A Study on Prevalence of Ocular Injuries among Workmen of Welding, Grinding and Polishing, Attending the Out Patient Department and Emergency Department of a Tertiary Care Centre

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ABSTRACT

BACKGROUND

We wanted to estimate the incidence and prevalence of ocular injuries among occupational workers in welding and grinding industry treated in a tertiary care hospital, determine the major types of ocular morbidities in welding and grinding workers and identify the vulnerable age groups suffering from ocular injuries due to welding and grinding.

METHODS

This hospital based cross-sectional study was carried out among 712 patients having ocular injuries only for occupational workers doing welding, grinding or polishing work. The study period was from 01 / 01 / 2018 to 30 / 06 / 2018. The study was conducted in the Department of Ophthalmology, Hi-Tech Medical College and Hospital. All patients were assessed for demographic distribution, detailed ocular evaluation and a questionnaire related to awareness about the injuries and safety measures taken during the work.

RESULTS

During the period of study, 712 patients who had ocular injuries due to welding and grinding work were included in the study. The mean age was 33.87 years with a standard deviation (SD) of 9.86. There were no female workers who reported such injuries. Most injuries were corneal foreign body (63.90 %), conjunctival foreign body (2.81 %), conjunctivitis due to fumes (11.94 %), laceration (8.71 %) and keratoconjunctivitis (12.64 %).

CONCLUSIONS

To complement standard epidemiological research, the narrative accident text offers useful evidence. Staff conducting a welding job or working with local welders should be qualified to recognise possible dangers and appropriate protective equipment should be used to prevent eye injury.

KEYWORDS

Ocular Injuries, Welding & Grinding Work, Risk Factor for Eye Injuries

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BACKGROUND

Efficiency is improved in workers with better health; health directly influences productivity. Ocular accidents account for a large percentage of all injuries related to work. Welding is a process that connects the material using high heat, usually metal or thermoplastic material. The process melts the materials together and allow them to cool thus creating fusion. For welding, several different energy sources, including a gas blaze (chemical), an electric arc (electrical), may be used. Welding is a risky job and precautions are required to avoid burns, electric shock and exposure to intense ultraviolet radiation. Ultraviolet radiation can cause inflammation of cornea or photokeratitis and can burn the retina too.

The method of welding exposes employees to a variety of mechanical, radiation, thermal or chemical injury hazards. Welding and grinding workers are primarily working in construction, manufacturing, transportation and automotive workshops. An infrared absorption green glass shield mounted inside the welder's helmet is the primary personal protective equipment for eye safety from welding arc radiation.[1] This helmet guards from chemical injuries as well. Fumes containing elements like F, Mn, Zn, Pb, As, Ca, S, Cr, Ni are created by welding. Gases released are CO, CO2, F, HF.[2] Welding gases are associated with a variety of health concerns. Welding fumes can lead to acute respiratory symptoms, pulmonary oedema, pulmonary fibrosis, lung cancer, encephalopathy, lead poisoning and neurological complications. Long-term persistent UV radiation exposure, dusty environment, outdoor work is associated with conditions such as pterygium and pinguecula.[3] One study in South Africa showed that 50 % of welders had watery eyes, 30 % had itchy eyes, 15 % had pain behind eyes and 5 % had tired eyes.[4] Intense ultraviolet (UV) light from welding arc can cause painful corneal burns, called welders flash.[2]

Sadly, welding and grinding employees do not often wear safety glasses because of lack of experience, low risk awareness and improperly maintained glass. This discomfort leads to their ocular injuries among welding and grinding workers.[5] We investigated all welding and grinding related ocular injuries reported to a tertiary care hospital of Bhubaneswar, a city of eastern part of India.

METHODS

This study was approved by the ethical committee of a medical institution in Bhubaneswar, Odisha. Subjects were ensured confidentiality and they were explained the purpose and ethical issues involved in the study. Written informed consent was obtained from each subject participating in the study.

Study Design and Setting

This study was hospital based cross-sectional study on the patients having ocular injuries among workmen of welding, grinding and polishing occupation. The study period was 01 / 01 / 2018 to 30 / 06 / 2018. The study was conducted in the Department of Ophthalmology, Hi Tech Medical College and Hospital, Bhubaneswar, Odisha. Out of those who gave written consent to be a participant in the study, only the patients having ocular injuries due to occupational works like welding, cutting, grinding, drilling, polishing etc. were included in this study.

Data Collection Procedures

A pretested, pre-designed semi-structured questionnaire administered by trained research assistants was used for data collection. Participants' demographic characteristics, relevant welding, grinding, social and ocular history were collected. Data regarding all types of injuries related to occupation that include mechanical injuries, arc eye injuries, foreign body in the eye, retinal damage, burns, electrical injuries, occupational diseases or hazards like back ache, hearing impairment, pinguecula, pterygium, metal fumes fever and pneumonia were collected based on history and or previous diagnosis. A detailed examination was done. This included distance visual acuity using Snellen chart. Examination of eyelids, conjunctivae, cornea, anterior chamber, pupil and iris was done using slit lamp microscope. Any other ocular anomalies detected during assessment were both documented and managed where possible.

Statistical Analysis

The collected data was entered in Statistical Package for Social Sciences (SPSS) version 16. The data was analysed and expressed in terms of proportion and percentages. Statistical analysis was done to find out the possible association between type of injuries and associated factors. P value less than 0.05 was considered as statistically significant. Statistical tests like percentage and chi-square were used for the purpose of data analysis.

RESULTS

Age Group (Years)	Male	%	Total
18 - 28	240	33.71	**240**
28 - 38	292	41.01	**292**
38 - 48	134	18.82	**134**
48 - 58	46	6.46	**46**
Total	**712**	**100**	**712**

Table 1. Distribution of Study Participants by Age and Sex

Type of Ocular Injuries	Age Group In Years	N (%)	Total
	18 - 38	**38 - 58**	
Corneal foreign body	310 (68.1)	145 (31.9)	455 (63.9)
Conjunctival foreign body	14 (70.0)	6 (30.0)	20 (2.81)
Conjunctivitis due to fumes	77 (90.5)	8 (9.5)	85 (11.94)
Laceration	49 (79.0)	13 (21.0)	62 (8.71)
Kerato-conjunctivitis	82 (91.0)	8 (9.0)	90 (12.64)
Total	**532 (74.7)**	**180 (25.3)**	**712 (100.0)**

Table 2. Association of Different Types of Ocular Injury with Age Group

Chi-square = 35.43, d. f = 4, P < 0.0001. The test is highly significant as the P value < 0.05

As shown in Table 1, during the period of study a total of 712 patients having ocular injuries due to occupational work who attended the OPD and emergency OPD of the

Department of Ophthalmology were included, out of which, 292 (41.01 %) were in the age group of 38 - 48 years, 240 (33.71 %) were in the age group of 18 - 28 years and 46 (6.46 %) were in the age group of 48 - 58 years. There were no female workers reported for such injuries in this hospital during the study period [Table 1]. The mean age was 33.87 years with a SD of 9.86.

The study participants were divided into two major groups like the younger group (18 - 38) and elder group (38 - 58) and comparison was made to ascertain difference in having ocular injuries as stated in table 2. 532 (74.7 %) patients were in the age group of 18 - 38 years and 180 (25.3 %) were in the age group of 38 – 58 years. A chi-square test was applied to test the significance at 95 % confidence level where chi-square = 35.43, degrees of freedom (d f) = 4, and P < 0.0001 showing the test as highly statistically significant at 5 % level of significance. It implied that there was significant association in these two groups of study participants. There was a statistically significant association found between age group and type of ocular injuries (x^2 = 227.319 P = 0.038)

Type of Occupation of the Patients							
Age-Group	**Welding**	**%**	**Polishing Grinding**	**%**	**Cutting, Drilling, Cleaning**	**%**	**Total**
18 - 28	79	32.92	128	53.33	33	13.75	240
28 - 38	96	32.88	160	54.79	36	12.33	292
38 - 48	42	31.34	79	58.96	13	9.7	134
48 - 58	28	60.87	13	28.26	5	10.87	46
Total	**245**	**34.41**	**380**	**53.37**	**87**	**12.22**	**712**

Table 3. Association of Ocular Injuries in Different Occupations in Relation to Age Group

Chi-square = 22.29, d. f = 6, P = 0.0010, Significant

The study participants were divided in three major occupations like (a) welding, (b) polishing and grinding and (c) cutting drilling. A comparison was made to know the difference within these traits of different age groups. A chi-square test was fitted to test the significance at 95 % confidence level. Where chi-square was equal to 22.29, d. f = 6, P = 0.0010. This indicates that the test was highly statistically significant under a high percent level of significance.

Associated Factors	Age-Group	Response Yes	Response No	Chi Square Value	P Value
Use of PPE	18 - 38	223 (41.9 %)	309 (58.1 %)	5.29 significant	0.021*
	38 - 58	58 (32.2 %)	122 (67.8 %)		
Knowledge of occupational hazard	18 - 38	168 (31.5 %)	364 (68.5 %)	69.85 Highly significant	< 0.0001*
	38 - 58	114 (63.3 %)	66 (36.7 %)		
Availability of first aid	18 - 38	183 (34.4 %)	349 (65.6 %)	1.23 Not significant	0.266
	38 - 58	62 (34.4 %)	118 (65.6 %)		
Rest within duty hours	18 - 38	178 (33.4 %)	354 (66.6 %)	4.58 significant	0.032*
	38 - 58	52 (28.8 %)	128 (71.2 %)		
Duty hours > 8 hrs. per day	18 - 38	382 (71.8 %)	150 (28.2 %)	23.12 Highly significant	< 0.0001*
	38 - 58	161 (89.4 %)	19 (10.6 %)		
Adequate ventilation	18 - 38	227 (42.6 %)	305 (53.4 %)	12.86 Highly significant	0.0003*
	38 - 58	61 (33.8 %)	129 (66.2 %)		
Safety training	18 - 38	112 (21 %)	420 (79 %)	34.12 Highly significant	< 0.0001*
	38 - 58	78 (43.3 %)	102 (56.7 %)		

Table 4. Associated Factors Pertaining to Ocular Injuries of the Patients Under Study

*Indicates statistically significant association at P < 0.05

This table shows that use of PPE was 41.9 % among younger age groups. Despite 63 % of participants in the 38 to 58 age group being aware of occupational hazards, only 32.2 % were found to be using PPE.

DISCUSSION

During the study period of six months, the number of patients who were suffering from ocular trauma visited the OPD of ophthalmology department was 2341, out of which 712 patients had ocular injuries due to occupational hazards like welding, grinding, cutting, drilling, polishing etc. The prevalence of ocular trauma was 8.25 % and the prevalence of ocular injuries due to welding, grinding etc. was 2.51 %. The patients under this study were from 18 years to 58 years of age.

Injuries due to corneal foreign bodies were noticed to be higher in magnitude as 455 (63.90 %) patients had corneal foreign body followed by 90 (12.64 %) patients had keratoconjunctivitis, 85 (11.94 %) patients had conjunctivitis due to fumes, 62 (8.71 %) patients had ocular laceration and 20 (2.81 %) patients had conjunctival foreign body and the test was found to be significant with P value as 0.038071. 245 (34.4 %) patients were found to have welding profession, 380 (53.37 %) patients had professions like cutting, drilling, polishing, cleaning etc. A significant difference was noticed in type of work, like welding, etc. as chi-square = 22.29, d. f. = 6 and P value = 0.0010 for 95 % confidence level. A recent study in a metal smelting industry in India reported that incidence rate of injuries varied from 40.7 to 85.8 per thousand exposed workers.[6] A study in Nigeria showed that 48.5 % had goggles, but 47 % used goggles.[7] Adopting health promotional measures at the workplace is an important measure to prevent injuries.

The associated factors like use of PPE, knowledge on occupational hazards, availability of first aid at workplace, rest within duty hours, working for more than 8 hours per day, adequate ventilation and safety training in the workplace were analysed within younger groups of 18 years to 38 years and older groups of 38 to 58 years with their response as available or not available. A significant difference was noticed in these groups, for all these risk factors. A recent study from Nigeria showed that 85.3 % of the welders had at least one injury in the preceding year.[8] A study done in Pakistan showed that 18.7 % welders reported injuries in the past three months.[9] A study in the US showed that eye injuries accounted for 25 % of all claims for welders. Most injuries were foreign bodies (71.7 %), burns (22.2 %) and 17.6 % were bilateral.[10,11] A study in the southern part of India showed that 43 % belonged to the age group of less than 30 years. They were five times at higher risk of sustaining more than 10 injuries as compared to the age group of above 50 years.[12] A study from Nigeria showed that flying metal chips were the chief source of ocular injuries with 68.15 % and arc rays accounted for 31 %. There was a high level of awareness of the risks, but only 15 % used protective eyewear at the time of sustaining injuries.[13] The difference in injuries reported in various countries may be due to the difference in methodology adopted and social

culture. Our study highlighted the fact that predictors of injuries include age less than 38 years, alcohol use, tobacco use and lack of institutional training.

CONCLUSIONS

Welders are part of an informal occupational sector and like most other informal occupational sectors in India, very little information is available on occupational injuries. Ocular injuries account for one quarter of all welding and grinding related injuries, making them by far the most common injuries in welders according to research from Liberty Mutual Research Institute for Safety.

From this study, it could be concluded that workmen engaged in welding, grinding and polishing etc. should be given repeated health awareness messages by trained health teams. Changes in their occupational environment like the removal of tripping hazards can be helpful in avoiding accidents due to reduced peripheral vision. The working area should be contained with curtains to reduce radiation hazards to other workmen. Eye protection is paramount to safety and should be worn at all times. The eye protection worn should be of high quality and specific to the type of welding. Educating and increasing awareness is also an important step to reduce accidents. The workmen should be trained to seek immediate medical treatment in the case of an injury. The lawmakers of the nation should implement strict laws for safety and task contractors with providing ample safety equipment to the workmen. Regulatory authorities should increase the frequency of spot checks for the use of PPEs.

In this study, a relevant finding was that ocular injuries due to foreign bodies account for 63.9 % of all injuries studied. Thus, we emphasise focusing on the prevention of dangers associated with propelled debris during welding and grinding activities via engineering controls and enhance tool design.

Regarding the study findings, risk factors for the fabrication workers can be addressed through imparting safety training to the workers, providing personal protection equipment like goggles, head gear, gloves, gum boots etc. Overworking is another area of concern. Workers should not work for more than 8 hours per day and should get ample rest. First-aid kits must be provided at the workplace.

Limitations

This study has many limitations. Non-welders such as pipe fitters, staff and assistants sometimes walk by or around welders leading to eye injury. It is unclear if there are terms that are truncated, overlooked, lost in speech or abbreviated by those reporting the problem.

The system of accident category classification was another drawback of this review. In order to identify injuries, the current research used the general existence of accident types rather than the International Classification of Diseases Clinical Modification, 9th Revision (ICD-9) or other related diagnostic codes. The full extent of ocular injuries is not represented in the report. Patients under the age of 18 years were not recruited for the research, but many had ocular injuries.

The strength of this research involves a relatively large number of analytical cases and a diverse study population from multiple industries.

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