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Study on Efficacy of Visual Feedback on Dyspnea and Exercise Tolerance of Asthma Patients

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Abstract:-

- ***Background*:**

Asthma is a common respiratory disease. Asthma is a widespread chronic health problem. Dyspnea is a major cause of functional impairment and disability in patients suffering from asthma. The visual feedback assisted breathing training has an important role in asthma patients. The breathing re education with visual feedback has been shown to increase the exercise tolerance and decrease the dyspnea of asthma patients.

- ***Aim***

Study to find out the efficacy of visual feedback on dyspnea and exercise tolerance of asthma patients.

- ***Methodology***

The population includes with the diagnosis of asthma. A total of 30 patients satisfying criteria were divided into two groups of 15 each using random sampling. Group A (control group) and Group B (Experimental group). Group A received conventional physiotherapy and Group B receives conventional physiotherapy and pursed-lip breathing with assistance of visual feedback. Treatment was given 15 minutes per day for 6 days in a week for a period of 4 weeks. The outcome measures were taken for the study were exercise tolerance using six minute walk test(SWT) and dyspnea using visual analog scale(VAS). The significance of difference between pre-test and post-test is tested by using student's 't' test.

- ***Result***

On VAS, Experimental group showed a significant gain of 19.8% ($p<0.01$). The control group also showed a significant gain of 12.6% ($p<0.01$). Statistical analysis of the post test mean values of VAS between two groups showed that group received pursed lip breathing with visual feedback is having a significant high effect when compared to control.

On six minute walk test, experimental group showed a significant gain of 28.42% ($p<0.01$). The control group also showed a significant gain of 11.97% ($p<0.01$).Statistical analysis of the post test mean value of six minutes walk test between two groups showed that group received pursed lip breathing with visual feedback is having a significant high effect when compared to control.

- ***Conclusion***

Pursed – lip breathing with visual feedback is an effective treatment for exercise tolerance and dyspnea of asthma patients compared to lip breathing alone. Pursed-lip breathing with visual feedback is used to enhance the speedy recovery and can be provided easily in a hospital, community rehabilitation center, or in the patients home itself. Pursed- lip breathing with visual feedback is simple to practice and it is cost effective.

Keywords:- *Asthma, Visual Feedback, Exercise Tolerance, Dyspnea.*

I. INTRODUCTION

Asthma is currently a worldwide problem, with increasing prevalence in both children and adult. Total prevalence is estimated to be 7.2% of world's population (6% in adults, 10% in children). Asthma deaths may be declining but the disease is becoming more common throughout the world – it's prevalence has doubled in last 15 years. The symptoms may begin at any age. Although the exact mechanism of airway hyperactivity is unknown, genetic predisposition, environmental contributions, automatic nervous system imbalance, and mucosal epithelial damage has been implicated in the development of asthma. Asthma associated with considerable patients morbidity and diminution of productivity. Reduction in exercise tolerance and Dyspnea are the major cause of functional impairment and disability in patients suffering from asthma. Pursed- lip breathing is the common treatment used for improvement of exercise tolerance and decrease dyspnea of asthma patients. The use of visual feedback with pursed- lip breathing is an effective treatment for improvement in exercise tolerance and decreased respiratory rate of asthma patients.

II. METHODOLOGY

➢ ***Study Approach*** ***:*** *Experimental comparative approach*

➢ ***Sampling method :*** *Random sampling*

➢ ***Study Settings :***

1. Mid Town Medical center, Kakkanad.
2. Medical college hospital, Trivandrum

➢ ***Sample size*** ***:*** *30*

➢ ***Total Duration of study*** ***:*** *6 months*

➢ ***Inclusion criteria:***

- Diagnosis of referring doctor as chronic stable asthma { Mild intermittent-FEV_1 >= 80%, Moderate persistent FEV_1>60% to< 80%
- Patient with same medication
- Gender-both males and females
- Age group- between 30 and 60 years

➢ ***Exclusion criteria:***

- Other lung disorders
- Auditory and visual impairment
- Any orthopedic, neurological conditions like pain, recent fracture or paralysis,
- Psychiatric problems
- Other significant medical conditions that might be exacerbated by physical exertion
- Other than mild intermittent, mild persistent and moderate persistent asthma

III. PROCEDURE

Prior sanction was taken from the authorities for the study. Purpose of the study and procedure was explained to the patients. Ethical committee and written consent from patients was taken. Thirty asthma patients who fulfill inclusion criteria were included, were divided into two groups using randomized sampling .15 patients were taken in each group. Group A (Control) and Group B(experimental). Assessment was taken on the 1st day and on completion of treatment after one month using an assessment form. The outcome measures were taken as per the following procedures.

➢ *Outcome Measurements*

1. Exercise Tolerance measured using SWT (SIX MINUTE WALK TEST)
2. Dyspnea measured using VAS (VISUAL ANALOG SCALE)

➢ *Assessment procedure*

- *Exercise Tolerance*

Six minute walk test was used for the assessment of exercise Tolerance.

1. Before the first walk , dyspnea (VAS), blood pressure,pulse and respiratory rate were measured and recorded for all patients.
2. Walk had taken place at approximately the same time of the day,at least two hours after a meal.
3. Patients were asked to walk from end to end of the walking track covering as much ground as possible in six minute.
4. The walk had been carried out at an area with minimal traffic, indoor, along a long flat straight , enclosed corridor with a hard surface. The walking course must be 30 meters in length.
5. Three walks were carried out with fifteen minutes of rest between each walk.
6. The following instructions had been given to the subjects:

The purpose of this test is to find out how far the subject can walk in six minutes. The subject will start from a particular point (indicate marker at one end of the course) and follow the hall way to the marker at the end, then turn around and walk back when the subject arrive back at the starting point, the subject will go back and forth again. Repeat back and forth as many time as subject can in six minute period. If needed subject may stop and rest, just remain where the subject can until go on again. However, the most important thing about the test is that the subject cover as much ground as possible during the six minute. The researcher will let you know when the six minutes are up. When the researcher says stop please stand right where you are. The subjects are then asked to repeat the same gist of the instructions to valid understanding.

7. During the walks standardized phrases used for encouragement in every two minutes.
8. During the first pulsoxymetry was carried out during the rest on every one. Patients who desaturate to levels below 85% were asked to stop walking and the walk had discontinued.
9. Patients were told when the two, four and six minutes have elapsed.
10. The longest distance walked of the three trials were noted, although all distance had been documented.
11. Immediately following completion of each walking test, patients were asked to rate their level of breathing efforts on the VAS.

➢ *Dyspnea*

Visual Analog Scale was used for this. VAS consists of vertical line, usually 100mm in length, with verbal anchors at each end indicating extremes for the sensation. The anchor at the bottom of the scale is " no breathlessness" and anchor at the top is " great breathlessness". Patients are asked to

indicate the point on the scale that corresponds to their sensation of breathlessness. Immediately after the completion of each walking test, patient will be asked to rate their level of breathing effort on the VAS. The score is obtained by measuring the distance from the bottom to point indicted by the patient.

IV. TOOLS AND MATERIALS USED

1. Distance marker
2. Traffic cones
3. Visual feedback
4. Sphygmomanometer
5. Stethoscope
6. Inch tape
7. Stop watch
8. Six minute Walk Test(SWT)
9. Visual Analog Scale (VAS)

➢ *Control group (Group A)*

The control group consisted of 15 patients.

Male patients = 5
Female patients = 10

✓ On day one, following the basic assessments, the patients in control group were treated with the conventional treatment.
✓ Treatment protocol for control group
✓ Pursed-lip breathing

➢ *Technique*

1. Have the patient assume a comfortable position and relax as much as possible.
2. Explain to the patient that expiration must be relaxed (passive) and that contraction of the abdominals must be avoided.
3. Place your hands over the patient's abdominal muscles to detect any contraction of the abdominals.
4. Instruct the patient to breathe in slowly and deeply.
5. Then have the patient loosely purse the lips and exhale.

➢ *Treatment dosage*

15 minutes per day for 6 days in a week for four weeks.

➢ *Experimental Group (Group B)*

The experimental group consisted of 15 patients.
Male patients =7
Female Patients =8

On day one, following the basic assessments patients in the experimental group were treated with pursed-lip breathing and pursed –lip breathing with visual feedback.

Treatment protocol for experimental group

1. Pursed-lip breathing (same as the control group)
2. Pursed-lip breathing with visual feedback

About visual feedback instrument

Fig 1

It is simple feedback instrument with the size of 20.8 cm length, 15.6 cm breadth and 6 cm height.

➢ *Parts of equipment*

1. Power switch
2. Red and green LED bulbs
3. Right and left fine tuning Knobs
4. 9 volt battery and adapter

➢ *Treatment procedure*

1. Permit the patient assumes a comfortable position and relax as much as possible.
2. Explain to the patient that expiration must be relaxed (passive) and that contraction of the abdominals must be avoided.
3. Place your hand over the patient's abdominal muscles to detect any contraction of the abdominals.
4. Instruct the patient to breathe in slowly and deeply
5. Then ask the patient slowly purse the lips and exhale.
6. Keep the visual feedback in front of the patient in an adequate distance and comfortable position.
7. The visual feedback instrument consists of a green light and a red light.
8. Take the inspiratory time of patient with the help of a stop watch.
9. Adjust the time setting on the visual feedback depend upon the inspiratory and expiratory time of the patient (select the time adjustment Knobs with the help of catalog and decide the required time and do fine tuning with the help of the right and left fine tuning Knobs).
10. At the time of inspiration the light selected for inspiration will switched on automatically and it will burn up to the end of the inspiration and the other light which select for expiration will switched on automatically.
11. Teach the patient pursed-lip breathing and after that keep the machine in front of the patient and ask them to do

pursed lip breathing with the assistance of visual feedback.

12. Ask the patient to breathe in slowly and deeply till the light selected for inspiration is shining.
13. Then have the patient loosely purse the lips and exhale till the light selected for expiration is switched on.

➢ *Dosage*

15 minutes pursed-lip breathing with visual feedback per day for 6 days in a week for a period of four weeks.

V. STATISTICAL ANALYSIS

Student 't' test was used to compare the dyspnea and exercise tolerance between the groups and within groups. Control and experimental group responses to the treatment were analyzed using paired 't' test.

➢ *Demographic Presentation of Data*

Variables		**Experimental**		**Control**	
		No.	**%**	**No.**	**%**
Gender	Male	8	53.3%	10	66.7%
	Female	7	46.7%	5	33.3%
	Total	15	100%	15	100%
Age	30-40	3	20%	3	20%
	40-50	6	40%	5	33.3%
	50-60	6	40%	7	46.7%
	Total	15	100%	15	100%

Table 1

VI. ANALYSIS AND INTERPRETATION

A. Visual Analog Scale (VAS)

➢ *Comparison of Pre-Test and Post Test Vas Within Groups and between Group Comparisons*

Group	Pre test mean	't' test value	Post test Mean	't' test value	't' test value	% Decrease in pain
Experimental Group	3.07	0.72^{NS}	1.09	2.67*	20.37**	19.8 %
Control Group	2.89		1.63		12.67**	12.6 %

Table 2

* Statistically significant with $p < 0.05$, **Statistically significant with $p < 0.01$,

NS - Not Significant

The mean value of VAS control group 2.89 is with SD 0.765 and 1.63 with SD is 0.545 in pre test and post test respectively.

The mean value of VAS Experimental group 3.07 is with SD 0.604 and 1.09 with SD is 0.567 in pre test and post test respectively.

➢ *Analysis of Results*

✓ Using independent 't' test (unpaired)
✓ Comparison pre-test VAS of control group and experimental group
✓ Pre-test mean of control group is 2.89 and the experimental group is 3.07

After analyzing the data, calculated 't' value is 0.72 with $p>0.05$. The result shows that there is no significant difference between control group and experimental group in the pre test at 5% level of significance.

➢ *Comparing post- test VAS of control group and experimental group*

Post-test mean of control group is 1.63 and experimental group is 1.09. After analyzing the data, calculated't' value is 2.67 with $p<0.01$. The result shows that there is significant difference between control group and experimental group in the post test at 1% level of significance. So, null hypothesis is rejected.

➢ *Using dependent 't' test*

Comparing pre- test and post- test value of VAS in experimental group. The mean pre-test value is 3.07 and post-test value is 1.09.

Comparing the pre-test and post –test of experi9mental group the calculated 't' value is 20.37061 with $p<0.01$. Hence there is significant difference between pre-test and

post-test of the experimental group at 1% level of significance. Comparing pre- test and post- test value of VAS in control group. The mean pre-test value is 2.89 and post-test value is 1.63.

Comparing the pre-test and post –test of controll group the calculated 't' value is 12.67262 with $p<0.01$. Hence there is significant difference between pre-test and post-test of the control group at 1% level of significance.

➢ *Percentage of Difference*

Statistical analysis shows 12.6% decrease in VAS in control group and 19.8% decrease in experimental group from the initial value. When comparing the percentage difference in VAS between experimental group and control group, there is more decrease in experimental group.

B. SIX MINUTE WALK TEST (SMWT)

➢ *Comparison of Pre-Test and Post Test 6 Minutes Walk Test within Groups and Between Group Comparisons*

Group	Pre test mean	't' test value	Post test Mean	't' test value	't' test value	% Increase in distance walked
Experimental Group	155.33	1.02^{NS}	199.47	2.43*	16.37**	28.42 %
Control Group	152.00		170.20		8.22**	11.97 %

Table 3

* Statistically significant with $p < 0.05$, **Statistically significant with $p < 0.01$,
NS - Not Significant

The mean value of six minute walk test for control group is 152.00 with SD 28.020 and 170.20 with SD 27.282 in pre-test and post-test.
The mean value of six minute walk test for experimental group is 155.33 with SD 28.402 and 199.47 with SD 30.100 in pre-test and post-test.

➢ *Analysis of Results*

Using independent 't' test (unpaired)
Comparison pre-test 6 minute walk test of control group and experimental group
Pre-test mean of control group is 152.00 and the experimental group is 155.33

Since calculated 't' value is 1.02 with $p>0.05$. The result shows that there is no significant difference between control group and experimental group in the pre test at 5% level of significance.

➢ *Comparing post- test VAS of control group and experimental group*

Post-test mean of control group is 170.20 and experimental group is 199.47
After analyzing the data, calculated 't' value is 2.43 with $p<0.01$. The result shows that there is significant difference between control group and experimental group in the post test at 1% level of significance.

➢ *Using dependent 't' test*
Comparing pre- test and post- test value of six minute walk test in experimental group.
The mean pre-test value is 155.33 and post-test value is 199.47.
Comparing the pre-test and post –test of experimental group the calculated 't' value is 16.37 with $p<0.01$. Hence there is significant increase in distance walked in the experimental group .

➢ *Comparing pre- test and post- test value of Six minute walk test in control group*
The mean pre-test value is 152.00 and post-test value is 170.20.
Comparing the pre-test and post –test of control group ,the calculated 't' value is 8.22 with $p<0.01$. Hence there is significant increase in distance walked in the control group.

➢ *Percentage of Difference*
Statistical analysis shows 11.97% increase of Six minute walk test in control group and 28.42% increase in experimental group from the initial value . When comparing the percentage difference between experimental group and control group, there is more increase in experimental group.

VII. DISCUSSION

The study is an experimental research to study on efficacy of visual feedback on dyspnea and exercise tolerance of asthma patients. The age of the subjects was almost similar in both groups. Both groups were assessed in the 1st day and last day of treatment. The tools taken for measuring the outcome were Visual analog scale (VAS) for dyspnea and Six minute walk test for exercise tolerance, followed by the basic assessment chart.

The control group received pursed lip breathing. The experimental group received pursed lip breathing with the assistance of visual feedback. On statistical analysis using paired t test experimental group showed significant

difference in pre and post test scores of dyspnea and exercise tolerance.

Following are the interpretations after four weeks of treatment.

On VAS , Experimental group showed a significant gain of 19.8% ($p<0.01$). The control group also showed a significant gain of 12.6% ($p<0.01$). Statistical analysis of the post test mean values of VAS between two groups showed that group received pursed lip breathing with visual feedback is having a significant high effect when compared to control.

On six minute walk test , experimental group showed a significant gain of 28.42% ($p<0.01$). The control group also showed a significant gain of 11.97% ($p<0.01$).Statistical analysis of the post test mean value of six minutes walk test between two groups showed that group received pursed lip breathing with visual feedback is having a significant high effect when compared to control.

Research articles advocates that breathing re- education with visual feedback has been shown to increase the exercise tolerance and decrease the dyspnea of asthma patients. Another study concludes that feedback with breathing training will cause significant improvement in exercise tolerance and decrease respiratory rate of asthma patients.

Thus this study suggest the assistance of visual feedback instrument in pursed-lip breathing along with conventional treatment for asthma patients.

VIII. LIMITATIONS

1. Sample size was small
2. The study did not include follow up program.
3. Secondary outcome of Six minute walk test was not taken as outcome measure.
4. There was no standardization of nutrition intake.
5. Patients were not instructed for home exercise program.
6. All measurements were taken manually and this may introduce human error, which could threat the study's reliability.
7. The instrument doesn't have a digitalized display or knobs for the time setting so that human errors may occur.

IX. CONCLUSION

Asthma is now widely recognized as being a common condition leading to illness and disability, which results in large social and economic burden in society. Reduction in exercise tolerance and dyspnea are the main symptoms leading to medical consultation by patients with asthma. Pursed –lip breathing is the common treatment given to improve the above said symptoms. Here in this study along with pursed lip breathing visual feedback is used to enhance the speedy recovery and can provide easily to patients in any set up. The combination is simple to practice and is cost effective. Thus based on the study it is concluded that pursed lip breathing with visual feedback is an effective treatment for exercise tolerance and dyspnea of asthma patients compared to pursed lip breathing alone.

- **Conflict of interest:** None
- **Source of funding :**Self
- **Ethical Clearance ;** The procedure followed was in accordance with the ethical standards and after the attainment of informed consent from patients.

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