

OCULAR MANIFESTATIONS AND SAFETY AWARENESS AMONG QUARRY WORKERS IN PUDUCHERRY

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ABSTRACT

BACKGROUND

The study aims to determine the prevalence of ocular manifestations in quarry workers in Puducherry. Quarry workers are at high risk of developing pterygium, dry eye, ocular injuries, scleral pigmentation, nonspecific inflammation, irritation and watering. Quarry work accounts for the highest rate of injury amongst industrial work and the safety awareness is poor amongst the workers.

MATERIALS AND METHODS

A cross-sectional study involving 254 quarry workers was conducted between March 2015 and September 2015. A structured questionnaire was used to obtain information on demographics, ocular symptoms, ocular injury and use of protective wear during work. Slit lamp examination was done to detect ocular surface disorders like pterygium. Schirmer's test was done for the detection of dry eye. Pterygium and dry eye were graded based on the severity.

RESULTS

Among quarry work, the ocular manifestations included pterygium (57.48%), dry eye (46.6%), inflamed eyes (18.5%) and scleral pigmentation (57.48%). The workers were subdivided based on the severity of pterygium (Grade I - 49.80%, Grade II - 6.49%, Grade III - 1.37%) and based on the severity of dry eye (mild - 18.11%, moderate - 13.85%, severe - 9.05% and very severe - 5.09%). The awareness about hazards and safety precautions to be followed are poor among quarry workers. Most of them fail to use protective measures during work.

CONCLUSION

The study shows a definite predilection for pterygium, dry eye and ocular injuries in quarry workers. Awareness of such morbidity and use of safety measures would improve ocular health.

KEYWORDS

Quarry Workers, Pterygium, Dry Eye, Ocular Injuries, Safety Measures.

HOW TO CITE THIS ARTICLE: Muthukrishnan V, Baba D, Maheshvaran M, et al. Ocular manifestations and safety awareness among quarry workers in Puducherry. J. Evid. Based Med. Healthc. 2017; 4(6), 274-278. DOI: 10.18410/jebmh/2017/52

BACKGROUND

A quarry is an open cavity where slates or stones are extracted and rocks such as granite, gypsum and limestone used in building work are deposited. Quarry work is generally performed using different tools and equipment such as hand tools, explosives, power saws, channelling and wedging for stone extraction. The environment in a quarry is dry, hot and heavily polluted, which increases the susceptibility for ocular morbidity. A quarry also provides one of the most dangerous occupational environments where

there is high risk of ocular injuries and quarry work accounts for the highest rate of injury amongst industrial work.^{1,2}

Quarry workers have high risk of developing pterygium (24.3%) and frequently complain of symptoms including burning sensation and watering from eyes (18.2%).¹ Another major disease of the eye that is highly prevalent in quarry workers is dry eye syndrome. Dry eye remains an extremely common yet undiagnosed disease in the population and about 30% of patients seeking ophthalmologists have symptoms related to dry eye.³ A study reports that 68.9% of workers have experienced ocular injury and 14.9% complained of vague irritation in eyes.⁴

In spite of considerable risks involved, there appears to be low awareness about the detrimental health effects as evident in a study where 81% failed to use personal protective equipment (safety goggles) and 94% had poor knowledge about the health problems involved in the quarry work.⁵

Financial or Other, Competing Interest: None.

Submission 25-12-2016, Peer Review 31-12-2016,

Acceptance 15-01-2017, Published 17-01-2017.

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DOI: 10.18410/jebmh/2017/52



MATERIALS AND METHODS

This is an observational prevalence study, which aims at assessing the prevalence of ocular morbidity among 254 quarry workers (508 eyes). This is a cross-sectional study, which was carried out in 6 quarries in Puducherry. This would encourage the quarry workers to seek timely health care and also motivates the medical professionals to expand their knowledge about the occupational hazards involved in quarry work.

This study includes 6 stone quarries that consists of 254 quarry workers. This group consists of stone mine workers such as drillers, maintenance workers, plant operators, process operators, drivers and shot firers. The quarry workers are examined and those with abnormal ocular findings are referred for a detailed ocular workup at our tertiary care centre.

All quarry workers with more than 6 months exposure with or without ocular symptoms are included in the study. Exclusion criteria included workers with diabetes, hypertension and other medical conditions (SLE, rheumatoid, Sjogren's syndrome and thyroid dysfunction), use of drugs such as diuretics or beta blockers, history of using tear substitutes and history of any ocular surgery.

Institutional ethics committee approval was obtained. The permission was obtained from the management organisation of individual quarries and informed consent was obtained from each worker after explaining in their vernacular language.

A structured questionnaire was administered, which contains both open and closed ended questions to obtain basic information like age, educational status, years of work in quarry, socioeconomic status and ocular complaints. It was followed finally by a set of questions framed about the knowledge, awareness and attitude towards the health effects caused by quarry work and ocular protective measures.

After the questionnaire was completed, ocular examination was done using pen torch, scale and Schirmer's strip for assessment of pterygium and dry eye. Schirmer's test was performed at ambient room temperature to assess the aqueous component of precorneal tear film. A Whatman filter paper No. 41 with dimensions of 5 mm x 35 mm is used. Without the use of topical anaesthesia, the paper is placed at the junction of lateral 1/3rd and medial 2/3rd of the lower lid and the extent of wetting after 5 minutes is measured.

Dry Eye Severity Level-

Grade 1- Mild dry eye- Schirmer's value 11-15 mm.

Grade 2- Moderate dry eye- Schirmer's 6-10 mm.

Grade 3- Severe dry eye- Schirmer's 3-5 mm.

Grade 4- Very severe dry eye- Schirmer's ≤ 2 mm.

Slit-lamp examination of conjunctiva and cornea was done to detect degenerative conditions. The diagnosis of pterygium was made and graded based upon the growth of tissue as follows-

Grade I - Just beyond the limbus.

Grade II- Midway between the limbus and the pupillary margin.

Grade III- At the pupillary margin.

Grade IV- Encroaching the visual axis.

Inflamed eye is noted and excluded if secondary to systemic disease unrelated to quarry work. Scleral pigmentation and pingueculae were also noted.

After complete data collection from all the quarry workers, analysis was done. Statistical analysis was done with SPSS version 19 statistical software for coding and analysis. The results were finally analysed and discussed.

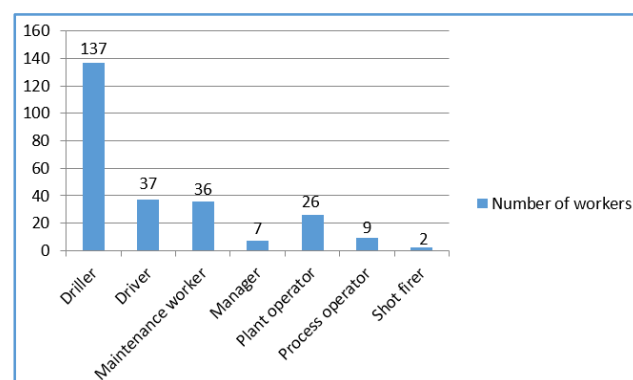
RESULTS

A total of 254 quarry workers (508 eyes) were interviewed and examined of which 246 were males and 8 were females. The age group was 18-69 years with an average of 37.

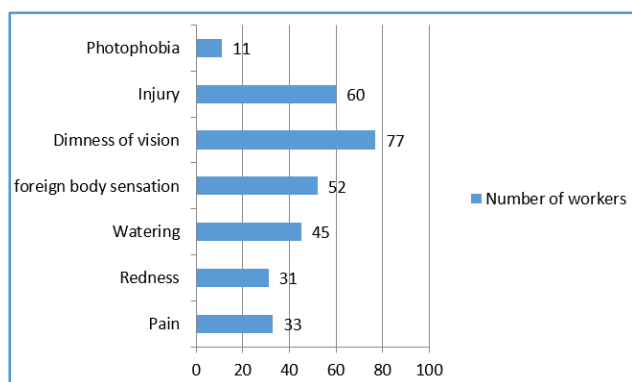
The number of quarry workers differ based on the nature of work done at the quarry (Graph 1). The ocular symptoms complained by the workers included blurring of vision, photophobia, foreign body sensation, pain, redness and watering. Ocular injury was a complaint in 60 workers. (Graph 2).

Pterygium was present in 293 eyes, which was graded based on the severity (Graph 3). There was variable prevalence of pterygium amongst the different types of workers depending on the extent of exposure (Graph 4). Dry eye was present in 236 eyes, which was graded as mild, moderate, severe and very severe (Graph 5) and also showed a marked difference in prevalence in different type of workers (Graph 6). Muddy conjunctiva was present in 292 eyes and pinguecula in 5 eyes. Inflamed eye was present in 94 eyes.

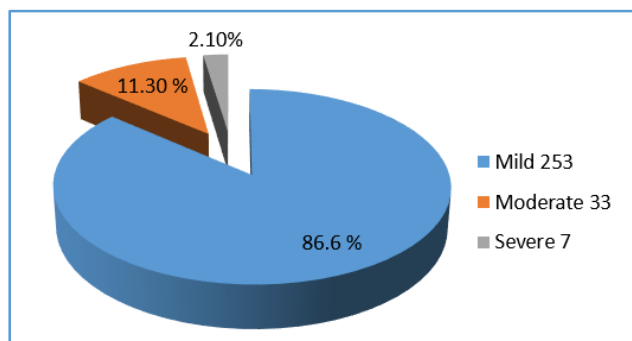
The questionnaire-based results regarding the safety awareness is as follows. When questioned about the usage of protective measures at work, 82.3% of the workers were unaware, 10% felt it was uncomfortable and 7.7% felt it was unnecessary. Regarding the response of the workers to ocular injury during work, only 20.9% agreed to visit hospital and 79.1% believed in self-medication and native treatment. When asked about the ill effects caused due to working in quarry, 35% of workers were unaware, 19.3% felt it may cause irritation in eyes and 45.7% of them knew about the possibility of ocular injury.



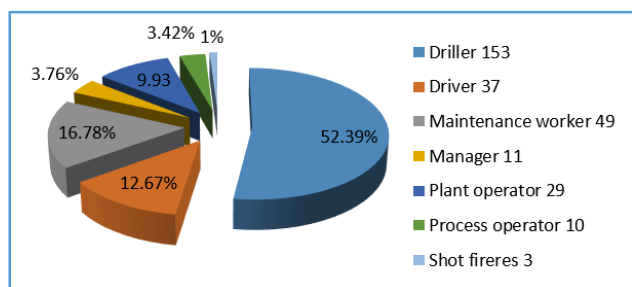
Graph 1. Number of Quarry Workers Based on Type of Work



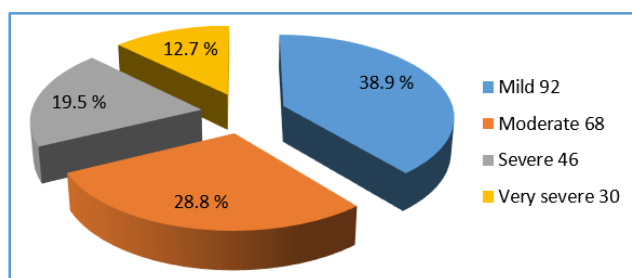
Graph 2. Ocular Symptoms and Injury



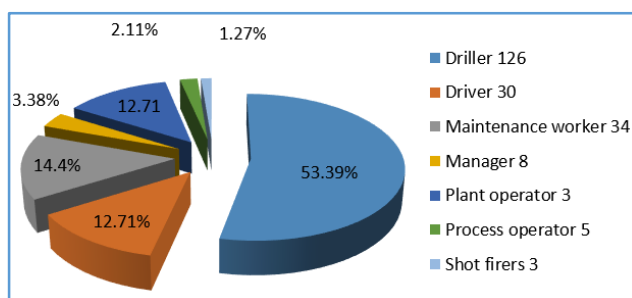
Graph 3. Grades of Pterygium



Graph 4. Prevalence of Pterygium Based on Type of Work



Graph 5. Grades of Dry Eye



Graph 6. Prevalence of Dry Eye Based on Type of Work

DISCUSSION

The common chemical and physical substances that cause ocular hazard in quarry work include fumes, gases, dust, debris and ultraviolet rays. Excessive wind, direct sunlight and air pollution are major factors for development of pterygium and dry eye syndrome.⁶ It has been found that about 24.1% of the population suffering from dry eye are asymptomatic.⁷ Long-term exposure to air pollutants leads to tear film abnormality.⁸

Pterygium is the fibrovascular growth of conjunctiva onto the cornea and mostly presents on the nasal side.⁹ Pterygium mainly results from chronic exposure to ultraviolet rays of sunlight and is not closely linked to pinguecula and climatic droplet keratopathy.^{9,10} People working in hot, dry and dusty polluted areas are more prone to develop pterygium. UV rays damage the Bowman's membrane of cornea causing thickening and hyperplasia in subconjunctival connective tissue leading to pterygium.¹⁰

In this study, 57.48% of the quarry worker population were diagnosed with pterygium (Grade I - 49.80%, Grade II - 6.49%, Grade III - 1.37%) (Graph 3). This is significantly high when compared to prevalence of 5.2% in the Indian population.¹¹ A similar study reports prevalence of pterygium in 24.3% of quarry workers.¹ Pterygium prevails in a specific range of latitude, which is 37° to the north and south of equator due to the hot and dry arid atmosphere.¹² The prevalence varies with age and extent of exposure to dust and ultraviolet rays, which explains why drillers have higher prevalence than plant operators, maintenance workers or drivers (Graph 4).

Most of the workers seek medical advice only at later stages of pterygium when symptoms and postoperative recurrences are frequent.¹³ Prevalence of pterygium runs parallel to the prevalence of foreign body sensation and inflamed eye, because both cause ocular irritation potentiated by the dust and fumes from heavy trucks and equipment use in quarries.¹⁴ A similar study by Mansour and others showed that among 20 rock drillers, subepithelial opacities were seen in 12 drillers (63%) and pigmented trabecular meshwork in 13 drillers (68%).¹⁵ Drillers seem to be at a higher risk than other types of quarry workers.

Dry eye is a widely prevalent ocular disorder in the study, which has been graded as mild (18.11), moderate (13.85), severe (9.05) and very severe (5.09) (Graph 5). It was seen in 46.6% of quarry workers, which was remarkably higher compared to the prevalence of 29.25% in the general population.⁶ The prevalence runs parallel with the years of exposure in quarry.

Presence of dry eye is more in drillers rather than plant operators, maintenance worker or drivers. Since, air pollution is one of the major underlying pathogenetic factors for both dry eye and pterygium, it is not surprising that drillers who are in close contact with smoke produced during drilling are more prone to develop the disease (Graph 6). Also, it has been shown that pterygium indirectly causes destruction of the precorneal tear film leading to dry eye.^{11,2,16} The ocular surface (cornea and conjunctiva) is mainly protected from ultraviolet rays by the tear film, which

is altered in dry eye. Hence, patients with dry eye are more predisposed to develop pterygium.^{11,17} This was consistent with our study, which shows that pterygium and dry eye coexist in the majority of quarry workers, much more than could be ascribed to chance.

About 35% of workers have poor knowledge about the ill effects caused by quarry work as discussed in previous studies.¹⁸ 38.5% had high school level education and only 0.2% had a graduate degree. The lower literacy level partly explains their ignorance. The poor awareness also reflects inadequate awareness programmes directed towards quarry workers. About 65% of our study population knew that some ill effects (injury, irritation due to dust, etc.) are associated with quarry work, but could not explain them with accuracy.

Periodic ophthalmic examination is imperative in quarry workers as ocular injury (11.7%) is more prevalent than facial injury (8.3%) in quarry work.¹⁹ Out of 5671 patients examined in a study, 13.7% of patients presented with ocular injury sustained during work.²⁰ 64.2% of the study population had injury caused by foreign body (corneal and conjunctival) and majority of the injuries occurred with sand dust.¹⁸ A small minority involved injury to intraocular structures.

Our study shows that in case of ocular injury due to accidents at quarry, about 79.1% do not seek hospital treatment and take some form of self-treatment. Ocular trauma are generally neglected and this often results in compromised vision.²¹ This behaviour was more among illiterates or those with primary level education. These workers seek medical advice only in case of serious injuries in the eye, which are critical and carry a guarded prognosis. Most of the workers who sought treatment at hospital had higher secondary education. Literature clearly demonstrates that the use of safety measures during work are a bare minimum among the quarry workers.^{4,22} This unfortunate situation can be substantially improved by health education and proper guidelines at work as it has been shown that there was a 16% reduction of ocular injury after enhanced education and protective eyewear for three months.²³

None of the quarry workers were using personal protective measures like goggles, which indicate that they are unaware about the risk involved, which is consistent with other studies.²⁴

CONCLUSION

The study shows a definite predilection for pterygium, dry eye and ocular injuries in quarry workers. Awareness of such morbidity and use of safety measures would improve ocular health in quarry workers.

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