
ORIGINAL RESEARCH ARTICLE

**A Study on Effect of Cement Dust on Pulmonary Function Test in
Construction Workers**

Amey Paranjape

*Assistant Professor, Department of TB & Chest, B.K.L.Walawalkar Rural Medical College and
Hospital, Sawarde, Maharashtra, India*

Abstract:

Background:

Exposure to cement dust has long been associated with the prevalence of respiratory symptoms and airway obstruction in human beings. The present study was carried out to investigate the effect of long-term dust exposure on lung functions of cement workers in Dervan, Maharashtra.

Method and Materials:

After obtaining Ethical committee clearance this cross sectional study was done among 150 construction workers compared with 75 controls & their respiratory functions were assessed with help of spirometry.

Results:

Overall prevalence of respiratory symptoms & abnormal spirometry parameters among study group was statistically significant when compared with control group. Spirometry tests of 150 construction workers compared with control group of 75 subjects revealed that this impairment in respiratory functions was correlating with duration of exposure to cement dust.

Key words:

Construction workers, Occupational exposure, Respiratory morbidity.

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Address for correspondence:

Dr. Amey Paranjape,

Assistant Professor, Department of TB & Chest, B.K.L.Walawalkar Rural Medical College and Hospital, Sawarde, Maharashtra, India

Email: ameyparanjape100@gmail.com, Mobile No: 7447520160

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Introduction:

The Construction forms the backbone for urbanization of any country. In these rapidly growing economic conditions health remains neglected. Also in rapid industrialization and urbanization, occupation morbidities are on high risk in India. Occupational exposure includes Portland cement whose constituents are calcium oxide, silicon oxide, aluminum oxide, ferric oxide, magnesium oxide and other impurities. Portland cement is one of most important building material which is been exposed to all construction workers in handling, blending & grinding. The aerodynamic diameter of cement particle ranges from 0.05 to 5 μm . These particles are respirable in size; hence Portland cement is important as potential cause of occupational lung disease. ⁽¹⁾

All construction sites generates high level of dusts typically from the concrete, silica, asbestos, wood, stones, sands and the workers are exposed to this airborne dust. Dust and

Cement Particles which are inhaled are lodged in lungs and causes lung irritation, mucus hyper secretion initially followed by lung function impairment, lung inflammation, chronic obstructive lung disease, restrictive lung disease and pneumoconiosis. So far, very little is known about the patterns of respiratory morbidity in various professional groups of construction industries. Also the increased lung dysfunction is reported in several studies of various construction workers but there is paucity of data of such reports in India. As construction Workers are considered as second largest workforce in unorganized sector of the country, there is critical need to study risk assessment of respiratory functions and health disturbances among construction workers occupationally exposed to dusty environment. Spirometry is one of best diagnostic tool in estimation of lung impaired functions and prolonged expose consequences of cement dust. So keeping all these facts in mind the pulmonary function test was done in

the present study in construction workers occupationally exposed to dusty environment.

Methodology:

This cross sectional study was done among 150 construction workers compared with 75 controls to assess the respiratory illness, lung functions.

This cross sectional study was done at Construction sites in and around the area of Dervan in B.K.L.Walawalkar Rural Medical College and Hospital, Dervan and approved by institutional ethical committee. The present study was done in 225 participants (study group-n=150, Control group n= 75) selected by simple random technique.

Data collection- Subjects were selected on the basis of the results of a preliminary questionnaire specifically designed for this study. Subject from the control group were selected from the general population not directly exposed to the dusty environment.

Selection criteria- Construction workers occupationally exposed to the polluted environment were randomly selected on the basis of inclusion and exclusion criteria.

Inclusion criteria- Construction workers (exposed subjects) include:

1. Male or female workers with age group of 18–60 yrs.
2. Male or female workers working for at least one year at construction site.

Exclusion criteria of workers (exposed subjects) include:

1. Subjects less than 18 yrs of age and greater than 60 yrs.
2. Workers with less than six months work experience.
3. Those suffering from chronic lung diseases.
4. Smokers

Procedure and Instruments:

All the participants had undergone routine general examination (pulse, BP, respiratory rate, pallor cyanosis, clubbing), anthropometric measurements which includes height, weight, chest circumference, informed consent was taken from all the participants.

Questionnaire:

The participants were interviewed using the “Respiratory surveillance questionnaire by OHF (March 2013)”.

Clinical examination for respiratory health was done and the symptoms for respiratory illness were recorded in the questionnaire for every individual who participates in this study.

Lung function tests FEV₁ (Forced Expiratory Volume in 1 second), PEF (Peak Expiratory Flow Rate) and FVC (Forced Vital Capacity) for pulmonary impairment of each subject (study group and control group) was performed using a Spirometer (RMS-HELIOS 702) by following standard protocols .

Results were interpreted with the predicted values of lung function parameters calculated by reference equation for Indian population. All data was analyzed statistically by decade age groups adjusting for smoking habits.

Results:

The present study was done in 225 participants (study group-n=150, Control group n= 75). In study group out of 150, 120 subjects were male and 30 were female subjects. In control group 55 were male and 20 were female subjects. The Mean age of participants of study group is 35.7 ± 6.2 and that of control group 35.2 ± 5.1 . The Mean weight of participants of study group is 60.53 ± 5.3 and their mean

height is 152.8 ± 4.3 . The Mean weight participants of control group is 62.81 ± 3.5 and their mean height is 155.2 ± 6.12 . Table no. 1 showed the prevalence of various respiratory symptoms in study and control group. Respiratory symptoms were more common among the study group as compare to control group. Overall prevalence of respiratory symptoms among study group 26.2% which is statistically significant when compared with control group. Table no. 2 showed that all the parameters of Pulmonary Function Test were significantly decreased ($p < 0.0001$) in study group as compare to control group.

Table no.1 prevalence of respiratory symptoms in study and control group.

| Respiratory symptoms | Study Group (n=150) | Control Group (n=75) |
|----------------------|------------------------|-------------------------|
| Dyspnoea | 35 (23.3%) | 2 (2.6%) |
| Cough-Dry | 30 (20%) | 5 (8 %) |
| Cough-Productive | 11 (7.33%) | 0 (0%) |
| Wheeze | 20 (13.3%) | 0 (0%) |
| Sore throat | 13 (8.6%) | 2 (2.6%) |
| Haemoptosis | 2 (0.86%) | 0 (0%) |

Table no. – 2 Comparison of PFT parameters in study and control group

| PFT parameters | Study group | Control group | T-Value | Level of Significance |
|----------------|--------------------|---------------------|---------|-----------------------|
| FVC(lit) | 2.089(\pm 0.35) | 3.32 (\pm 0.38) | 24.34 | P < 0.0001 |
| FEV1(lit) | 2.07(\pm 0.37) | 3.04(\pm 0.57) | 15.36 | P < 0.0001 |
| PEFR(lit/min) | 5.96(\pm 0.53) | 6.13 (\pm 1.02) | 1.64 | P =0. 1 |
| MVV(lit/min) | 90.60(\pm 10.4) | 106.4 (\pm 11.3) | 10.43 | P < 0.0001 |

*FVC - forced Vital Capacity, FEV1- Forced expiratory Volume in first second

PEFR - Peak Expiratory Flow Rate, MVV- Maximum Voluntary Ventilation

Discussion:

Although, smoking is considered the most important predisposing factor in development of emphysema; environmental exposures also play an important role. There have been several studies on work related respiratory symptoms and ventilator disorders among employees of cement industry. The present study is done among the construction workers. In the present Study the Pulmonary Function tests FEV1, FVC, PEFR and MVV has shown significant decrement. Occupational and environmental exposure to hazardous particulate matter (PM) had lead to respiratory health care problems. Other Studies has shown that cement dust may enter into Systemic circulation and thereby reaching all the organs of body and different tissues including heart, liver, spleen, Bone, hair,

skin^(2,3) and ultimately affecting their microstructures and physiological performance⁽⁴⁾ as it creates the breeding ground for vector. Also while conducting such kind of studies little consideration has to be given to promising factors which affect the lung function such as age, height, weight, and smoking. Therefore the study was designed to investigate the effects of airborne dusts on the lung function of construction workers matched for age, height and weight.

In the present study, FEV1, FVC, PEFR, MVV values showed highly significant reduction as compare to control groups. The significant decrease in these values is indicative of obstructive type of changes in lung functions. Continuous exposure to dusty environment leads to inflammatory changes in small airways as well as in lung parenchyma

leading to development of obstructive type of lung dysfunction. These obstructive types of changes among study group can be correlated with the duration of exposure to dusty environment at the construction site, as majority of the subjects in study group were occupationally exposed to PMs for 5 to 10 years on an average. Also the prevalence of respiratory symptoms was more among the study group than the control group which can be explained on the same basis.

Ulvestad et al⁽⁵⁾ conducted a study to find out association between dust exposure and airway inflammation and found lower airway inflammation even though they worked for only 1 year. The results of the present study also showed a decreased FEV1 which is in agreement with the observations made by these authors.

The hexavalent chromium content of cement has been implicated as the etiology of allergic occupational pulmonary impairment.

⁽³⁾ Sultan Ayoub Meo et al carried out a study which showed that cement dust adversely affects the respiratory function and this impairment is associated with duration of exposure to cement dust.⁽⁶⁾

Similarly to our findings, Zeleke ZK investigated the effect of cement dust exposure on 127 cement factory workers with a mean of 10 years exposure to cement dust on

lung function.⁽⁷⁾ They found that pulmonary function test parameters were significantly lower in cement factory workers than in control subjects. Their results suggest that chronic cement dust exposure impairs lung function. Concurrently, Zelke et al found that FVC, FEV1 were significantly reduced among the cement production workers but not among the controls. The reduction in lung function was probably associated with high cement dust exposure.

Also, Mwaiselage et al investigated ventilatory function in cement factory workers and reported that exposed workers had significantly lower FVC, FEV1, and PEF than controls.⁽⁸⁾

Conclusion:

The present study adds evidence that cement dust adversely affects the respiratory functions and this impairment is association with duration of exposure to cement dust. The Findings are of Importance in that it highlights the need to overcome the effect of long term exposure. It also suggests that the workers must undergo pre-employment and periodic medical examination including lung function test. Thus, this study showed existing changes in pulmonary function related to dust exposure, and generated evidence to integrate primary prevention methods towards dust-related morbidity and mortality.

Conflict of interest: None to declare

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