To Compare The Effects Of Marble And Stone Dust On Lung Volumes And Capacity

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Abstract : Background and objectives: Occupational pulmonary diseases are more widespread and more disabling than any other group of occupational disease in form of pneumoconiosis, silicosis, byssinosis, farmerslung, asbestosis, asthma, allergic alveolitis. Early recognition of disturbed lung functions will be of great clinical, social and preventive importance in industry workers who constantly exposed to air borne pollution. So the present study was conducted to determine the effect of marble and stone dust on marble cutters and stone cutters. Methods: Thirty subjects were marble cutters and thirty were stone cutters . The pulmonary function tests viz forced vital capacity (FVC), forced expiratory volume in 1st second (FEV1), peak expiratory volume(PEFR) and maximum ventilatory volume (MVV) were carried out with the help of compurterised medspiror. The data were collected, and conclusions were drawn on the basis of appropriate statistical analysis.Results and interpretation: The results were compared with students `t` test which showed a significant reduction in pulmonary function tests due to marble dust and stone dust. The decrease in FVC and MVV indicates a restrictive impairement whereas decrease in (FEV1), (FEF25-75), (PEFR) indicates an obstructive impairment. Conclusion: The observed changes in pulmonary function tests could be due to mechanical irritation caused by exposed dust and individual's susceptibility to silica dust. The pulmonary function tests are more decreased in marble cutters as compared to stone cutters which may be due to longer duration of exposure suggesting an urgent need to improve dust control measures and health status of marble as well as stone cutters. [Vyas S et al NJIRM 2013; 4(3) : 23-28]

KEY Words: Anti Industrial dust exposure, marble cutters, stone cutters Pulmonary Function Tests (PFT)

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Introduction: Airborne dusts are of particular concern because they are well known to be associated with widespread occupational lung diseases like pneumoconiosis but in modern era, there is an increasing interest in other dust related diseases such as asthma, allergic alveolitis, irritation as well as a whole range of non respiratory illness which can occur at much lower dust exposure levels. Inhalation of silica particles injures lung tissue, leading to silicosis through an immunological mechanism involving alveolar macrophages[1-3].

Silicosis is one of the oldest occupational disease known to man. This incurable lung disease caused by inhalation of dust containing crystalline silica is irreversible and disease progresses even when exposure stops. Dust originates from larger masses of same material through mechanical breakdown process .such as cutting, explosion, strong friction between rocks.

These occupational pulmonary diseases are more widespread and more disabling than any other group of occupational disease. The lung with its extensive surface area, high blood flow and thin alveolar epithelium is an important site of contact with substance in environment. The inhalation of dust over periods of time leads to proliferation and fibrotic changes in lungs[4] .

Early recognition of disturbed lung functions will be of great clinical, social and preventive importance in industry workers who constantly exposed to air borne pollution. Many studies have been undertaken in West and in India and have shown changes in pulmonary function tests in different dust industries like cotton mill, grain - dust, granite-dust, sand dust, flour-mill dust etc.

The pulmonary function tests help in assessing the effects of exposure of known hazards by the early recognition of their alteration in industry workers who are constantly exposed to various dust pollutants and so that appropriate measures can be taken to minimize the hazards of exposure to polluted environment. Hence it was planned the compare the effect of marble dust and stone dust on pulmonary function tests in Jaipur district of organized and non-organized sectors

Materials and Methods: The present study was conducted in 60 male subjects of age group 25-40 years from general population of Jaipur district. Out of which 30 subjects were taken as marble cutters and 30 subjects were stone cutters. Pulmonary function tests viz forced vital capacity (FVC), forced expiratory volume in 1st second (FEV1), forced expiratory flow between 25-75% (FEF25-75), peak expiratory flow rate (PEFR) maximum voluntary ventilation (MVV) were determined using Medspiror, a dry type of spirometer after a detailed history of working in terms of daily number of hours, period of working, dietary history and free from any illness and general physical examination was done.

Exclusion criteria-presence of any acute or chronic respiratory disorder, systemic illness indirectly affecting respiratory system.

In present occupation for less than 5 years, age less than 25 and more than 40 years, subjects not willing to participate. The anthroprometric parameters age, height, weight were assessed and pulmonary function tests were performed in resting state with nose clip with subject sitting on the stool between 9 a.m. to 11 a.m. The study was approved by the institute and informed consent was taken prior to the study by the subjects and there was full co-operation. Statistical analysis was carried for all the parameters using SPSF program version 10.0 (Microsoft Corp). 'P' value was determined. P>0.05 was considered as non-significant. Student t test was used for between groups comparison.

Result: There was no significant difference in the mean age, height and weight of Marble cutters and stone cutters as shown in Table 1.

TABLE 1: Age, Height and Weight of Subject

Parameters	Marble cutters	Stone cutters
Age (years)	33.26±4.32	34.03±5.12
Height (cm)	163.56±4.24	163.56±4.199
Weight (kg)	51.83 ±5.57	52.73±3.56

FVC (Forced Vital Capacity): Table-2 shows the mean and standard deviation in marble cutters and stone cutters as 2.44 ±0.542and 2.65±±0.35 respectively which is not significantly different.

FEV1: The mean and standard deviation in marble cutters and stone cutters as 1.50±0.296and 2.65±±2.35 respectively which shows that the values are highly significant.

TABLE - 2 showing M± S.D. of pulmonary parameters in marble cutters and stone cutters

Units	Parameters	marble cutters		Stone cutters		pvalue	Significance
		M	S.D.	M	S.D.		
Litre	FVC	2.44	±0.542	2.65	±0.35	>0.05	NS
Litre	FEV_1	1.50	±0.296	2.35	±0.328	<0.001	HS
Litre/sec	FEF_{25-75}	1.77	±0.298	2.56	±0.361	<0.001	HS
Litre/sec	PEFR	3.10	±.326	4.45	±0.88	<0.05	S
Litre/min	MVV	83.0	±14.61	88.5	±11.51	>0.05	NS

HS: Highly Significant p<0.01, <0.001, S: Significant p<0.05, NS: Non-significant p>0.05

FEF25-75: Table-2 shows the mean and standard deviation of marble cutters and stone cutters as1.77±0.lly significant 298 and 2.56±0.361respectively with highly significant difference.

PEFR: The mean and standard deviation for marble cutters and stone cutters is 3.10±0.328 and 4.45±0.88which is statistically significant

MVV : The mean and standard deviation between marbe and stone cutters is non-significant as 88±14.61and 88.5±11.5 respectively

TABLE- 3: Mean values± S.D. Exposure years for marble cutters, Stone cutters

Dust workers	Exposure years
Marble cutters	9.8±4.24
Stone cutters	8.63 ±2.02

Discussion: Pulmonary function tests are performed to assess lung functions, to determine the degree of damage to the lungs, diagnosis of certain types of lung disease and to analyze whether exposure to contaminants at work affects lung function. In occupational studies respiratory diseases, spirometry is one of the most important diagnostic tools, most widely used, most basic and effort dependent pulmonary function test. It plays a significant role in the diagnosis and prognosis of these diseases and describes the effect of restriction or obstruction on the lung functions.

Many studies have been done in relation to pulmonary functions both in normal subjects and in workers exposed to different occupation dust hazards. With a progressive trend towards industrialization, there is a definite increase in occupational lung diseases not only in other states of India but also in Rajasthan. 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, farmers lung etc.

In the present study both the groups were matched for age, height, weight and for same socioeconomic status. The results in this study are indicating that marble cutters and stone cutters are prone to respiratory dysfunctions while working in the dusty environment according to duration of exposure to silica dust predisposing them to suffer from benign pneumoconiosis, silicosis and tuberculosis. When small particles are inhaled daily and retained in pulmonary acini resulting into genesis of lung diseases due to interaction between silica dust and alveolar macrophages.

Our study showed decrease in FVC in both marble cutters and stone cutters which may be due changes in bronchii and elastic components of lungs resulting into restrictive impairement but the differenence is non significant in both the groups. The decrease in FEV1and PEFR is highly significant between two groups more in marble cutters as compared to stone cutters which may be due to concentration of silica dust in workplace, physical charactertics, duration of exposure, number of hours of work[11,12,25,40]

The decrease in PEFR is significant between marble cutters and stone cutters resulting into maximum dust concentration are more vulnerable to impairment of peak expiratory flow rate[27,30,31,48] . There is a decrease in MVV which is related to mechanical efficiency of lungs showed the findings to be in significant in both the groups.

The pattern of impairement of pulmonary function tests in marble cutters and stone cutters in present investigation is both restrictive and obstructive. The restrictive pattern has been due to reduction in FVC and MVV resulting from stiffening of lung parenchyma and lung compliance due to increasing deposits of silica dust and obstructive pattern is due to reduction in FEV1, FEF 25-75 and PEFR due to chronic bronchitis occurring due to chronic obstruction of bronchial airways by fibrotic nodules.

So, it appears that when marble cutters and stone cutters are exposed to silica dust while working hours 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 and by industrial chronic bronchitis with a decrease in expiratory flow rates (FEV1, FEF25-75, PEFR) and an obstructive type pattern and deposition of dust along conductive airways leading to fibrotic nodules and stiffening of lung parenchyma so decrease in lung compliance and lowered FVC, MVV values and a restrictive type pattern.

The occupational exposure to silica dust for a prolonged duration of time itself may not be wholly responsible for such observed low values for increased risk of lung and lung function involvement but some other factors such as overtime duties, fatigue, no protective measures, poverty, and congested atmosphere, inefficient medical health check up must also have contributed to these values.
So looking to these observations all types of measures should be taken to prevent the

hazardous effects of different dusts in industrial occupations so as to provide a healthy environment for the workers.

Conclusion: The study shows a significant to highly significant decrease in lung parameters in workers of marble cutters and stone cutters when exposed to air pollutants in the form of silica dust resulting into pulmonary dysfunction. The difference is statistically significant indicating that the air pollution at work site accelerated decline in lung functions.

So appropriate exposure measures are to be taken to minimize the effect of silica dust in these workers.

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