



RESEARCH ARTICLE

EFFECT OF QUAKE DEVICE TRAINING ON ENHANCEMENT OF DRAINAGE IN PATIENTS WITH CHRONIC BRONCHITIS

^{1,*}Bassem Salah El Din Mohamed, ¹Prof. Dr. Nesreen Ghareeb El Nahas, ²Prof. Dr. Hoda Ibrahim Fahim and ³Prof. Dr. Azaa Abd El Azia Abd El Hady

¹Assistant Professor of Physical Therapy for Cardiovascular Respiratory, Disorder and Geriatric, Faculty of Physical Therapy Cairo University

²Professor of Public Health, Faculty of Medicine Ain-Shams University

³Professor of Physical Therapy for Cardiovascular, Respiratory Disorder and Geriatric, Faculty of Physical Therapy, Cairo University

ARTICLE INFO

Article History:

Received 20th February, 2019

Received in revised form

24th March, 2019

Accepted 17th April, 2019

Published online 30th May, 2019

Keywords:

Quake Device-posture
Drainage –Chronic Bronchitis.

ABSTRACT

This study was conducted to determine the Effect Of Quake Device Training On Enhancement Of Drainage In Patients With Chronic Bronchitis. **Subjects:** Forty patients from both sexes (22 women and 18 men)were diagnosed clinically according to GOLD 2016 have moderate (GOLD 2) COPD with age ranged from 40-60years enrolled in the study. They were chosen from outpatient clinic of chest department in Internal Affairs Police Hospitals. **Methods:** They were assigned into two groups equal in numbers. **Group (A):** Twenty patients (12 females, 8 males) received Quake device twice daily, 3time/week for 8 week plus breathing exercises (diaphragmatic and localized breathing exercises), **Group (B):** Twenty patients received (10 females, 10 males) received postural drainage twice daily that was carried out according to sputum anatomical presentation revealed in the chest radiograph (x- ray)., 3time/week for 8 week plus breathing exercises (diaphragmatic and localized breathing exercises). They were assessed by taking blood samples to measure arterial blood gases (Pao₂, Paco₂, pH, Hco₃) using arterial blood gases analyzer. **Results:** There was significant difference when comparing between pre and post-treatment mean values of the measured arterial blood gases as for **group A** it showed percentage of improvement in Pao₂(mmHg) (23.27%), Paco₂ (mmHg) (12.89%),pH(3.87%) and Hco₃ (mmHg)(35.3%) improvement while **group B** The results showed a much lesser improvement asPao₂(mmHg) (14.25%), Paco₂ (mmHg)(6.18%), [H (mmHg) (2.4%) and forHco₃ (mmHg) (16.74%).**Conclusion:** It was concluded that management of removing secretions with quake and posture drainage is likewise important by both methods with furthermore noticeable enhancement in quake training than in posture drainage.

INTRODUCTION

Chronic pulmonary disease (COPD) were being the most common and major cause of lung-related disability that needed pulmonary rehabilitation and care for patients with chronic lung disease based on a growing body of scientific evidence (Anderson et al., 2017) the main symptoms of COPD include shortness of breath and cough with sputum production (COPD is a progressive disease, meaning it typically worsens over time. Eventually everyday activities, such as walking or getting dressed, become difficult. In COPD, it may take longer to breathe out than to breathe in. Chest tightness may occur but is not common and may be caused by another problem. Those with obstructed airflow may have wheezing or decreased sounds with air entry on examination of the chest with a stethoscope. The devices of respiratory physiotherapy have emerged which offer Alternatives to standard CPT which are less time-consuming and offer greater independence to the patient with chronic lung disease.

*Corresponding author: Bassem Salah El Din Mohamed

Assistant Professor of Physical Therapy for Cardiovascular Respiratory, Disorder and Geriatric, Faculty of Physical Therapy Cairo University.

Alternative respiratory physical therapy methods in order to facilitate and improve mobilization of mucus from airways, through which better lung ventilation and improved pulmonary function can be achieved. These devices are safe and offer acceptable airway clearance to conventional CPT. The Quake is also a pipe-shaped device with a manually operated rotating handle that creates the oscillations on the bowl. The frequency of oscillation is, therefore, controlled by how quickly the handle is rotated. Rotating the handle slowly creates a low-frequency oscillation and a higher expiratory pressure. Rotating the handle quickly provides high-frequency oscillations and a lower expiratory pressure. The theoretical benefits of OPEP have been described as a two-fold increase in airway clearance.

PATIENTS AND METHODS

This randomized and control study was conducted to the effect of Quake device training on enhancement of drainage in patients with Chronic Bronchitis. Forty patients from both sexes (22 women and 18 men) were diagnosed clinically according to GOLD 2016 have moderate (GOLD 2) COPD with age ranged from 40-60 years enrolled in the study for

eight weeks. They were chosen from outpatient clinic of chest department in Internal Affairs Police Hospitals (police hospitals) and were assigned into two groups equal in numbers.

Group (A): Twenty patients (12 females, 8 males) received Quake device twice daily, 3time/week for 8 week plus breathing exercises (diaphragmatic and localized breathing exercises) and

Group (B) : Twenty patients received (10 females, 10 males) received postural drainage twice daily, 3time/week for 8 week plus breathing exercises (diaphragmatic and localized breathing exercises).

For evaluation: Blood samples were taken to measure arterial blood gases were (Pao₂, Paco₂, Ph, Hco₃) using arterial blood gases analyzer (RADIOMETER- ABL800 FLEX blood gas analyzer) then Weight and height Scale: to measure height and weight to calculate BMI Wt (kg) / Ht (cm²),

For training: Quake device training for group (A).Postural drainage, for group (B) postural drainage was carried out according to sputum anatomical presentation revealed in the chest radiograph (x- ray). Age, weight, height, and body mass index values were recorded as physical characteristics of the patients. Patients in group (A) used quake device in sitting position were advised to take deep breath and hold it for 3-5 sec. The patient had the mouthpiece firmly sealed to the lips and were asked to inhale and Exhale completely, while the handle will be rotated at a steady and comfortable rate of (half to one rotation/sec.) This allows control of vibration as it depends on a hand-turned crank, like a fishing reel, It was recommended that the procedure to be repeated at 6 times, this constituted, One set and 10 such sets were given interspersed with a rest period for 10 min. Patients were advised to suppress the desire to cough during these cycles later. They were advised to exhale forcefully to aid airway clearance. Diaphragmatic and localized birthing exercises was carried out after each session. This procedure was applied 3 time/week for 8 week (Amit et al., 2012). Postural drainage, for group (B) postural drainage was carried out according to sputum anatomical presentation revealed in the chest radiograph (x-ray).positioning was carried out with the patient either sitting or laying comfortable in bed. Each drainage position was maintained for 20 minutes . percussion, vibration and Shaking were used as adjuncts to postural drainage . Postural drainage was done twice daily 3time/week for 8 week.Diaphragmatic and localized birthing exercises was carried out after each session (Telaet et al., 2010)

Statistical analysis: The data was collected from patients and classified into pre and post training values. Data was statistically described in terms of mean± standard deviation (±S.D).Paired (t) test was used to compare the results pre and post training in the same group. Unpaired (t) test was used to compare the result pre and post in the two groups. All statistical analyses were significant at 0.05 of probability (p≤ 0.05).

RESULTS

Comparing the mean values of Pao₂ (mmHg) among the two groups: The results of group (A) revealed that, pre-treatment mean ± SD value was 50.7 ± 3.03, while that of post-treatment was 62.5 ± 3.55.

According to paired t-test; the significant difference was revealed (p= 0.000) when comparing between pre and post-treatment mean values (MD= 11.8) as shown in table (1) and figure (1) and % of improvement= 23.27 %. The results of group (B) revealed that, pre- treatment mean ± SD value was 49.8 ± 3.53, while that of post- treatment was 56.9 ± 3.96. According to paired t-test; the significant difference was revealed (p= 0.000) when comparing between pre and post-treatment mean values (MD= 7.1) as shown in table (1) and figure (1) and % of improvement= 14.25 %.

Comparing the mean values of Paco₂ (mmHg) among the two groups: The results of group (A) revealed that, pre-treatment mean ± SD value was 41.1 ± 2.27, while that of post-treatment was 35.8 ± 1.7. According to paired t-test; the significant difference was revealed (p= 0.000) when comparing between pre and post- treatment mean values (MD= 5.3) as shown in table (1) and figure (2) and % of improvement= 12.89 %. The results of group (B) revealed that, pre- treatment mean ± SD value was 41.2 ± 2.26, while that of post- treatment was 38.65 ± 2.46. According to paired t-test; the significant difference was revealed (p= 0.000) when comparing between pre and post- treatment mean values (MD= 2.55) as shown in table (1) and figure (2) and % of improvement= 6.18 %.

Comparing the mean values of PH (mmHg) among the two groups: The results of group (A) revealed that, pre- treatment mean ± SD value was 7.49 ± 0.1, while that of post- treatment was 7.2 ± 0.11. According to paired t-test; the significant difference was revealed (p= 0.000) when comparing between pre and post- treatment mean values (MD= 0.29) as shown in table (1) and figure (3) and % of improvement= 3.87 %. The results of group (B) revealed that, pre- treatment mean ± SD value was 7.5 ± 0.11, while that of post- treatment was 7.33 ± 0.09. According to paired t-test; the significant difference was revealed (p= 0.000) when comparing between pre and post-treatment mean values (MD= 0.18) as shown in table (1) and figure (3) and % of improvement= 2.4 %.

Comparing the mean values of Hco₃ (mmhg) among the two groups: The results of group (A) revealed that, pre-treatment mean ± SD value was 32.57 ± 2.62, while that of post- treatment was 21.07 ± 3.3. According to paired t-test; the significant difference was revealed (p= 0.000) when comparing between pre and post- treatment mean values (MD= 11.5) as shown in Table (1) and figure (4) and % of improvement= 35.3 %. The results of group (B) revealed that, pre- treatment mean ± SD value was 31.95 ± 3.04, while that of post- treatment was 26.6 ± 3.62. According to paired t-test; the significant difference was revealed (p= 0.000) when comparing between pre and post- treatment mean values (MD= 5.35) as shown in table (1) and figure (4) and % of improvement= 16.74 %.

DISCUSSION

Chest physiotherapy (CPT) with bronchial drainage is the standard treatment for mobilization and removal of airways secretions in many types of respiratory dysfunction especially in chronic lung disease, such as cystic fibrosis, bronchiectasis, bronchitis, bronchial asthma, primary ciliary dyskinesia syndrome. CPT has been shown to be effective in maintaining pulmonary function and prevention or reduction of respiratory complications in patients with chronic respiratory diseases (Papadopoulou et al., 2008).

Table 1. Statistical Analysis of measured arterial blood gases for both groups throughout the study:

Pao ₂ (mmHg)	Group (A)		Group (B)	
	Pre Training	Post Training	Pre Training	Post Training
Mean ± SD	50.7 ± 3.03	62.5 ± 3.55	49.8 ± 3.53	56.9 ± 3.96
MD	11.8		7.1	
% of improvement	↑23.27 %		↑14.25 %	
t-value	35		29.64	
p-value	0.000		0.000	
Level of Significant	S		S	
Paco ₂ (mmHg)	Group (A)		Group (B)	
	Pre Treatment	Post Treatment	Pre Treatment	Post Treatment
Mean ± SD	41.1 ± 2.27	35.8 ± 1.7	41.2 ± 2.26	38.65 ± 2.46
MD	5.3		2.55	
% of improvement	↑12.89 %		↑6.18 %	
t-value	25.67		13.81	
p-value	0.000		0.000	
Level of Significant	S		S	
pH (mmHg)	Group (A)		Group (B)	
	Pre Treatment	Post Treatment	Pre Treatment	Post Treatment
Mean ± SD	7.49 ± 0.1	7.2 ± 0.11	7.5 ± 0.11	7.33 ± 0.09
MD	0.29		0.18	
% of improvement	↑3.87 %		↑2.4 %	
t-value	10.07		9.64	
p-value	0.000		0.000	
Level of Significant	S		S	
Hco ₃ (mmHg)	Group (A)		Group (B)	
	Pre Treatment	Post Treatment	Pre Treatment	Post Treatment
Mean ± SD	32.57 ± 2.62	21.07 ± 3.3	31.95 ± 3.04	26.6 ± 3.62
MD	11.5		5.35	
% of improvement	↑35.3 %		↑16.74 %	
t-value	19.26		17.99	
p-value	0.000		0.000	
Level of Significant	S		S	

Pre: Before application of treatment Post: After eight weeks of treatment.SD: Standard Deviation. MD: Mean Difference. % of improvement: Percentage of improvement. t-value: Paired and Un-paired t-test value. p-value: Probability value. S: Significant.

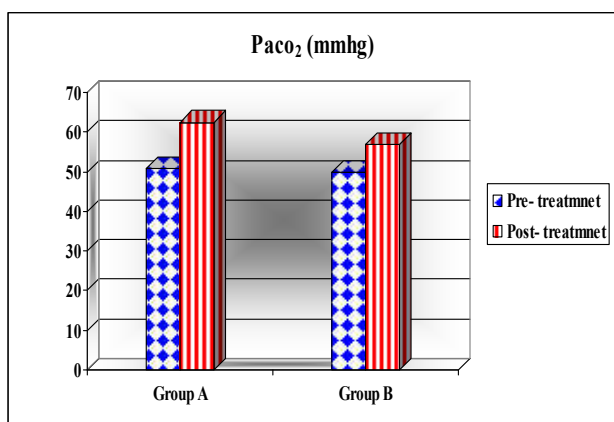


Fig. 1. Pre and post treatment mean values of Pao₂ (mmHg) among the two groups

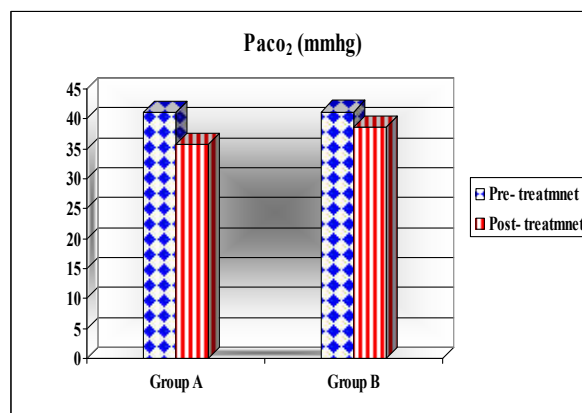


Fig. 2. Pre and post treatment mean values of Paco₂ (mmHg) among the two groups

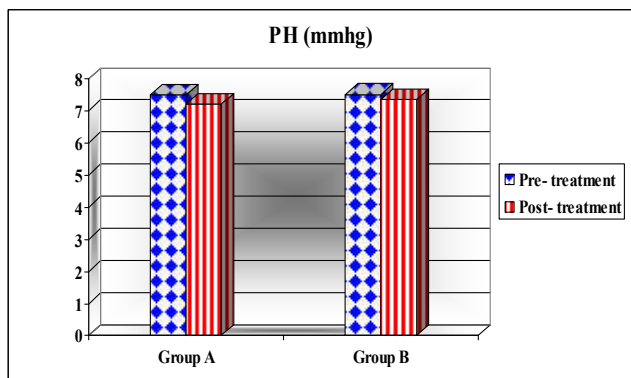


Fig. 3. Pre and post treatment mean values of PH (mmHg) among the two groups

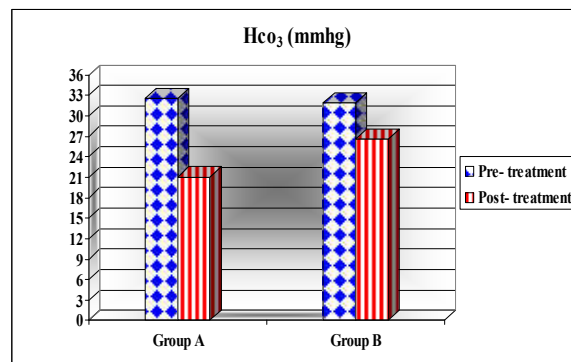


Fig. 4. Pre and post treatment mean values of Hco₃ (mmHg) among the two groups

The results of our study were consistent with results achieved by Bellone et al., 2000 who stated that the used treatments of posture drainage, flutter and ELTGOL were effective in removing secretions without causing any undesirable effect on oxygen saturation in patients with chronic bronchitis exacerbation. Because the techniques other than postural drainage allow patients to do their treatment by themselves, they might be valid alternatives to postural drainage and should be considered very attractive first choices of CPT in the treatment of chronic bronchitis exacerbation. Furthermore, Flutter and ELTGOL are more effective than postural drainage in prolonging the secretion-removal effect, which suggests a more homogeneous drainage of the bronchial tree. The results in blood gases in this study that was reflected on the easier way to remove secretion coincided with the results achieved by Rogers 2005 who declares that devices which have an oscillatory component which consider intra-or extra-thoracic oscillations is of great benefit for bronchial hygiene. Exhalation through these devices generates both oscillations of positive pressure in the airways and repeated accelerations of expiratory airflow that have been shown to result in improved sputum clearance. Furthermore, a study done by Fink and Mahlmeiter. 2002 who stated that the oscillating PEP maneuver consists in making the patient take a breath with a volume greater than the tidal volume, but without reaching total lung capacity, and then performing a non-forced expiratory activity without surpassing the functional residual capacity delayed the patient fatigue or discomfort. Papadopoulou et al., 2008 evaluated the effectiveness of current respiratory physical therapy devices, including PEP, HFCWO, oral high-frequency oscillation, IPV, incentivespirometry (IS), Flutter R, Acapella R, and RC-Cornet R. were observed to be more efficient in mucus evacuation, which was confirmed by pulmonary function tests, while HFCWO and IPV proved as effective as CPT.

Beside these effective results for alternative CPT devices a study done by El-Nahas et al. 2011 who studied the effect of flutter device on the functional capacity of COPD patients in relation to oxygen saturation and they declares that the benefit of removal of secretions improves the ventilation perfusion ratio that was added to the results of improved pulmonary functions which also agreed with the results in our study. In clinical practice the application and physiological effects of improving airway clearance are of great importance that was discussed by Olsen et al., 2015 who aimed in their study to describe the purpose, clinical application and underlying physiology of PEP when it is used to increase lung volumes, decrease hyperinflation or improve airway clearance. Intra or extrathoracic oscillations expressed as quake (Intrathoracic) or Posture drainage (Extrathoracic) both are of great benefit of patients according to their indications and more important their contraindications in choosing the suitable maneuver to apply with the patient as to ensure the patients compliance to treatment as well as his / her benefit as mentioned in our study. That was supported by Linz and Wirth, 2012 who reported that intrathoracic oscillations during obstructive apneas disturb ventricular repolarization that was in contrast to the benefits mentioned in the behalf of Intra-thoracic oscillations that may be generated orally and created using variable resistances within the airways generating controlled oscillating positive pressure which mobilizes respiratory secretions.

When the oscillation frequency approximates the resonance frequency of the pulmonary system, end bronchial pressure oscillations are amplified and result in vibrations of the airways. These vibrations loosen mucus from the airway walls.

Conclusion

It was concluded that management of removing secretions with quake and posture drainage is likewise important by both methods with furthermore noticeable enhancement in quake training than in posture drainage.

REFERENCES

- Amit V.A., Vaishali K., Alaparthi G.k, Krishnan S and Acharya V.Z. 2012. Comparison of quake and RC-Cornet for Airway Clearance in bronchiectasis: A Randomized Crossover Trial . International journal of health sciences and Research ; 2(6): 20-27
- Anderson B., Conner K., and Dunn C. 2017. Institute for Clinical Systems Improvement. Diagnosis and management of chronic obstructive pulmonary disease (COPD). 10th edition. . Updated January. Accessed July 18.
- Bellone A., Lascioli R., Raschi S., Guzzi L., Adone R. 2000. Chest physiotherapy in patients with acute exacerbation of chronic bronchitis: effectiveness of three methods. Arch Phys Med Rehabil 2000;81(5) 558–560.
- El-Nahas NG., Ismaeil AF., Mohamed GS. 2011. Oscillating Positive Expiratory Pressure Improves Exercise Capacity in Patients with Chronic Obstructive Pulmonary Disease, Medical journal of Cairo university vol.79, N0.1:693-698.
- Fink JB., Mahlmeiter MJ. 2002. High-frequency oscillation of the airway and chest wall. Respir Care;47(7):797-807.
- Linz D. and Wirth K. 2012. Intrathoracic pressure oscillations during obstructive apneas disturb ventricular repolarisation, European Journal of Applied Physiology, Vol.(112), Issue(12):4181-4184
- Mellwaine PM., Wong LT., Peacock D. and Davidson AG. 2001. Long-term comparative trial of Positive expiratory pressure versus oscillating positive expiratory pressure (flutter) physiotherapy in the treatment of cystic fibrosis . J pediatr, 138: 845-849.
- Olsen MF., Lannefors L., Westerdahl E. 2015. Positive expiratory pressure-common clinical applications and physiological effects. Respiratory Medicine, Elsevier, ScienceDirect, vol.(109), Issue(3):297-307.
- Papadopoulou A., Tsanakas J., Dimou G. and Papadopoulou O. 2008. Current devices of respiratory physiotherapy. Hippokratia ; 12(4) :211-220.
- Papadopoulou A., Tsanakas J., Dimou G. and Papadopoulou O. 2008. Current devices of respiratory physiotherapy. Hippokratia ; 12(4) :211-220.
- Telaet B.A., Osho O.A., Abiose J.O. and Akinbo S.R. 2010. A Efficacy of postural drainage combined With percussion and cycle of breathing technique in patients with chronic bronchitis. Journal of Medical and Applied Biosciences ; 2:99-107.
