



ORIGINAL RESEARCH PAPER

Management

A STUDY THE EFFECTIVENESS OF INCENTIVE SPIROMETRY IN INCREASING THE LUNG VOLUME CAPACITIES AMONG THE QUARRY WORKERS

KEY WORDS: quarry worker, occupational hazard, lung problem, spirometry

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ABSTRACT

Introduction: India is facing various environment problems, seventy percentage of respiratory problems due to suspended particular matter, is high in Indian environment. The sources of respiratory suspended particular matter are diesel vehicle, power plant, cook stoves and industrial process emissions.

Aim: A study to evaluate the effectiveness of incentive spirometry in increasing the lung volume capacities among the quarry workers in a selected industry at Kollam district.

Methods: Pretest and posttest lung volume capacities were checked by spirometer. In this study includes forced expiratory volume (FVC), forced expiratory volume at one second (FEV1), forced expiratory volume in 1 sec/forced vital capacities (FEV1/FVC), forced mid expiratory flow rate (FEF25-75%), forced expiratory flow rates at 75% (FEF75%).

Results: The mean posttest lung volume capacities of the group were greater than the mean pretest lung volume capacities with a significant mean difference. There is a association between forced vital capacities and selected demographic variable work experience (p = 0.02).

Conclusion: Incentive spirometric exercise is effective in improving the lung volume capacities and also it was found that there is no significant association between the lung volume capacities and the demographic variables.

INTRODUCTION

The respiratory system is one of the vital organ systems in our body. The primary function of this system is to supply the oxygenated blood to each and every tissue of the body. Breathing is the mechanism, which is responsible for the gas exchange. In the breathing mechanism, there are two processes-inhalation and exhalation. Respiratory problems associated with stone crusher workers are asthma, rhinitis, bronchitis, obstructive disorders, reduced vital capacity etc. Restrictive disorders are due to the fumes and dust from sanding and grinding. According to the result of polycentric study carried out in 2003 revealed that the prevalence of asthma among stone crusher workers in the age group 20-40 years is 5.4 percent and work relatedness of the disease was reported as 24.7 percent in asthma patient. The prevalence of chronic bronchitis was significantly associated with increase of dust application method, the evidence that exposure to isocyanate oligomers is responsible for asthma with bronchial hyper responsiveness, around 54 percent of stone crusher workers were suffering with one or other respiratory problems. The annual report of census and analysis of occupational illnesses reported that in the years 1985 to 1996, the total numbers of occupational illness ranged from 400 to 706 cases annually, and then the number came up suddenly to 2026 in 1997 and jumped to 4784 in 1998. Reporting of occupational illness is still far less than expected, based on the size of the population and the documented shortage of occupational health services coverage of the working population. One of the places where there is high risk of occurrence of occupational health hazards are the quarries. Quarry workers are exposed to various hazards and are dangerous places, often using large numbers of vehicles, explosives and handling large amounts of heavy materials. The quarry injury rate was noted at " three times that of the construction industry".

AIM

A study to evaluate the effectiveness of incentive spirometry in increasing the lung volume capacities among the quarry workers in a selected industry at Kollam district.

MATERIALS AND METHODS

In this study, the demographic variables include age, dietary pattern, family monthly income, nature of work, work experience in quarry, history of allergy, treatment, smoking habits, known diseases, respiratory problem, place of stay, getting ESI benefit, regular medical checkups and how often, breathing exercises, use of any protective devices, family history of respiratory disorders. Pretest and posttest lung volume capacities were checked by

spirometer. In this study includes forced expiratory volume (FVC), forced expiratory volume at one second (FEV1), forced expiratory volume in 1 sec/forced vital capacities (FEV1/FVC), forced mid expiratory flow rate (FEF25-75%), forced expiratory flow rates at 75% (FEF75%). Estimation of lung volume capacities was done by the expert using the universally accepted PFT (spirometer) method and was found to be reliable. Subjects were explained about the study and study purpose and verbal consent was taken from the study participants. The samples were selected by purposive sampling method. Pretest was done to assess the lung volume capacities and from the next day incentive spirometric exercise was given for each individual, every day 2 groups of 15 members were gathered and have 15 min to do the exercise after that next group of 15 members were gathered for the exercise, this was continued for 14 days and after that posttest was done on 15th day to find out the effectiveness of exercise in increasing the lung volume capacities.

RESULTS

Among 30 quarry workers regarding age 2(7%) were with the age group of 35-40, 3(10%) were with the age group of 41-45, 8(27%) were with the age group of 46-50yrs, 17(56%) were with the age group of above 50 yrs. 29(97%) of the workers were smokers and 1(3%) was not a smoker. 24(80%) had monthly income of Rs 1601 to 8009, 6(20%) had monthly income of Rs8010 to 16019. 12(80%) were suffering from diabetes mellitus, and another 3(20%) were suffering from heart disease and none of them were not having any diseases. 26(87%) were not having any allergy and another 4(13%) were having allergy. 18 (60%) were not using any protective devices and 12(40%) were using protective devices. 26(87%) were having the working experience of more than 7 years, 3(10%) were having the work experience in between 4-6 years and 1(3%) was having the work experience of 1-3 years. 29(97%) were not having any respiratory problems and 1(3%) is having respiratory problem that he is suffering from asthma. 29(97%) of them were not gone for any medical checkups and 1(3%) of them was gone for regular medical checkups once in a year.

In pretest among 30 quarry workers, 19(63.333%) were having lung forced vital capacity below normal (≤ 80), another 11(36.667%) were having forced vital capacity of normal group >80 . In the posttest the frequency and percentage distribution of lung forced vital capacities volume was equally 15 (50%) respectively for both below normal ($\leq 80\%$) and normal ($>80\%$).

TABLE 1 DISTRIBUTION OF FORCED VITAL CAPACITIES

Classification of spirometric value (FVC in %)	Pre test		Post test	
	Frequency	Percentage (%)	Frequency	Percentage (%)
≤80	19	63.333	15	50
>80	11	36.667	15	50

TABLE 2 DISTRIBUTION OF FORCED EXPIRATORY VOLUME IN 1 SEC.

Classification of spirometric value FEV1 (in %)	Pre test		Post test	
	Frequency	Percentage (%)	Frequency	Percentage (%)
≤80	28	93.3	11	37
>80	2	6.7	19	63

In pretest among 30 quarry workers, 28(93.3%) were having forced expiratory volume in 1 sec below normal group (≤80%), another 2(6.7%) were having forced expiratory volume in 1 sec of normal (>80%). In post test 11 (37%) were having forced expiratory volume in 1 sec in the below normal group <80, another 19 (63%) were having forced expiratory volume in 1 sec of normal (>80%).

TABLE 3 DISTRIBUTION OF FORCED EXPIRATORY VOLUME IN 1 SEC/FORCED VITAL CAPACITIES (FEV1/FVC).

Age (in years)	Classification of spirometric value FEV1/FVC (in %)	Pre test		Post test	
		Frequency	Percentage (%)	Frequency	Percentage (%)
	<50	<75	0	0	0
	≥75	13	10	13	10
≥50	<70	3	17.64	3	17.64
	≥70	14	82.36	14	82.36

In pretest among 30 quarry workers 13 is under the age group <50, among 13 persons all of them were having FEV1/FVC of normal (≥75%) and another 17 comes under the age group of ≥ 50 years, in that 14(82.36%) were having FEV1/FVC of normal (≥70%) and 3(17.64%) were having FEV1/FVC of below normal (<70%). In the posttest the frequency and percentage distribution of lung forced expiratory volume in second/ forced vital capacity has been improved to some extend but the subject's remains in the same group.

TABLE 4 DISTRIBUTION OF FORCED MID EXPIRATORY FLOW RATE (FEF25-75%).

Age in years	Classification of spirometric value FEF25-75% (In %)	Pre test		Post test	
		Frequency	Percentage (%)	Frequency	Percentage (%)
<50	<75	13	100	12	92
	≥75	0	0	1	8
≥50	<70	17	17	17	100
	≥70	0	0	0	0

In pretest among 30 quarry workers 13 is under the age group <50, among 13 all (100%) of them were having Forced Mid expiratory Flow Rate of normal (≥75%) and another 17 comes under the age group of ≥ 50 years, in that 17(100%) were having

forced mid expiratory flow rate of normal (≥70%). In the posttest forced mid expiratory flow rate among 13 workers 12(92%) are having below normal (<75%) and 1(8%) is having forced mid expiratory flow rate of normal (≥75%) in the age group of ≥50 years among 17 workers there was an improvement to some extend but the subject's remains in the same group.

TABLE 5 DISTRIBUTION OF FORCED EXPIRATORY FLOW AT 75%.

Classification of spirometric value forced expiratory flow at 75 % (FEF75%) (In %)	Pre test		Post test	
	Frequency	Percentage (%)	Frequency	Percentage (%)
≤50	29	97	28	93
>50	1	3	2	7

In pretest among 30 quarry workers, 29(97%) were having forced expiratory flow at 75 % below normal (≤50%), another 1(3%) were having forced expiratory flow at 75% of normal (>50%). In post test 28(93%) were having forced expiratory flow at 75 % in the below normal (≤50%), another 2(7%) were having forced expiratory flow at 75% of normal (>50%).

TABLE 6 MEAN, STANDARD DEVIATION, MEAN DIFFERENCES, AND 't' VALUE AND 'p' VALUE OF INCENTIVE SPIROMETRY IN INCREASING LUNG VOLUME CAPACITIES.

Sl. no	Parameters	Mean		SD		MD	't' value	'p' value
		pretest	posttest	Pre test	Post test			
1	FVC	73.17	79.77	19.39	20.39	6.6	3.078	0.04 ^s
2	FEV1	60.83	67.53	18.12	20.39	6.7	4.02	0.00 ^s
3	FEV1/FVC	84.1	85.17	12.84	13.20	5.16	4.75	0.00 ^s
4	FEF25-75%	36.67	41.83	15.06	17.34	5.16	4.18	0.00 ^s
5	FEF75%	33.53	38.23	13.33	15.47	0.08	5.21	0.00 ^s

S Significant (p<0.05 level of significance)

Mean posttest lung volume capacities like FVC, FEV1, FEV1/FVC, FEF25-75%, FEF75% of the group were 79.77, 67.53, 85.17, 41.83, and 38.23 respectively is greater than the mean pretest lung volume capacities 73.17, 60.83, 84.1, 36.67 and 33.53 with a significant mean difference of 6.6, 6.7, 5.16, 5.16 and 0.08. Hence H1 is accepted indicating that the incentive spirometer was effective on increasing the lungs volume capacities that p<0.05 among all the parameters FVC, FEV1, FEV1/FVC, FEF25-75%, FEF75% .

CONCLUSION

Exercise is an important component of pulmonary rehabilitation for patients with chronic lung disease. Change in physical activity habits is associated with change in cardio respiratory fitness, Incentive spirometric exercise is effective in improving the lung volume capacities and also it was found that there is no significant association between the lung volume capacities and the demographic variables. As that we can give an awareness of how important the breathing exercise helps to keep healthy.

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