



# Comparison of Active Cycle Breathing Technique (ACBT)/Forced Expiration Technique (FET) vs. Flutter Device (Therapeutic Lung Flute®) in Facilitating Sputum Expectoration Among Stable COPD patients at UST Hospital



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## BACKGROUND

The changes in the airways such as mucous gland enlargement and goblet cell hyperplasia results in cough and persistent mucus production while bronchial squamous metaplasia disrupts mucociliary clearance in chronic obstructive pulmonary disease. Mucociliary clearance is the most important defense mechanism of respiratory system and its impairment results in a vicious cycle of colonization and infection of bronchi with pathogenic organisms. Airway clearance techniques are available and their efficacy needs to be looked into.

## METHODS

A randomized controlled open labelled trial was done from July 1, 2011 to October 31, 2011 at the University of Santo Tomas Hospital Out-Patient Department. A total of twenty two patients (22) were randomized and trained to lung flute group (n=12) and active cycle breathing technique/force expiration technique (ACBT/FET) group (n=10). Patients were instructed to collect sputum using standard measuring cup during a 15 minute-session per day of these airway clearance techniques done for 3 days. Patients graded the level of difficulty of sputum expectoration pre and post intervention using the visual analog score.

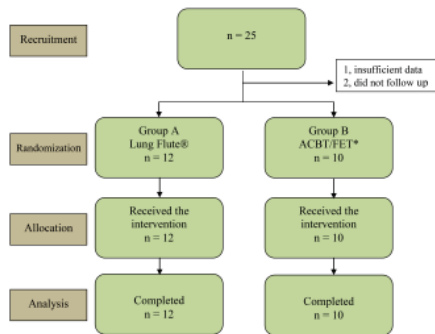


Figure 1. Schematic diagram of screening and randomization. \*Active Cycle Breathing Technique/Forced Expiratory Technique

## RESULTS

Patients were mostly in the 5th and 6th decade of life and majority (86%) were males with an average of 40 pack year smoking history. The sputum volume recorded in 3 treatment days for both groups were presented as mean volumes in ml  $\pm$  2 standard deviation.

The mean sputum volume for 3 days was relatively higher among patients on ACBT/FET (6.58 + 2.94 ml) compared to the Lung Flute group (5.90 + 2.99 ml) however there was no statistical difference (p=0.525). Sixty seven percent (8/12) of the subjects expectorated mucopurulent sputum in the lung flute group compared to 50% (5/10) in the ACBT/FET group. The mean visual analog score of the Lung Flute group was 6.83  $\pm$  1.11 with a relief of difficulty to VAS 2.8  $\pm$  0.63 post-treatment compared to the ACBT group with pre-treatment and post-treatment score of 6.6  $\pm$  0.97 and 3.0  $\pm$  0.74, respectively. There was significant relief in difficulty of sputum expectoration for both groups with a p-value of <0.0001.

Table 1. Demographic and Clinical Characteristics of Subjects.

Characteristics	TLF (n=12)	ACBT/FET (n=10)	p-value
AGE (years)	64.83 $\pm$ 12.9	67.8 $\pm$ 6.3	0.492
SEX			1.000
Male	10 (83.33%)	9 (90%)	
Female	2 (16.67%)	1 (10%)	
SMOKING (in pack years)	40.83 $\pm$ 9.86	40.2 $\pm$ 7.41	0.869
FEV1, L/s	1.05 $\pm$ 0.243	1.003 $\pm$ 0.25	0.452
FEV1/FVC	55.17 $\pm$ 12.09	51.7 $\pm$ 10.52	0.486

Age, Smoking, FEV1 and FEV1/FVC, were presented in Mean  $\pm$  Std Dev; Independent T-test was used to test significance. Sex was presented in Count (Percentage). Chi-Square test was used to test significance. A p-value of < 0.05 (95% level of confidence) is significant.

Table 3. Comparison of sputum volume between two groups.

Days	Sputum Volume in mL TLF (n=12)	Sputum Volume in mL ACBT (n=10)	Total (n=22)	Within-Subjects (Days)* p-value	Within-Subjects (Days Groups)** p-value	Between-Subjects (Groups)*** p-value
Day 1	6.46 $\pm$ 2.91	6.75 $\pm$ 2.9	6.59 $\pm$ 2.84	0.141	0.852	0.525
Day 2	6.25 $\pm$ 3.45	7.00 $\pm$ 3.5	6.59 $\pm$ 3.41			
Day 3	5.00 $\pm$ 2.61	6.00 $\pm$ 2.42	5.45 $\pm$ 2.52			

Sputum Volume was presented in Mean  $\pm$  Std Dev; Repeated Measures ANOVA was used to compare the 3 readings (days 1-3) of TLF vs ACBT; \*Within-Subjects (Days) - p-value of the days (1-3), determining if there is significant difference in the sputum volume from the different days (1-3) \*\*Within-Subjects (Days/Groups) - p-value of the interaction effect of Days and Group (TLF vs ACBT), determining if the interaction effect of days and group is significant \*\*\*Between-Subjects (Groups) - p-value of groups (TLF vs ACBT), determining if there is significant difference in the sputum volume from the different groups.

## CONCLUSION

The use of flutter devices (Therapeutic Lung Flute®) is as effective as the Active Cycle Breathing Technique (ACBT)/Forced Expiration Technique (FET) in facilitating sputum expectoration among stable COPD patients.

Table 2. Measured Clinical Parameters Pre and Post-Treatment

Clinical Parameters	TLF (n=12)	ACBT/FET (n=10)	p-value (TLF vs ACBT)*
Oxygen Saturation			
Pre-treatment	96.14 $\pm$ 1.11	96.77 $\pm$ 0.55	0.102
Post-treatment	96.28 $\pm$ 0.9	96.97 $\pm$ 0.73	0.065
p-value (Pre vs Post)*	0.677	0.217	
Blood Pressure			
Systolic			
Pre-treatment	123.89 $\pm$ 8.27	124.67 $\pm$ 7.89	0.825
Post-treatment	125 $\pm$ 8.1	127.33 $\pm$ 3.06	0.372
p-value (Pre vs Post)*	0.489	0.259	
Diastolic			
Pre-treatment	75 $\pm$ 11.06	73.33 $\pm$ 3.14	0.651
Post-treatment	75.83 $\pm$ 3.79	75.33 $\pm$ 2.81	0.734
p-value (Pre vs Post)*	0.784	0.168	
Pulse Rate			
Pre-treatment	81.08 $\pm$ 3.74	79.73 $\pm$ 6.88	0.587
Post-treatment	82.08 $\pm$ 4.02	80.17 $\pm$ 6.4	0.424
p-value (Pre vs Post)*	0.117	0.308	
Respiratory Rate			
Pre-treatment	20.61 $\pm$ 1.31	20.1 $\pm$ 1.66	0.428
Post-treatment	20.86 $\pm$ 0.98	20.83 $\pm$ 1.31	0.955
p-value (Pre vs Post)*	0.523	0.010	

Clinical Parameters were presented in Mean  $\pm$  Std Dev

\*Independent T-test was used to test significant difference between groups - TLF vs ACBT

\*\*Paired T-test was used to test significant difference between time - Pre vs Post

Table 4. Sputum Characteristic.

SPUTUM CHARACTER	LUNG FLUTE GROUP n = 12	ACBT/FET n = 10
Mucopurulent	8 (67%)	5/10 (50%)

Table 5. Visual Analog Score

	TLF (n=12)	ACBT (n=10)	TOTAL (n=22)	p-value (TLF vs ACBT)*
VAS Pre-treatment	6.83 $\pm$ 1.11	6.6 $\pm$ 0.97	6.73 $\pm$ 1.03	0.610
VAS Post-treatment	2.8 $\pm$ 0.63	3 $\pm$ 0.74	2.91 $\pm$ 0.68	0.508
VAS Difference (Pre-Post)	3.83 $\pm$ 0.94	3.8 $\pm$ 1.23	3.82 $\pm$ 1.05	0.943
p-value (Pre vs Post)*	<0.001	<0.001	<0.001	

VAS Score was presented in Mean  $\pm$  Std Dev

\*Independent T-test was used to test significant difference between groups - TLF vs ACBT

\*\*Paired T-test was used to test significant difference between time - Pre vs Post