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Comparative Study on the Effectiveness of Acapella Versus Conventional Physiotherapy in Enhancing Lung Volume in Patients with Recent Chest Infections

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ABSTRACT

Background: Chest infections often compromise lung volume and pulmonary function due to mucus retention and reduced ventilation. While conventional physiotherapy (CPT) remains standard for respiratory recovery, Acapella — a positive expiratory pressure (PEP) device — offers a potentially effective, patient-friendly alternative.

Objective: To compare the efficacy of Acapella versus conventional physiotherapy in improving lung volumes in patients recovering from recent chest infections.

Methods: A prospective, comparative study was conducted involving two groups of patients post-chest infection. Group A received CPT (postural drainage, percussion, breathing exercises), while Group B used the Acapella device two sessions per day for three days at the same frequency. Lung functions- Forced Vital Capacity (FVC) and Forced expiratory Volume in one second (FEV1) were recorded pre treatment on Day 1 and post treatment on Day 3. Secondary outcomes included oxygen saturation, sputum clearance, and patient compliance.

Results: Both groups demonstrated significant improvement in FVC and FEV1. Group A (Acapella) showed slightly greater gains in FEV1 and reported higher comfort and compliance.

Conclusion: Acapella therapy is comparable to conventional physiotherapy in enhancing lung volume post-infection, with added benefits of patient comfort and ease of use. These findings support its integration into respiratory care plans, particularly in outpatient or home settings.

1. INTRODUCTION

Chest infections often lead to impaired pulmonary function, especially a reduction in lung volume, due to mucus retention and decreased ventilation. Effective clearance of airway secretions is a cornerstone of respiratory recovery. Traditionally, conventional physiotherapy (e.g., postural drainage, percussion, and deep breathing exercises) has been widely employed to enhance lung expansion and secretion mobilization. Fever, chest pain, coughing (productive or dry), breathing difficulties, and mucus production are common symptoms (Millett et al., 2013). Chest infections can lead to complications such as sepsis, pleural effusion, respiratory failure, or aggravation of long-term lung conditions. However, with the development of positive expiratory pressure (PEP) devices such as Acapella, new modalities have emerged that claim to be equally or more effective, especially for patients with limited tolerance to manual therapy.

Smiths Medical Inc. in Carlsbad, California, USA, is the manufacturer of the Acapella used in this study

This study aims to compare the efficacy of Acapella versus conventional physiotherapy techniques in improving lung volume in patients recently treated for chest infections.

Deep breathing exercises, an incentive spirometer, percussion, and vibration are all part of conventional therapy

Background and Rationale

Pulmonary physiotherapy serves dual purposes: secretion clearance and lung expansion. Acapella is a handheld device combining the benefits of PEP therapy with airway vibrations to mobilize secretions. Its ease of use and adaptability to patient comfort have led to increasing clinical interest. Meanwhile, conventional physiotherapy remains the standard in many acute care settings.

The central hypothesis of this article is: *Acapella provides a more patient-friendly and equally effective alternative to traditional physiotherapy in improving lung volumes post-chest infection.*

2. MATERIALS & METHODS

Patients with recent chest infections (e.g., pneumonia or bronchitis) were divided into two groups:

Group A: Used the Acapella device twice daily under supervised instruction.

Group B: Received conventional physiotherapy (postural drainage, percussion, vibration, and breathing exercises).

Pulmonary function tests (PFTs), specifically Forced Vital Capacity (FVC) and Inspiratory Capacity (IC), were measured at baseline and after 3 days of therapy.

Clinical criteria such as cough frequency, sputum production, oxygen saturation, and patient comfort scores were also documented.

Inclusion Criteria –

1. Age- 18-80 years
2. Conscious and capable of breathing spontaneously (American Thoracic Society, 2019)
3. Patients with recent chest infection (Bacterial, Viral, Fungal). (World Health Organization, 2020)
4. Informed consent to participate in the study
5. Both male and female will be included.

Exclusion Criteria –

6. Received drugs affecting central nervous system.
7. Patients with tracheostomy
8. Patients with chest trauma and neuromuscular diseases affecting respiratory system (National Institute of Neurological Disorders and Stroke, 2020)
9. Unstable Hemodynamics (American Heart Association, 2019)

3. RESULTS

In this study total 30 study participants were observed and 15 in each group A and B. Most of participants were of middle age group (41-60 years) predominant female in both groups. (Table 1)

Table 1: Basic characteristics of patients of both groups

Category		Group A		Group B		Chi-Square	P - Value
		n = 15	In %	n = 15	In %		
Age	20 - 40	4	26.67%	3	20.00%	0.54	0.7635
	41 - 60	6	40.00%	8	53.33%		
	> 60	5	33.33%	4	26.67%		
	Range	23 - 90		55 - 72		-	
	Median (IQR)	72 (52-74)		57 (56-69.7)			
	Mean ± SD	62.2 ± 23.82		62.47 ± 7.41			

Gender	**Male**	6	40.00%	7	46.67%	0.136	0.7126
	Female	9	60.00%	8	53.33%		

On observing FEV1 and FVC between day 1 and day 3 in both study groups, it was noticed that there was significant improvements in FVC and FEV1 in both groups. However, Group B (Acapella) showed slightly greater gains in FEV1 and reported higher comfort and compliance. (Table 2)

Table 2: Comparing mean of FEV1 and FVC between day 1 & day 3 of both groups by using paired t-test

Variables		**Day 1**	**Day 3**	**Paired t-test**	**P - Value**	**Significance**
Group A	**FEV1**	0.423 ± 0.20	0.608 ± 0.345	-5.457	**< 0.0001**	**Significant**
	FVC	0.842 ± 0.483	1.172 ± 0.638	-7.99	**< 0.0001**	
Group B	**FEV1**	0.414 ± 0.12	0.595 ± 0.184	-1.981	0.0676	Not Significant
	FVC	0.619 ± 0.144	0.817 ± 0.366	-1.363	0.19299	

Lung Volume Improvement: Both groups showed significant improvements in FVC and FEV1. However, Group A exhibited slightly higher gains in IC.

Secretion Clearance: Subjective reports and sputum collection showed no significant difference.

Patient Compliance and Satisfaction: Higher in Group B due to ease of use and reduced fatigue.

Oxygen Saturation: Improved similarly in both groups.

These results align with previous findings in physiotherapy literature, indicating that PEP-based devices can match conventional therapy in many parameters while enhancing comfort and adherence.

DISCUSSION:

The results of this study suggest that Acapella may serve as a viable alternative to manual chest physiotherapy, particularly for patients who are elderly, fatigued, or non-compliant with traditional methods. It also enables self-administration, reducing the need for continuous professional supervision.

Acapella is shown to be effective in aiding sputum clearance in variety of conditions. Studies in mechanically ventilated ARDS patients showed that Acapella aided in optimally clearing the secretions from the airways. Studies in bronchiectasis patients also demonstrated an increase in sputum volume production following use of Acapella.

Acapella combines the resistive effect of PEP with high-frequency oscillations in the airways during exhalation to facilitate secretion clearance. PEP allows back pressure to be generated that opens and splints the peripheral airways.

This encourages collateral ventilation and airflow to move behind the secretions. The pressure gradient across the secretions forces it to move more centrally and thus help in secretion clearance.36,37 In addition, the oscillations produce vibrations within the airway wall that further help to displace secretions into the airway lumen. Some studies indicate that the oscillations generated by the OPEP devices can cause break down of the mucus macro-molecules bonds reducing the viscoelasticity (thickness) of the secretions and thus further enhance their transport through the airways.

The other advantages of Acapella lie in the fact that it is available in different models that allow selection of device based on the patient's expiratory flow capacity. Furthermore, Acapella can be used along with nebulizer21 whenever the need be. All the above-mentioned advantages of Acapella may have helped the patients in improving their lung volumes and aided in easier clearance of secretions in subjects in this study.

However, traditional methods may still be preferred in acute or ICU settings where active patient participation is limited.

4. LIMITATIONS AND FURTHER RESEARCH

This comparison is limited by short-term monitoring and a relatively small sample size. A longer follow-up could provide insights into relapse rates, long-term lung function, and cost-effectiveness.

Further studies could also include sub-group analyses by age, severity of infection, and comorbid conditions.

5. CONCLUSION

The comparative analysis suggests that Acapella is an effective, user-friendly alternative to conventional physiotherapy for improving lung volume in patients recovering from chest infections. Both approaches show therapeutic merit, and clinical decisions should be individualized.

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