EFFECTIVENESS OF FLUTTER MUCUS CLEARANCE DEVICE ON LUNG FUNCTION IN COPD SUBJECTS WITH RETAINED SECRETION

A Dissertation Submitted In Partial Fulfillment

of the Requirements for the Degree of

MASTER OF PHYSIOTHERAPY

With Specialization In

ADVANCED PHYSIOTHERAPY IN ORTHOPAEDICS

Register Number: 27091415

Submitted to

THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY
Chennai

JKK MUNIRAJAH MEDICAL RESEARCH FOUNDATION

COLLEGE OF PHYSIOTHERAPY

Department Of Post Graduate Studies

Komarapalayam - 638 183

April - 2011

EFFECTIVENESS OF FLUTTER MUCUS CLEARANCE DEVICE ON LUNG FUNCTION IN COPD SUBJECTS WITH RETAINED SECRETION

Internal Examiner:

External examiner:

A Dissertation Submitted In Partial Fulfillment

of the Requirements for the Degree of

MASTER OF PHYSIOTHERAPY

To

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

Chennai

April – 2011

CERTIFICATE

This is to certify that the Research work entitled "**EFFECTIVENESS OF FLUTTER MUCUS CLEARANCE DEVICE ON LUNG FUNCTION IN COPD SUBJECTS WITH RETAINED SECREATION"** was carried out at JKK MUNIRAJAH MEDICAL RESEARCH FOUNDATION COLLEGE OF PHYSIOTHERAPY, KOMARAPALAYAM, affiliated to The Tamilnadu **Dr. M.G.R. Medical university,** Chennai – 32, towards partial fulfillment for the award of Degree of **"Master of Physiotherapy"** course with **"Advanced Physiotherapy in cardio respiratory"** as specialization. This work was done under the supervision and guidance of Professor Mrs**.S.SHARMILA, M.P.T., M.I.A.P**

Mr. D. KANNAN, M.P.T. MIAP,
Principal
JKKMMRF College of Physiotherapy,
Komarapalayam.

CERTIFICATE

This is to certify that the research work entitled "**EFFECTIVENESS OF FLUTTER MUCUS CLEARANCE DEVICE ON LUNG FUNCTION IN COPD SUBJECTS WITH RETAINED SECREATION"** was carried out at JKK MUNIRAJAH MEDICAL RESEARCH FOUNDATION COLLEGE OF PHYSIOTHERAPY, KOMARAPALYAM, affiliated to The Tamilnadu Dr.M.G.R. Medical university, Chennai – 32, towards partial fulfillment for the award of Degree of "Master of Physiotherapy" course with "Advanced Physiotherapy in Cardio-respiratory" as specialization. This work was done under my supervision and guidance.

Mrs. S. SHARMILA, M.P.T. MIAP,

Professor,
JKKMMRF College of Physiotherapy,
Komarapalayam.

CONTENTS

ACKNOWLEDGEMENT

The investigator expresses her whole hearted gratitude to **"THE GOD ALMIGHTY"** who has given countless opportunities and parents and brother who laid the foundation for knowledge and wisdom.

The investigator extends sincere thanks to **Dr. J.K.K MUNIRAJAHH, M.Tech**., (**Bolton**), Managing Director, JKKKMRF college of Physiotherapy for providing all necessary infrastructure for an excellent P.G. Programme.

The investigator expresses deep concern and gratitude to **Mr. D.KANNAN, M.P.T, (Neuro), MIAP,** Principal, JKKMRF college physiotherapy for his valuable suggestion, guidance and support.

The investigator acknowledges with all gratitude and deep indebtedness for the guidance and encouragement provided by **Mrs. S.SHARMILA, M.P.T.** (**Cardio**), **MIAP**, Professor JKKMRF college of Physiotherapy.

The investigator expresses much gratitude to **Mr.JOHN VINOTH RAJ, M.P.T., (Neuro), Mr.S.SARAVANAN, M.P.T., (Ortho), Mr.A.AYYAPPAN, M.P.T. (Neuro), Mr.K.NANDHA KUMAR, M.P.T., (Neuro), Mr.C.RAVISANKAR, M.P.T. (Cardio), Mr.A.SARAVANAN, M.P.T. (Cardio)** for their valuable guidance

The investigator expresses much gratitude to **Mr.UDHAYAKUMAR, B.P.T., Mrs.KOHILAVANI, B.P.T., Ms.MEENA, B.P.T., Mrs.THENMOZHI, B.P.T.,** for their valuable support.

The investigator also has much gratitude to **Mr.K.DHANAPAL, M.Sc.,** JKKMRF college of Physiotherapy, Statistician for his unrelenting devotion and determination for statistical excellence.

The investigator also has much gratitude to **Mr.V.MOHANRAJ & TEAM,** for helping the project run smoothly.

The investigator is also indebted to his friends for their support and criticism during the work of this dissertation.

The investigator extends her sincere thanks to subjects who took part in the study.

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

INTRODUCTION

Chronic obstructive pulmonary disease is the most common lung disease and major causes of disability and death in the world population. WHO estimates that by 2000, 2.74 million copd people died, world wide.

Copd is the most common disorder, affiliating 10-15% of adults over the age of 40 Yrs and prevalence is increasing.

According to American thoracic society 1952, chronic bronchitis is defined as chronic cough, expectoration for at least for 3 months for 2 consecutive years. Most common causes are cigarette smoking (Vs surgeon general, 1984), air pollution, frequent bronchial infection and certain occupation.

Institution based pulmonary rehabilitation programs incorporating the airway clearance technique have shown to improve HRQL (Health related quality of life), reduces dyspnoea and improve exercise tolerance. Mechanical device such as the flutter valves is able to provide the benefits of improved airway clearance in COPD patients.

Flutter a positive expiratory pressure technique eliminates mucus from the bronchial airway and thus improves bronchial hygiene in chronic bronchitis patients.

By using flutter device there was a statistically significant improvement in FEV_1 and FVC, whether patients were pretreated with

mucus clearance device there was a significant improvement in lung function compared to baseline with combined bronchodilator therapy.

Therefore the present study is intended to analyze the effectiveness of flutter device on lung function in copd subjects with retained secretion.

AIM OF STUDY

The aim of the study is to analyze the effectiveness of flutter mucous clearance device on lung function in copd subjects with retained secretion.

OBJECTIVES OF THE STUDY

- To study the effectiveness of flutter device on mucous clearance in copd subjects and retained secretion.
- To study the effectiveness of lung function in copd with retained secretion.

HYPOTHESIS

Null Hypothesis

There will be no significant difference between pre and post test value of flutter device on mucus clearance and lung function in copd subjects with retained secretion.

Alternate Hypothesis

There will be significant difference between pre and post test value of flutter device on mucus clearance and lung function in copd subjects with retained secretion.

REVIEWS OF LITERATURE

NORMAN WOLKOVE et al., (2010)

Conducted this study with 23 copd patients, to determine the use of mucus clearance device (MCD) could improve the bronchodilator response delivered by a metered – dose inhaler. And concluded immediately after the use of MCD there was a statistically significant improvenment in FEV_1, and FVC.

ANGSHU BROWMIKA et al., (2008)

Conducted a study in patients with copd experience mucus hypersecretion. This review examines the current evidence base and best clinical practise in the area of airway clearance. Mechanical device such as flutter valves, positive end expiratory pressure, high frequency chest wall oscillation may be able to provide the benefits of improved airway clearance.

CHIEN LING SU et al., (2007)

A Prospective, randomized, controlled study of 32 patients with COPD. They have been divided into 2 groups, of either PEP+FET(n=16) or FET alone(n=16) for 4 weeks. Finally the result shows, at the end of 4 weeks intervention PEP + FET had shows significant increase in diffusing capacity (DLCO).PEP therapy as an adjunct to FET .

L.C.de LIMAA et al., (2004)

Conducted this study to show the mechanical behavior of the flutter VRP_1, a respiratory physiotherapy device designed to aid sputum clearance and showed information that could be beneficial to the professional of the respiratory physiotherapy.

HRISTARA – PAPADOPOULON et al., (2003)

Conduced a study to show the effectiveness of current devices of respiratory physiotheraphy, like PEP, High frequency chest wall oscillation, oral high frequency oscillation, Incentive spirometer, the flutter and the cornet, and concluded these devices, help the removal of mucus from the airways and improvement of pulmonary function.

SHARON M.H. et al., (2003)

Conducted a randomized study with 15 bronchiectasis patients, divided into 3 groups: postural drainage and breathing and coughing; flutter valve + Breathing and coughing; Breathing coughing along, applied for 15 minutes daily in all groups and concluded flutter device was perceived as being the most effective in clearing secretion.

ANDREA BELLONE et al., (2000)

Conducted a study to compare the short-term effects of postural drainage, oscillating positive expiratory pressure (using flutter device)

and expiration with the glottis open in the lateral posture (ELTGOL) with 10 chronic bronchitis patients, at the end of the treatment, concluded that FLUTTER and ELTGOL techniques were more effective in prolonging secretion removal in chronic bronchitis.

ANNE E HOLLANDI et al., (2000)

A clinical trials of airway clearance techniques (ACT_S) in COPD have shown a physiological rationale for the use of ACT_S in COPD. Positive Expiratory pressure theraphy or autogenic drainage may prove effective in COPD Patients.

SKARIA SMIBI et al., (1998)

Conducted a randomized controlled study by, comparing the effect of positive pressure technique using flutter device, over forced expiratory pressure technique, with 30 chronic bronchitis patients divided into 2 groups (Group A and Group B) each of 2 session per day for 15 minutes for 5 days weekly for totally 2 weeks and concluded at the end of 2^{nd} week, significant improvement in bronchial hygiene was found with independent 't' test at in Group-A when compared with Group – B.

LANGENDERFER et al., (1998)

Conducted the studies on the efficacy of old and new mucus clearance techniques and the recommendation for different patients. Percussion and postural drainage was the traditional method of facilitating mucus clearance, but the hazards and contraindication along

with poor patient complaints led to the development of alternative therapy like autogenic drainage, PEP, flutter valve therapy and high-frequency cheast compression. These alternatives depends on the ability, motivations, preference, and resource of each patient.

MATERIALS AND METHODOLOGY

MATERIALS

- Personal data
- Flutter device
- Stethoscope
- Computerized Spirometer
- Sputum box

METHODOLOGY

Study Design

Quasi experimenta study

Study Setting

The study was conducted at the outpatient department in JKKMMRF College of physiotherapy, and District Head Quarters Hospital, Erode, under the supervision of concerned authority.

Study sampling

A total of 30 subject were selected by purposive random sampling method after due consideration to the inclusion and exclusion criteria. They were divided into Group A and Group B, with 15 subjects in each group.

STUDY DURATION

Duration of study : 1 Month

Group A: Flutter Device by the session of 5 to 15 perday along with general medication

Group B : Chest physiotherapy for 5 to 15 minutes along with general medication.

INCLUSION CRITERIA

- Sex : Both
- Age : 40 – 60
- Stable clinical subject
- Chronic bronchitis (COPD)
- Smokers
- History of copd for past 2 years

EXCLUSION CRITERIA

- Pneumothorax
- Overt right sided heart failure
- Severe heart, Renal, Liver, Blood system and endocrine system dysfunction
- Active hemoptysis
- Acute coronary syndrome

PARAMETERS

Pulmonary Function Test

- Force vital capacity (FVC)
- Forced Expiratory volume in one second (FEV_1)

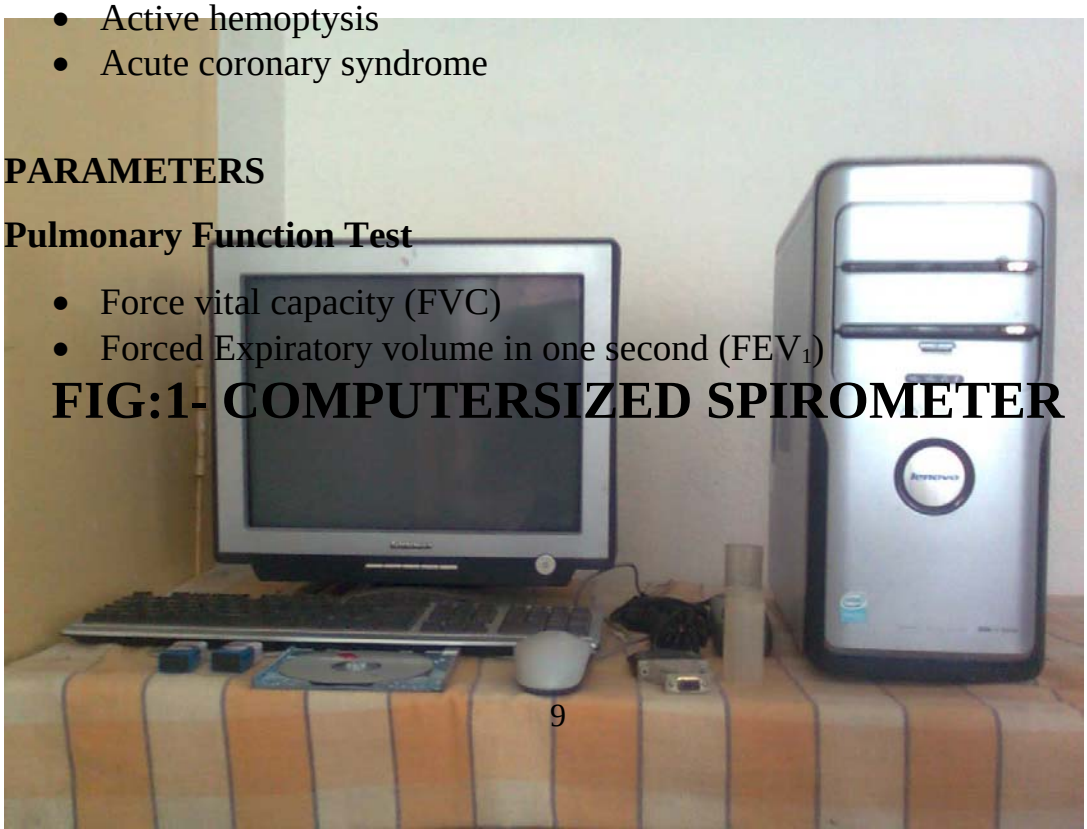
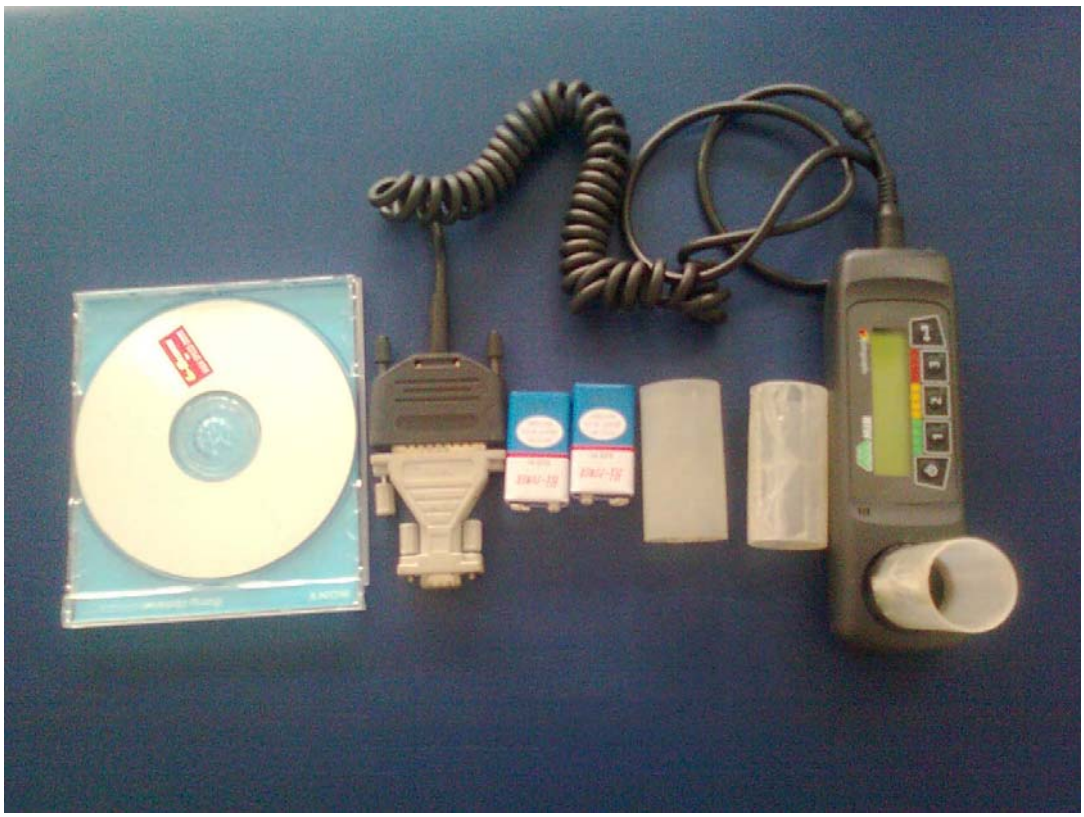


FIG:1- COMPUTERSIZED SPIROMETER

FIG:1- ASSESSORY



PARAMETER DESCRIPTION

Computerization of pulmonary function testing is forcing rewrites of time – honored protocols and shifting responsibilities from technician to machine. Pulmonary function testing measures how well we are breathing. Spirometry is a simple test to measure how much (volume) and how fast (flow) you can move air into and out of our lungs, and provide visual and auditory feed back as the patient breaths.

FVC (FORCED VITAL CAPACITY)

The Maximum volume of air forcibly expired after a maximum inspiration. It consist of tidal volume + inspiratory and Expiratory reserve volume. Normal value of FVC is 4.7 to 5 liters.

FEV1 (FORCED EXPIRATORY VOLUME PER SECOND)

The Volume of air forcibly expired after a maximum inspiration in one second. Normal value of FEV1 is 4.3 – 4.6 liters.

PROCEDURE

- 30 Subjects were selected by convenient sampling method with due consideration of inclusion and exclusion criterias, each group consist of 15 subjects.
- Experimental group-A were given general medicine along with flutter device
- Control group-B subjects were given general medicine with chest physiotherapy.
- Pre test values were obtained for both experimental and control group.
- After the intervention the post test values were obtained for both experimental and control group.
- The pre and post test mean values of both the groups were compared.

FIG:2- COMPUTERSIZED SPIROMETER WITH PATIENT

STATISTICAL TOOLS

The collected data was subjected to statistical analysis using paired and unpaired ‘t' test to find out the research effectiveness.

Paired “t” Test

The paired “t” test will be used to find out the statistical significance between pre and post test values of flutter device by using lung function in Group A and B subjects.

Formula: Paired t-test

$$S = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{S}$$

d = Difference between the Pre Test Vs Post Test

$\bar{d}$ = Mean difference

n = Total number of subjects

S = Standard deviation

Unpaired T-Test :

The unpaired t-test was used to compare the statistically significant difference between Group A and B subjects treated with flutter device by using Lung function test.

$$S = \sqrt{\frac{(n_1 - 1)S_1^{\,2} + (n_2 - 1)S_2^{\,2}}{n^1 + n_2 - 2}}$$

$$t = \frac{\left|\overline{x_1} - \overline{x_2}\right|}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

n_1 = Total number of subject in Group - A

n_2 = Total number of subject in Group – B

x_1 = Difference between Pre test Vs post test of Group - A

$\overline{x_1}$ = Mean Difference between Pre test Vs post test of Group – A

x_2 = Difference between Pre test Vs post test of Group – B

$\overline{x_2}$ = Mean Difference between Pre test Vs post test of Group – B

S = Standard deviation

DATA PRESENTATION

TABLE – 1

Sl.No.	FVC in liters				FEV_1 in liters			
	Group – A		Group – B		Group – A		Group – B	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1.	3.2	3.3	2.1	2.12	3.2	3.8	3.0	3.2
2.	2.30	2.41	1.52	2.18	2.30	2.41	2.13	2.17
3.	4.54	4.63	3.12	3.16	4.54	4.58	4.29	4.50
4.	2.8	2.64	3.02	3.17	2.8	2.12	3.9	3.50
5.	4.97	5.10	2.0	2.22	4.97	5.4	2.89	3.10
6.	2.29	3.06	2.07	3.12	2.29	2.44	2.18	3.2
7.	2.04	2.06	2.15	2.33	2.04	2.12	1.18	1.29
8.	2.45	2.49	2.04	2.18	2.45	2.58	2.40	2.43
9.	3.77	3.78	2.15	3.93	3.77	3.82	3.70	3.88
10.	3.85	3.93	2.47	3.52	3.85	3.98	3.80	3.88
11.	3.57	3.64	2.15	2.42	3.57	3.78	3.58	3.65
12.	2.92	3.94	3.08	3.12	2.92	2.98	2.88	3.91
13.	2.33	2.52	3.11	3.21	2.33	2.47	2.02	2.17
14.	2.08	2.12	2.07	2.14	2.08	3.02	2.08	2.15
15.	1.12	1.49	2.33	2.47	1.12	1.49	1.07	1.17

FVC- Forced Vital Capacity

FEV_1 – Forced Expiration Volume in 1 Second

DATA ANALYSIS & INTERPRETATION

TABLE II

FVC in Liters	Mean	Mean Diff.	SD	Paired T value
Pre Test	2.94	0.2	0.08	10.15
Post test	3.14			

The paired “t” value 10.15 was greater than that of the tabulated value 2.15, which showed a significant difference at 0.05 the level of between pre & post test result. The pre test mean was 2.94 & post test mean was 3.14 with a mean difference of 0.2. This showed a **significant difference** in FVC level between pre & post scores in **experimental group.**

GRAPH-1: PRE Vs POST TEST OF FVC AMONG GROUP-A

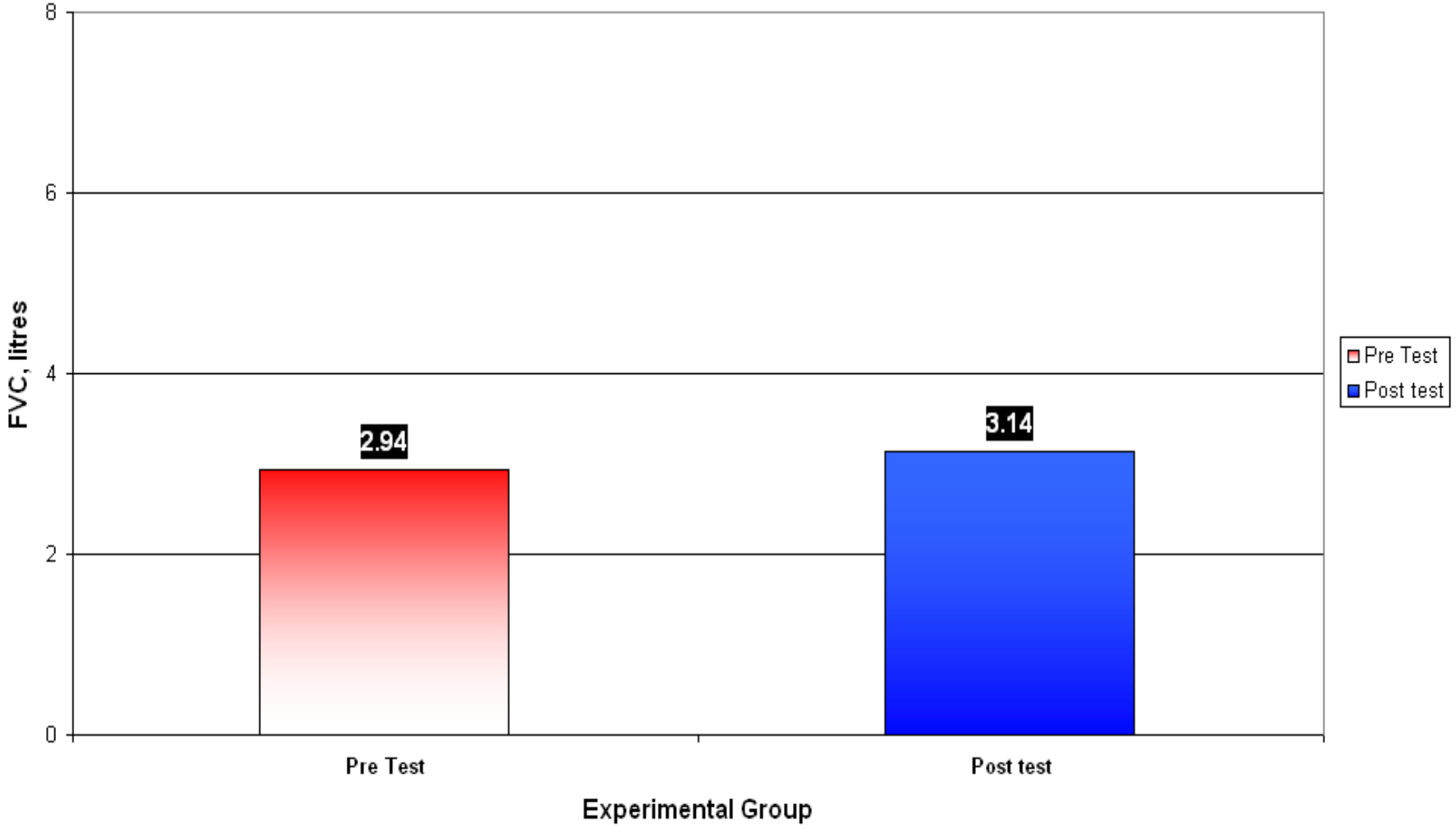


TABLE III

FVC in Liters	Mean	Mean Diff.	SD	Paired 't' Value
Pre Test	2.35	0.4	0.19	8.96
Post test	2.75			

The paired 't' value 8.96 greater than that of the tabulated 't' value 2.15 which showed no significant difference at 0.05 level between pre vs. post test result. The pre test mean was 2.35 & post test mean 2.75 with mean difference only 0.4. This showed **no significant difference** in FVC level between pre & post level of **control group.**

GRAPH-2: PRE Vs POST TEST OF FVC AMONG GROUP-B

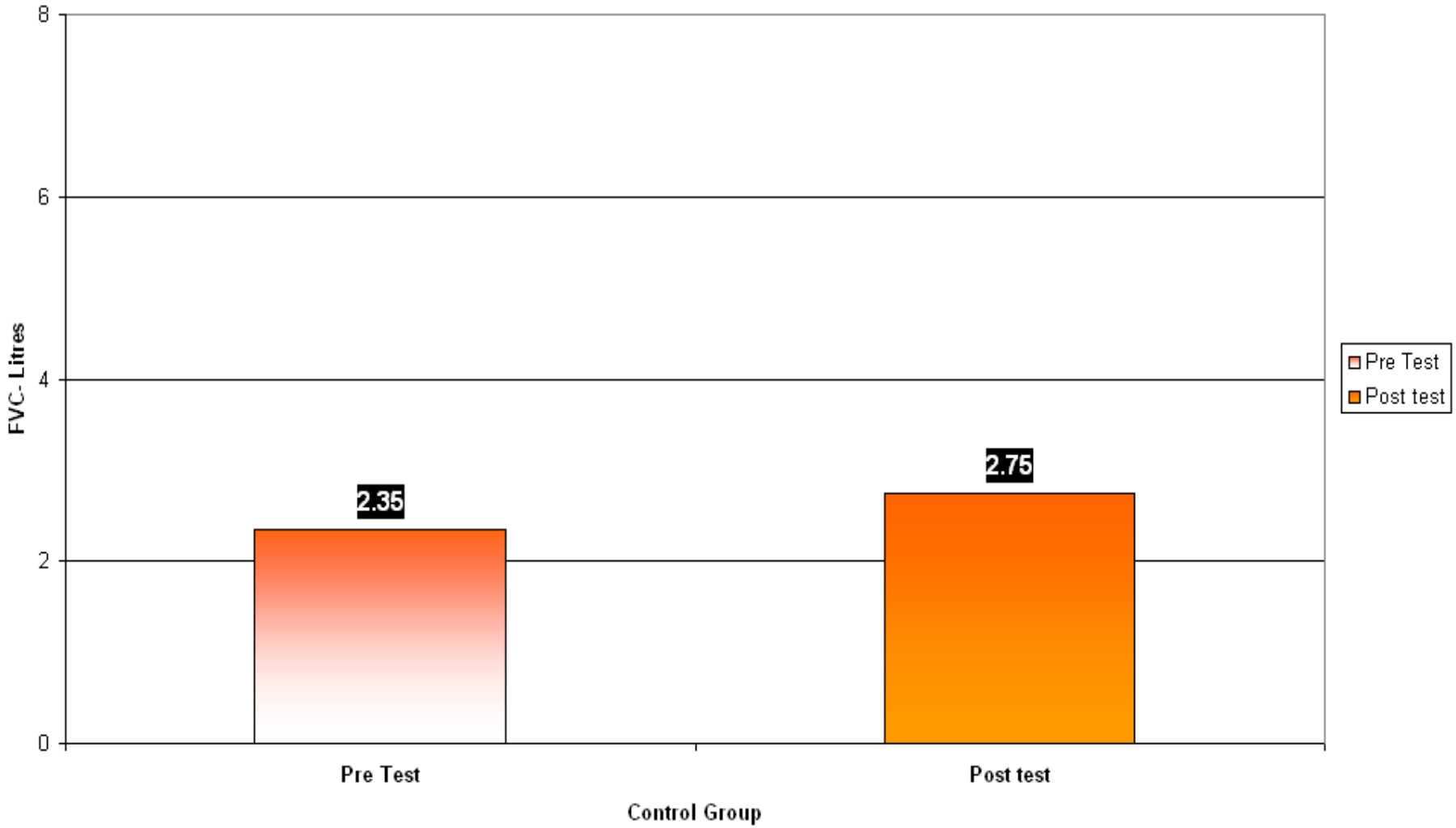


TABLE IV

FVC in Liters	Mean	Mean Diff.	SD	Unpaired T – value
Post Test (Experimental group)	3.14	0.39	0.13	7.95
Post test (Control Group)	2.75			

The unpaired ‘t’ value 7.95 was greater than that of the tabulated value 2.05 which showed a significant difference at the level of 0.05 between post FVC of control & experimental group.

The post test mean of control group being 2.75 & that of experimental group being 3.14 with mean difference of 0.39. This showed a significant difference in FVC level between post test score between **control & experimental group.**

GRAPH-3: COMPARISON OF POST TEST VALUES OF FVC BETWEEN GROUP-A, GROUP -B

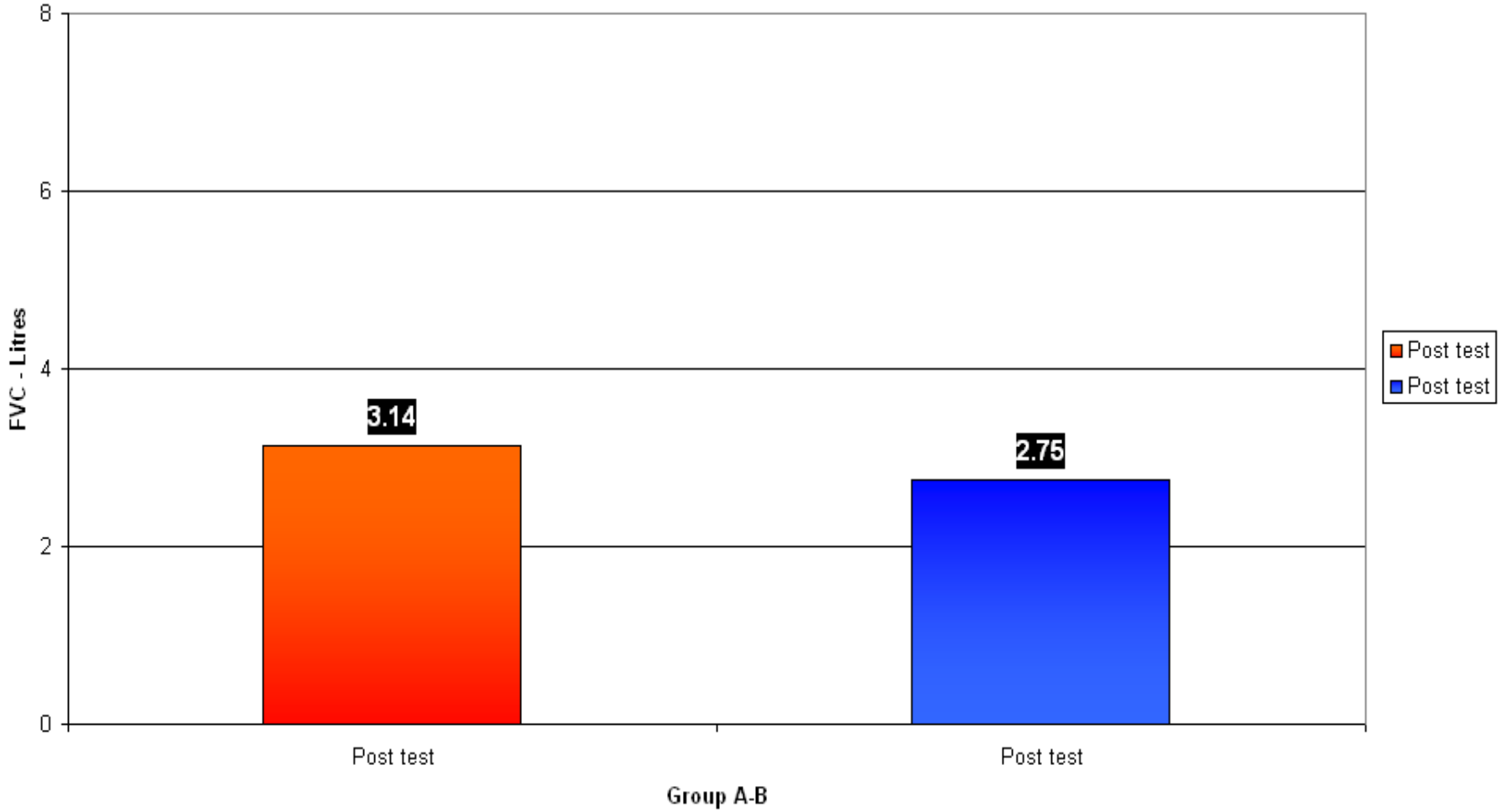


TABLE V

FEV_1 Liters / Sec	Mean	Mean Diff.	SD	Paired T – value
Pre Test	2.94	0.19	0.08	13.06
Post test	3.13			

The paired ‘t’ value 13.06 was greater than that of the tabulated value 2.15 which showed significant difference at 0.05 level between pre vs. post test result. The pre test mean was 2.94 & post test mean was 3.13 with mean difference of 0.19. This showed **significant difference** in FEV_1 level between pre & post level **in experimental group.**

GRAPH-4: PRE VS POST OF FEV_1 AMONG GROUP-A

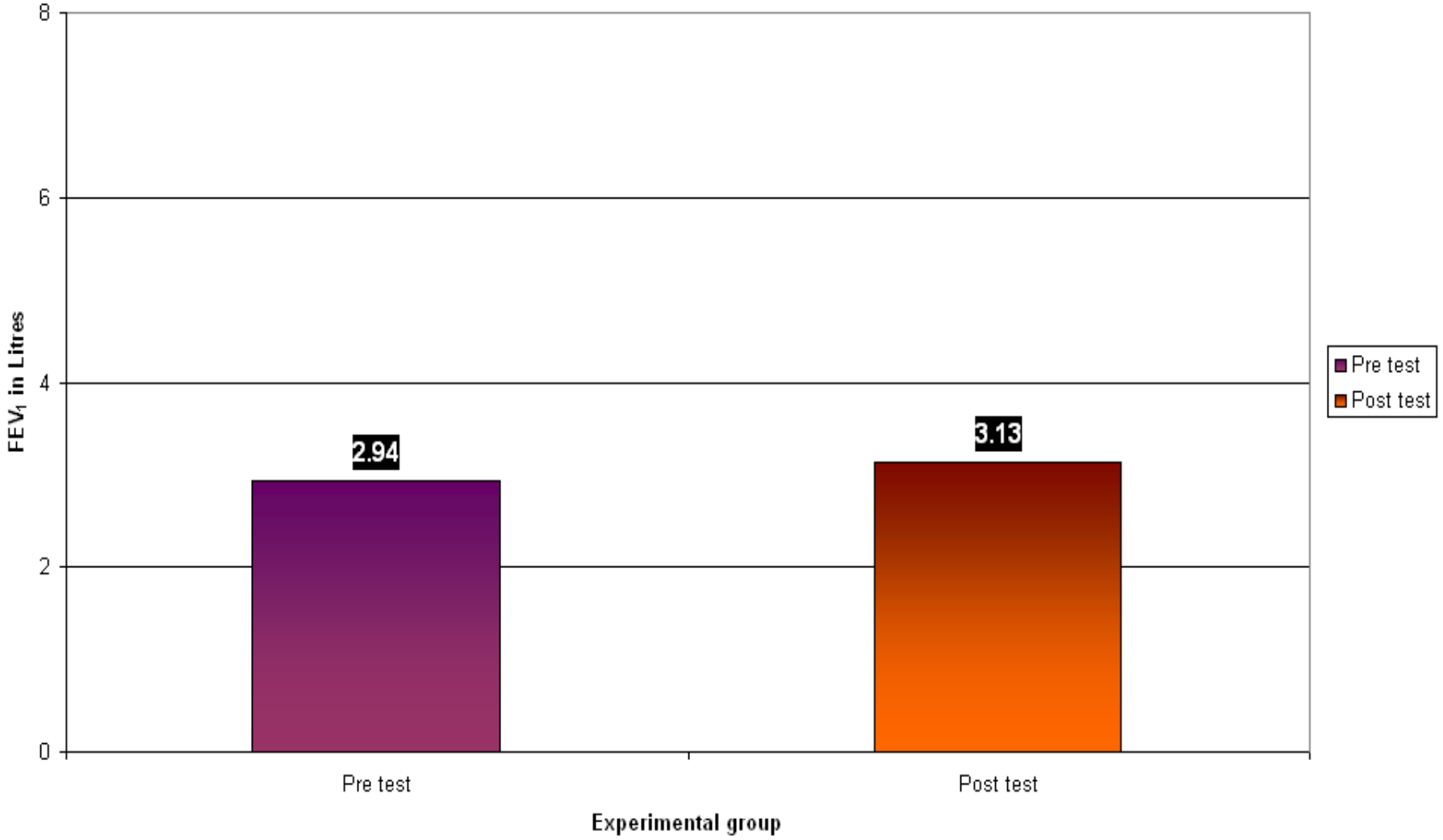


TABLE VI

FEV_1 Liters / Sec	**Mean**	**Mean Diff.**	**SD**	**Paired T – value**
Pre Test	2.74	0.2	0.10	10.06
Post test	2.94			

The paired 't' value 10.06 was greater than that of the tabulated 't' value 2.15 which showed no significant difference at 0.05 level between pre vs. post test result. The pre test mean was 2.74 & post test mean 2.94 with mean difference only 0.2. This showed **no significant difference** in FEV_1 level between pre & post stress level **of control group.**

GRAPH-5: PRE VS POST TEST OF FEV_1 AMONG GROUP-B

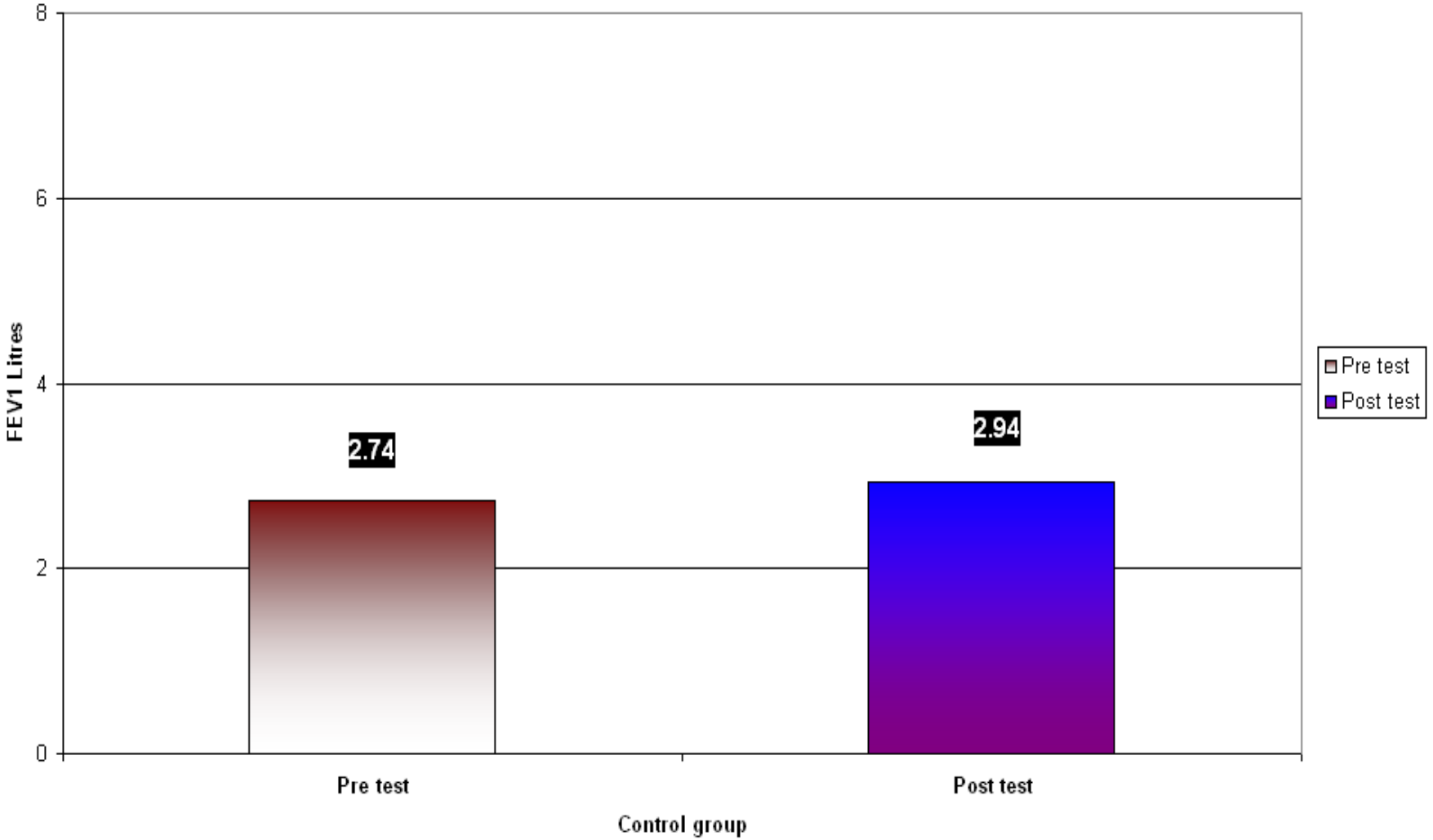


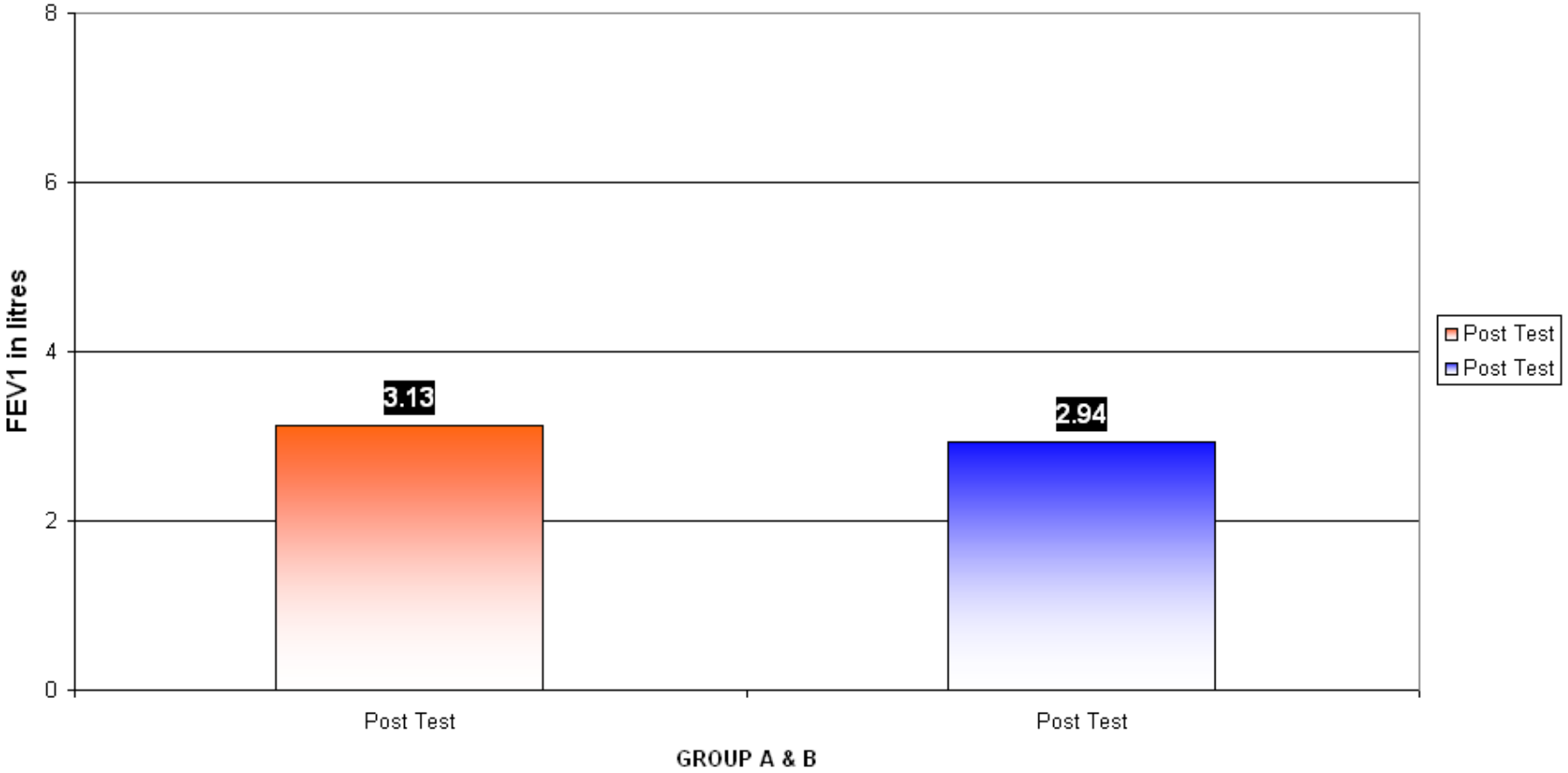
TABLE VII

FEV_1 Liters / Sec	**Mean**	**Mean Diff.**	**SD**	**Un Paired T – value**
Post Test (Experimental Group)	**3.13**	**0.19**	**0.09**	**5.93**
Post test (Control Group)	**2.94**			

The unpaired "t" value 5.93 was greater than that of the tabulated 't' value 2.05 which showed a significant difference at the level of 0.05 between post FEV_1 of **control & experimental group.**

The post test mean of control group being 2.94 & that of experimental group being 3.13 with mean difference of 1.19. This showed a significant difference in FEV_1 level between post test score between **control & experimental group.**

GRAPH-6: COMPARISON OF POST TEST OF FEV_1 AMONG GROUP A & GROUP B



DISCUSSION

The aim of the study was to assess the effectiveness of flutter mucus clearance device on Lung function in COPD subjects with Retained secretion.

TOOL SELECTION

Tool selection was based on the study of **HARISTARA – PAPADOPOULON, NORMAN WOLKOVE,** Which is highly reliable.

STUDY SELECTION

Studier done by **SHARON M.H. et al., L.C. de. LIMAA et al., ANGSHU BROWMIKA et al.,** supported the present study result of increased pulmonary function and mucus removal with flutter mucus clearance device.

In the data analysis and interpretation using forced vital capacity the post test value of controlled group was 2.75. The post test value of Experimental group was 3.14, which showed a significant different in FVC levels between post test levels between controlled and Experimental group of 0.39.

By using the Force expiratory volume in one second, the post test mean of control group was 2.94 and that of experimental group was 3.13 with mean different being .

This showed a significant difference in FEV1 and FVC level between post test scores between control and experimental groups.

REASONS FOR IMPROVEMENT

Norman wolkove 2010 found that flutter device produce a positive expiratory pressure which is turn produces a vibrating movement is the chest which looses the mucus and retained it out, thus improving the lung function in COPD subjects.

Hristara papadopoulon 2003 determine the effectiveness of current devices of respiratory physiotherapy as an alternative method. These mucus clearance devices, seem to increases patient's compliance of daily treatment, as an independent application, full control of therapy and easy use, which helps removal of mucus from the airways and improves quality of life of the patients and pulmonary function.

SUMMARY & CONCLUSION

SUMMARY

The purpose of this study was to find out the effect of Flutter mucous clearance device on Lung function in CODD subjects. The total 30 subjects of age group 40 to 60 years were diagnosed as bronchitis (COPD) from GH and OP were randomly selected for this study and they were taught to use flutter device for the period of 2 months. Before and after 2 months of training programme, the pre and post test values were measured with computerized spirometer were recorded. The paired t-test was used to compare the difference between pre and post test value.

Based on the statistical analysis the result of the study showed significant improvement in increasing Lung function by using flutter Device.

CONCLUSION

As the incidence of stress and chronic illness increase the challenge to the physiotherapist to treat Bronchitis (COPD) Patients. Flutter device increases the Lung function and reduce mucous retention.

This study concluded that there was a significant effect of flutter Mucus clearance device on Lung function in COPD subjects with retained secretion.

RECOMMENDATION

- Further studies can be conducted with positive end expiratory Pressure and High frequency chest wall oscillation with the same parameter which were followed in this study.
- Further studies can be conducted with flutter device on other respiratory conditions such as Bronchiectasis, Cystic fibrosis, Asthma etc.,
- Further Studies can be done with flutter device on Parameters like Sputum scale, dyspnoea scale etc.,
- Further studies may be done to compare the flutter device and Acapella on COPD subjects.

BIBLIOGRAPHY

1. Brannon Frances. J., **"Cardiopulmonary rehabilitation : Basic theory and Application",** F.A. Davis company, Philadelphia, 2nd Ed., 1993.
2. Cash's **"Text book of chest heart and vascular disorders for physiotherapist",** Jaypee brothers, New delhi, 4th Ed., 1993.
3. Crofton and Dougloss, **"Respiratory diseases"**, Vol-2, Blackwell Science, England, 5th Ed., 2003.
4. Davidson's, **"Principles and practice of Madicine"**, Churchill Livingstone, Philadelphia, 19th Ed., 2002.
5. Dr. Shan Siddharth.N., **"AP1 text book of medicine: The association of physician of India",** Mumbai, 7th Ed., 2003.
6. Frown Felter, **"Principles and practice of cardiopulmonary physical therapy",** C.V. Mosby company, Philadelphia; 3rd Ed., 1996.
7. Gupta.S.P., **"Statistical methodes"**, Sultanchand and Sons, New Delhi, 2000
8. Kothari.C.R., **"Research Methodology",** Vshwa Prakasham, Pun., New Delhi, 2000.
9. Guyton, **"Text book of medical physiology",** W.B. Saunder Company, Philadelphia; 9th Ed., 1988.
10. Mahajan B.K., **"Methods in Biostatistics",** Jaypee Brothers, New Delhi; 5th Ed., 1991.
11. Scotirwin, **"Cardio pulmonary physical therapy",** C.V. Mosby Company, Philadelphia; 2nd Ed.,

REFERENCES

1. Brenda M Buttonl, **"Is there a role for airway clearance techniquest in chronic obstructive pulmonary disease",** Department of physiotherapy, alfred Hospital melbourne, Australia, 2000.
2. Diomou G, **"Current devices of respiratory physiotheraphy",** 2003.
3. Sharon M.H. Tsang, **"Postural Drainage or flutter device in conjunction with breathing and coughing compared to breathing and coughing along in improving secretion removal",** Sep 2003.
4. Gillian Austinb, **"Improving mucociliary clearance in chronic obstructive pulmonary disears",** 16 Oct – 2008.
5. Skeria smibi et at., **"Effect of positive expiratory pressure technique over forced expiratory technique on bronchial hygiene in patients with moderate chronic bronchitis",** Goutham college of Physiotheraphy, Bangalore.
6. Norman Wolkove, **"Use of a Mucus clearance Device Enhances the Broncholdilator response in patients with stable COPD",** Chest Journal.
7. L.C. de, Limaa et al., **"Mechanical evaluation of a respiratory device",** 29 Sep – 2004.
8. Langender fer et al., **"Alternatives to percussion and postural Drainage",** July / august 1998 – vol 18 – Issue 4 PP 283 – 289.
9. Chien – Ling su, **"Domiciliary PEP improves pulmonary function and Exercise capacity in patients with COPD",** 2007, VOL 106, No.3

10. Andrea Bellone **“Chest physical Therapy in patients with Acute Exacerbation of Chronic bronchitis: Effectiveness of three methods”** American congress of Rehabilitation, 2000.

APPENDIX

TECHNIQUE

POSITION OF PATIENT

The patient should be seated with back straight and head slightly tilted upward so the upper airway is wide open.

As an alternative, the patient may be seated with elbows resting on a table at a comfortable level and head positioned as slightly tilted upward.

TECHNIQUES

STAGE 1- MUCUS LOOSENING AND MUCUS MOBILIZATIONS

- Make the patient to relax assume proper posture and position.
- Ask the patient to slowly inhale beyond a normal breath, but do not fill lungs completely.
- Now ask the patient to hold breath for 2 to 3 seconds.
- Now ask the patient to place the FLUTTER in Mouth, adjust tilt to feel maximum of vibrations within chest, keep checks stiff.
- Now exhale through FLUTTER at a reasonably fast but not too forceful speed, using abdominal breathing.
- Exhale beyond a normal breath, but do not empty lungs completely.

- Patient should Attempt to suppress cough.
- Make the patient to repeat stage 1 for 5 to 10 breaths.

FIG:3-FLUTTER DEVICE WITH PATIENT

STAGE 2 – MUCUS ELIMINATION

- Ask the patient to slowly inhale, filling lungs completely.
- Ask to hold the breath for 2 to 3 seconds.
- Now ask the patient to place FLUTTER in mouth, adjust tilt to feel maximum of vibrations with in chest, keep cheeks stiff.
- Ask to exhale forcefully through FLUTTER as completely as possible.
- Make the patient to repeat stage 2 for 1 to 2 breaths.
- Now the patient should initiate cough (or "huff" maneuver) and return to stage 1 and repeat full sequence (stage 1 and 2) until lungs are clear or therapy is over.

Each Session ranging from 5-15 minutes per day

TERMINATION

FLUTTER therapy is complete when no further mucus can be expectorated following several diligent sequences, and successful clearing of the airways occur is approximately 5 to 15 minutes.

INFORMED CONSENT FOR VOLUNTARY PARTICIPATION IN A RESEARCH INVESTIGATION

Name :

Age :

Sex :

Occupation :

Address for communication :

Declaration

I have fully understood the nature and purpose of the study. I accept to be a subject in this study. I declare that the above informed is true to my knowledge.

Date :

Place :

Signature of the subject

ASSESSMENT CHART

Name :

Age :

Sex :

Side :

Mode of treatment : Flutter device

Measurement

Parameter	Before treatment	After treatment
Forced vital capacity in litres		
Forced expiratory volume per second		

Signature of the investigator