A Study to Compare the Effect of Respiratory Muscle Stretch Gymnastic (RMSG) and Diaphragmatic Breathing on Pulmonary Function Test among Geriatric Population– An Interventional Study

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Abstract

Introduction : Aging is the universal phenomenon, India is the Second Largest country in the world with 72 million elderly person in 2011. It is suspected that it will be 172 millions by 2031.People above the age of 60 years are consider as Geriatric. Aging is associated with decrease in lung compliance and Thoracic Mobility. Kyphotic curvature of spine occurs due to aging, which increases AP diameter of the thorax. Increase in AP diameter of thorax alters the curvature & optimal length of Diaphragm and decreases its force generation capacity. Also due to poor posture Shoulder Quadrant muscle undergoes Shortening due to which pump handle and bucket handle movement do not occur properly, ultimately reducing the Thoracic Mobility & Flexibility. So there is a need to improve Pulmonary function among Geriatric Population.

Aim : To compare the effect of respiratory muscle stretch gymnastic (RMSG) and diaphragmatic breathing on pulmonary function test among geriatric population

Objectives : (1)To find out the effect of RMSG on FEV1, FVC and FEV1/FVC ratio in geriatric population

(2) To find out the effect of diaphragmatic breathing on FEV1 ,FVC and FEV1/FVC ratio in geriatric population

(3) To compare the effect of RMSG & diaphragmatic breathing on FEV1 ,FVC and FEV1/FVC ratio in geriatric population.

Method: Subjects who fulfil exclusion and inclusion criteria were selected by purposive sampling and were assigned to group A and group B by simple random sampling. They were explained about the study, its usefulness and written consent were taken. 60 subjects were divide into two Groups: Group A: 30 subjects were given RMSG Group B: 30 subjects were given Diaphragmatic Breathing.

Results: Data were analyzed using software SPSS version 20 . Paired t-test was applied within the group and Unpaired t-test was applied between the two groups. Pre-treatment and post-treatment FVC, FEV1 and FEV1/FVC ratio was analyzed, it showed statistically significant (P value < 0.05) difference in both the group but when comparison was done between two groups, it was statistically non-significant (P value > 0.05).

Conclusion: Respiratory Muscle Stretch Gymnastic and Diaphragmatic breathing both were effective in improving pulmonary functions in geriatric population after performing breathing techniques for consecutive 3 days (once a day). But there was no significant difference between the two Groups in improving pulmonary function in geriatric population.

Key words: *FVC, FEV1, FEV1/FVC ratio, geriatric population, RMSG*

Introduction

According to census 2011 - India is the second Largest country in the World with 72 million elderly person. People above 65 years of age are considered as Geriatric. Aging leads to: Loss Of Elastic Recoil of lung, Hyperinflation, Increases in Residual Volume, Alteration in Optimal Length of Diaphragm, Decreases Strength Of Respiratory Muscle.[1,2]

Kyphotic curvature of the spine increases with Age which increases AP Diameter of thorax & Shoulder Quadrant muscle undergoes Shortening due to which Pump Handle & Bucket Handle Movement do not Occur Properly ultimately reduces thoracic Mobility.[2,3]

RMSG Includes 5 Technique :[4]

1. Elevating & Pulling Back the Shoulder
2. Stretching the Upper Chest
3. Stretching the Lower Chest
4. Stretching the Back Muscle
5. Elevating Elbow

Diaphragmatic Breathing is a technique in which patient was asked to breath by the optimal use of Diaphragm.[4,5] It involves Slow & Rhythmic Breathing. Pulmonary Function Test in form of FVC FEV1 & FEV1/FVC ratio was taken as an outcome Measure. [5,6.7]

Till now various respiratory techniques are used to improve pulmonary function among Geriatric but no study have been found which shows the effect of RMSG on Pulmonary functions among Geriatric Population. So the Need of the Study was to find out whether RMSG was effective in Improving pulmonary functions among Geriatric Population and than to Compare it's effect with Diaphragmatic breathing among geriatric population

Aims and Objectives

· To Find Out the Effect of RMSG on FVC, FEV1 and FEV1/FVC ratio among Geriatric Population.

· To Find Out the Effect of Diaphragmatic Breathing on FVC, FEV1 and FEV1/FVC ratio among Geriatric Population.

· To Compare the Effect of RMSG and Diaphragmatic breathing on FVC, FEV1 and FEV1/FVC ratio among Geriatric Population.

HYPOTHESIS

H_0- There is no significant difference between the Effect of RMSG and Diaphragmatic breathing on FVC, FEV1 and FEV1/FVC ratio among Geriatric Population.

H_1- There is a significant difference between the Effect of RMSG and Diaphragmatic breathing on FVC, FEV1 and FEV1/FVC ratio among Geriatric Population

Methodology

· Research Design: Comparative Interventional Study

· Sample Size: 60 Subjects

· Sample Source: Rajkot- Gujarat-India

· Inclusion Criteria:

Age: Subjects > 65 years

Gender: Both Male and Female

Subjects who understands & follow the command

· Exclusion Criteria:

Subjects doing meditation or yoga or exercise on regular basis.

Subjects with the history of smoking.

Subjects with neurological, Cardiorespiratory or Musculoskeletal disorders related to

spine which may affect respiratory mechanics.

Uncooperative Subjects & Subjects who denied for Participation.

· Instrumentations:

o Instruments and Tool used:

§ Spirometer (Helios 401)

§ Pen

§ Paper

§ Data Collection Sheet

§ Consent Form

§ Towel

§ Cotton

§ Spirit

§ Mouthpiece

§ Nose clip

§ Plinth

§ Pillow

§ Stopwatch

PROCEDURE

Subjects those who fulfill the study's inclusive and exclusive criteria and give their consent form were included in the study. Prior to testing, the subjects were familiarized with the testing procedure.

Subjects were divided into 2 Group Group A was Given RMSG & Group B was Given Diaphragmatic Breathing. Pre & Post Pulmonary Function Test was taken as per the standard guideline of American Thoracic Society.

PFT (Pulmonary Function Test- FVC, FEV1, FEV1/FVC) measurement procedure:[7]

· Pre and post pulmonary function test was taken as per the standard outlined by American Thoracic Society. Subjects were given comfortable position on table without back support and foot resting on the floor, a soft nose clip was placed to prevent air escaping from nose and test was performed.

· For measurement of FEV1, FVC and FEV1/FVC ratio, patients were asked to take the deepest breath as much as possible than place the mouthpiece in mouth with lips sealing it and immediately exhale hard and fast for as long as possible, preferably atleast 6 seconds followed by a rapid inspiration from the mouthpiece.

· Three trials were given for each procedure and best trial was selected. The trial was considered "unacceptable" if it showed evidence of cough, early termination of expiration or inconsistent effort.

After collection of data, pre and post value for FEV1, FVC and FEV1/FVC were analyzed by statistical software and results were found.

Group A was given RMSG Technique: [4]

RMSG Includes 5 Technique :

1. Elevating & Pulling Back the Shoulder
2. Stretching the Upper Chest
3. Stretching the Lower Chest
4. Stretching the Back Muscle
5. Elevating Elbow

These breathing techniques was given for 7 consecutive days (once a day).

Group B was given Diaphragmatic Breathing Technique: [5,6]

— Subjects were ask to sit in semi fowler's position.

— They were told to place their hand below the anterior costal margin and feel the movement occurring. Then the subjects were told to breathe in slowly and deeply through the nose allowing the abdomen to rise slightly and then relax and exhale slowly through the mouth.

— These breathing technique was performed for continuous 5 minutes such that patient takes 6 to 8 deep breath per minute.

— These breathing technique was given for 7 consecutive days (once a day).

Result

Statistical Analysis

Study design: Comparative study.

Statistical software: The statistical software named SPSS 20.00 was used for data analysis. Microsoft Excel and Word were used to generate graphs and tables.

Test: The normality of data was checked by using Shapiro-Wilk test which shows data was of parametric type. Comparison between with groups was done by

unpaired t-test.

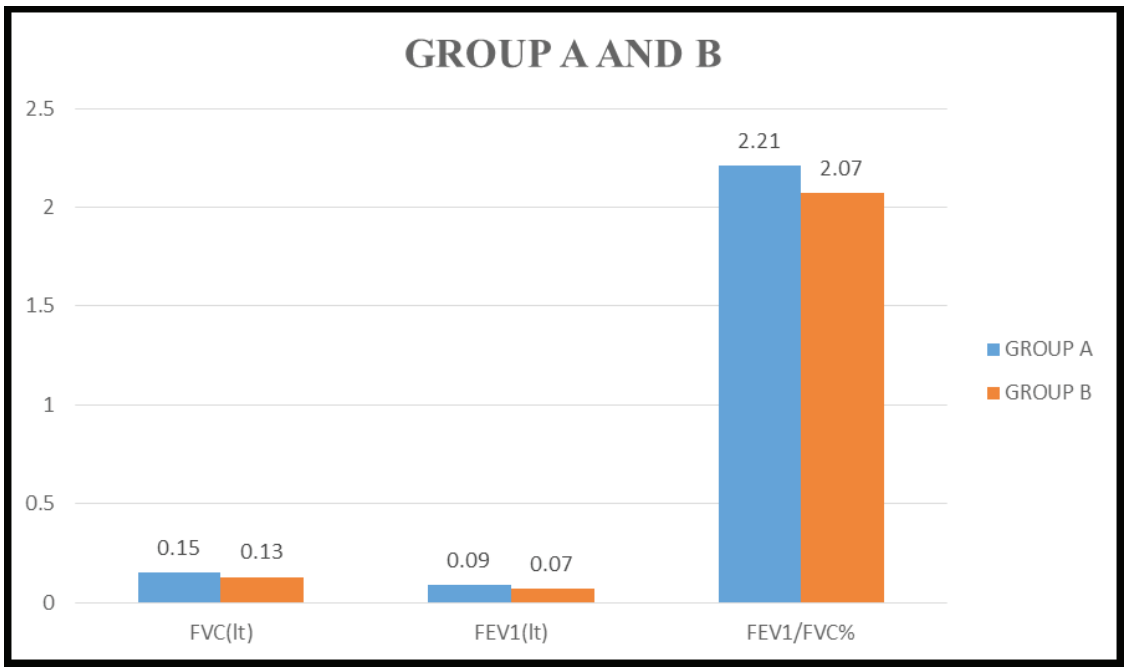
Level of significance (p value) was set to 0.05

Table 1 Intra group comparison of FVC, FEV1 and FEV1/FVC ratio for GROUP A- RMSG.

Parameters	Mean ± Std. Deviation		t	p	Result
	Pre	Post			
FVC(l)	1.89 + 0.29	2.18 + 0.30	-4.993	<0.05	Significant
FEV1(l)	1.70 + 0.28	1.87 + 0.24	-2.863	<0.05	Significant
FEV1/ FVC (%)	88.15 + 6.16	88.90 + 4.73	-1.492	>0.05	Non-Significant

Table 2 Intra group comparison of FVC, FEV1 and FEV1/FVC for GROUP B – Diaphragmatic Breathing.

Parameters	Mean ± Std. Deviation		t	p	Result
	Pre	Post			
FVC(l)	2.08 + 0.34	2.27 + 0.34	-4.271	<0.05	Significant
FEV1(l)	1.91 + 0.27	1.98 + 0.26	-4.572	<0.05	Significant
FEV1/FVC (%)	88.71 + 5.02	88.73 + 4.45	-2.028	>0.05	Non- Significant



Graph 1 Comparison of mean difference of FVC, FEV1 and FEV1/FVC ratio between Group A and Group B.

Figure 1 Patient Performing RMSG Exercises

Discussion

The result of these study supports the null hypothesis. In group-A significant difference was found in pre & post FVC and FEV1 but no significant difference was found in pre and post FEV1/FVC ratio. In group B significant difference was found in pre & post FVC and FEV1 but no significant difference was found in pre and post FEV1/FVC ratio. Inter Group comparison of Group A and Group B suggested that there was no significant difference for FVC, FEV1 and FEV1/FVC ratio between the two Groups.

RMSG is based on theory of Lapascle's law – Ventilation of Lung depends upon the Length of Respiratory muscle. Maximal Force is Generated by the respiratory muscle when they are in their Optimal Length. As Geriatric have alteration in the Optimal length of respiratory muscle (Diaphragm & Intercostal muscle).[3,13]

When RMSG is given Muscle Spindle Stimulates & Sends Signals to Alpha motor Neuron, as a result of which Extrafusal fiber of Muscle Spindle Contracts. The more the muscle contracts, the more it will relax according to the frank starling law. Hence by Giving RMSG, Optimal Length of the respiratory Muscle can be reached. [13]

Nidhi ved et al stated that RMSG have beneficial effect on pulmonary function among Menstruating women when RMSG was given for consecutive 3 days(Once a day).

Some studies suggested that diaphragmatic breathing increases the lung compliance and reduces the airway resistance. The reason behind it is believed that during diaphragmatic breathing the maximum deflation of lungs occurs, which is an important physiological stimulus for the release of surfactant and prostaglandin into the alveolar spaces, surfactant reduces the surface tension and improves the lung compliance, allowing the lung to inflate more easily and reduces the airway resistance.[8]

According to **Sheetal Panwar et al and Prem kumar yadav et al** during diaphragmatic breathing pulmonary pressure continues to rise due to increase in venous return to the heart, these increase in pulmonary pressure may provide an adequate driving force to propel the blood to the upper most part of the lung where ventilation of the air is more, this results in more perfusion from top to bottom and improves ventilation perfusion ratio.[8, 9]

The present study show statistically significant results for Diaphragmatic breathing exercise, supporting to these **Kyochul Seo et al** stated that there was a significant increase in tidal volume, inspiratory capacity, inspiratory reserve volume and breathing capacity in experimental group (Diaphragmatic group) than the control group after performing 30mins session for 3 times a week for 4 week in male smokers.[10] **Karina m et al** demonstrated that Diaphragmatic breathing shows positive result in improving lung volumes, respiratory motion, SPO2 and also in reducing respiratory rate among both COPD and Healthy individual while Pilate breathing do not show any changes among COPD but improves lung volume and SPO2 among healthy individual.[12]

In harmony with the result of present study **Prem Kumar Yadav et al** suggested that diaphragmatic breathing significantly increases FVC, FEV_1, PEFR, MVV, FEV_1/FVC ratio and TV in 50 healthy adults who performed diaphragmatic breathing exercise for 3 months. However, FEV_1/FVC ratio was more significant in male than female while FVC was more significant in female.[8]

Conclusion

Respiratory Muscle Stretch Gymnastic & Diaphragmatic Breathing both were effective in Pulmonary function test among geriatric Population. But there was no significant difference between two groups after performing breathing technique for consecutive 7 days among geriatric Population.

Clinical relevance

Results suggest that both the techniques i.e. Respiratory Muscle Stretch Gymnastic and Diaphragmatic breathing showed statistical significant difference in pulmonary functions after performing breathing technique for consecutive 7 days among geriatric Population.Hence both the technique can be alternatively used as an adjunct with other techniques for improving pulmonary functions in individual who have reduce lung volumes and capacities.

Limitation

- Blinding was not done in the study.
- Sample size was relatively small.
- Study duration of the treatment protocol was short

Further recommendations

- Study can be done with large sample size.
- Treatment can be given for longer duration with follow up.
- Other pulmonary function parameters and outcome measures like PEFR, Chest expansion can be used.
- Different populations who have reduced lung volume and capacities can be studied.
- Study can be done with control group.
- Blinding could be done in future study.

Source of Funding – self

Conflict of Interest - Nil

Ethical Clearance – was taken at K K Sheth Physiotherapy College.

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