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Original Research Paper

Physiology

TO ASSESS THE PULMONARY FUNCTION TEST OF MARBLE INDUSTRIES WORKERS

Dr. Meghshyam Sharma Associate Professor, Department of Physiology, R. N. T. Medical College, Udaipur

Dr. Mukesh Kumar Chaturvedi* Assistant Professor, Department of Physiology, S. P. Medical College, Bikaner *Corresponding Author

ABSTRACT Marble is a metamorphic limestone that is widely used in the sculpturing of statues and the construction of buildings and monuments. Working with these materials generates marble dust, which can cause respiratory issues and irritation of the eyes and skin. So this study has been conducted to assess the lung function parameters of the person who engaged in Marble Cutting and Grinding. This study was carried upon 50 healthy males in the age group of 18-55 years. The subjects were divided into two groups Study group and Control group. One group comprised 25 subjects in Study group (person engaged in Marble Cutting) and other had 25 subjects in Control group. The parameters used as determinants of lung function were predicted percent of means of FVC, FEV1 and PEFR recorded as per standard procedure using RMS- Helios spirometer. In our study the Study group was having significantly lower mean value of FVC, FEV1 and PEFR as compared to Control group.

KEYWORDS : Marble dust, Silica and Pulmonary Functions.

INTRODUCTION

Workers involved in manufacturing, finishing, and installing natural and manufactured stone countertops are at risk for significant crystalline silica exposure. Silicosis results in permanent lung damage. Silica dust particles become trapped in lung tissue, causing inflammation and scarring and reducing the lungs' ability to take in oxygen. Symptoms of silicosis can include shortness of breath, cough and fatigue, and may or may not be obviously attributable to silica. Workers exposed to airborne crystalline silica also are at increased risk for lung cancer, chronic obstructive pulmonary disease (COPD), and kidney disease. Marble has been commonly used in the sculpturing of statues, the construction of buildings and monuments since the ancient times. It is a material used in tiles, countertops and indoor flooring. The industry's disposal of the marble powder material, consisting of very fine powder, today constitutes one of the environmental problems around the world.[1]

Workers who quarry, grind, polish and install marble are exposed to the dust, which contains particles of calcium carbonate and silica. Prolonged exposure to respirable crystalline silica has long been known to cause one of the oldest known industrial diseases, silicosis.[2,3]

Stone carving of a hard stone like marble requires the use of power tools such as saws, drills, grinders and sanders. Inhaling marble dust causes toxic effects on the respiratory system. Workers and residents living in areas adjacent to stone quarries are prone to a disease called silicosis, whereby inhaled marble dust damages the cells of the respiratory system. Symptoms include a chronic cough and shortness of breath. Processing of marble result in the formation of marble dust, which is suspended in the air and inhaled by the workers.

MATERIAL AND METHOD

This study has been undertaken to observe the effect of Marble Dust on Pulmonary Functions of healthy male of age group 18-55 years.

The pulmonary functions of Marble Workers (Study Group) were compared with the Control group. This study was conducted in the Department of Physiology, R. N. T. Medical College, Udaipur.

The subjects of Study Group were taken from Marble Cutting Industries, Udaipur and the subjects of Control Group were selected from the General Population of Udaipur City. The readings were taken in sitting position using computerized Spiro-meter (RMS –HELIOS 401).

GROUP I (Study Group): 25 Persons who engaged in Grinding and Cutting of Marble.

GROUP II (Control Group): 25 Person from the General population (who engaged in office job).

Inclusion Criteria:

- Healthy Male
- Age group 18-55 years
- Physically and mentally capable of adequate co-operation during the performance of the tests.

Exclusion Criteria

- The patients suffering from chronic bronchitis, asthma tuberculosis, cardiovascular disease and smokers were excluded from the study.

Statistical analysis

The data were expressed as mean±SD. Statistical analysis were performed according to an intention to treat strategy. Quantitative data were presented as mean±SD and the student's unpaired't' test was used to compare the differences. All p values were 2 tailed, p values <0.05 was considered significant. Analysis was performed by using SPSS version 6.0 computer software.

Following parameters were measured Pulmonary function tests
FVC- Forced vital capacity.

FEV1- Forced expiratory volume in 1 second.
PEFR- Peak Expiratory Flow Rate.

RESULT

Compare the lung functions parameters between Study Group and Control group is shown in table-1.

Forced vital capacity (FVC):

The mean value of FVC of Study group (72.20) is lower than the mean value of Control group (79.28). The difference of mean of FVC was significant between the subjects of Study group and Control group (p=0.0365).

Forced expiratory volume in 1 second (FEV1):

The mean value of FEV1 of Study group (82.40) is lower than the mean value of Control group (90.64). The difference of mean of FEV1 was significant between the subjects of Study group and Control group (p=0.009).

Peak expiratory flow rate (PEFR):

The mean value of PEFR of Study group (76.46) is lower than the mean value of Control group (84.28). The difference of mean of PEFR was significant between the subjects of Study group and Control group (p=0.0267).

This study showed that Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV1) and Peak Expiratory Flow Rate (PEFR) value were significantly lower in Person engaged in Grinding and Cutting of Marble.

Table-1:- Showing the comparison of Pulmonary Function Test between Study and Control groups.

S. No.	Parameters	Study Group (Mean±S.D)	Control Group (Mean±S.D)	t Value	p value
1.	FVC	72.20 ±10.12	79.28± 12.97	2.1518	0.0365
2.	FEV1	82.40± 9.50	90.64± 11.96	2.6974	0.009
3.	PEFR	76.46±10.78	84.28±13.28	2.2859	0.0267

DISCUSSION

The stone-quarry manual workers are exposed to dust from the rocks they cut; especially during saw-cutting and finishing, theses dust contain silica dust.[4] which may lead to pulmonary problems (silicosis). Silicosis appears after prolonged exposure to silica dust. Besides, it depends upon a number of other factors such as size of the particle; concentration of silica particles in the air, duration of exposure, particle surface characteristics including the age of the particle and the concentration of trace metals such as iron.[5] Dust inhalation has been co-related with number of respiratory diseases as one of the etiological factor in form of pneumoconiosis, silicosis, byssinosis, grain fever syndrome, occupational asthma, farmer's lung etc.

High prevalence of silicosis has been reported among workers engaged in quarrying shale sedimentary rock in India. According to Urom, et al.,[6] the major respiratory symptoms among quarry workers include non-productive cough, chest pain, catarrh and dyspnea. Considerable pulmonary function impairments have been reported in quarry workers.[7,8]

Workers who engaged in marble cutting for a prolonged period of time showed a reduction in pulmonary function tests which may be due to mechanical irritation of respiratory tract by dust itself, release of mediators as histamine resulting into airway obstruction by inducing asthma by immunological mechanism because of toxins present in dust cause decrease in expiratory flow rates (FEV1, PEFR)and an obstructive type pattern and deposition of dust along conductive airways leads to fibrotic nodules and stiffening of lung parenchyma so decrease in lung compliance and lowered FVC values.

CONCLUSION

This study shows a highly significant decrease in pulmonary function tests in workers of marble industries when exposed to air pollutants in the form of dust of different types resulting into pulmonary dysfunction. This study showed that Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV1) and Peak Expiratory Flow Rate (PEFR) value were significantly lower in Person engaged in Grinding and Cutting of Marble.

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