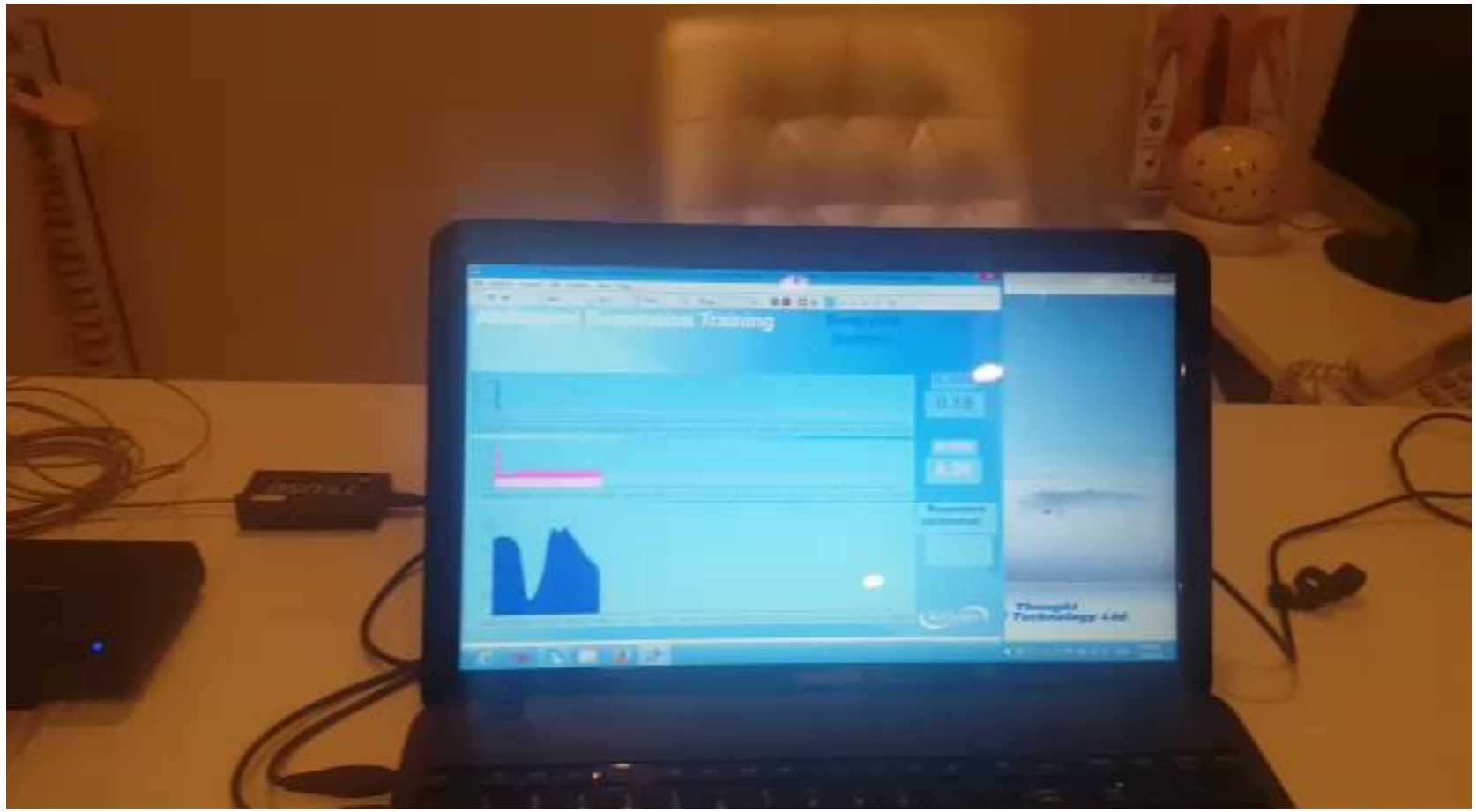
Patients received biofeedback training to recruit the abdomen and manual training including diaphragmatic breathing with scooping and again the diameter was assessed at the end of every session which were the first $10^{th}$ and $20^{th}$ session. EMG readings were assessed again.



# EMG BIOFEEDBACK

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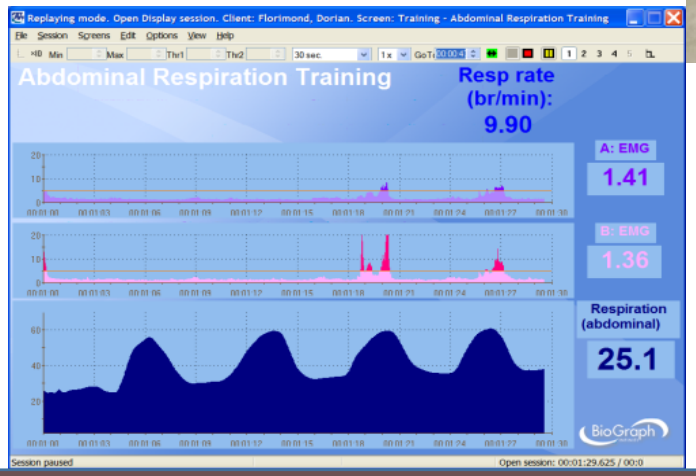


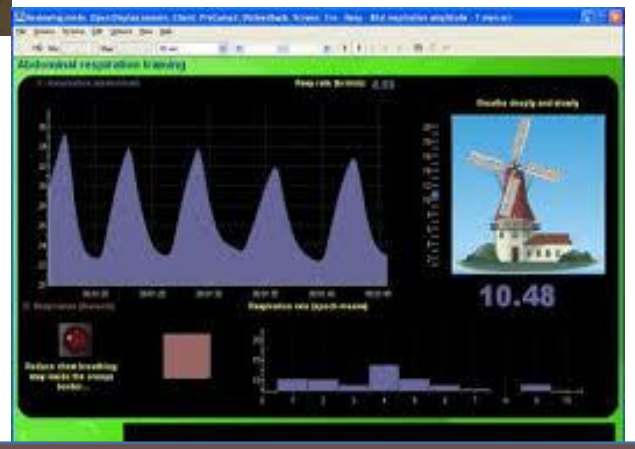

# RESULTS



- All the patients in two groups were compared for thoracic amplitude and abdominal amplitude and cross sectional area of thorax and abdomen post biofeedback training or with diaphragmatic breathing and scooping technique.
- Data was statistically analysed using the t-test for inter group comparison.
- The statistical analysis was done using SPSS software.
- The level of significance was set as 0.05 with 95% confidence limits and p- value of $< 0.05$ was considered significant.

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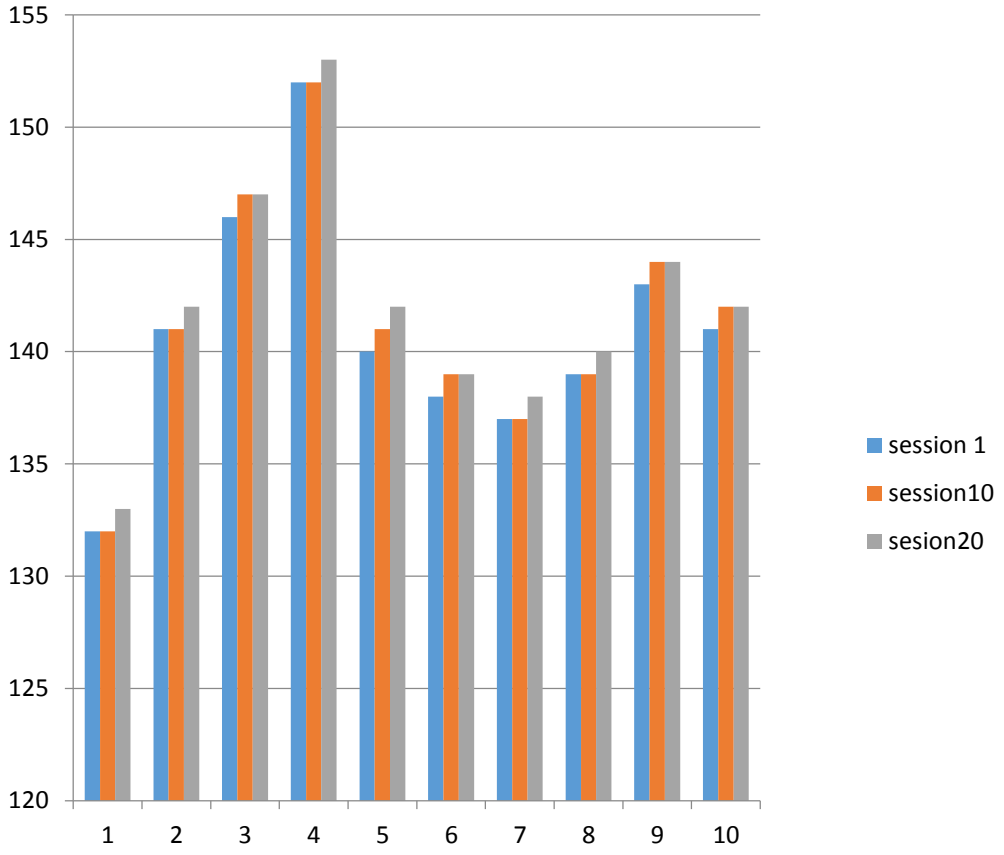
# GROUP A ( MANUAL): **CROSS SECTIONAL AREA**

In this graph, it shows when we used manual therapy the changes in cross sectional area were non significant if we compare the 1st to the 20th session.



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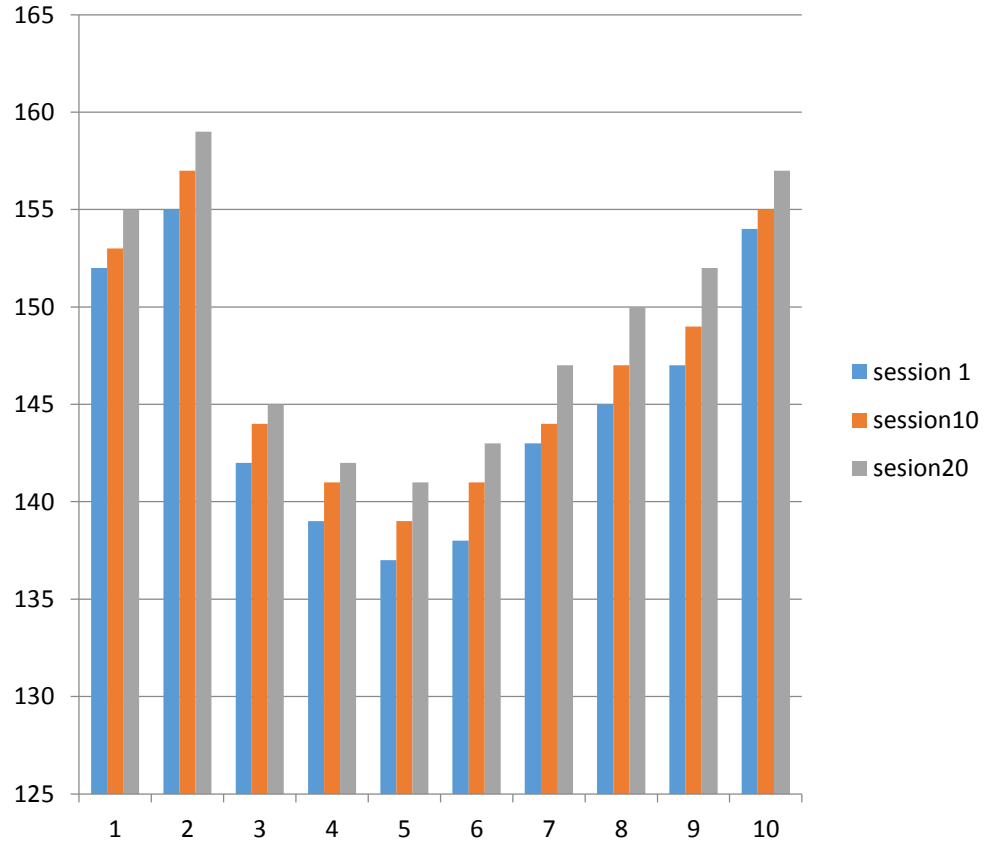
# GROUP B( EMG BIOFEEDBACK): CROSS SECTIONAL AREA

In group B ,the chest expansion increased significantly with EMG Biofeedback when we compared the 1st to the 20th session



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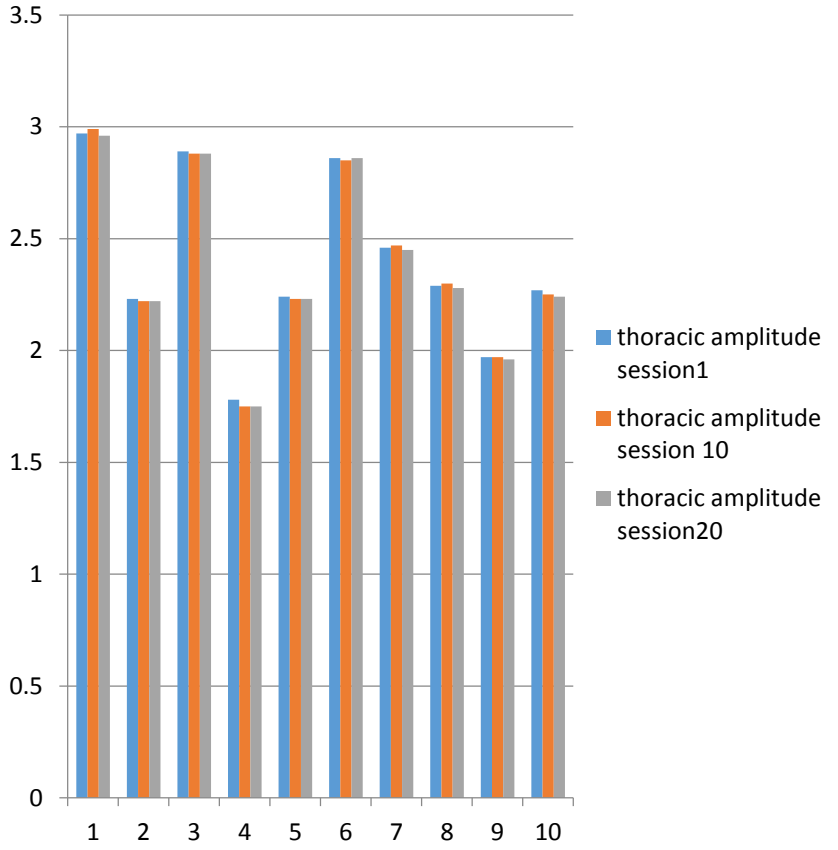
# GROUP A ( MANUAL): THORACIC AMPLITUDE

The thoracic amplitude showed non significant results when we compared the 1st session to the 20th session.



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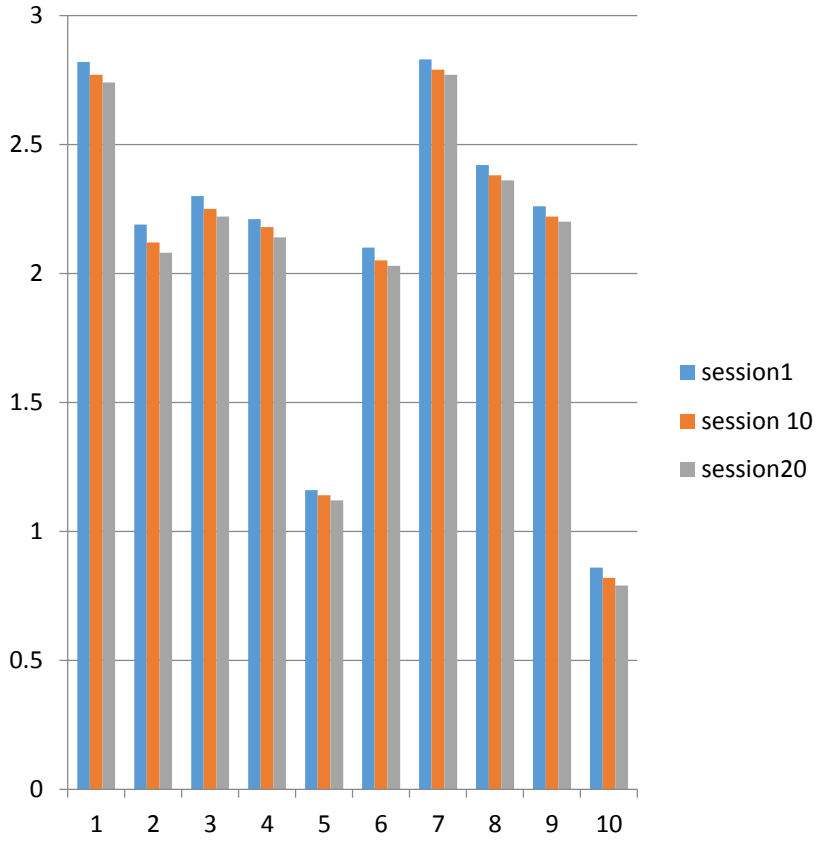
# GROUP B( EMG BIOFEEDBACK): THORACIC AMPLITUDE

The thoracic amplitude showed synchrony with abdominal amplitude when we compared the 1st session to the 20th session. This synchrony can be used as a treatment modality.



# GROUP A( MANUAL) : ABDOMINAL AMPLITUDE

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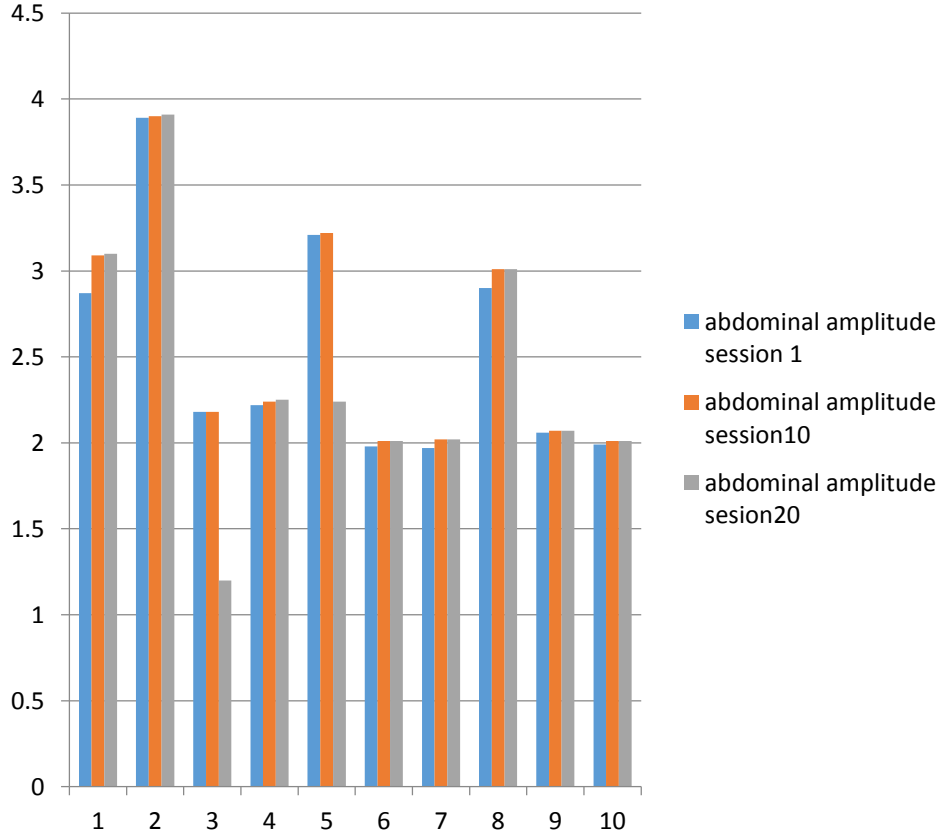
Patients given the manual treatment showed non significant results when we compared the 1st and the 20th session.



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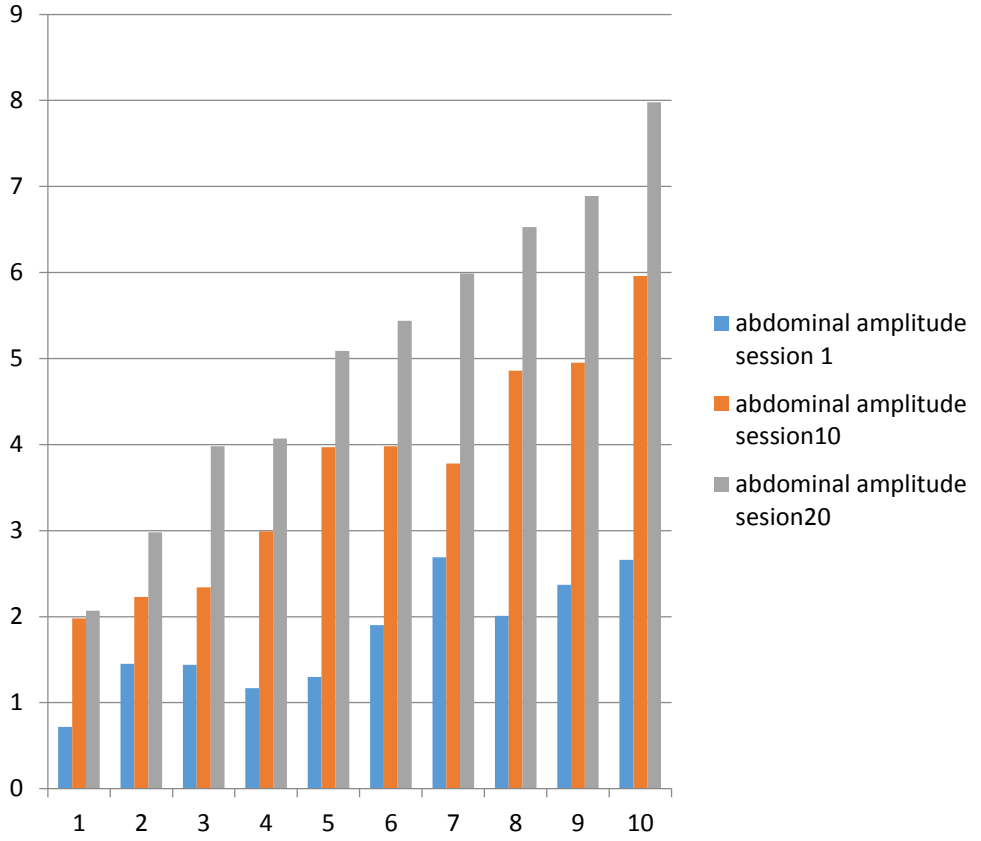
# GROUP B( EMG BIOFEEDBACK): ABDOMINAL AMPLITUDE

EMG Biofeedback showed significant results in abdominal amplitudes when we compared 1st session to the 20th session.



# DISCUSSION



- In this study it was found that Group B ( EMG biofeedback) showed significant reduction in thoracic amplitude and significant increase in abdominal amplitude as compared to Group A ( Manual).
- It was found that in Group B there was a highly significant change in the abdominal amplitude with p value > 0.01 though there was not much significant change in the thoracic amplitude.
- It was found in both Group A and B, the changes in the thoracic amplitude were significant in Group B and the changes in abdominal amplitude were highly significant in Group B again.

# EMG BIOFEEDBACK

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- The Biofeedback training with electromyography EMG biofeedback is a method of retraining muscle by creating new feedback systems as a result of the conversion of myoelectrical signals in the muscle into visual and auditory signals. EMG uses surface electrodes to detect a change in skeletal muscle activity, which is then fed back to the user usually by a visual or auditory signal, so biofeedback training helps in giving your brain the signal to work accordingly.

- Biofeedback has been used for more than fifty years in rehabilitation to facilitate normal movement patterns after injury . It is the technique of providing biological information to patients in real-time that would otherwise be unknown. This information can sometimes be referred to as augmented or extrinsic feedback, that is feedback that provides the user with additional information, above and beyond the information that is naturally available to them as opposed to the sensory (or intrinsic) feedback that provides self-generated information to the user from various intrinsic sensory receptors

# FURTHER RESEARCHES RECOMMENDATION

In this study we have taken obese population, in further studies we can study on various disorders which leads to thoraco abdominal paradox.

- Further we can asses the volumes and capacity and can compare the difference pre and post biofeedback training

- There is an effect of heart rate variability training on hypertensive patients and research has already been presented at cardiomersion 2014, tokyo,japan
- Further studies are required to assess the synchrony between HRV training and respiratory training.

# CONCLUSION



- EMG biofeedback can be affective mode of treatment for thoraco-abdominal paradox.
- It can be used in various conditions such as obesity, kyphosis and postural related disorders.
- EMG Biofeedback can improve the respiratory compliance of patient thus improving the quality of life.

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