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Original Research Article

The Frequency of Pterygium and Dry Eye in Chronic Cement Exposure: A Clinical Case-Control Study

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ABSTRACT

Introduction: Cement manufacturing has led to airborne pollution in the form of dust, gases, noise and vibration when operating machinery and during blasting in quarries, and damage to countryside from quarrying. In view of the health hazards, the present study was undertaken to find the prevalence of dry eye and pterygium among workers chronically exposed to air pollution in cement factory and thus to find out practicable protective measures to prevent external ocular surface problems among this group.

Subjects and Methods: The present study comprised of total 260 subjects of which 188 subjects were enrolled from Sarchinar Cement factory (CF) and 72 controls from Sulaimaniya Company for prepared clothes (GF). The prevalence of eye problems were then compared between the subjects enrolled from two factories. Data so obtained was analyzed using the SPSS Version 17 and Chi square test was used for statistical analysis with *p* value ≤0.05 considered as significant value.

Results: The prevalence of pterygium was 65%, dry eye 33% in study group and whereas among the control group, the prevalence of dry eye was 11% and pterygium 16.2%. Chronic Congestion was 100% in study group and 18.9% in control group with significant p-value (0.03).

Conclusion: Higher prevalence of dry eye, pterygium and ocular surface irritation in the studied cases in comparison to the controls. Health surveillance programs are needed for the dust exposure in the cement factory to monitor risk areas and to identify employees with ocular and other health problems as early as possible.

Key Words: Dry Eye, Pterygium, Cement, Ocular Surface Disease.

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INTRODUCTION

Cement industry is one of the most basic industries involved in the development of a country as cement is the most widely used building material throughout the world. Cement manufacturing has caused environmental impacts at all stages of the process. These include emissions of airborne pollution in the form of dust, gases, noise and vibration when operating machinery and during blasting in quarries, and damage to countryside from quarrying.[1]

Barnett AG et al[2] reported acute adverse health effects of ambient levels of air pollution on cardiovascular health. Al-Neaimi YI et al[3] evaluated respiratory illnesses and ventilatory function among workers at a cement factory and reported that a higher percentage of the exposed workers suffered from recurrent and prolonged cough, phlegm, wheeze, dyspnoea, bronchitis, sinusitis, shortness of breath and bronchial asthma. Novaes P et al[4] demonstrated significant association between exposure to air pollution and goblet-cell hyperplasia in human conjunctiva. In view of the health hazards, the present study was undertaken to find the prevalence of dry eye and pterygium among workers chronically exposed to air pollution in cement factory and thus to find out practicable protective measures to prevent external ocular surface problems among this group.

SUBJECTS AND METHODS

The present case control observational study comprised of total 260 subjects of which 188 subjects above 16 years of age were enrolled from Sarchinar Cement factory (CF) and 72 controls from Sulaimaniya Company for prepared clothes (GF). The subjects were interviewed in their factories during the period from 25th November 2006 to 30th June 2007. Ethical clearance and permission for the commencement of the study was obtained from factory managers and informed verbal consent was taken from the factory workers enrolled for the study after the explanation of the

procedure. Subjects those who had direct contact with the cement dust and those who had indirect contact with it i.e. office staff was enrolled in the study group. Each worker and office staff was interviewed individually using cement factory's industrial clinic and also using a specially designed questioner which contend full systemic and ocular histories with the result of examinations. Patients were asked regarding chief complain and duration, history of presenting illness and associated symptoms, all systemic reviews, past medical and surgical histories, family history of chronic illness, drug history (systemic and topical), social history and habits (smoking and drinking).

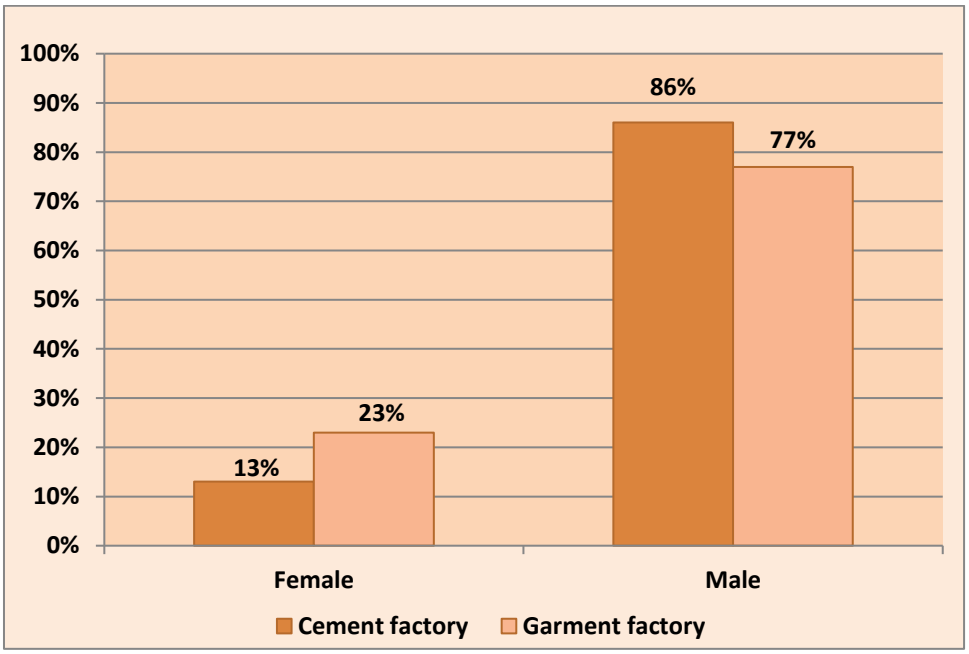
During the history taking, a nurse was specified only for the counting the blinking rate. Detailed ocular examination was carried out on all the subjects and for both eyes separately, eye lid skin for any changes due to cement exposure.

Visual acuity was carried out with Snellen 'E' chart placed at a distance of 6 meters. The measurement was taken for each worker separately; with or without the person's own glasses if worn for distance, those with refractive error were at hospital because of the lack of refraction set in the factories. It was done in order to know the best corrected visual acuity. With portable slit-lamp both anterior and posterior segments were examined, an anterior segment was examined for lid margins to detect any abnormality. The posterior segment was examined after pupillary dilation with 2.5% phenylephrine hydrochloride eye drop by biconvex 90 diopters lens. Special test and auxiliary investigations i.e. blinking rate, tear break up time, Rose Bengal staining and Schirmer test were carried to evaluate ocular problems.

Schirmer test was done with Whitman no.41 papers for both eyes at the same time without using any topical anesthesia i.e. Schirmer type 1, then the results were categorized as normal (more than 15 mm), mild dry eye (15-11mm) (Gupta.1957), moderate dry eye (10-5mm) and severe dry eye(less than 5 mm) wetting of the paper after 5 minutes or it can be regarded as severe dry eye of the wetting after 1 minute is less than 2mm.

If tear fluid fails to diffuse over the lid margin along the strip within 2 minutes, it was removed to another site within the sac and timing was recommenced. This method obviates false positive results.

The prevalence of eye problems were then compared between the subjects enrolled from two factories. Data so obtained was analyzed using the SPSS Version 17 and Chi square test was used for statistical analysis with *p* value ≤0.05 considered as significant value.



Graph 1: Gender distribution among the study and control group

Table 1: Demographic characteristics of participants

Variables		Cement factory	Garment factory	*p* –value
Gender	**Male**	86.7%	77%	0.060
	Female	13.3%	23%	
Age	**Range**	16-65 years	16-65 years	0.052
	Mean	43.8 years	41.6 years	
Job	**Active workers**	75%	8.1%	0.051
	Office employee	25%	91.9%	
Residency	**Inside and nearby**	35.6%	24.3%	0.050
	Distant	64.4%	75.7%	

RESULTS

Demographic characteristics of participants: **Table 1** shows demographic details of the participants. Age distribution ranged 16 to 65 years in both factories with mean of (43.8 years) and (41.6 years) in CF and GF subjects respectively with non-significant p-value (0.052).

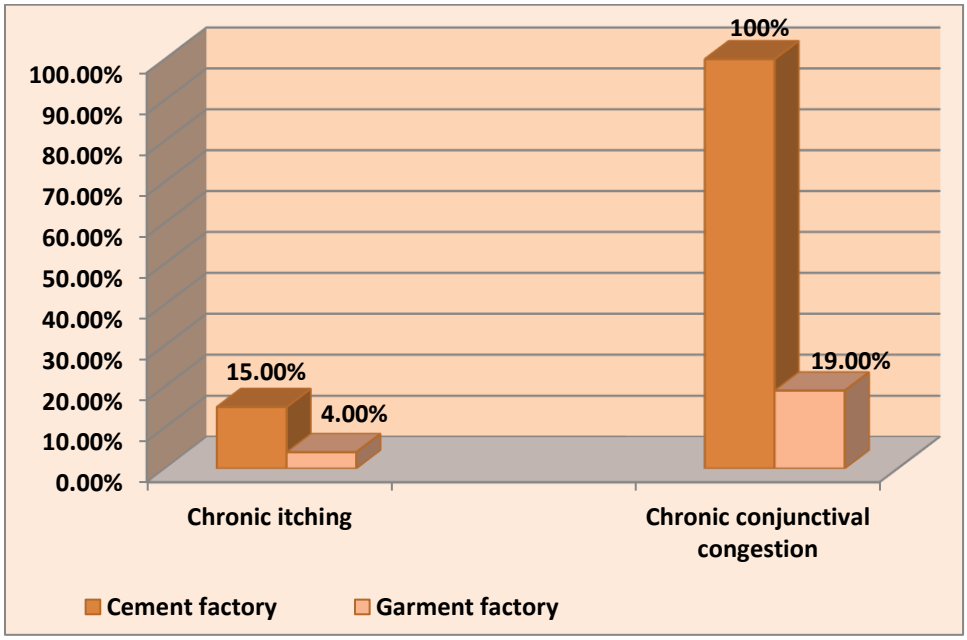
According to gender distribution, 86.7% were males and 13.3% were females in CF; while 77%were males and 23% were females in GF, with insignificant p-value (0.06).

According to job distribution 75% were workers and 25% were office staffs in CF while 8.1% were workers and 91.9% were office staffs in GF. The p-value is insignificant (0.051).

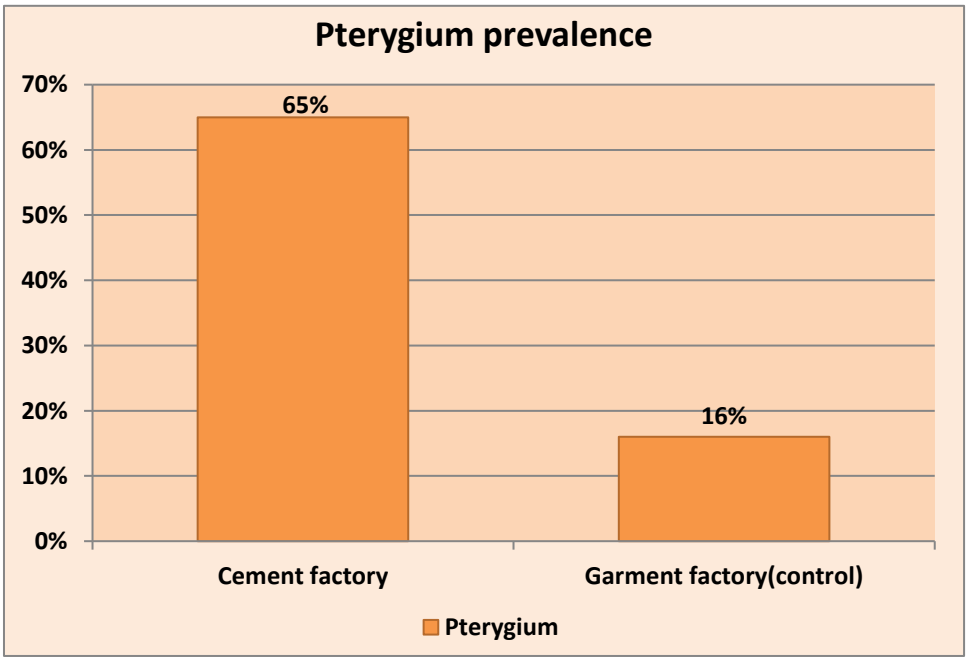
According to residence distribution, no one was living inside cement factory, 35.6% were living in the nearby areas while 64.4% in the far areas in study group, while 9.5% of controls were living in a group of houses inside the GF, 14.9% near and 75.7% in the far areas.

Type of chief complaint: Regarding the chief complaint **(Graph 2),** 15.4% of cases were complaining of eye itching among cases while 4.1% among controls. There was also higher prevalence of watery eye in cases than controls which could be due to the irritation occurred by cement dust. Refractive errors were more prevalent in controls than in cases except astigmatism.

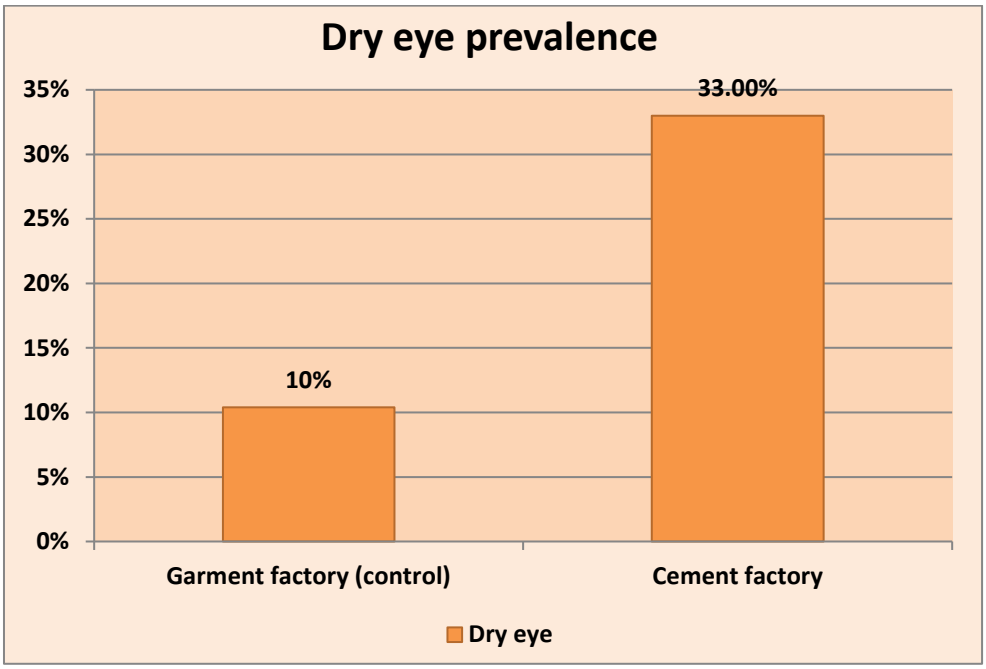
The prevalence of Pterygium was 65%, dry eye 33% in study group and whereas among the control group, the prevalence of dry eye was 11% and pterygium 16.2% **(Table 2, Graph 3,4).** Chronic Congestion was 100% in study group and 18.9% in control group with significant p-value (0.03). None of the subject showed any visible conjunctival scar on slit-lamp examination. Almost all cases and controls (100%) with severe degree of the dry eye were associated with abnormal (convex) or (absent) marginal tear meniscus and approximately 65% in both factories had abnormal marginal tear meniscus (MTM) in moderate stage while a very few in mild stages.



Graph 2: Distribution according to chief complain of the participants



Graph 3: Pterygium prevalence in CF and in GF



Graph 4: Dry eye prevalence in CF and in GF

Table 2: Demonstration of ocular affects due to cement dust

Variables	Cement factory (CF)	Garment factory (GF)	P value
Chronic congestion	100%	18.9%	0.03
Pterygium	65%	16.2%	0.036
Dry eye	33%	10.4%	0.03

DISCUSSION

Cement industry is involved in the development of structure of this advanced and modern world but generates dust during its production.[5] Cement dust if it is inhaled or if it comes in contact with eyes or skin or if it is swallowed it affects the body.[6]

Cement dust causes lung function impairment, chronic obstructive lung disease, restrictive lung disease, pneumoconiosis and carcinoma of the lungs, stomach and colon. Cement dust may enter into the systemic circulation and thus reaches the essentially all the organs of body and affects the different tissues including heart, liver, spleen, bone, muscles and hairs and ultimately affecting their micro-structure and physiological performance.[5] Cement dust has been identified as an eye allergen and can cause Conjunctivitis.[7] The present study was the first study on the ocular hazards of the cement dust or clinker exposure occurring in Cement factory in Sulaimaniya, Kurdistan region/Iraq. The present case control observational study showed disparity in sample size due to less workers in garment factory as compared to cement factory.[8] The study revealed that prevalence of more ocular problems occurred in those employees who constituted the high-risk group for cement dust exposure. Gender distribution across both factories was non-significant as the p-value showed (0.06).

The present study found that the dry eye was found in 33% and pterygium 65% among study group, whereas among the control group, dry eye was 11%, pterygium 16.2%, thus, this difference between the CF and GF group can be attributed to the chemical effect of the cement. Pterygium is speculated to be associated with corneal and conjunctival microtrauma from exposure to dust and/or sunlight.[9] People working in garment factory were taken as control because it provides a dust-free environment as compared to cement factory. Pterygium is a slow growing proliferation of wing shaped fibrovascular tissue arising from the conjunctiva, subconjunctival connective tissue, or from the limbal epithelial basal cells. The multiple risk factors associated with pterygium are sun exposure, hot climate, toxic material exposure, familial transmission and dry eye.[10]

Dry eye represents a multifactorial, heterogeneous disorder of the preocular tear film, which results in ocular surface disease. The tear film and ocular surface form a complex and stable system that can lose its equilibrium through numerous disturbing factors. Reduction in quality of life is inevitable when symptoms of dry eye occur. These symptoms range from mild transient irritation to persistent dryness, burning, itchiness, redness, pain, ocular fatigue and visual disturbance.[11] Epidemiological studies have indicated increasing incidence of dry eye disease due to exposure to unfavorable working conditions. Due to the apparent relationship between the environmental influences and dry eye disease, this disease can be better defined by delineating Environmental Dry Eye Disease as a clinical subtype of Dry Eye Disease.[12]

The excessive prevalence of eye problems among the exposed community compared to the control could be attributed to increased exposure to chemical and particulate matter irritants in the ambient air.[13] Soussia T et al[1] reported acute and chronic eye conditions among workers people at a Portland cement plant. Similarly, Merhaj SS et al[14] reported that 97% of the participants residing within the vicinity of a cement factory suffered from eye irritations.

The dry eye was more common in the males than females in cement factory which can be attributed to the fact males were distributed more in the production areas i.e. workers, while females were more in the office i.e. were less exposed to the cement dust as compared to production area. There were no home/house groups inside the cement factory to show the effect of cement on the eye, but it was present inside clothing factory. Those who were living in nearby areas i.e. in Sarchinar to CF were affected largely affected as compared to controls residing inside the garment factory were affected. Limitation of the present study was that cases were not divided into subgroups according to the time of exposure. Exposures to environmental factors such as air pollution had been correlated in literature with ocular surface irritation, resulting in symptoms of hyperemia, swelling, tearing, and dry eye sensation.[12]

Okoye OI et al[15] conducted an ophthalmological survey to determine the ocular health in Nigeria and results showed a high frequency of eye injuries among industrial workers and a low level of use of protective eye cover while at work. Thus, the present study recommends that a health unit (well equipped) should be established in the factory in order to manage minor injuries and to refer other injuries after the necessary first – AID measures have been provided. A qualified nurse should be assigned to safeguard the workers' health and to improve the factory's health facilities The health education and training program should be regularly carried out, with an emphasis on the use of personal protective measures and on the serious complication that may occur if such measures are not observed.

Face shields should always be used over safety glasses or goggles. Special designed filters for clinker, useful for two points, the first one is economical and the other is the health point of view which prevents clinker to be flight and distributed in the nearby areas.

Environmental data monitoring and safety limits obtained from international or governmental agencies may help clinicians to associate dry eye disease stages with environmental factor exposure. Researchers may be aided in identifying relevant stress to apply to their different model systems to pinpoint the mechanisms mediating responses underlying environmental dry eye disease.[12]

CONCLUSION

The prevalence of ocular manifestations such as pterygium and dry eye was high in Cement factory as compared to controls. Health surveillance programs are needed for the dust exposure in the cement factory to monitor risk areas and to identify employees with ocular and other health problems as early as possible. More plans should be carried out to reduce dust exposure in the high risk areas of the factory i.e. crusher, crane and packing. This should probably involve engineering control of the work environment as well as administrative control.

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