Sports Scientists Views in
Indian Journal of Physical Education, Sports & Applied Sciences
I.J.P.E.S.A.S
Available Online
www.sportscientistsviews.com
Journal DOI-05-2016-44975451
UGC APPROVED JOURNAL
Scientific Journal Impact Factor-4.917

EFFECT OF UPPER EXTREMITY PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION COMBINED WITH MANUAL RESISTANCE ON RESPIRATORY FUNCTION.

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ABSTRACT

Respiratory muscle training, which applies linear resistance pressures during spontaneous breathing, has had significant effects on respiratory function and endurance..Aim of study wasto evaluate the effect of Proprioceptive neuromuscular facilitation with manual resistance in upper extremity with respiratory function. Total 45 Patients referred to medicine Physiotherapy department with cardiopulmonary conditions were screened for inclusion criteria among which 30 subjects were selected. Subjects were selected of 18 years and above with mean age group 48.600± 18.005. Participants were evaluated pre intervention with international physical activity questionnaire (IPAQ), pre and post intervention using peak flow meter for analysis of pulmonary function test . Treatment was carried out for 4 weeks. The pre mean and SD of peak flow meter was 222.76 (70.21), post mean was 226.61(61.65) with mean difference -3.855 and P value was <0.0001 which was considered extremely significant .The study concluded that PNF with manual resistance for Upper extremity, is significantly effective in improving the respiratory conditions.

Keywords: proprioceptive neuromuscular facilitation, respiratory condition, manual resistance ,upper extremity.

1. INTRODUCTION

Resistance exercise training produces several changes in muscle, such as hypertrophy, increased oxidative capacity, and changes in muscle fibre type[1,2]. These physiological adaptations are accomplished to increase muscle force, endurance, and functional exercise capacity, which are reflected in improved quality of life and independence in activities of daily living. Therefore, several applications of this type of training exist in various areas of rehabilitation, including the orthopedic and cardio-respiratory fields.

The goal of breathing exercise interventions is to minimize disabilities resulting from diseases and to prevent recurrence, rather than complete recovery from disease, developing and applying diverse programs that can prevent decreases in respiratory activities and promote the functional performance of breathing is very important. Respiratory muscle strength and endurance can be improved by various breathing exercises which can consequently improve respiratory functions. Breathing exercises using direct interventions that improve respiratory functions have been performed by diverse subjects. Many studies have been conducted, including studies of vital capacity using high frequency inspiratory muscle training for normal persons, respiratory muscle training for normal persons, pursed-lip breathing exercises performed by COPD patients, exercises combining diaphragmatic breathing exercises and pursed-lip breathing exercises, diaphragmatic breathing exercises performed by PMD patients, respiratory muscle strengthening exercises performed by inspiratory muscle weakness patients, breathing exercises using pursed-lip breathing exercises and diaphragmatic breathing exercises performed by stroke patients, forced breathing exercises, and chest expanding exercises. Although many studies have conducted respiratory muscle training based on the theory that pulmonary functions are improved through direct respiratory function strength training, it is true that these studies comprise simple self-breathing exercises or one-dimensional basic resistive breathing exercises. A study conducted by Dietz indicated that muscle strength can be improved through three dimensional spiral large scale resistive exercises using proprioceptive neuromuscular facilitation (PNF). Therefore this study examined the improvement of respiratory functions induced by direct respiratory muscle resistive exercises through the PNF respiration pattern. Although this study was limited in that the experimental subjects were normal persons, clinical grounds for actual implementation of the exercises will be prepared based on its results.

improvement in muscle strength is often a desired outcome of patient rehabilitation. To this end, therapists have a variety of training modes available. Isotonic, isokinetic, and isometric exercise represent the major classifications of strengthening exercise Isotonic exercise requires that a segment move a constant weight through a range of motion. Isokinetic exercise is performed whereby joint motion occurs at a preset ' speed or under a controlled velocity. During isokinetic exercise, varied resistance is encountered throughout the joint range of motion. Isometric exercise uses a sub maximal or maximal muscle effort with no joint motion occurring. The choice of exercise appears to influence the amount and rate of strength gain and the adaptations that occur in skeletal muscle. However, regardless of the choice of exercise, the resistance must be progressive for the most rapid strength gains to occur." The training method usually depends on the patient's type of injury, stage of recovery, and ability." Resistance training using elastic tubing seems to fall into a distinct

category. Unlike traditional resistance exercise methods, use of elastic tubing relies on the tensile properties of latex or other elastic polymers as a form of resistance. The level of resistance varies according to rate and elongation of stretch of the material. The resistance properties of tubing are often compared to the dynamics of a spring, whereby the change in length (applied force), type of material (modulus of elasticity), and cross-sectional area dictate the magnitude of resistance and the amount of potential energy stored. Since the resistance is not constant, elastic exercise is not formally considered isotonic exercise. In addition, the rate of stretch may be non-uniform, and this prohibits elastic tubing exercise from being categorized as a form of isokinetic exercise. Despite this categorical dilemma, elastic tubing exercise is commonly used for therapeutic exercise because of its low cost, simplicity, portability, versatility, and non-reliance on gravity for resistance. Elastic tubing exercise seems especially popular for shoulder rehabilitation, specific protocols and methods have been described that advocate exclusive use of elastic bands in strengthening the rotator cuff muscles. When the respiratory muscles are activated, they change the thoracic volume by providing movement of joints in the thorax thereby improving the chest wall mobility and exercise capacity in COPD patients[12]

1.1 PNF TECHNIQUES

PNF technique has develop muscular strength and endurance , joint stability, and mobility, neuromuscular control and co-ordination- all of which are aimed at improving the overall functional ability of patients. Analysis of functional development motor control, motor learning and neurophysiology .Irradiation is when maximal contractions of muscle recruits the help of additional muscle flexibility.

FIG A:D1flexion with elastic resistance.

Fig B:D2 flexion with elastic resistance.

Figa:D1 extension with elastic resistance band.

Fig b:d2 extension with elastic resistance band.

1.1.1 Pulmonary Function Test

Pulmonary function tests (PFT's) are breathing tests to find out how well you move air in and out of your lungs and how well oxygen enters your body. The most common PFT's are spirometer (spy-RAH-me-tree), diffusion studies and body plethysmography. Sometimes only one test is done, other times all tests will be scheduled, often on the same day.

An individual's lung and airway function can be assessed by using a hand held peak flow meter. These measurement is often used to diagnose and monitor asthma and other respiratory conditions. A peak flow meter is a small instrument that an individual blows into. It measures the fastest rate of air flow that they can blow out of their lungs. The air flow is recorded in liters/ min .

The normal peak flow reading will vary depending upon an individual's age, size, and sex, even the time of the day. In healthy individuals peak flow readings will vary slightly e.g. in the morning the reading will tend to be higher than in the evening. In general peak flow readings are higher in men than women due to their physical size and because they are more muscular. The taller a person is the higher their peak flow. The highest peak flow reading for an individual occurs between the age of 30-40 years. A reading of 400-600 l/min is considered normal. An individual suffering with respiratory condition would have a lower reading of 200-400 l/min.

Exercise can increase an individual's peak flow readings. This is because exercise makes the lungs stronger and this increases the lungs ability to take in oxygen.

1.2 Normal values of peak flow :

Green- the green zone is 80-100 % of your highest peak flow reading. Air is moving well through the large airways in your lungs. It means that you can do your usual activities and go to sleep without trouble.

Yellow –Lung function tests can be used to: Compare your lung function with known standards that show how well your lungs should be working. Measure the effect of chronic diseases like asthma, chronic obstructive lung disease (COPD),or cystic fibrosis on lung function. Identify early changes in lung function that might show a need for a change in treatment. Detect narrowing in the airways. Decide if a medicine (such as a

bronchodilator) could be helpful to use. Show whether exposure to substances in your home or work place have harmed your lungs. Determine your ability to tolerate surgery and medical procedures.

The aim of the study was to evaluate the effect of Pro-prioceptive neuromuscular facilitation with manual resistance in upper extremity with respiratory function.

2. METHODOLOGY

2.1 Study Setting : Hospital Setup

2.2 Study Duration: 6 months**.**

2.3 Sample Size :30

2.4 Inclusion criteria : age group between 18 years old and above. history of cardiopulmonary conditions.

2.5 Exclusion criteria : Any orthopedic and neurological condition.

2.6 Materials required : Pen, Notebook, Elastic Resistance Band.

2.7 Outcome measure : International Physical Activity Questionnaire , Peak -flow meter.

2.8 Procedure:

Initially, Synopsis was presented and approval from ethical committee was obtained. Hospitals were approached and permission for data collection was taken. Total 45 patients referred to the medicine Department with cardiopulmonary conditions were screened and 30 patients satisfying inclusion and exclusion criteria were recruited. Prior to participation, subjects were informed about study protocol and written informed consent was taken from all subjects. The International Physical Activity Questionnaire (IPAQ) was be taken to interprète the physical activity of patient. The pulmonary function was measured by peak flow meter pre-study. The lighter resistance of Elastic Band was used, based on The calculation of the percentage of elongation was as follows: % elongation = [(final length - initial length) / (initial length)] × 100. Elongation percentage was obtained through the values at each load produced in a specific colour range.[1]The pattern will be used as flexion – abduction – external rotation with the elbow extended and extension – adduction – internal rotation with the elbow extended, using the reversal of antagonists as a specific technique.[1] The training protocol consisted of 3 sets of ten repetitions, with a 60-second rest interval between sets. The training protocol consisted of 3 sessions per week for 4 weeks. Sessions were held in the late afternoon and in the early evening. Total lung capacity measure using peak-flow meter pre and post exercises.

3. RESULTS:

To evaluate the effect of Pro-prioceptive neuromuscular facilitation with manual resistance in upper extremity with respiratory function, percentage, mean and standard deviation were computed and data pertaining to this has been presented in table 1 to 4 and depicted in graph 1 & 2.

TABLE 1
DISTRIBUTION OF PERCENTAGE INDICATION OF SAMPLE OF SIX AGE GROUPS

S.N0.	Age Group	Sample	%
1	25-34	10	34
2	35-44	03	10
3	45-54	03	10
4	55-64	07	23
5	65-74	04	13
6.	75-94	03	10
	Total	30	100

GRAPH- 1

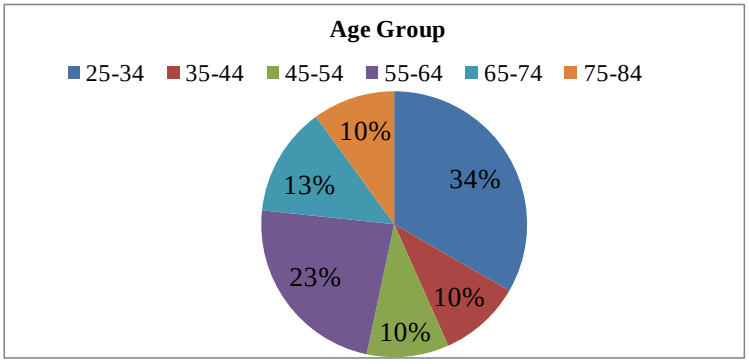


TABLE 2
MEAN AND STANDARD DEVIATION OF TOTAL SAMPLE OF PATIENTS IN DIFFERENT AGE GROUPS

Age Groups	Total Subjects	Mean	SD
06	30	48.60	18.005

Interpretation :The total sample size is 30 , the mean value 48.600±18.005.

TABLE 3
DISTRIBUTION OF PRE-TEST AND POST-TEST SAMPLE ON THE BASIS OF PULMONARY FUNCTION TEST VALUES

S.N0.	Pulmonary Function Test (PFT)	Pre-test	Post-test
1	100-149	3	2
2	150-199	7	9
3	200-249	9	7
4	250-299	4	7
5	300-349	2	3
6	350-399	0	2
	Total	25	30

TABLE 4
DIFFERENCE BETWEEN PRE-TEST AND POST-TEST MEAN ON PULMONARY FUNCTION TEST OF SELECTED PATIENTS

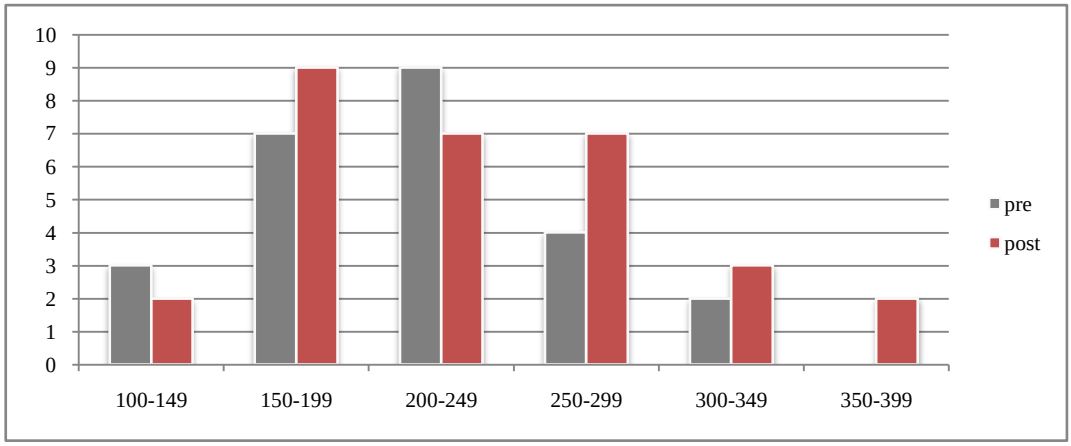
Test	Mean	SD	MD	P-value
Pre-test	222.76	70.21	3.85	<0.0001
Post-test	226.61	61.65		

Table 1 to 4 indicates that the pre mean and SD of peak flow meter was 222.76 (70.21), post mean was 226.61(61.65) with mean difference 3.855 and P value was <0.0001 which was considered extremely significant.

But according to international physical activity questionnaire. physical activity in last 7 days as per IPAQ scorings. We found that there were 17 subjects as minimally active

amongst 30 subjects, and heap active were 9 subject out of 30 samples and the inactive subjects were the remaining 4 subjects in the study. The study shows the significant improvement in the respiratory conditions.

GRAPH-2



4. DISCUSSION

This study was to aimed to evaluate the effect of proprioceptive neuromuscular facilitation with combined elastic resistance band in upper extremity with respiratory muscle strength, where a randomized control trail was taken, initially the synopsis was approved by the ethical committee and permission for data collection was received from the hospitals in Mumbai.

In the study 30 patients with age group of 18 and above years with cardiopulmonary conditions were selected according to inculsion and exculsion criteria. The international physical activity questionnaire (IPAQ) will be taken to interpret the physical activity of patients and peak flow meter to evaluate pulmonary function pre and post sessions. Treatment was given for 3 sessions per week for 4 weeks. Pre interventions reading of pulmonary function test were analysed where we found the p value is <0.001 with ore mean 222.76± 70.21 and the data collection we found the p value 226.61 ± 61.65 with mean difference of 3.855. after the evaluation we found that there was significant improvement in the upper extremity in respiratory conditions. Statistical analysis was done under 95% confidence interval.

Similar results were found by Guilherme P. T. Areas and colleagues in their study which showed that PNF combined with ERB showed significant increases in MIP and MEP ($p<0.05$). In addition, there were significant differences between the TG and CG regarding ΔMIP ($p=0.01$) and ΔMEP ($p=0.04$).they concluded that PNF combined with ERB can have a positive impact on respiratory muscle strength. These results may be useful with respect to cardiopulmonary chronic diseases that are associated with reduced respiratory muscle strength. PNF is an approach to exercise therapy that uses specific movement patterns in diagonal and spiral directions together with specific techniques that facilitate the increase in strength and muscle function.[10] In these study which were evaluated the effects of PNF alone on respiratory muscle force amongst 7 healthy subjects , the study found that there was increase in inspiratory and expiratory muscle strength had a very similar magnitude with similar sample.

Based on these studies, it can be inferred that the beneficial physiological muscle response of increase in respiratory muscle strength is related to changes in muscle fiber type associated with two muscle resistance training techniques. However, future research in this area is needed to address these issues and more firmly establish the relationship between the changes in the type of muscle fibers of respiratory muscles and the combination of PNF and ERB training. Moreno et al.[9] reported that PNF possibly stimulates the main respiratory muscles (diaphragm and inter-costal), as well as other accessory muscles (neck muscles, chest wall, and upper limbs). Although the pattern used in the current study did not directly influence the muscles mentioned above, it is known that PNF operates indirectly from the main muscles trained[10]. it is known that various respiratory diseases produce changes in both respiratory function and respiratory muscle function[7-9] and that the use of neuromuscular facilitation for the treatment of disorders combined with elastic bands would help the treatment of these patients, as it is of great importance in clinical practice due to the ease of use of these modalities in physical rehabilitation.

ERB are inexpensive, require no complicated installation, and can be used both at home and in the clinical environment, in contrast to pulleys as proposed by Voss et al.[10] and Moreno et al.[9]. However, future studies should focus on the comparison between PNF combined with pulleys and PNF combined with elastic bands in the clinical improvement of respiratory disorders.

A different study by KyoChulSeo and their colleagues The purpose of this study was to determine whether proprioceptive neuromuscular facilitation(PNF) respiration exercise increases the pulmonary function of normal adults. Twenty eight normal adults in their 20s were randomly assigned to an experimental group (n=14) or control group (n=14).Over the course of four weeks, the experimental group participated in PNF respiration pattern exercises for 30 minutes three times per week. Subjects were assessed pre-test and post-test by measurement of pulmonary function (tidal volume, inspiratory reserve volume, expiratory reserve volume, Inspiratory capacity, and vital capacity).result showed that Our findings show that the experimental group had significant improvements in expiratory reserve volume and vital capacity. In the comparison of the two groups, the experimental group had higher pulmonary function than the control group In this study, they concluded the experimental group showed greater improvement in pulmonary function than the control group, which indicates that the PNF respiration exercise is effective at increasing the pulmonary function of normal adults. The experimental group showed significant differences in TV, ERV, and VC ($p<0.05$), but did not show any significant difference in IRV and IC ($p>0.05$).

The control group did not show any significant difference in any of the measured items ($p>0.05$). Pulmonary function tests were conducted after four weeks of intervention. The experimental group showed significant increases in TV, ERV, and VC after the intervention compared to measurements taken prior the intervention, but they did not show significant increases in IRV or IC. COPD patients saw significant increases in ventilator and inspiratory threshold load and expiratory pressure, and Satori et al.[26]) observed that feedback breathing exercises significantly increased fibrous cyst patients' forced expiratory volume in 1 second. In previous studies, pulmonary functions were improved by diverse exercises aimed at improving the respiratory activities of normal persons, lung disease patients, and nervous system disease patients. PNF breathing

exercises showed similar effects to those of direct breathing exercises, for normal persons. PNF

Breathing exercises, the mobility of the subjects' chest walls increased, which led to improvements in pulmonary function.

Breathing physical therapy has not yet been universalized in rehabilitation centers in Korea. the experimental group showed a 67% change in vital capacity, while the control group showed a 27% change. Jones et al.7) reported that respiration volume per

Breath cycle at normal times were increased by diaphragmatic breathing exercises performed by COPD patients, and that increases in final inspiration volumes and momentary amounts of ventilation appeared in COPD patients after pursed-lip breathing exercises.

M. Paul Raj et all found that PNF of respiration to improve the exercise capacity in patients with coped was effective. Chronic Obstructive Pulmonary Disease (COPD) is described by persistent breathing symptoms and airflow restriction that is due to respiratory system abnormalities usually caused by substantial contact with harmful particles or gasses. This usually leads to increased breathlessness, frequent coughing with or without sputum, wheezing and tightness in the chest and reduced endurance. Limited research has been done on the effects of PNF of Respiration. The present study was a randomized controlled pilot trial that aimed to evaluate if the addition of PNF of Respiration to pursed lip breathing exercise would enhance the treatment effects when compared to the effects of Pursed lip breathing exercise alone in the management of COPD. Fourteen subjects (9 males, 5 females; mean age, 48.3 years; age range, 40–60 years) diagnosed with COPD were recruited from a local thoracic medicine out patient department. Subjects were randomly allocated to receive either PNF of respiration and pursed lip breathing exercise (Group A) or pursed lip breathing exercise alone (Group B). Outcome measures were distance covered in the six minute walk distance test and Modified Rate of Perceived Exertion (MRPE) during the 6 minute walk test. Between the group analysis showed that the results of Group A was statistically more significant than Group B for both the outcome measures (distance covered in 6min walk test (t value - 13.62, p value <0.001) and MRPE (t value - 2.95, p value <0.01). Hence, this study concluded that the PNF of respiration was more effective and can been useful therapy in improving exercise capacity in patients with COPD.

Therefore , our study concluded that PNF with manual resistance for Upper extremity is significantly effective in improving the respiratory conditions.

5. CONCLUSION

The study concluded that PNF with manual resistance for Upper extremity, is significantly effective in improving the respiratory conditions significantly effective in improvement of respiratory function and pulmonary conditions which was assessed through outcome measures like international physical activity questionnaire.

6. LIMITATIONS

- Limited age group can be taken for study sample.
- Outcome measure for measuring PFT can be alternate such as spirometer.
- Duration of time can be extended, week / sessions.

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