Ocular trauma in an iron forging industry in the Eastern Province, Saudi Arabia

S. G. Ballal

College of Medicine and Medical Sciences, King Faisal University, Dammam, Kingdom of Saudi Arabia

Occupational accidents occur in industry worldwide, and the Kingdom of Saudi Arabia (KSA) is no exception. However, accidents are not routinely analyzed in this country and therefore their extent and types remain unknown. The aim of this study was to calculate the rates of ocular injuries in an iron forging factory in the Eastern Province of the KSA. It also aimed at identifying the main causes of injury and the groups at risk. All ocular and non-ocular injuries that occurred during 1991 were reviewed. Data sources were the company's accident report and the employees' medical files. A total of 193 injuries were reported. Seventy-seven (39.9%) of these affected the eyes. The incident rate for ocular injuries was 111.8 per 1,000 men exposed. The age group 33–42 had the highest prevalence rate (55.8%) and 67.5% of the eye injuries involved employees with job experience of 11 months or less. Use of pneumatic chisels was among the most hazardous activities. Projectile foreign bodies were responsible for 76.6% of the incidents. More than a third of the injured were not wearing eye protection. Avoidable factors, such as negligence, were major contributory factors. A training programme concerning safety has much to commend it, and pneumatic chisels should be replaced by other safer means.

Key words: Eye; injury; occupational; Saudi Arabia

INTRODUCTION

Industrial accidents are common worldwide particularly in the manufacturing sector in most rapidly expanding economies such as that of the Kingdom of Saudi Arabia (KSA). Data collection and analysis of accidents are essential for planning preventive programmes. There have been a few hospital-based reports regarding occupational injuries in this country, but only one community-based study concerning loss of vision. The latter study reported the prevalence of unilateral traumatic loss of vision as 6.8/1,000 persons. The present retrospective study was conducted in an iron forging (manufacturing) company in Dammam, KSA. The objective was to calculate the ocular accident rates, identify the main causes of injury and the at-risk groups, and delineate areas where preventive measures are most needed.

METHODS

All occupational injuries including those to the eyes that occurred within the company premises from 1 January to 31 December 1991 were reviewed. The relevant variables were obtained from the company's accident records. This included type, cause and place of injury and demographic characteristics. The number of days off-sick were retrieved from the accident notification form 10 of the General Organization for Social Insurance (GOSI), and verified from the employees' medical files at the contract hospital. The mid-year population of the company was obtained from the personnel department.

The incident, severity and frequency rates of ocular injuries were calculated as follows:

- Incident rate = \( \frac{\text{Number of accidents} \times 1000}{\text{Average number of persons exposed}} \)
- Severity rate = \( \frac{\text{Number of days lost} \times 1000}{\text{Total man-hours worked}} \)
- Frequency rate = \( \frac{\text{Number of disabling accidents} \times 10^6}{\text{Total man-hours worked}} \)

Correspondence and reprint requests to: Dr S. G. Ballal, King Faisal University, PO Box 2114, Dammam 31451, Kingdom of Saudi Arabia.
A disabling accident is that which causes loss of working days. It was not possible to obtain the number of days lost through certified or uncertified absence other than those which were work-related since access to personnel files was not granted. For the same reason the dates of birth of the uninjured could not be obtained.

A database file was created in EPI INFO version 5.01b on a personal computer. Statistical analysis was done with EPI INFO and Statistical Package for Social Sciences (SPSS PC+). One way analysis of variance, chi-squared test, and relative risk with 95% confidence interval (RR, 95%CI) were computed where appropriate. A p-value of 0.05 or less was regarded as statistically significant.

### RESULTS

The mid-year population of the at risk group was 689: 57 Saudis, 468 Filipinos, 158 Indians and six Arabs. Their distribution within the factory sections were as follows: 306 in the structural steel plant/King Fahd Ship Repair Yard (SSP/KFSR), 250 in the Pre-engineered Buildings (PEB), 96 in Towers and Galvanizing (T & G), and 37 in Contracts and Erection (C & E). There were 252 administrative staff who were not exposed to the hazards inside the factory and none of them experienced any eye injury.

The total number of all accidents during the study period was 194. Essential information was missing for one incident and this was excluded from the analysis. Of the remaining 193 incidents, 77 (39.9%) were ocular injuries. The incident, severity and frequency rates were 111.8, 0.06 and 40.9 respectively.

The prevalence for unilateral (55.2%) and bilateral (60.0%) eye trauma was highest among the 33–42 year age group. On the other hand, the lowest was at either end of the age spectrum (Table 1). Similarly, the rate for non-ocular trauma (39.7%) was highest in the 33–42 age category and least in the 22 or less and the 53 or more age groups.

The incident rate for ocular injuries per 1,000 men exposed for nationals of the Indian-subcontinent was 139.2 (RR = 1.34, 95% CI = 0.85–2.13). For Filipinos and Saudis the rates were 106.8 and 87.7 respectively. However, none of the six Arabs sustained any trauma to their eyes.

Fifty-two (67.5%) of the 77 eye incidents involved employees with job experience of 11 months or less. Similarly, the prevalence rate for non-ocular accidents was high in this inexperienced group (67.2%) (Figure 1).

Forty-three incidents (55.8%) of ocular trauma occurred in the SSP/KFSR affecting 48 eyes. The remaining incidents were distributed as follows: 27 in the PEB (31 eyes), and seven in the T & G (eight eyes) (p < 0.04).

Contributory factors to eye trauma are shown in Table 2. Such information was missing for seven incidents. Avoidable factors, such as negligence (negative human behaviour) and lack of training, were especially common (83.1%) in the 33–42 age category.

Projectile foreign bodies, mostly metallic in origin, were responsible for more than three quarters (59 incidents) of the ocular injuries. Two-thirds (39) of these were removed from the cornea under local anaesthesia, one by irrigation and another one under slit lamp. Of the remaining 18, the foreign bodies did not lodge in the eyes and only eye wash was required. Welding spark/glare caused 14 (18.2%) injuries, blunt trauma caused two (2.6%) and chemical splash and welding fumes caused one each.

The most common activity engaged in at the time of the incidents was welding (28.6%) followed by the use of overhead cranes/fork lifts, and pneumatic chisels (26.0% each). Grinding with rotating discs was responsible for 3.9% while hammering of metals caused only one eye injury (1.3%). Other miscellaneous activities were responsible for the rest.

### Table 1. Injuries distributed by age group at time of incident

<table>
<thead>
<tr>
<th>Body part</th>
<th>≤22</th>
<th>23–32</th>
<th>33–42</th>
<th>43–52</th>
<th>≥53</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>(%)</td>
<td>n</td>
<td>(%)</td>
<td>n</td>
<td>(%)</td>
</tr>
<tr>
<td>One eye</td>
<td>1 (1.5)</td>
<td>19 (28.4)</td>
<td>37 (55.2)</td>
<td>9 (13.4)</td>
<td>1 (1.5)</td>
<td>67 (34.7)</td>
</tr>
<tr>
<td>Both eyes</td>
<td>— (0.0)</td>
<td>4 (40.0)</td>
<td>6 (60.0)</td>
<td>— (0.0)</td>
<td>— (0.0)</td>
<td>10 (5.2)</td>
</tr>
<tr>
<td>Other parts</td>
<td>9 (7.8)</td>
<td>39 (33.6)</td>
<td>46 (39.7)</td>
<td>19 (16.4)</td>
<td>3 (2.6)</td>
<td>116 (60.1)</td>
</tr>
<tr>
<td>Total</td>
<td>10 (5.2)</td>
<td>62 (32.1)</td>
<td>89 (46.1)</td>
<td>28 (14.5)</td>
<td>4 (2.1)</td>
<td>193 (100.0)</td>
</tr>
</tbody>
</table>
Thirty of the 77 injured employees (39.0%) did not use any form of eye protection while two (2.6%) used non-specific protective devices. The remaining 45 (58.4%) got injured in spite of eye protection.

The man-days lost were not in the records of six (7.8%) subjects. The remaining 71 cases of eye trauma caused a loss of 110 man-days (mean = 1.52, SD = 0.94 days per accident). This was equivalent to 10.4% of the 1,060 man-days lost during the year due to all 193 accidents.

DISCUSSION

The ocular accident rates shown by this study seem unacceptably high. However, these rates are not truly representative of the situation in KSA although they give a reasonable measure of the risk to the eye in similar industries.

The computed severity and frequency rates are more likely to have been underestimated and therefore, these figures should be interpreted with caution. The reason was that data for absenteeism from causes other than those which were work-related were unavailable. On the other hand, the incident rate is similar to that found in some countries but much higher than the figures reported from elsewhere. However, these studies were hospital-based and as such differ from the current study. Occupational eye trauma rates of 16% and 39.1%, as a proportion of all eye injuries, have been reported in two hospital-based studies from this country. However, neither study specified the place or type of work.

The majority of the eye injuries in the present study occurred in the 33-42 year age group and is similar to that reported by Dannenberg et al. This distribution parallels that for non-ocular accidents which points to the need for more attention to this group.

Accidents are non-random events and can therefore be prevented or controlled by safety measures, education and training. In this study the rate of injury was high among the inexperienced which agrees with previous reports. Work place safety is the responsibility of managers, supervisors and workers. Therefore, attitudes toward safety should be looked at and analyzed at each level. The objective should be to allow the worker to learn from the mistakes of others rather than from his own.

Collectively, welding, grinding and use of pneumatic chisels carried a higher risk of injury to the eye. The latter tool has been previously reported to be an important source of ocular trauma. Banerjee reported about three to four eye injuries per day in metal workers with grinding being the leading cause. In another large prospective hospital-based study Macewen noted that 46.5% of the eye injuries occurred during grinding/buffing.

Presumably donning of eye protective devices should prevent eye trauma. However, eye injuries have been reported despite the use of protective devices. This was because foreign bodies entered through gaps between the goggles and the face or forcefully through the protective device. This confirms the finding in the present study.

The highest rate of trauma occurred in the SSP/KFSRY and PEB sections. This was not unexpected since work in these sections involved welding and cleaning of the metal sheets and slabs more so than at T & G.

In conclusion, this study has shown a high risk of injury to the eyes in this company. There were several preventable risk factors. The need for education and training concerning safety cannot be over-emphasized. The use of eye protective devices should be strictly enforced and the chosen devices must be comfortable and efficient. It is also strongly recommended that the pneumatic chisels be replaced by safer means of removing excess welding material.

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